DRAFT

WATER QUALITY IN COLORADO

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BACKGROUND INFORMATION

ATLAS

State Population - 3,631,601

State Surface Area - 104,247 Square Miles

Number of Water Basins - 7

Arkansas
Rio Grande
San Juan
Colorado
Green
Platte
Republican

Total Number of Rivers Miles - 105,581[1]

Number of Border Miles 0

Estimated Number of all Lakes/Reservoirs/Ponds - 3,258[1]

Estimated Acreage of all Lakes/Reservoirs/Ponds - 143,019[1]

Acreage of freshwater wetlands - unknown[2]

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[1] Total State Waters: Estimating River Miles and Lake Acreages for the 1992 Water Quality Assessment (305(b) Reports). U.S. EPA 1991 Draft.

[2] Sixty acres of freshwater wetlands are site specifically classified in the Colorado Water Quality Standards.

Summary of Classified Uses

Classified Use	River (Mi)	Lakes (Acres)	Wetlands[3]
Aquatic Life Class 1, Cold	17,902	82,180	
Aquatic Life Class 1, Warm	987	64,708	60
Aquatic Life Class 2, Cold	2,762	3,162	
Aquatic Life Class 2, Warm	12,157	2,799	
Public Water Supply	18,262	121,900	
Recreational Class 1	12,436	122,391	
Recreational Class 2	22,240	31,100	60
Agricultural	34,705	153,199	60
Outstanding Waters[4]	380	287	
Unclassified	62	0	
Total[5]	35,112	148,328	60

3 Colorado does not separately classify wetlands except where critical to endangered species.

4 High Quality waters are suitable for all uses. High Quality Class 1 was renamed Outstanding National Resource Water and High Quality Class 2 was eliminated by the Colorado Legislature in 1992.

5 Total does not equal sum of classified uses because of multiple classifications. Data base is WBS.

Surface Water Quality Summary for Colorado

Degree of Use Support

River Miles

Degree of Support	Assessment Basis		
	Evaluated	Monitored	Total Assessed
Fully Supporting	23,195	6,615	29,180
WQL	1101	573	1,674
WQLA	127	111	238[6]
Partially Supporting	1,051	873	1,924
Not Supporting	7	242	249
Total	25,481	8,414	33,895

Lake Acres

Degree of Support	Assessment Basis		
	Evaluated	Monitored	Total Assessed
Fully Supporting	94,647	55,604	150,251
WQL	2,730	0	2,730
WQLA	0	3,153	3,153[7]
Partially Supporting	0	12,930[8]	12,930
Not Supporting	40	300	340
Total	97,417	71,987	169,404

[6] Includes 139 miles where appropriate discharge limits are in place.

[7] Cherry Creek, Chatfield, Dillon and Bear Creek Reservoirs have had Clean Lakes Phase I studies which have identified them as being water quality limited. The element of concern is phosphorous.

[8] Teller, Mary, Ladora, Derby Reservoirs have restrictions on taking fish for consumption due to toxics. Advisories to limit consumption of fish are posted at McPhee, Navajo, Narraguinnep and Sanchez Reservoirs. Terrace Reservoir is impaired due to metals loadings in combination with severe drawdowns.

State Summary of Waterbodies Meeting Fishable/Swimmable Criteria

River Miles

	Fishable	Swimmable
Miles Meeting	29,810[9]	11,671
Miles not Meeting	2,562	0
Miles not Attainable	710	23,441

Lakes Acres

	Fishable	Swimmable
Acres Meeting	139,175	115,630
Acres not Meeting	7,961	0
Acres not Attainable	40	29,883

State Summary of Water Bodies not Fully Supporting Classified Uses

Affected by Various Source Categories

River Miles

Source Category	Major Impact	Moderate/Minor Impact
Point Sources		
Industrial	117	16
Municipal	0	96
Nonpoint Sources[10]		
Agriculture	584.5	1,503.0
Silviculture	0.0	43.0
Construction/Urban Runoff	0.0	210
Resource Extraction	224.5	1,012.4
Hydrologic Modification	0.0	16.0

9 Sum of all aquatic life use classes that are not partially supporting or non supporting.

10 Nonpoint source impacts were taken from Colorado Nonpoint Assessment Report, Colorado Water Quality Control Division, April 1988, and represent both individual judgements and comparison of ambient data against Colorado criteria. No judgement was made as to whether or not the impacted waters fully support "fishable-swimmable" uses.

State Summary of Water Bodies not Fully Supporting Classified Uses

Affected by Various Source Categories (Continued)

Lakes Acres

Source Category	Major Impact	Moderate/Minor Impact
Point Sources		
Industrial	262.0[11]	0
Municipal	0.0	7,172.0
Nonpoint Sources		
Agriculture	1,503.0	13,976.0
Silviculture	43.0	0.0
Construction/Urban Runoff	900	8,552.0
Land Disposal	0.0	325.0
Resource Extraction	300	0.0

State Summary of Water Bodies Not Fully Supporting Classified Uses

Affected by Various Cause Categories

River Miles

Cause Categories	Major Impact	Moderate/Minor Impact
Effluent Toxicity	40	2
Metals	873	705[12]
Ammonia	0	28
Dissolved Oxygen	3	10
Pathogens	30	25

[11] Impacts due to toxics accumulation in aquatic life. All lakes are on Federal property.

[12] Teller Reservoir, result of Summitville mining.

State Summary of Water Bodies Not Fully Supporting Classified Uses

Affected by Various Cause Categories (Continued)

Lakes Acres

Cause Categories	Major Impact	Moderate/Minor Impact
Metals	342[13]	9,384[14]
Organics	160[15]	--
Nutrients	--	7,952[16]

State Summary of Waterbodies Affected by Toxics[17]

Water Body	Size Monitored for Toxics	Size with Elevated Levels of Toxics
Rivers (miles)	8,414	1115
Lakes (acres)	10,355	9,686

---

13 Teller Reservoir and Terrace Reservoir

14 Includes 23 miles for which appropriate limits are in place.

15 Mary Lake, Ladora Lake, Derby Lake

16 Dillon, Chatfield, Cherry Creek and Bear Creek Reservoirs. Clean Lakes Studies have identified phosphorus as impacting the uses. Barr Lake has seasonal violations of un-ionized ammonia criteria.

17 In Colorado the only toxics for which there are surface water quality data above detection limits are metals. Biomonitoring has identified four reservoirs on Federal lands that are contaminated by organics (Derby, Ladora, Mary) and mercury (Teller). Mercury contamination in fish tissue has been identified at McPhee, Narraguinnep, Navajo and Sanchez Reservoirs.

PART 1

SURFACE WATER QUALITY IN COLORADO

1994

I. INTRODUCTION

The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. This report, prepared pursuant to Section 305(b) of the Act, is designed to inform the citizens and decision makers of Colorado and the nation of the quality of Colorado's waters. This report serves as a means of reporting quality conditions and also the status of water quality management programs and benefits associated with achieving the objectives of the Act to both the Environmental Protection Agency and the Congress.

The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environemnt has prepared this document drawing upon a number of sources of information. Particularly important among these sources are monitoring efforts sponsored by public and private agencies, areawide water quality management plans, the Colorado Nonpoint Source Assessment and efforts sponsored by the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA).

The Colorado Department of Public Health and Environment is the agency charged with protecting water quality and implementing Federal and State regulatory control programs in Colorado. Among these regulatory responsibilities are the setting of use classifications and numeric standards, the issuance of discharge permits, enforcement, and administration of grants and loans for the construction of publicly owned treatment works. This report provides a measure of the effectiveness of these programs maintaining and improving the quality of the State's waters.

The thrust of this report is to provide information on the current status of water quality in Colorado, to describe how the water quality compares to the water quality standards established under federal and state law, and to describe what improvements have been made or will be needed in the future.

Some anomalies may appear in this report between identified problem areas compared to those identified in the nonpoint evaluation. This is due to the nonpoint source assessment report practice of identifying all water quality problems associated with nonpoint sources using table value standards instead of adopted stream standards.

During this reporting period the WQCD has changed from statewide monitoring to a basinwide or watershed approach to monitoring. Some of the old stations have been retained to identify trends in water quality throughout Colorado. The first basin to be analyzed on a watershed approach was the Rio Grande. This basin was chosen for at least two reasons. The first and most important was that the timing was right for the triennial review of this basin. The second was that this basin is the smallest basin in Colorado and the experience obtained in this basin would aid the WQCD in the larger basins in the state. The next basin to be analyzed is the Arkansas River Basin in Colorado. This basin and the Lower Colorado River Basin, which is defined to be the Colorado River and tributaries from the confluence of the Roaring Fork River - at Glenwood Springs - to the state line will be done during the next reporting period.

Sampling sites were chosen throughout the Rio Grande Basin so that nearly all of Colorado's stream segments were sampled and there was good representation of all the ecoregions in this basin. Thus multiple sites were chosen in each ecoregion and multiple samples were taken at each site. The data collected were analyzed by ecoregion and were also used to resegment the streams in the Rio Grande Basin. This resegmentation of streams in this basin has changed the waterbody ID's (WBID) for many of the waterbodies.

Because of the increased data collection in the Rio Grande Basin, its narrative discussion in this report is much more extensive than for the other basins. In the future, as additional watersheds benefit from the intensified monitoring described above, their discussion will expand accordingly to the point where the 305(b) report will consist of a brief statewide atlas of statistical information followed by seven "stand alone" comprehensive watershed reports. Until that status is achieved, the WQCD does not intend to spend more than minimal effort at updating those basin narrative discussions which have not received the intensive monitoring.

II. AN OVERVIEW OF COLORADO HYDROLOGIC BASINS

Several major river systems, the Arkansas, the Colorado, the Rio Grande, and the Platte (a Missouri River tributary) originate in the Rocky Mountains of Colorado, Figure 1. The Republican River, another tributary of the Missouri, has its headwaters on the eastern plains of Colorado. Each of these systems is considered a hydrologic basin except for the Colorado River which is subdivided into three sub-basins: the Upper Colorado, the Green, and the San Juan. The State's river basins vary greatly in size and population as shown in Table 1. There are no rivers that form borders between Colorado and contiguous states. A brief discussion of the characteristics of each basin is given below.

Table 1 Selected Statistics for Hydrologic Basins of Colorado

Basin	Area 10^3 mi^2	Percent Area of State	Population, Thousands	Percent of Population
Arkansas	28.3	27.2	744	20.5
Upper Colorado	22.2	21.3	272	7.5
Platte	21.2	20.4	2,456	67.6
Green	10.5	10.0	33	0.9
Republican	8.7	8.4	25	0.7
Rio Grande	7.5	7.2	44	1.2
San Juan	5.8	5.5	58	1.6
Total	104.2		3,632	

Platte River Basin

The Platte River Basin is comprised of the North Platte River basin located in north central Colorado and the South Platte River basin which drains the northeastern quadrant of Colorado, Figure 1. The North and South Platte rivers join in Nebraska to form the Platte River.

The North Platte Basin is sparsely settled with about 1,500 population. Its economy is for the most part agriculturally based, although recreation provides a significant contribution. At present, no significant water quality problems exist in the basin.

The South Platte portion of the Platte Basin on the other hand has a larger population than the rest of Colorado with about 68 percent of the state's population, or 2,243,500 persons. It also has more critical water quality problems and issues facing it than any other basin in Colorado. From its mountainous regions, the South Platte and its tributaries, such as Bear Creek, Clear Creek, Cache La Poudre, Big Thompson, St. Vrain, and Boulder Creek, supply high quality water to cities, industries, and agriculture along the Front Range. Most of these streams provide excellent habitat for aquatic life and abundant recreational opportunities as well. Several tributaries, for example Clear Creek, North Fork of the South Platte, Geneva Creek, and James Creek intersect the Colorado mineral belt and have been degraded by past mining activities and natural causes due to contact with minerals. Aquatic life in these streams is severely restricted.

The middle region of the South Platte River flows through the populated front range areas. Municipal and industrial wastewater, non-point source pollution, and other sources of water pollution place a significant burden on the assimilative capacity of the river and its tributaries. A number of the treatment facilities have completed upgrades or are planning upgrades to meet water quality standards. Several important recreational reservoirs, including Cherry Creek, Chatfield, and Bear Creek Reservoirs, located in the Denver Metropolitan area are affected by eutrophication owing to urbanization of their watersheds. Site-specific control regulations are in place to provide protection for these reservoirs.

Downstream of the Denver area, nitrates exceeding drinking water standards are found in the wells of several municipalities withdrawing their water from the alluvium of the South Platte River. These exceedances appear to be the result of agricultural practices, but may also be influenced in certain cases by the quality of water in the South Platte. A number of studies are underway in the South Platte Basin which will provide additional information on the sources of, and solutions to, this problem.

The lower third of the Platte River is one of Colorado's major agricultural regions. This area is largely dependent on irrigated agriculture and livestock feeding operations, both of which have the potential to affect water quality. The control of point source discharges of pollutants from sugar beet facilities, packing houses, and other related agricultural industries in the mid-1970's has resulted in one of the most significant water quality improvements in Colorado.

Republican River Basin

The Republican Basin covers the northern high plains of Colorado, Figure 1. This is the most sparsely populated basin in Colorado with 22,000 population. The area depends primarily on ground water from the Ogallala aquifer for irrigating cropland and providing domestic water for the farm communities. Chemigation, or the practice of adding fertilizers and pesticides to the irrigation well discharge without adequate backflow protection, has recently received more attention and aroused the concern of local citizens. Several important surface waters of this basin are the North Fork Republican River, a high quality stream of which a portion has the only trout habitat in eastern Colorado, and Bonny Reservoir which is an important recreational resource.

Arkansas River Basin

The Arkansas Basin, the largest in Colorado with 28,300 square miles, consists of the Arkansas River and its major tributaries: Fountain Creek, Huerfano River, and the Purgatoire River. The Arkansas drains most of the southeastern part of Colorado, Figure 1, as well as a large portion of the central mountains. The headwaters of the Arkansas, like the Platte, were subjected to intensive mining activities in the late 1800's which significantly degraded several tributaries to the river, and has affected the water quality of the mainstem itself. Mining continues to be important to the economy in the upper basin, although several operations have shut down in the last few years. Two investigations were initiated to determine the feasibility of controlling the discharge of pollutants from several inactive sites. California Gulch, the most significant pollution source in the Basin, and ground water contamination from a uranium mill near Canon City have resulted in the filing of NRDS (Natural Resource Defense Suits) lawsuits in late 1984. Both suits have been settled and remediation is underway at the uranium mill site and a wastewater treatment plant is on-line to treat the Yak Tunnel discharge to California Gulch. Another wastewater treatment plant is also on-line to treat the discharge from the Leadville Drain.

About twenty percent (681,000) of the State's population reside in the Arkansas Basin, mostly in the Colorado Springs and Pueblo areas. The Colorado Springs area, in the Upper Fountain Basin, is the major growth center in the Arkansas Region. Elevated nitrate concentrations in the range of 7 mg/l are found in the wells of several municipalities withdrawing their water from an alluvial aquifer along Fountain Creek downstream from Colorado Springs. A study by the United States Geological Survey (USGS) concluded that 85 percent of the nitrogen load to Fountain Creek was from the Colorado Springs wastewater treatment plant (Edlemann, 1985).

A 1992 draft report by Geraghty and Miller, Inc. concluded that Fountain Creek does not recharge the northern end of the Widefield Aquifer. Rather, ground water flow is predominantly toward Fountain Creek and not from it.

The lower Arkansas River Basin is extensively irrigated. Colorado consumes all of the water in the Arkansas River to which it is legally entitled with municipal and industrial interests in the middle basin and agricultural interests in the lower basin competing for the available supply. Because so much of the river's flow is consumptively used, salts (total dissolved solids) are concentrated in the remaining water. The high total dissolved solids concentrations impair the quality of the water for municipal and agricultural purposes from La Junta to the state line.

Rio Grande Basin

The Rio Grande Basin includes the Rio Grande and its major tributary the Conejos River, as well as the northern part of the San Luis Valley which contains a large ground water basin referred to as the Closed Basin. Less than two percent (44,000) of the state's population lives in the Rio Grande Basin. Agriculture is the largest employer in the Basin; however, mineral extraction has been an important factor. Like other regions of the state with previous mining activities, water quality has been impaired.

San Juan Basin

The San Juan Basin, includes the San Juan River and its principal tributaries, the Piedra, Los Pinos, Animas, La Plata, and Mancos Rivers, Figure 1. It is a major tributary of the Colorado River drainage located in southwestern Colorado. Agriculture, mining, and tourism are important to the region's economy. Although population in the basin is sparse with about 53,000 people, the increasing growth of tourism is placing demands on the resources of several communities to provide adequate wastewater treatment. Several major year-round resorts are proposed in the upper San Juan River region which could significantly impact water quality in the future. Water quality in several streams is impaired by both current and previous mining activities.

Upper Colorado Basin

The Upper Colorado Basin is the second largest basin in Colorado covering 21 percent of the state. It includes the Colorado River and the tributaries that join it in Colorado as well as the Dolores River which joins it in Utah, Figure 1. Major tributaries include the Blue, Eagle, Roaring Fork, Gunnison, Dolores and San Miguel. Water quality in this region is generally good, however, major efforts have been required to maintain it.

The headwaters of the region are subject to intense year-round recreational developments. Advanced wastewater treatment for many municipal facilities and control of nonpoint sources of pollution from urbanizing areas that discharge to Dillon Reservoir, the Fraser River, Eagle River, Roaring Fork River and several other tributary streams have been necessary to maintain the existing high quality of those waters.

Active and inactive metals mines have created problems in many streams. A NRDS lawsuit against an inactive metals mine and mill on the upper Eagle River has been settled and remediation is underway. Another problem of the past has centered around runoff from a coal mining operation which had significant impact on the aquatic habitat of the Crystal River.

The lower portion of the basin was the center for energy development in Colorado during the 1970s. Many communities faced significant growth issues including water quality and wastewater problems during those years. The recent slowdown in the demand for fossil and nuclear fuels, however, has significantly impacted the economy and halted growth. Grand Junction, located at the confluence of the Colorado and Gunnison Rivers is the largest population center (28,000) in the Basin.

The Grand Valley on the lower mainstem is a major agricultural area. It and the Paradox Valley of the Dolores River basin are two of the largest sources of salt loading to the entire Colorado River system. The problem of salt loading from the Grand Valley has been investigated for the past few years and programs of the U.S. Departments of Interior and Agriculture are now being implemented to line selected canals and laterals, to make on-farm improvements, and to initiate other water management practices, all of which are expected to reduce salt loading. The Paradox Valley is the site of a U.S. Bureau of Reclamation project to prevent ground water brine from entering the Dolores River. Two separate sites on the San Miguel River, a tributary of the Dolores, are named in NRDS lawsuits. One site is a metal mining and milling operation near the headwaters above Telluride. The second site is a uranium mine and milling operation just above the San Miguel's confluence with the Dolores at Uravan. The latter has been settled and remedial action is underway.

The Gunnison River Basin includes the Gunnison River and its principal tributaries, the North Fork Gunnison, East River, Taylor River, Lake Fork, and Uncompaghre River. Agriculture, mining, and tourism are the economic foundation of the Gunnison Basin. Extraction of energy fuels, both coal and uranium, and exploratory work on a major molybdenum mine near Crested Butte are additional factors which have stimulated growth and water quality concerns in recent years. The mine development work near Crested Butte has resulted in the construction and operation of a facility to treat the effluent from the inactive Keystone mine. This facility has successfully restored aquatic life to Coal Creek and has reduced metals concentrations in the Slate River below Coal Creek. Except for coal mining along the North Fork of the Gunnison, the other mining activities in the Gunnison Basin are virtually inactive at the present time due to depressed prices in the metals industry. The NRDS lawsuit being processed against the mining operation on the Upper San Miguel is also in effect against the same company for problems on Red Mountain Creek, a tributary of the Uncompaghre above Ouray. The lawsuit on Red Mountain Creek has been settled and remediation is underway.

Green River Basin

The Green River Basin is mainly the Yampa and White river basins which are the principal Colorado tributaries to the Green River, Figure 1. The Green River enters the northwest corner of the state from Utah where it is joined by the Yampa in Dinosaur National Monument. The Green turns back into Utah where it is then joined by the White River. Both the Yampa and White Rivers are among the least developed rivers in Colorado. The Basin, although large in size (10 percent of the state), is sparsely populated accounting for less than one percent of Colorado's population. Major reserves of coal and oil shale are located within the watersheds of both rivers, and the extraction of both types of energy resources may impair water quality in the future. At present, only coal mining is being practiced and that on a limited basis.

III. SUMMARY OF WATERBODY ASSESSMENTS

Colorado has to date completed assessments on a majority of the rivers in the State. Lake assessments, however, have received much less attention, basically, due to lack of data.

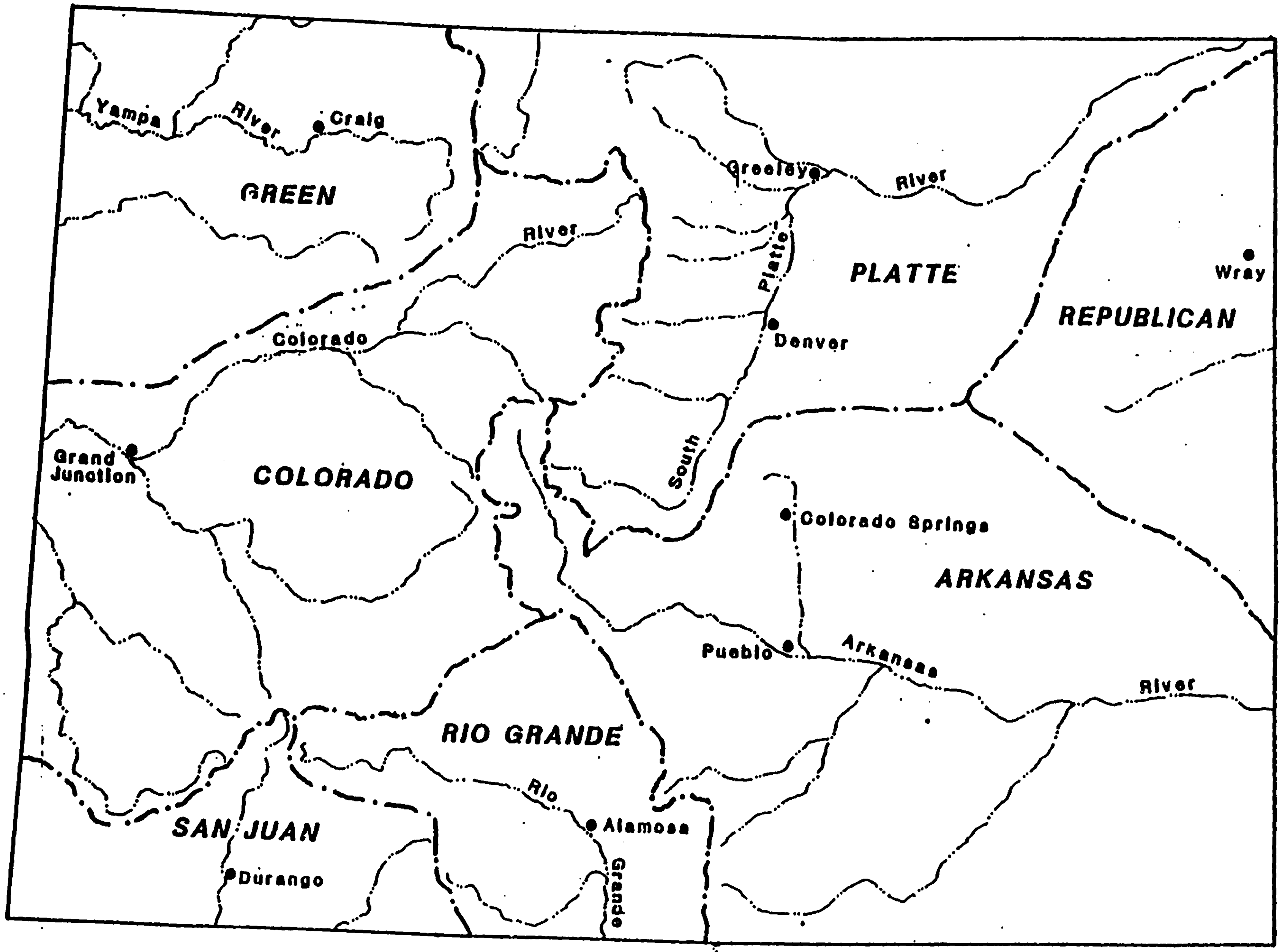
Total River Miles Assessed and Monitored

Colorado has 31,470 miles of perennial streams, nearly 100 percent of which are classified under state water quality standards (62 miles designated as unclassified). A total of 8,414 stream miles have been or are being routinely monitored and an additional 25,481 miles have been assessed either through routine monitoring or by special studies as to chemical and biological quality. Both the USGS and the WQCD maintain routine chemical water quality monitoring stations on streams within Colorado. A summary by basin is given in Table 2.

Total Lakes Acres Assessed and Monitored

Table 3 summarizes the trophic status of lakes by river basin. Only 87 lakes have been assessed for trophic status out of the 176 lakes in the WBS data base.

Figure 1



Major River Basins in Colorado

Table 2 Summary of Chemical Assessment of Colorado Streams, by Miles

Basin	Total Miles of Streams	Miles Evaluated	Miles Monitored
Arkansas	5,270	3,198	2,072
Upper Colorado	8,548	6,641	1,907
Platte	6,763	3,057	3,706
Green	6,113	5,926	187
Republican	1,988	1,854	134
Rio Grande	5,700	1,495	4,205
San Juan	2,577	1,494	1,083
TOTAL	36,959	23,665	13,294

Table 3 Summary of Estimated Trophic Status of Publicly Owned Lakes and Reservoirs

Basin	Total		Assessed		Oligotrophic		Mesotrophic		Eutrophic[18]	
	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres
Arkansas	41	49,450	12	33,865	1	2,497	1	1,780	9	28,588
Upper Colorado	30	32,026	17	29,107	3	3,850	11	23,032	3	2,225
Green	6	2,574	4	2,414	1	287	1	264	2	1,863
San Juan	12	13,850	4	3,911	1	780	2	3,023	1	108
Platte	72	43,526	42	28,062	3	735	13	13,510	26	13,817
Rio Grande	14	5,697	7	3,364	2	74	1	845	4	2,445
Republican	1	1,900	1	1,900	0	---	0	---	1	1,900
TOTAL	176	149,023	87	102,623	11	8,223	30	42,454	46	51,946

18 Eutrophic Category includes those lakes assessed as hypertrophic. WBS data base.

IV. EXISTING WATER QUALITY

The objective of this section of the report is to compare ambient water quality of each of Colorado's hydrologic basins against adopted water quality standards and classifications as a measure of progress towards meeting the water quality goals of the Clean Water Act. The 50 states and the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) completed the States Evaluation of Progress (STEP) in 1984 and the Nonpoint Source Assessment report in 1985. Out of that effort came criteria for describing the degree of use impairment which was used in past 305(b) reports. These criteria have been slightly modified for this 305(b) report. The definitions and criteria, presented in Table 4, are the basis for designating not supporting, partially supporting, water quality limited or fully supporting designations.

Where the degree of impairment for a segment was evaluated by a comparison of water quality data to the adopted standards for that segment, 1987 through 1991 data for the following parameters were utilized: un-ionized ammonia, dissolved oxygen, fecal coliforms, cadmium, copper, lead, manganese and zinc, except in the Rio Grande Basin. The data used in this basin were data collected during the intensive monitoring that occurred in 1993. Impairment assessed by biological or direct observation/professional judgement may have come from a variety of sources including Water Quality Control Division special studies, Superfund/NRDS studies and the Colorado Nonpoint Assessment Report.

Platte Basin Water Quality Summary

The water quality of the middle and lower portions of the South Platte River Basin has been impacted by man's activities more than any other major river basin in Colorado. Those impacts include exceedance of water quality standards for dissolved oxygen, un-ionized ammonia, fecal coliforms and metals concentrations of phosphorus, nitrate and dissolved solids in parts of the basin are among the highest in the state. Total suspended solids concentrations, however are comparatively low.

Dissolved Oxygen - In recent years, only one documented case of a potential dissolved oxygen problem has been noted in the South Platte basin. A water quality investigation by the WQCD (1985) showed that the then existing dissolved oxygen (DO) standard of 5.0 mg/l was not continuously met in all portions of Segment 15 downstream of the Metro Wastewater Reclamation District (Metro) discharge. Metro has begun operation of facilities to nitrify and denitrify a portion of their effluent to reduce oxygen demand to the river from ammonia. Additionally, the DO standard was modified to be a 24 hour average and to set the standard at 4.5 mg/l minimum in the late summer when early life stages are not likely to be present, the water temperature is warm and the river flow is dominated by effluent from Metro. Current data indicate that there are sections of the stream which have diel depressions of dissolved oxygen and may not meet these stream standards. Studies are currently underway to

Table 4 Designated Use Impairment Conventional Pollutants

Intensity of Designated Use Impairment	Water Quality Information	Biological Information	Direct Observation/Professional Judgement
FULLY SUPPORTING: Designated uses are not measurably impaired due to water quality.	The water quality standard is exceeded in not more than 10% of the analyses and the mean measured value is less than the standard.	The designated uses of the water body are not impaired due to water quality, and data indicate full supporting of aquatic life, including survival, propagation, production, dispersion, community structure, species diversity within the limits of the physical habitat.	The water body is being used as designated, based on observation, and professional judgement indicates no reason why it should not be.
WATER QUALITY LIMITED, ALLOCATED (WQLA): Designated uses not measurably impaired due to water quality, but the assimilative capacity of the segment has been allocated. If additional growth occurs in the areas served by the current treatment facilities or an additional wastewater plant will discharge to the same more restrictive limits will be required for some or all dischargers.	The water quality standard is exceeded in 10-15% of the analyses and the mean measured value is less than the standard and the dischargers are all meeting their permit limits for conventional pollutants.	The designated uses of the water body are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life including survival, propagation, production, dispersion, community structure and/or species diversity.	Water quality based effluent limits, which may include an approved wasteload allocation, are in effect on the segment.
WATER QUALITY LIMITED: (WQL) Designated uses not measurably impaired due to water quality but assessment information or segment specified water quality based controls indicate the potential for impairment of the designated uses in the near future.	The water quality standard is exceeded in 10-15% of the analyses and the mean measured value is less than the standard or data indicate a trend of deteriorating water quality which could impair uses(s).	The designated uses of the water body are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life including survival, propagation, production, dispersion, community structure and/or species diversity.	The segment has been identified as in need of study through a 208 plan, a site application process, or a State permitting process; OR population or industrial siting increases indicate a probable downward trend in water quality which may lead to impairment of uses in the absence of additional management.

Table 4 Designated Use Impairment Toxic Pollutants (Continued)

Intensity of Designated Use Impairment	Water Quality Information	Biological Information	Direct Observation/Professional Judgement
PARTIAL SUPPORT: Some interference with designated uses, but use is not precluded.	The standard is exceed in 15-25% of the analyses and the mean measured value is less than the standard; OR the standard is exceeded in not more than 15% of the analyses and the mean measured value exceeds the standard.	The designated uses of the water body are present, but it is uncertain that these are at attainable levels, or some impact on the uses has been noted.	The use exists in the water body based on observation, but professional judgement, which may be based on limited data, indicates that the uses in not fully supported
NOT SUPPORTING: Designated uses measurably impaired because of water pollution. Use may be present but at significantly reduced levels from full support in all or some portion of the water body.	The standard is exceeded in more than 25% of analyses and mean measured value is less than the standard; OR the standard is exceeded in more than 15% of analyses and mean measured value exceeds the standards.	There is some certainty that the water body can not be fully used as designated because the survival, propagation, production dispersion, community structure, or species diversity of aquatic life is impaired.	No evidence exists that the entire water body can be used as designated; or known or suspected water quality impacts prevent anything but minimal use of all or a major portion of the water body.
FULLY SUPPORTING: Designated uses are not measurably impaired due to water quality.	An acute water quality standard is exceeded in not more than one sample in the previous three year period and the mean of all the samples is less than the chronic standard.	The designated uses of the waterbody are not impaired due to water quality, and data indicate full support of aquatic life use, including survival, propagation, dispersion, community structure, and/or species diversity within the limits of the physical habitat.	The water body is being as designated, based on observation and professional judgement indicates no reason why it should not be.
WATER QUALITY LIMITED, ALLOCATED (WQL): Designated uses not measurably impaired due to water quality, but the assimilative capacity of the segment has been allocated. If additional growth occurs in the areas served by the current treatment facilities or and additional wastewater plant will discharge to the same more restrictive limits will be required for some or all dischargers.	A chronic water quality is exceed in two or more samples in the past three years, but acute standard exceeded more than once in the last three years, the mean is less than the chronic standard, and all dischargers are meeting the limits specified in their permits.	The designated uses of the waterbody are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life use including survival, propagation, dispersion, community structure and/or species diversity.	Water quality based effluent limits, which may include an approved wasteload allocations, are in effect on the segment.

Table 4 **Designated Use Impairment Toxic Pollutants** (Continued)

Intensity of Designated Use Impairment	Water Quality Information	Biological Information	Direct Observation/Professional Judgement
WATER QUALITY LIMITED (WQL): Designated uses not measurably impaired due to water quality, but assessment information or segment specific water quality based controls indicate the potential for impairment of the designated uses in the near future.	A chronic water quality standard is exceeded in two or more samples in the past three years, but an acute water quality standard is not exceeded more than once in the same period, and the mean is less than the chronic standard OR the data indicate a downward trend toward deteriorations in water quality which could impair uses(s).	The designated uses of the waterbody are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life use including survival, propagation, dispersion, community structure and/or species diversity.	The segment has been identified as in need of study through a 208 plan, a site application process, or a State permitting process; OR population or industrial siting increases indicate a probable downward trend in water quality which may lead to impairment of uses int he absence of additional management.
PARTIAL SUPPORT: Some interference with designated uses, but use is not precluded.	An acute water quality standard is exceeded in two or more samples in the past three years, but the mean measured value is less than the chronic standard.	The designated uses of the waterbody are present, but it is uncertain that these are at attainable levels, or at least some impact on the uses has been noted.	The use exists in the waterbody based on observation, but professional judgement, which may be based on limited data, indicates that the use is not fully supported.
NOT SUPPORTING: Designated uses measurably impaired because of water pollution. Use may be present but at significantly reduced levels from full support in all or some portion of the waterbody.	An acute water quality standard is exceeded in two or more samples in the previous three years and the mean measured value is above the chronic standard.	There is some certainty that the waterbody can not be fully used as designated because the survival, propagation, production, dispersion community structure, or species diversity of aquatic life is impaired.	No evidence exists that the entire waterbody can be used as designated; or known or suspected water quality impacts prevent anything but minimal use of all or a major portion of the waterbody.

establish the basis for a revised dissolved oxygen standard which considers the diel fluctuations. Studies are also underway to identify the specific causes of depressed dissolved oxygen and develop appropriate solutions to meet the standards.

Un-ionized Ammonia - In the recent past several streams in the Platte basin which receive municipal effluent periodically exceeded the un-ionized ammonia standard. The magnitude of these exceedances ranged from small to large. The South Platte (Segments 14 and 15); and St. Vrain (Segment 3) occasionally exceeded the standard. Recent implementation of advanced secondary wastewater treatment at the Metro Wastewater Reclamation District (Metro) has significantly reduced ammonia nitrogen discharges. Ammonia removal has been incorporated into Longmont's permit which is expected to eliminate un-ionized ammonia violations in Segment 3 of the St. Vrain River and nitrification at Englewood-Littleton is expected to prevent future un-ionized ammonia violations in Segment 14 of the South Platte. Other municipal wastewater facilities in the South Platte Basin that are being evaluated for effluent ammonia reduction are shown in Table 5.

Monitoring at the station on Segment 10 of Boulder Creek (COSPBO10), located at the Boulder-Weld County line, indicates that this stream is severely impacted by un-ionized ammonia. An aquatic life survey conducted by consultants to the City of Boulder showed decreased abundance and diversity of aquatic organisms in parts of Segments 9 (COSPBO09) and 10, due primarily to the destruction of riparian zones by historic land use practices in this area. The quality violations are most likely to occur in late winter-early spring, and mid-fall periods. The station evaluated on Boulder Creek is below the confluence with Coal Creek. Investigations by the WQCD, the City of Boulder, and the cities of Lafayette, Louisville, and Erie have shown periodic exceedances of the un-ionized ammonia standard both above and below the confluence of Boulder Creek and Coal Creek, due to environmental factors and flow conditions. The Water Quality Control Commission deleted the un-ionized ammonia standard for Coal Creek in 1986 based on the limited ability of the stream to support aquatic life. Effluent limits are required of Coal Creek dischargers to protect Boulder Creek.

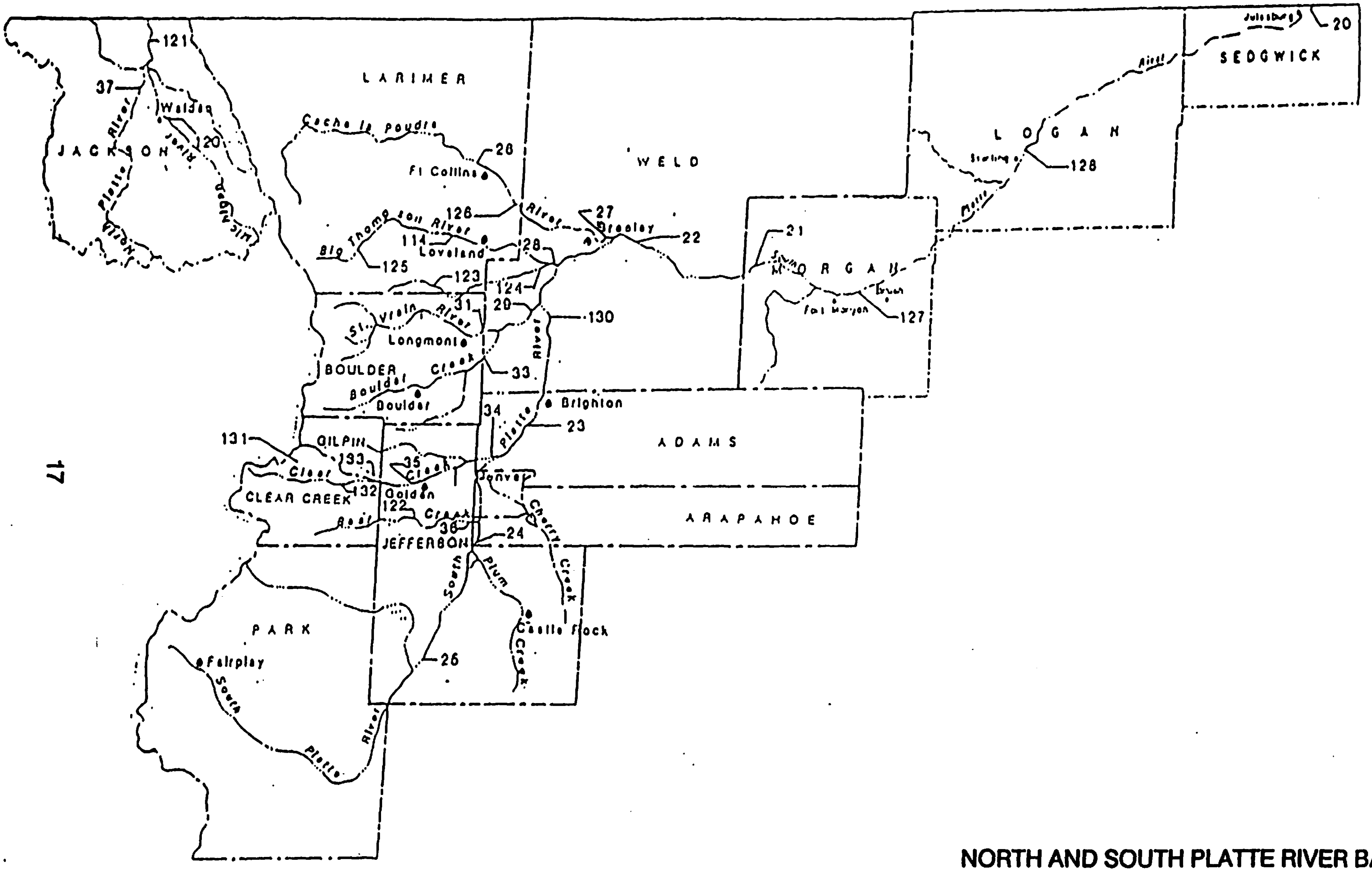
Total maximum daily loads and a wasteload allocation plan have not been found to be necessary for the Boulder Creek drainage basin at the present time. The need for such plans may be revisited at a future date. The City of Boulder, in cooperation with the Colorado Department of Public Health and Environment, has instituted a stream restoration project over the past three years to test the use of channel improvements in reducing nonpoint source degradation of water quality.

The City of Boulder has begun a stream and riparian corridor restoration program on Boulder Creek. This program is designed to improve water quality conditions in the stream. Improving temperature and pH conditions in the stream will help reduce the toxicity problems caused by wastewater effluent discharges in the stream.

The Coal Creek/Boulder Creek studies have documented significant diel as well as seasonal variations in temperature, pH, and nitrification rates (conversion of ammonia to nitrate), all of which affect the un-ionized ammonia concentrations in Boulder Creek.

Metals - Table 6 shows stream segments significantly exceeding metal standards in the Platte Basin. Clear Creek from Idaho Springs to the South Platte and its tributary, the North Fork, have the most significant problem in meeting metals standards. Principal sources of metals include the Argo drainage tunnel at Idaho Springs and mine and mill wastes and drainage from the Central City mining district. Several other small tributaries in the Platte drainage have also been documented as affected by previous mining activities. These segments were discussed in the previous Water Quality Status Reports and their status remains unchanged.

Figure 2



NORTH AND SOUTH PLATTE RIVER BASIN

Table 5
Dischargers with Water Quality Limited Effluent Requirements

South Platte Basin

Ammonia Limits			
Facility	Design Capacity MGD	Sub-Basin	Limited Segment
Centennial	0.5	South Platte	6
Englewood - Littleton	32.0	South Platte	14
Denver Metro	185.0	South Platte	15
Glendale	2.0	Cherry Creek	3
Evergreen	1.0	Bear Creek	1.1
West Jefferson	0.6	Bear Creek	1a
Kittredge	0.1	Bear Creek	1a
Genessee	0.4	Bear Creek	1a
Morrison	0.2	Bear Creek	1b
Clear Creek Valley	2.6	Clear Creek	15
Boulder	16.0	Boulder Creek	9, 10
Lousiville	1.0	Boulder Creek	10
Lafayette	1.0	Boulder Creek	10
Erie	0.1	Boulder Creek	10
Longmont	8.2	St. Vrain Creek	3
St. Vrain S.D.	0.5	St. Vrain Creek	3
Loveland	8.0	Big Thompson River	4
Ft. Collins #1	7.0	Cache La Poudre	11
Ft. Collins #2	21.0	Cache La Poudre	11
Boxelder S. D.	1.5	Cache La Poudre	11
Windsor	1.5	Cache La Poudre	12
Kodak	1.2	Cache La Poudre	12
Great Western Sugar	0.8	Cache La Poudre	12
Greeley	12.0	Cache La Poudre	12

Table 5 (continued)

Facility	Design Capacity MGD	Sub-Basin	Limited Segment
Phosphorus Limits			
Plum Creek Waste Water Authority	2.3	South Platte	6
Larkspur	0.4	South Platte	6
Louviers	0.04	South Platte	6
Perry Park	0.3	South Platte	6
Roxborough Park	0.6	South Platte	2
Martin Marietta	0.6	South Platte	6
Arapahoe W & S	0.4	Cherry Creek	2
Cottonwood W & S	0.3	Cherry Creek	2
Inverness W & S	0.9	Cherry Creek	2
Meridian W & S	1.2	Cherry Creek	2
Parker W & S	2.0	Cherry Creek	2
Denver SE Suburban W & S	0.6	Cherry Creek	2
Metals AWT			
Amax	1.5	Clear Creek	5
Amax	1.5	Clear Creek	7
Coors	13.0	Clear Creek	14
Cotter Corp	0.6	Clear Creek	17
Organics Reduction			
Conoco	0.5	South Platte	16

Table 6 Designated Use Impairment Platte River Basin

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[19]	Criteria[20]	Constituent(s)
COSPUS01A 3/1a	Mainstem of S. Platte above North Fork confluence	E E	Partially Supporting Slight	N N	Metals Sediment
COSPUS02A 3/2a	South Platte tribs to below Tarryall Creek	E	Slight	N	Sediment
COSPUS02B 3/2b	Mosquito Creek source/Middle Fork	M	Not Supporting	N	CU, Zn, Pb
COSPUS02C 3/2c	S. Mosquito Creek source/Mosquito Creek	E	Not Supporting	N	Zn, Cd, Fe
COSPUS04 3/4	North Fork S. Platte, source/S. Platte	E	Not Supporting	N	CU, Mn
COSPUS05A 3/5a	Geneva Creek above Scott Gomer Creek	E	Partially Supporting	N	Metals
COSPUS06L2 3/6b	Chatfield Reservoir	E M	Partially Supporting WQLA	N J	Nutrients Phosphorus
COSPUS010A 3/10	Plum Creek Above Chatfield	E	WQLA	J	Un-ionized Ammonia
COSPUS14 3/14	South Platte, Bowles/Burlington Ditch	M	WQLA	J	Un-ionized Ammonia
COSPUS15 3/15	South Platte, Burlington Ditch/Big Dry Creek	M M	WQLA WQLA	Q Q	Un-ionized Ammonia Dissolved Oxygen
COSPUS16 3/16	South Platte tribs, Chatfield/Big Dry Creek	M M	Slight	N B	Toxicity W.E.T.
COSPUS16L1 3/16	Mary Lake	M	Partially Supporting	B	Toxics

Table 6 Designated Use Impairment Platte River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[19]	Criteria[20]	Constituent(s)
COSPUS16L2 3/16	Ladora Lake	M	Partially Supporting	B	Toxics
COSPUS16L3 3/16	Derby Lake	M	Partially Supporting	B	Toxics
COSPCH01 3/1	Cherry Creek above Reservoir	E	WQLA	J	Un-ionized Ammonia
COSPCH02 3/2	Cherry Creek Reservoir	E M	Partially Supporting WQLA	N J	Nutrients Phosphorus
COSPCH03 3/3	Cherry Creek Below Reservoir	M M	Partially Supporting WQLA	N,Q,J J	Fecals NH3, DO
COSPBE01A 3/1a	Bear Creek above Harriman Ditch	E	WQLA	J	Un-ionized Ammonia
COSPBE01B 3/1b	Bear Creek, Harriman D/Bear Creek Reservoir	E	WQLA	J	Un-ionized Ammonia
COSPBE1C	Bear Creek Reservoir	E E M M	Partially Supporting Partially Supporting WQL WQLA Partially Supporting	N N B J Q	Metals Ammonia Phosphorous Phosphorous Dissolved Oxygen
COSPBE04a 34A	Bear Creek Tribs	E E	WQLA WQLA	N J	Metals Un-ionized Ammonia
COSPCL02 3/2	Clear Creek, I-70 bridge/Argo Tunnel	E	Partially Supporting	N	Metals
COSPCL03b 3/3b	Leavenworth Creek, Source/Clear Creek	E	Partially Supporting	N	Metals
COSPCL05 3/5	West Clear Creek, Woods Creek/Clear Creek	E	Not Supporting	N	Metals

Table 6 Designated Use Impairment Platte River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[19]	Criteria[20]	Constituent(s)
COSPCL07 3/7	Woods Creek	E	Not Supporting	B,J	Metals
COSPCL08 3/8	Lion Creek above West Clear Creek	E	Not Supporting	N	Metals
COSPCL09 3/9	Fall River and Tributaries	E	Not Supporting	N	Metals
COSPCL11 3/1	Clear Creek, Argo Tunnel/FHC	M	Not Supporting	N Q	Metals Metals
COSPCL13 3/13	North Fork Clear Creek	M	Not Supporting	Q,N	Metals
COSPCL14 3/14	Clear Creek, FHC/Youngfield	M	WQL	B	Metals
COSPCL15 3/15	Clear Creek, Youngfield/S. Platte	M	WQLA	J	Un-ionized Ammonia
COSPCL17 3/17	Ralston Creek Above Arvada Reservoir	E	WQL WQLA	N J	Metals
COSPBO09 3/9	Boulder Creek South Boulder Creek/Coal Creek	M	Partially Supporting	B,Q	Un-ionized Ammonia
COSPBO10 3/10	Boulder Creek, Coal Creek/ Saint Vrain	M	Partially Supporting	Q	Un-ionized Ammonia
COSPSV03 3/3	Saint Vrain Longmont/S. Platte	M	WQLA	J	Un-ionized Ammonia
COSPSV04 3/4	Left Hand Creek	E	Not Supporting	N	Metals
COSBT05 2/5	Big Thompson I-25/South Platte	M	WQLA	J	Metals

Table 6 Designated Use Impairment Platte River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[19]	Criteria[20]	Constituent(s)
COSPBT09 2/9	Little Thompson Culver D/Big Thompson	E	Partially Supporting	Q	Fecals
COSPSV04 3/4	Left Hand Creek above highway 36	E	Not Supporting	M	Metals
COSBT05 2/5	Big Thompson I/25 South Platte	M	WQLA	J	Un-Ionized Ammonia
COSPSV04 3/4	Left Hand Creek above Highway 36	E	Not Supporting	N	Metals
COSBT05 2/5	Big Thompson I/25/South Platte	M	WQLA	J	Metals
COSPBT09 2/9	Little Thompson Culver D/Big Thompson	M	Not Supporting	Q	Fecals Iron
COSPCP11 2/11	Cache La Poudre, Shields/Box Elder Creek	M	WQLA	J	Un-Ionized Ammonia
COSPCP12 2/12	Cache La Poudre, Box Elder	M	WQLA	J	Un-Ionized Ammonia

[19] For more information see Table 4.

[20] Q indicates chemical or microbiological water quality data, B indicates biological information, J indicates direct observation or professional judgement, N indicates reported in Colorado Nonpoint Assessment Report (See Table 4).

Nutrients - The highest concentrations of nitrate nitrogen in segment 15 of the South Platte River basin occur some distance downstream of the Metro Wastewater Reclamation District's discharge. Recent implementation of partial nitrification and denitrification at the metro facility has resulted in increases in nitrate nitrogen in the river, however, there have been no cases where the drinking water standard of 10 mg/l for nitrate has been exceeded. Stream modelling for the segment confirms that standards will not be exceeded.

Nitrate can be removed from the river by its application to agricultural land. However, much of the nitrate in the river water, elevated by agriculturally applied nitrates, can seep into the shallow aquifers and cause elevated nitrates in farm and domestic wells. It is believed the major portion if the nitrate contaminants in such wells originates from nitrogen fertilizers applied by the agricultural community.

Arkansas Basin Water Quality Summary

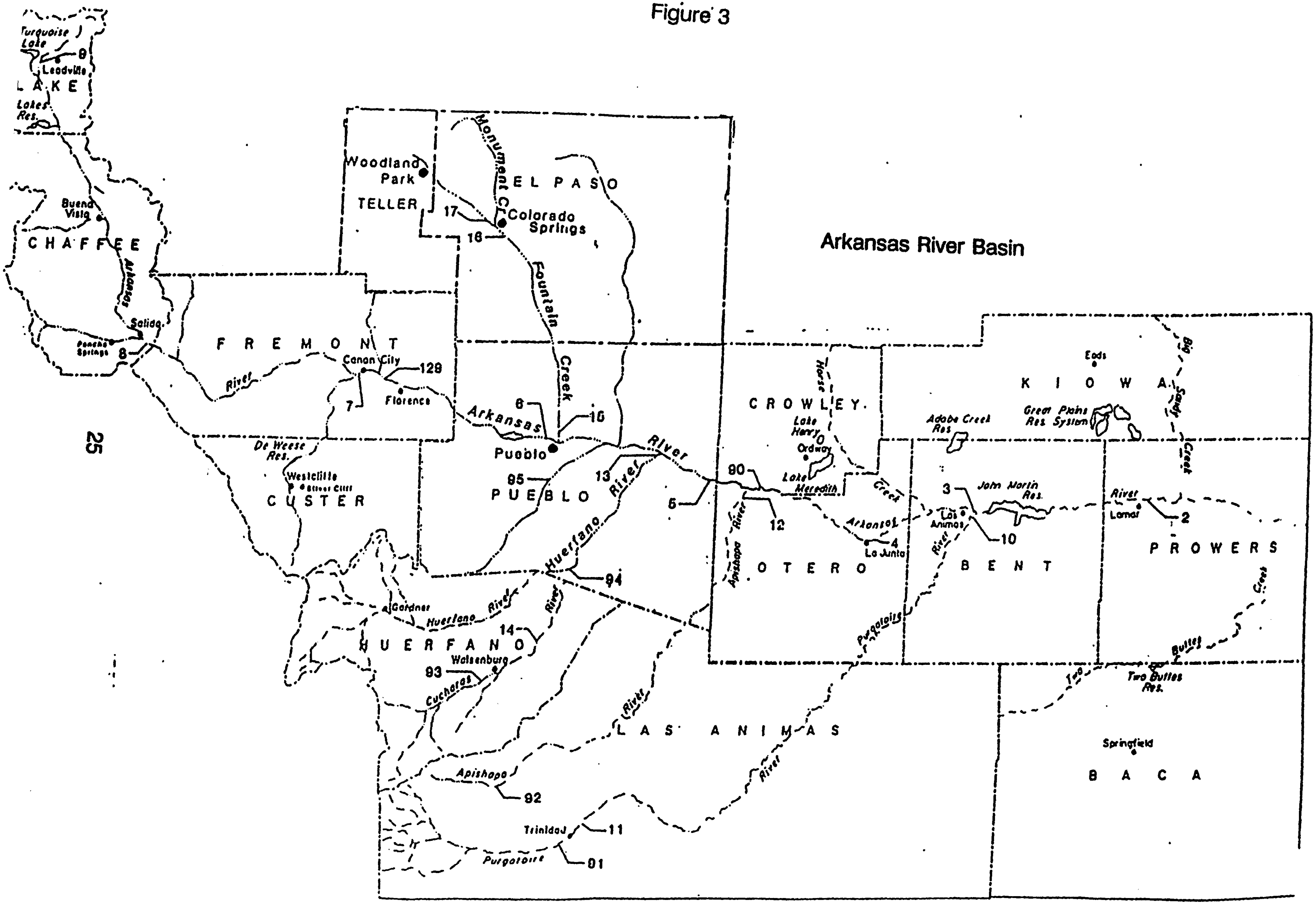
Water quality in the Arkansas River Basin is reflective of early mining activity in the Leadville area, burgeoning population in the middle basin, especially the Fountain Creek sub-basin, and agriculture in the lower basin. Sixteen routine water quality monitoring stations and several special studies conducted by the WDCD and other agencies were analyzed during this reporting period, Figure 3.

Metals - Metals problems related to previous mining activities in the Arkansas River basin have been well documented. Extensive mining which occurred in the Leadville area has eliminated or drastically reduced aquatic life in several of the headwater streams of the Arkansas, including the East Fork, California Gulch, Iowa Gulch, St. Kevins Gulch and several other tributary streams. Waters from these tributaries and the Leadville Drain have caused elevated metals concentrations, especially copper, lead, zinc, and cadmium, which are above water quality standards in segments of the Arkansas extending from near Leadville to Pueblo Reservoir. See Table 7.

Discharges from all current mining and milling operators in the Leadville mining district are meeting water quality based effluent limits or BAT. Cleanup of California Gulch was pursued as a NRDS lawsuit. As part of the settlement, a wastewater treatment plant is on line for YAK Tunnel, the major problem on California Gulch. A treatment plant for the effluent from the Leadville Drain is also on line. Full achievement of water quality standards in the Arkansas River will depend on control of abandoned and/or inactive mine areas as well as continued efforts with current operators.

High metals concentrations were also noted in the headwaters of the Purgatoire and Huerfano rivers. Both have high suspended sediment concentrations, which serves as a carrier for particulate metals. High copper and zinc concentrations near Colorado Springs in Fountain Creek, Segment 1, may be attributed to an inactive gold mill and tailings located on Fountain Creek just above its confluence with Monument Creek.

Figure 3



Arkansas River Basin

Table 7 Designated Use Impairment Arkansas River Basin

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[21]	Criteria[22]	Constituent(s)
COARUA02A 13/2a	East Fork Arkansas River Leadville/California Gulch	E	Not Supporting	N	Metals
COARUA02B 13/2b	East Fork Arkansas River California/Lake Fork	E	Not Supporting	N	Metals
COARUA02C 13/2c	Arkansas River, Lake Fork/Lake Creek	M	Partially Supporting	N	Metals
COARUA03 13/3	Arkansas River, Lake Creek/Canon City	M	Not Supporting Not Supporting	N Q	Metals Metals
COARUA04 13/4	Arkansas River, Canon City/Pueblo Reservoir	M	WQL WQL	N Q	Metals Metals
COARUA05 13/5	Arkansas River tribs above Browns Creek	M	Not Supporting	N	Metals
COARUA06 13/6	California Gulch & St. Kevin's Gulch	E	Not Supporting	N	Metals
COARUA09 13/9	Iowa Gulch Paddock #1 Ditch/Arkansas River	E	Partially Supporting	N	Metals
COARUA11 13/11	South Fork Lake Creek	E	Not Supporting	N	Metals
COARUA13 13/13	Arkansas River tributaries Brown's Creek/Pueblo Reservoir	E	WQL	N	Metals
COARUA14 13/14	Arkansas River tributaries Brown's Creek/Pueblo Reservoir	E	WQL	N	Metals

Table 7 Designated Use Impairment Arkansas River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[21]	Criteria[22]	Constituent(s)
COARUA14L1 13/14	Teller Reservoir	M	Partially Supporting	Q	Mercury
COARUA15 13/15	Grape Creek above DeWeese outlet	E	WQL WQL WQL	N N N	Metals Sediment Nutrient
COARUA20 13/20	Fourmile Creek and other Tributaries	E	Partially Supporting	N	Metals
COARUA23 13/23	Wilson Creek above Fourmile Creek	E	WQL WQLA	N	Metals Un-ionized Ammonia
COARMA06 7/6	St. Charles River tributaries	E	WQL	N	Metals
COARMA08 7/8	St. Charles River, Comanche/Arkansas	E	WQL	N	Salinity
COARMA15 7/15	Huerfano River below Muddy Creek	E	WQL	N	Salinity, Sediment
COARMA17 7/17	Cucharas River, Walsenburg/Cucharas Reservoir	E	WQL	N	Salinity
COARFO01 4/1	Fountain Creek above Monument Creek	E E	WQL Not Supporting	N J	Metals Metals
COARFO02 4/2	Fountain Creek Monument Creek/Arkansas River	M	Not Supporting	N	Sediment
COARFO07 4/7	Monument Creek Monument Lake/Fountain Creek	M M	WQLA WQLA	J J	Nitrate Un-ionized Ammonia

Table 7 Designated Use Impairment Arkansas River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[21]	Criteria[22]	Constituent(s)
COARLA01 6/1	Arkansas River, Fountain Creek/Stateline	E	Not Supporting Not Supporting	N[23] N	Sediment Salinity
COARLA02 6/2	Arkansas River Tributaries below Colorado Canal	E	WQL	N	Salinity
COARLA03 6/3	Mainstem Apishipa River above I-25	E	Partially Supporting	N	Salinity
COARLA05A 6/5a	Purgatoire River, Stonewall/I-25	E	Not Supporting	N,J	Metals
COARLA05B 6/5b	Trinidad Reservoir	E E	WQL WQL	N N	Metals Sediment
COARLA07 6/7	Purgatoire River I-25/Arkansas River	E E M	Partially Supporting Partially Supporting WQLA	N J J	Sediment Metals Un-ionized Ammonia

21 For more information see Table 4.

22 Q indicates chemical or microbiological water quality data, B indicates biological information, J indicates direct observation or professional or professional judgement, N indicates reported in Colorado Nonpoint Assessment Report (See Table 5).

23 The sediment problem is first detected by monitoring data as total recoverable iron, a good indicator of sediment, at the Nepesta sampling station. The total recoverable iron increases in a downstream direction to John Martin Reservoir. The salinity is also first detected increasing at the Nepesta gaging station is caused by non-point sources, including agricultural return flows. The salinity also increases in a downstream direction.

Nutrients - The highest nutrient concentrations for both nitrates and phosphates are found in Fountain Creek below the Colorado Springs wastewater treatment plant. Flow in this stream is dominated by municipal effluent. As in the case of the South Platte, the primary source of these nutrients is municipal wastewater effluent.

As in the Platte River basin, agriculture does not appear to be a significant contributor of nutrients. A detailed analysis of a small drainage basin near Lamar by Cain (1985) concluded that dissolved nitrite plus nitrate was less concentrated in water leaving the area than in applied water, suggesting removal during irrigation or plant growth.

Upper Colorado River Basin Water Quality Summary

Overall, the quality of water in the Colorado River mainstem (Figure 4) and its principal tributaries is probably the best in the state. This quality has been maintained by the investment of considerable manpower and fiscal resources into the basin since the early 1970s. Since much of the region's economy depends on outdoor recreation and water based activities such as fishing, white water boating, flat water boating, camping, and hiking it is a priority area for the state's water quality program. Planned energy development during the 1970s posed an additional threat to the quality of the basin's water due to additional growth and the extractive processes themselves. Low energy prices during the 1980s dampened much of the growth leaving many communities with excess wastewater treatment plant capacities, which allows better treatment than would normally occur at these treatment plants.

Dissolved Oxygen - During the 1987-1991 evaluation period there were no dissolved oxygen problems noted in the mainstem or its tributaries. Dissolved oxygen is not likely to be a problem in the foreseeable future because wasteloads are small in relation to receiving water capacity. Shallow, rapidly moving streams typical of the basin tend to reaerate well, thus further minimizing the potential for problems.

Un-ionized Ammonia - Most streams in the region are classified to protect cold water aquatic life, thus they have stringent un-ionized ammonia standards (0.02 mg/l). The un-ionized fraction of ammonia depends in a large part on stream pH, and streams in the Colorado River basin tend to have higher pH values than streams in other basins in the State. These two factors combined (high pH and strict standards), have resulted in several wastewater facilities being required to provide advanced wastewater treatment (Table 8).

There were no un-ionized ammonia exceedances associated with municipal wastewater in the Upper Colorado River basin between 1987-1991. A uranium mill located on the San Miguel River at Uravan was the subject of NRDS litigation and has moved their leach ponds away from the river, thus a past un-ionized ammonia problem is not expected to recur.

Metals - The water quality of several stream segments in the basin indicates that there may be some degree of impairment to aquatic life due to elevated concentrations of metals. Copper is the most common metal parameter to exceed standards, and much of this is most likely due to natural conditions. Lead, zinc, and cadmium are high on sections of the Eagle, Blue, Slate, Uncompaghre, Crystal, San Miguel, and Dolores rivers (Table 9). The first four of these rivers drain areas that were extensively mined in the late 1800s and early 1900s. Probable sources of the metals have been identified in previous 305(b) reports. NRDS lawsuits have been settled at locations on the Eagle and San Miguel Rivers and Red Mountain Creek (a tributary of the Uncompaghre) and clean-up actions are underway that should dramatically improve the water quality. The quality of the Slate River below Coal Creek continues to be as good or better than in the upper reach. This is due to a wastewater treatment facility constructed and operated by AMAX to remove metals from the inactive Keystone mine which in the past severely degraded both Coal Creek and the Slate River.

Nutrients - Concentrations of nitrate and total phosphorus are exceptionally low on all segments in the basin except Roan Creek, the Uncompaghre River, lower Colorado River and lower Dolores River. It is of interest to compare the ambient concentrations of phosphorus in effluent dominated streams such as Fountain Creek in the Arkansas basin and the South Platte with ambient concentrations in the Colorado River basin. The phosphorus concentration in effluent dominated streams is nearly 100 times greater than in natural streams. The lower Colorado and Uncompaghre Rivers do receive drainage water from irrigation; however, concentrations of total phosphorus are small. Streams with high sediment concentrations have higher phosphorus concentrations, but they do not approach the phosphorus concentration in streams dominated by municipal effluents.

Because of the high quality waters and low phosphorus concentrations, studies have shown that reservoirs such as Dillon may be extremely sensitive to additional phosphorus loading leading to accelerated eutrophication of those water bodies. Special phosphorus standards and a wasteload allocation have been adopted for Dillon Reservoir. The wasteload allocation plan requires that point and nonpoint source loading of phosphorus be controlled. Nonpoint source control of phosphorus may be traded for higher levels of phosphorus in the effluent thus allowing growth in the basin while maintaining phosphorus standard in the reservoir.

Figure 4

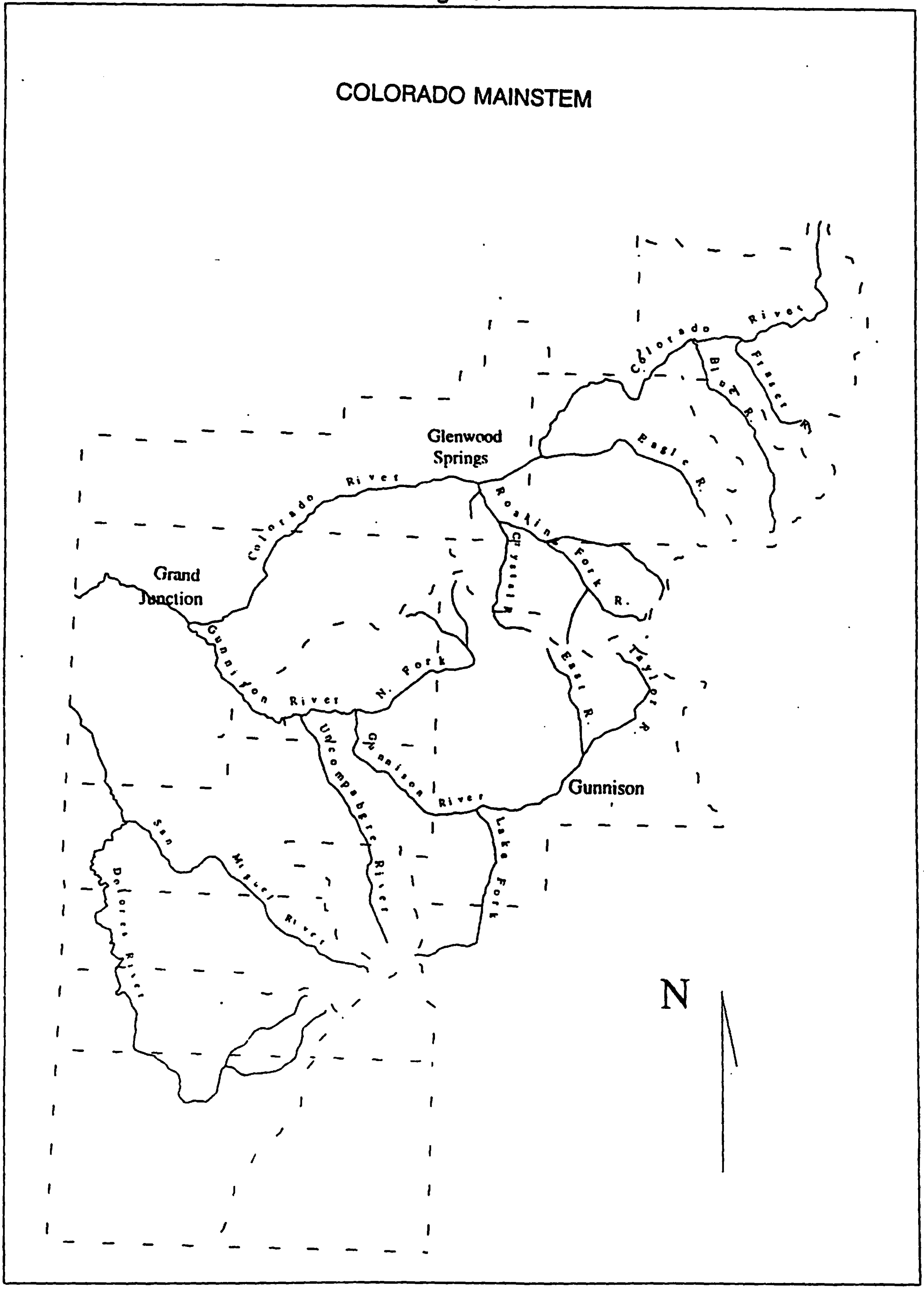

COLORADO MAINSTEM
Colorado River
Blue R.
Fraser R.
Glenwood Springs
Eagle R.
Colorado River
Roaring Fork R.
Crystal R.
Grand Junction
East R.
Taylor R.
Gunnison River
N. Fork
Uncompahgre River
Gunnison River
Gunnison
Lake Fork
San Miguel River
Dolores River
N

Table 8
Dischargers Required to Provide Advanced Wastewater Treatment

Colorado River Basin

Ammonia AWT			
Facility	Design Capacity MGD	Sub-Basin	Limited Segment
Aspen Metro	1.5	Roaring Fork	3
Frisco	0.8	Blue River	2
Granby	0.2	Upper Colo.	10
Upper Eagle	2.0	Eagle	9
Vail	1.6	Eagle	8
Snowmass	1.0	Roaring Fork	4

Phosphorus AWT			
Facility	Design Capacity MGD	Sub-Basin	Limited Segment
Summit County	1.0	Blue River	3
Breckenridge	0.7	Blue River	3
Copper Mountain	2.0	Blue River	3
Frisco	0.8	Blue River	3
Silverthorne	1.5	Blue River	17

Table 9 Designated Use Impairment Upper Colorado River Basin

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[24]	Criteria[25]	Constituent(s)
COGUUG13 10/13	Coal Creek PWS Div/Slate R	E	WQL	N	Metals
COGUUG30 10/30	Lake Fork Gunnison Includes tributaries above Blue Mesa Reservoir	E	Partially Supporting	N	Metals
COGUUG31 10/31	Henson Creek Includes tributaries	E	Partially Supporting	N	Metals
COGUUG32 10/32	Palmetto Gulch	E	Not Supporting	N	Metals
COGUUG33 10/33	North Fork Henson Creek	E	Partially Supporting	N	Metals
COGUNF04 10/4	Anthracite Creek Source/N. Fork Gunnison	E	Not Supporting	Q	Metals
COGUNF05 10/5	Hubbard Creek GMNF/N. Fork Gunnison	E	Not Supporting	Q	Metals
COGUUN02 10/2	Uncompahgre River, Source/Red Mountain Creek	E	Not Supporting	Q	Metals
COGUUN03 10/3	Uncompahgre River, Red Mountain/Hwy. 550	E	Not Supporting	N	Metals
COGUUN04 10/4	Uncompahgre River Hwy. 550/Gunnison River	E	Partially Supporting WQL WQL	N N N	Metals Sediment Salinity
COGUUN06 10/6	Red Mountain Creek	E	Not Supporting	N	Metals
COGUUN09A 10/9a	Canyon Creek above Waterhole Slide	E	Partially Supporting	N	Metals

Table 9 Designated Use Impairment Upper Colorado River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[24]	Criteria[25]	Constituent(s)
COGUL02 10/2	Gunnison River, Uncompahgre/Colorado	E	Not Supporting	N	Sediment
COGULG04 10/4	Gunnison River Tributaries Crystal Reservoir/Colorado River	E E	Not Supporting WQL	N N	Sediment Nutrients
COUCUC04 12/4	Colorado River Tributaries Lake Granby/Roaring Fork	E	Not Supporting WQL	N N	Sediment Salinity
COUCUC05 12/5	Colorado River, State Bridge/Roaring Fork	E	WQL	N	Sediment
COUCUC07A 12/7a	Muddy Creek	E	WQL	Q	Metals
COUCUCO8 12/8	Williams Fork River	E	WQL	Q, N	Metals
COUCUC10 12/10	Fraser River Source/Colorado River	E M	Partially Supporting WQL	N J	Sediment Un-Ionized Ammonia
COUCBL01 12/1	Blue River above Breckenridge WWTP	M	Partially Supporting	N	Metals
COUCBL03L1 12/3	Dillon Reservoir	E M M	WQL WQL WQL	N N N	Sediment Nutrients Phosphorus
COUCBL05 12/5	Soda Creek	E	WQL	N	Sediment
COUCBL06 12/6	Snake River above Dillon Reservoir	M	Partially Supporting Partially Supporting	N Q	Metals Metals
COUCBL07 12/7	Peru Creek above Snake River	M	Not Supporting Not Supporting	N B,J	Metals Metals
COUCBL09 12/9	Deer Creek	E	WQL	N	Metals

Table 9 Designated Use Impairment Upper Colorado River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[24]	Criteria[25]	Constituent(s)
COUCBL11 12/11	French Gulch below Lincoln/Blue River	M	Not Supporting Not Supporting	N N,J,Q,B	Metals
COUCBL17L 12/17	Green Mountain Reservoir	E	WQL	N	Nutrients
COUCBL18 12/18	Blue River Tributaries below Green Mountain	E	Partially Supporting Partially Supporting	N N	Sediment Nutrients
COUCEA02 12/2	Eagle River, Source/Belden	M	Not Supporting Not Supporting	N Q	Metals Metals
COUCEA05 12/5	Eagle River, Belden/Gore Creek	M	WQL WQL	N N	Metals Sediment
COUCEA06 12/6	Eagle River Tributaries Belden to Lake Creek	M	WQL	Q	Metals
COUCEA07 12/7	Cross Creek Source/Eagle river	M	Not Supporting Not Supporting	N Q	Metals Metals
COUCEA08 12/8	Gore Cree, Black Gore, Eagle River	M	WQL WQL	Q J	Metals Un-Ionized Ammonia
COUCEA09 12/9	Eagle River, Gore Creek/ Colorado River	M	Partially Supporting WQLA	Q J	Metals Un-Ionized Ammonia
COUCRF03 12/3	Roaring Fork Hunter Creek/Colorado River	M	WQL WQLA	N J	Sediment Un-Ionized Ammonia
COUCRF08 12/8	Crystal River Source/Roaring Fork	M	WQL	N	Sediment
COLCLC01 11/1	Colorado River, Roaring Fork/Parachute	E	WQL	N	Sediment

Table 9 Designated Use Impairment Upper Colorado River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[24]	Criteria[25]	Constituent(s)
COLCLC02 11/2	Colorado River, Parachute Creek/Gunnison River	M	WQL	N	Sediment
COLCLC03 11/3	Colorado River, Gunnison River Stateline	M	Partially Supporting WQL	N	Sediment Nutrients
COLCLC10 11/10	Roan Creek E	E	Partially Supporting	N	Metals
COLCLC13 11/13	Colorado River Tributaries Parachute Creek/Stateline	E	Not Supporting WQL WQLA	N N N	Sediments Nutrients Salinity

[24] For more information see Table 4.

[25] Q indicates chemical or microbiological water quality data, B indicates biological information, J indicates direct observation or professional judgement, N indicates reported in Colorado Nonpoint Assessment report. See Table 4.

Green River Basin Water Quality Summary

Water quality in the Yampa and White Rivers (Figure 5) and their tributaries met all water quality standards from 1987-1991. No problems were identified which relate to municipal wastewater, i.e., un-ionized ammonia, dissolved oxygen, or fecal coliforms. Dischargers with water quality based effluent limits are listed in Table 10. In the Stagecoach Reservoir and in the Yampa River immediately below the reservoir, dissolved oxygen problems were observed. These problems were caused by flooding a nutrient rich valley.

Nutrients - Nitrate and phosphate concentrations in the basin are generally low, reflecting the insignificance of municipal discharges on waters of the basin. Slightly higher phosphorus concentrations are associated with higher sediment loads in the arid portion of the basin. Table 11 details water quality problems in this basin.

Table 10
Dischargers in Green River Basin with Water Quality Limited Effluent Requirements

Ammonia Limits				
Facility	Design Capacity MGD	Sub- Basin	Limited Segment	Limited WBID
Steamboat Springs, City of	5.5	Yampa	2a	COUCYA02A
Hayden, Town of	0.8	Yampa	2a	COUCYA02A
Yampa, Town of	0.1	Yampa	2a	COUCYA02A
Oak Creek, Town of	0.8	Yampa	7	COUCYA07

Figure 5

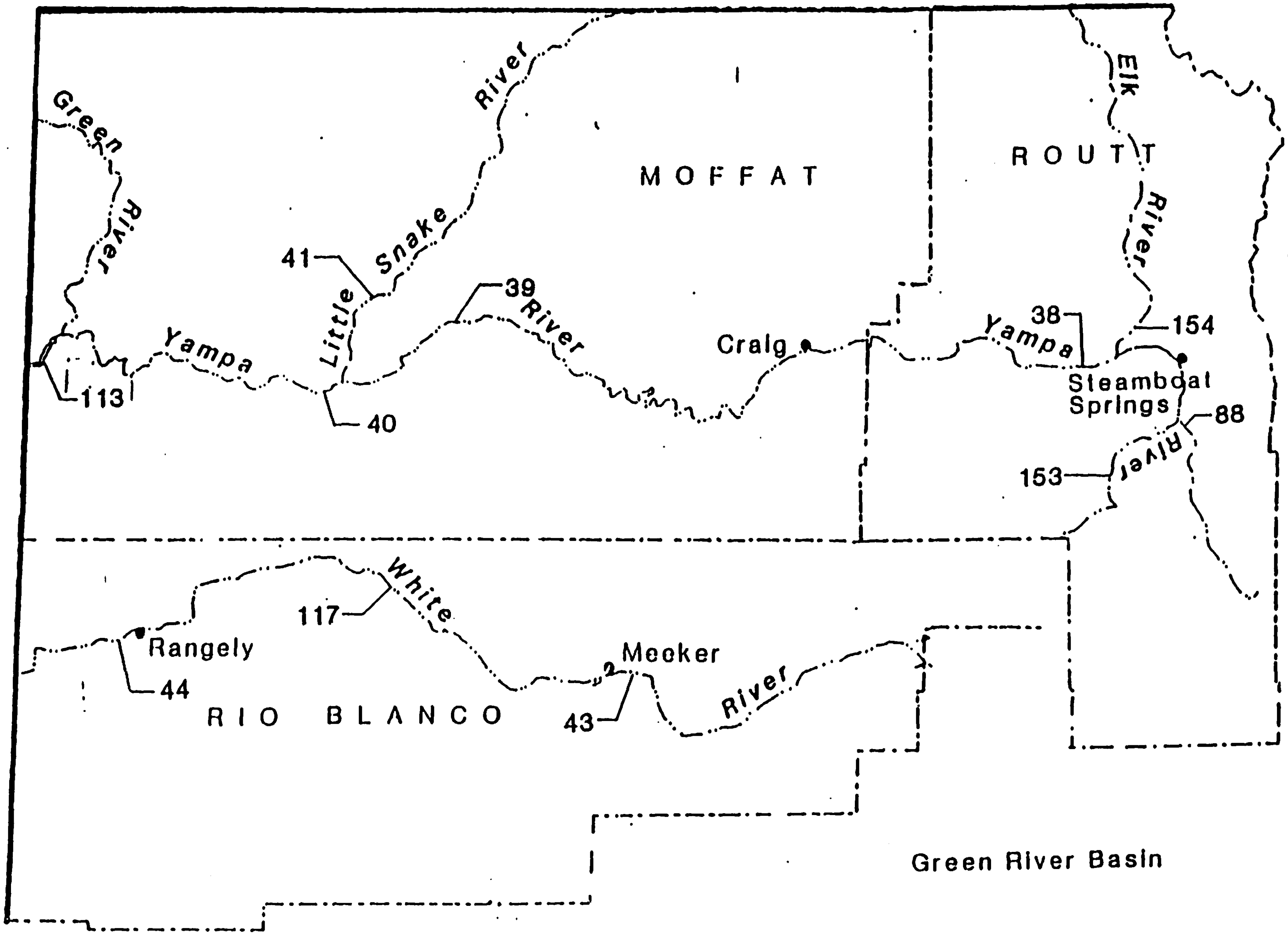

Green River
Little Snake River
MOFFAT
ROUTT
Elk River
41
39
River
Yampa
Little
Craig
38
154
Yampa
113
40
Steamboat
Springs
88
River
153
White
117
Rangely
Meeker
2
44
RIO BLANCO
43
River
Green River Basin

Table 11 Designated Use Impairment Green River Basin

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[27]	Criteria[28]	Constituent(s)
COUCYA02A 12/2A	Yampa River above Elkhead Creek	M	WQL WQL WQLA Not Supporting	N N N Q	Metals Sediment Un-Ionized Ammonia Dissolved Oxygen
COUCYA02BL 12/2B	Stagecoach Reservoir	M	Partially Supporting	B,Q	Dissolved Oxygen
COUCYA07 12/7	Oak Creek below Oak Creek WWTP Discharge	M	WQLA	J	Un-Ionized Ammonia
COUCYA08 12/8	Yampa River tribs Elk River/Elkhead Creek	E	WQL	N	Metals
COUCYA13A 12/13a	Trout Creek, Source/Yampa River	E	WQL	N	Metals
COUCYA13B 12/13b	Foidel Creek & Fish Creek	E	WQL	N	Metals
COLCLY02 11/2	Yampa River, Lay Creek/Green River	M	WQL WQL WQL	N N N	Sediment Metals Nutrients
COLCLY03B 11/3b	Named tributaries to Yampa River	E	Partially Supporting	N	Metals

Table 11 Designated Use Impairment Green River Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[27]	Criteria[28]	Constituent(s)
COLCLY16 11/16	Little Snake River, Powder Wash/Yampa River	E	Partially Supporting WQL	N N	Sediment Nutrients
COLCLY19 11/19	Green River in Colorado	E	Partially Supporting	N	Sediment
COLCWH12 11/12	White River, Piceance Creek/ Douglas Creek	E	Not Supporting	N	Sediment
COLCWH13A 11/13a	White River tribs Piceance Creek/Douglas Creek	E	WQL	N	Sediment
COLCWH21 11/21	White River, Douglas Creek/Stateline	E	Not Supporting	N	Sediment
COLCWH22 11/22	White River tribs Douglas Creek/Stateline	E	Not Supporting	N	Sediment

[27] For more information see Table 4.

[28] Q indicates chemical or microbiological water quality data, B indicates biological information, J indicates direct observation or professional judgements (see Table 4).

San Juan River Basin Water Quality Summary

The San Juan (Figure 6) basin has high quality water except for the Animas River in its headwaters near Silverton. Previous mining activities have resulted in high metals loads being contributed to the mainstem and several tributaries which have significantly affected their ability to support aquatic life (Table 12).

Two segments, (2, and 6) (COSJAF02, and COSJAF06) of the Animas River are not classified for aquatic life due to metals contamination of the streams by past mining practices.

Agriculture and tourism are two main components of the Region's current economy. Although there are no water quality impairments due to municipal wastewater, planned recreational developments in the upper reach of the San Juan River and above Electra Lake (Animas Basin) may threaten those water bodies. Nutrient concentrations are low throughout the basin. High suspended solids and total dissolved solids occur on several stream segments.

Figure 6

SAN JUAN BASIN
REGION 9

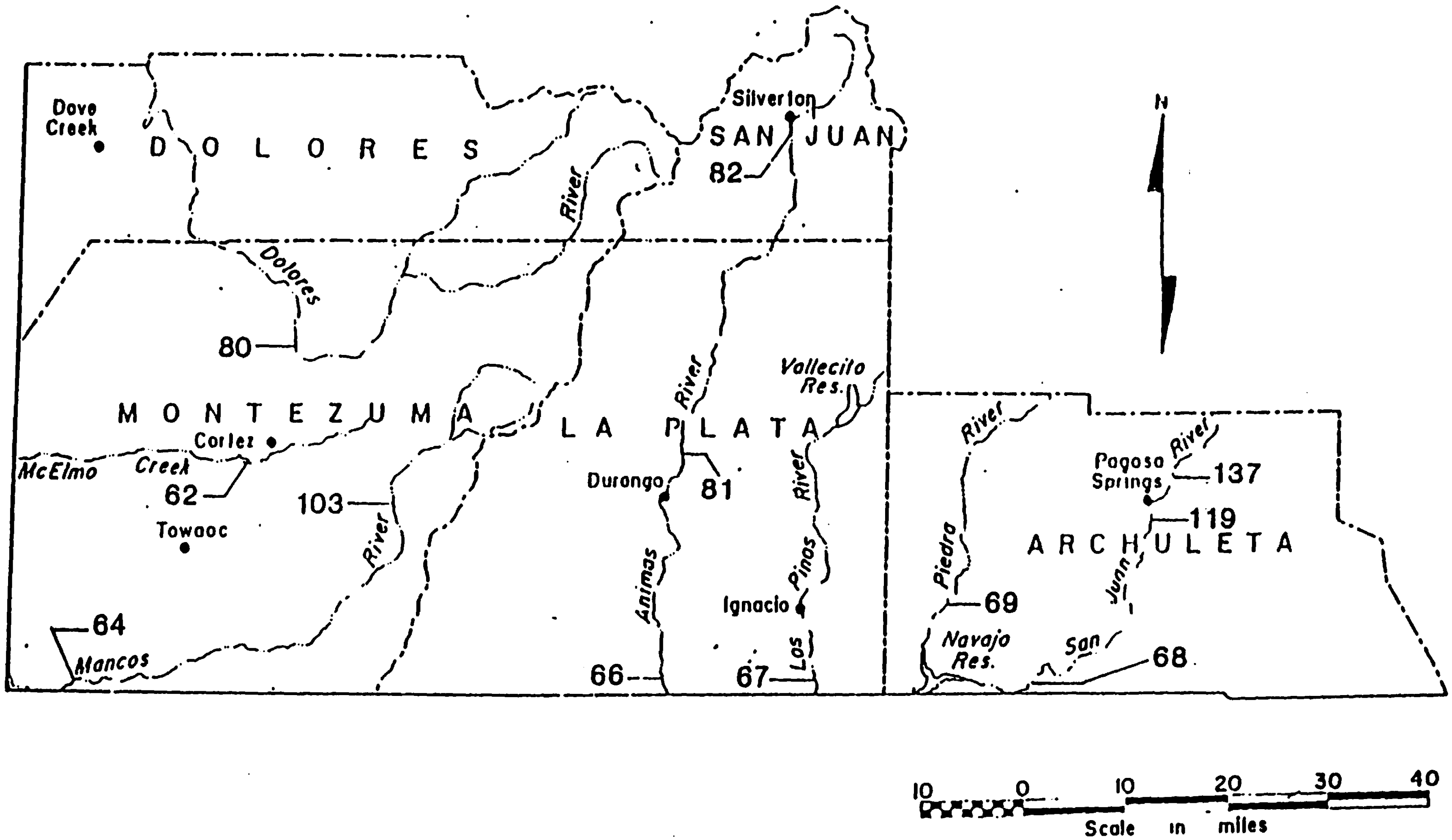


Table 12 Designated Use Impairment San Juan Basin

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[28]	Criteria[29]	Constituent(s)
COSJSJ07L 9/7	Navajo Reservoir (Portion in Colorado)	M	Partially Supporting	B	Mercury
COSJPI04 9/4	Piedra River Indian Creek/Navajo Res.	E	WQL	N	Sediment
COSJPN02B 9/2b	Los Pinos River, Hwy. 160/Stateline	E	WQL	N	Sediment
COSJPN06 9/6	Los Pinos River trib. below Bear Creek	E	Partially Supporting	N	Sediment
COSJAF02 9/2	Animas River source/Elk Creek	E M	Not Supporting Not Supporting	N B	Metals W.E.T.
COSJAF03 9/3	Animas River, Elk Creek/Junction Creek	E	Partially Supporting	N	Metals
COSJAF04 9/4	Animas River Junction Creek/Stateline	E E E	WQL WQL WQL	N N N	Metals Sediment Salinity
COSJAF05 9/5	Animas River tribs above Elk Creek	E	Partially Supporting	N	Metals
COSJAF06 9/6	Cement Creek and tribs	E	Not Supporting	N	Metals
COSJAF07 9/7	Mineral Creek and tribs	E	Not Supporting	N	Metals
COSJAF08A 9/8a	S. Mineral Creek above Clear Creek	E	Not Supporting	N	Metals
COSJAF11 9/11	Florida River below Florida Farmers Ditch	E	WQL	N	Sediment

Table 12 Designated Use Impairment San Juan Basin (Continued)

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[28]	Criteria[29]	Constituent(s)
COSJLP01 9/1	La Plata River above Hay Gulch	E	Partially Supporting	N	Metals
COSJLP05 9/5	Mancos River, Hwy. 160/Stateline	E E	Not Supporting Partially Supporting	N N	Sediment Salinity
COSJLP06 9/6	La Plata River, Hay Gulch/Stateline	E E	WQL WQL	N N	Salinity Sediment
COSJLP07 9/7	McElmo Creek, Source/Stateline	E	Not Supporting	N	Sediment
COSJLP08L1	Narraguinnep Reservoir	M	Partially Supporting	B	Mercury
COSJDO03 9/3	Dolores River, Horse Creek/Bear Creek	E M	Partially Supporting Not Supporting	N B	Metals W.E.T.
COSJDO04 9/4	Dolores River, Bear Creek/Bradfield Ranch	E	WQL	N	Metals
COSJDO04L	McPhee Reservoir	M	Partially Supporting	B	Mercury
COSJDO06 9/6	Slate Creek & Coke Over Creek	E	WQL	N	Metals
COSJDO07 9/7	Coal Creek above Dolores River	E	WQL	N	Metals

[28] For more information See Table 4.

[29] Q indicates chemical or microbiological water quality data, B indicates biological information, J indicates direct observation or professional judgement, N indicates reported in Colorado Nonpoint Assessment Report.

Republican River Basin Water Quality Summary

No water quality problems attributable to point sources have been identified in the Republican River basin, however, the North Fork of the Republican River is partially supporting for coliform bacteria, probably caused by agriculture.

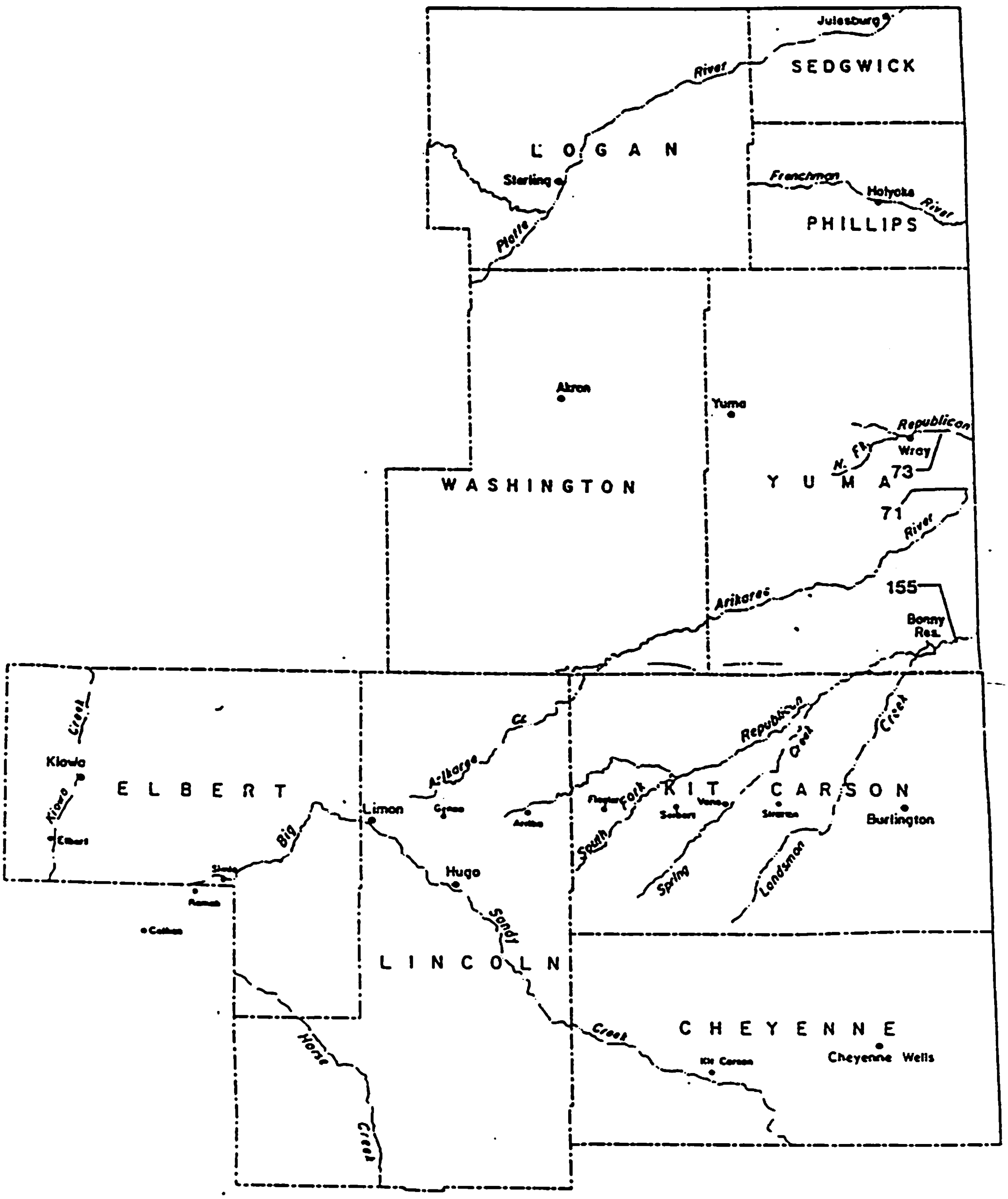
Table 13 Designated Use Impairment Republican River Basin

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status[30]	Criteria[31]	Constituent(s)
COSPRE03 5/3	North Fork Republican River source/stateline	E E M	Partially Supporting Partially Supporting Partially Supporting	N N Q	Nutrients Sediment Fecals

30 For more information see Table 4.

31 Q indicates chemical or microbiological water quality data, B indicates biological information, J indicates direct observation or professional judgement, N indicates reported in Colorado Nonpoint Assessment Report (See Table 4).

Figure 7



Republican River Basin

RIO GRANDE BASIN ASSESSMENT

BACKGROUND

The Rio Grande basin encompasses about 7,500 square miles in southern Colorado. Table 14 provides an overview of the streams, lakes, and wetlands in the Colorado portion of the Rio Grande basin. The headwaters arise at nearly 14,000 feet in the San Juan mountains to the west. The Sangre de Cristo mountains form the eastern boundary. The San Luis Valley, the largest alpine valley in the world, is at the center of the basin. The Rio Grande basin includes the Closed Basin as part of the San Luis Valley. The valley floor, with an average elevation of 7500 feet, receives only 7 to 8 inches precipitation annually while the headwaters, less than 75 miles away, receive more than 50 inches.

Table 14

Rio Grande Basin	Value
Population	42680
Surface area square miles	7500
Total miles rivers and streams Miles of perennial/seasonal streams Miles of ephemeral streams	5700
Number of lakes/reservoirs/ponds	8[30]
Number of significant publicly owned lakes/ reservoirs/ponds	8[30]
Acres of lakes/reservoirs/ponds	8313
Acres of significant publicly owned lakes/ reservoirs/ponds	8313
Acres of freshwater wetlands	Not determined

Land ownership is a mixture of federal, state, and private. The Rio Grande National Forest includes almost 3125 square miles of publicly owned land in the basin. The Great Sand Dunes National Monument is located near the southern end of the Closed Basin. The Alamosa and Monte Vista National Wildlife refuges are also found in the basin. The state and Bureau of Land Management own and administer extensive tracts of land as well. The majority of the San Luis Valley part of the basin is privately owned.

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30 There are many small lakes in the Weminuche, La Garita, and South San Juan Wilderness Areas that are not enumerated separately in this report.

Figure 8

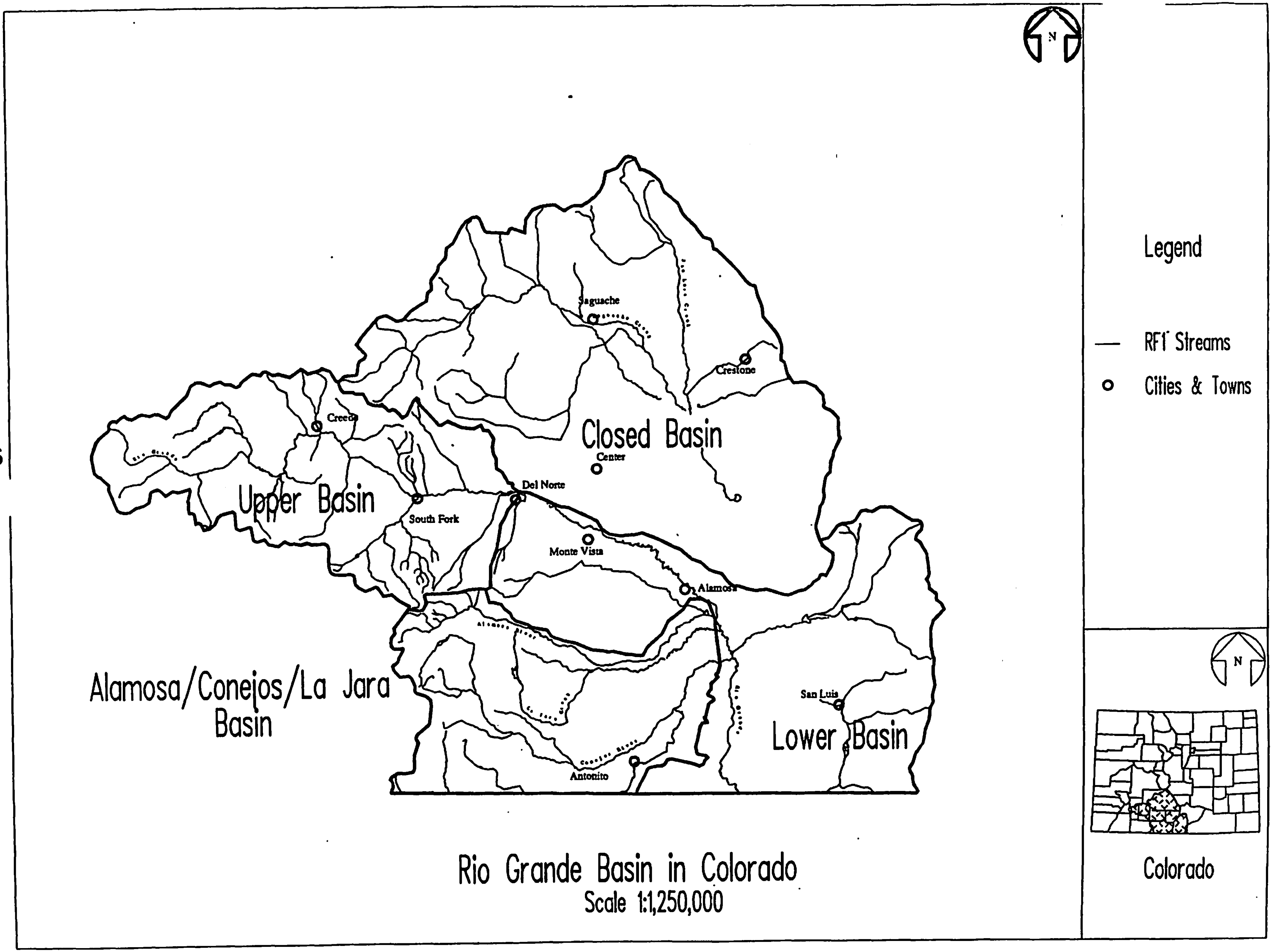

N
Saguache
Crestone
Creede
Closed Basin
Center
Del Norte
Upper Basin
South Fork
Monte Vista
Alamosa
Alamosa/Conejos/La Jara Basin
San Luis
Lower Basin
Antonito
Rio Grande Basin in Colorado
Scale 1:1,250,000
Legend
RF1 Streams
Cities & Towns
N
Colorado

Figure 8 shows the principal hydrologic features of the Basin. The Rio Grande mainstem and the South Fork of the Rio Grande are the largest drainages of the upper basin. Most of the upper basin is in the Southern Rocky Mountain physiographic province and is within the Rio Grande National Forest. Private lands, most of which are irrigated, border the lower reaches of most water courses. The lower basin, beginning around Del Norte and extending to the Colorado border with New Mexico has highly productive agricultural land. The Rio Grande mainstem is the principle surface drainage. Large diversions from the mainstem sustain agricultural production. Potatoes, barley, wheat and vegetable crops are grown in this part of the lower basin and the adjacent southern part of the Closed Basin. Relief is very flat and crops depend on irrigation. Other streams in the lower basin are small, most never reaching the mainstem owing to diversion for irrigation or recharge to the valley alluvium. Most of the residents of the Basin live in the communities of Alamosa, Monte Vista, Del Norte, San Luis and surrounding areas, Figure 8. The San Luis Valley portion of the lower basin contains some of the most extensive wetlands found in Colorado including those in the Alamosa and Monte Vista National Wildlife refuges.

The Closed Basin lies north of the Rio Grande in the San Luis Valley. There is no natural surface connection between the Closed Basin and the Rio Grande, however water is diverted from the Rio Grande to the Closed Basin for irrigation in the Center area. Water is also pumped via the Franklin Eddy canal from San Luis Lake in the Closed Basin to the Rio Grande south of Alamosa. Saguache Creek basin, the major drainage on the north west side of the Closed Basin, is devoted almost entirely to the livestock industry. Many small first and second order streams drain the Sangre de Cristos on the east side of the Closed Basin. None regularly reaches the valley floor. San Luis Creek flows intermittently from the north end of the Closed Basin to San Luis lake.

The Conejos, Alamosa, and La Jara Rivers drain the south eastern side of the San Juan mountains. The Conejos is one of the few tributaries to reach the Rio Grande in the lower basin. The flow of the Alamosa and La Jara Rivers are diverted for irrigation most of the year.

STREAM CLASSIFICATIONS AND WATER QUALITY STANDARDS

Classifications

Colorado's water quality classification system recognizes aquatic life, recreation, water supply, and agricultural uses. Waters are classified for current uses or for uses the waters are to become suitable. The Colorado Water Quality Control Commission reviewed and changed several segment descriptions, use classifications, and standards for the Rio Grande Basin in November 1993. A discussion of Colorado's use classifications and standards follows.

Aquatic Life

Aquatic life is classified as cold or warm and as class 1 or class 2. Cold water aquatic life streams have the physical characteristics to support a wide variety of cold water biota, usually trout in Colorado. Warm water aquatic life streams have physical characteristics to support a wide variety of warm water biota such as bass, catfish, carp, and fathead minnows. Class 2 streams lack the habitat and/or water quality of class 1 streams. Insufficient flow or water quality that is either naturally impaired or irreparably impaired by anthropogenic causes thus restricting the forms of aquatic life may be classified aquatic life 2.

Most waters in the Rio Grande Basin are classified cold water aquatic life class 1. Portions of Kerber Creek, Willow Creek, and several tributaries of the Alamosa River are not classified for aquatic life owing to high concentrations of metals. These streams are discussed in more detail later in the report. Ephemeral streams found at the lower elevations of the Southern Rocky Mountain and in the Arizona/New Mexico Plateau provinces of the lower Rio Grande and the Alamosa/Conejos/La Jara basins lack the flow to support a wide variety of aquatic life and are not classified for aquatic life.

Recreation

Recreation class 1 waters are used for activities in or on the water when the ingestion of small quantities of water is likely to occur. They include, but are not limited to, those used for swimming, rafting, kayaking, and water skiing. Class 2 waters are suitable for use on or about the water such as fishing and other streamside or lakeside activities. The difference between class 1 and class 2 recreations waters is the standard for fecal coliform. Recreation class 1 waters have a fecal coliform standard of 200/100ml whereas class 2 waters have a standard of 2000/100ml.

The goal of the federal Clean Water Act is to achieve "fishable-swimmable" waters wherever attainable, however, most waters in the Rio Grande Basin are too shallow and/or too cold to support recreational class 1 uses. The Rio Grande, Conejos River, and San Luis Lake are the only waterbodies with documented class 1 use. Several other streams may have sufficient size, i. e. Culebra Creek, to be locally important as class 1 waters.

The Water Quality Control Commission, Division, and U. S. Environmental Protection Agency agreed to propose as recreation class 1 waters only those that are used for recreation in or on the water, however, the class 1 standard for fecal coliform will be adopted for all class 2 waters unless existing point source discharges to the segment would incur substantial costs to meet the 200/100ml standard. The lowest segment of the La Jara River was the only location sampled that did not meet class 1 criteria. The class 1 standard was not adopted for ephemeral segments.

Water Supply

Waters classified for domestic water supply are suitable for potable water after receiving standard treatment. The water supply classification is applied if a public surface water supply is located on the segment or if the quality is suitable for that use.

Most public water supplies in the Rio Grande basin are from groundwater. Creede and Del Norte are the only communities to obtain all or a part of their supply from a surface source. Although few public entities use surface water, the streams in the basin generally meet water supply criteria. Willow Creek at Creede, and Kerber Creek exceed the mandatory criteria for lead. Manganese exceeded the recommended 50 microgram per liter criterion in the Alamosa River, Sangre de Cristo Creek at Fort Garland, the lower Conejos, and the La Jara at the Alamosa/Conejos county line. The criterion was slightly exceeded in the La Jara below La Jara Reservoir. The aforementioned segments are not classified for the water supply use.

Agriculture

Virtually all of the segments in the Rio Grande basin are used for agricultural purposes, either livestock watering or crop irrigation. Rarely is water unsuitable for this use.

The "Basic Standards" provide for an agricultural standard for manganese of 200 ug/l which is less restrictive than the drinking water standard but more restrictive than the aquatic life standard (1000 ug/l). This standard usually is not applied because manganese is toxic to crops only on low pH soils. Low pH soils are typically not found in Colorado, however the acid conditions created by the Summitville discharge together with high concentration of manganese may make this a concern if low pH levels and high manganese concentration continues for an extended period of time. The agricultural criterion for manganese was adopted for several segments of the Alamosa River basin.

Water Quality Standards

"The Basic Standards and Methodologies for Surface Water" has three approaches for establishing water quality standards. Table Value Standards (TVS) are applied to protect applicable classified uses when ambient quality is better than TVS for the most restrictive use. TVS have been applied to most segments in the Rio Grande Basin.

Ambient quality based standards are used where natural or irreversible man-induced ambient water quality levels are higher than the specified chronic TVS, but are determined to protect the classified use(s). This is based on the 85th percentile of the available and representative data (geometric mean of fecal coliform, 15th and 85th percentile pH, and 15th percentile for dissolved oxygen) for the water in question. Ambient standards have been adopted for portions of Willow Creek, Kerber Creek, the Alamosa River and several of its tributaries.

Site-specific standards, acute or chronic, are used for aquatic life segments where factors other than water quality substantially limit the diversity and abundance of species present. Site-specific standards require that a bioassay and habitat assessment be completed to support such standards. Site-specific standards have been adopted for several segments of the Alamosa River.

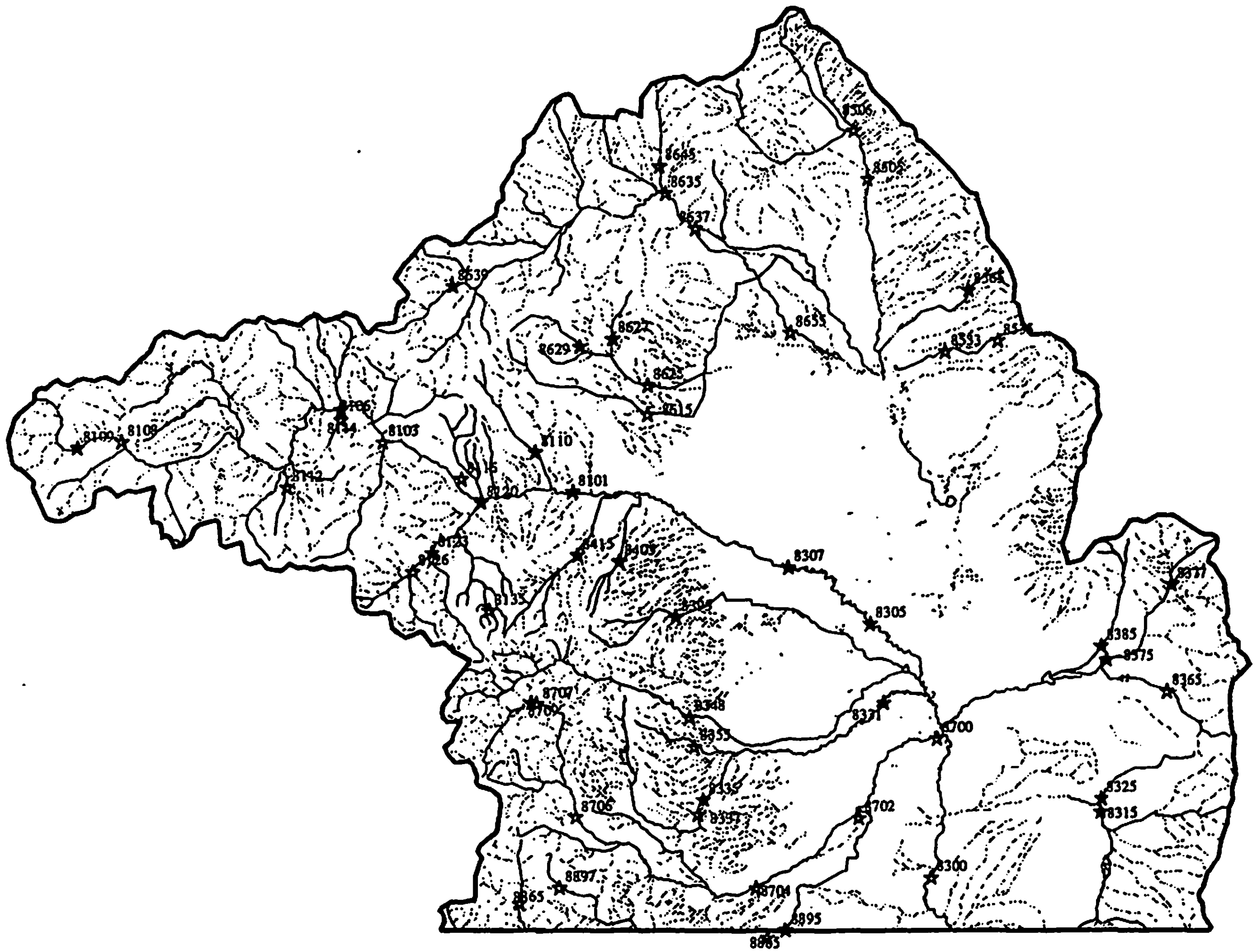
SURFACE WATER ASSESSMENT

The Rio Grande is Colorado's first basin wide water quality assessment project. Historically the Division operated six water quality stations in the Rio Grande Basin: four stations were located on the mainstem of the Rio Grande and one each on the South Fork and Conejos Rivers. Other water quality data, except for three sites disturbed by mining, was more than 15 years old. Twenty-nine (29) stations were selected for monthly monitoring for the 1992 assessment, Figure 9. The primary objective was to update baseline data for implementing the Colorado Water Quality Control Commission approach for establishing use classifications and water quality standards and to establish "reference conditions" based on ecoregions and subregions found in the Basin.

Sites were selected to reflect current water quality for the segments that could be used to support aquatic life and recreational classifications and recommend standards for those segments with a limited number of standards; and to begin the process of integrating physical, biological, and chemical factors into the classification and standards through identifying "reference conditions." Reference sites provide the data for extrapolating water quality and aquatic life information from monitored sites to streams with similar elevation, geology, plant cover, and land use.

Figure 9

Locations of water quality monitoring sites

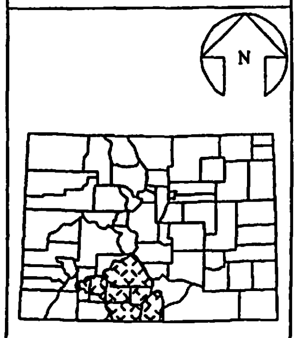


Rio Grande Basin in Colorado
Scale 1:1,250,000

RF3 Streams in Rio Grande Basin - CO

Legend

★ Sampling Sites



Colorado

Reference sites were selected to represent five subregions. Although there are seven subregions in the basin, the tundra is very small and relatively unimpacted and watercourses in the desert are commonly dry so they were not sampled. At least five sites were located in each subregion and included second, third and fourth order streams. Reference sites were chosen at locations least impacted by point source discharges, excessive grazing pressures, reservoirs, mining, or other conditions that could result in unusually severe habitat or water quality degradation.

Sites were chosen to maximize the use of the Colorado Division of Water Resources (CDWR) stream monitoring network in the Rio Grande Basin. Twenty-two (22) of 29 ambient monitoring sites, were located at or near a gaging station. A discussion of data collection and analytical methods is contained in Appendix A.

WATER QUALITY SUMMARY

The Colorado portion of the Rio Grande Basin includes two ecoregions--the Southern Rocky Mountain and Arizona/New Mexico Plateau--and seven sub-ecoregions, Figure 10, as described by Omernick (1987). The following descriptions of the ecoregions and subregions found in the Rio Grande basin, from Omernick, have been modified to better describe the Rio Grande basin in Colorado.

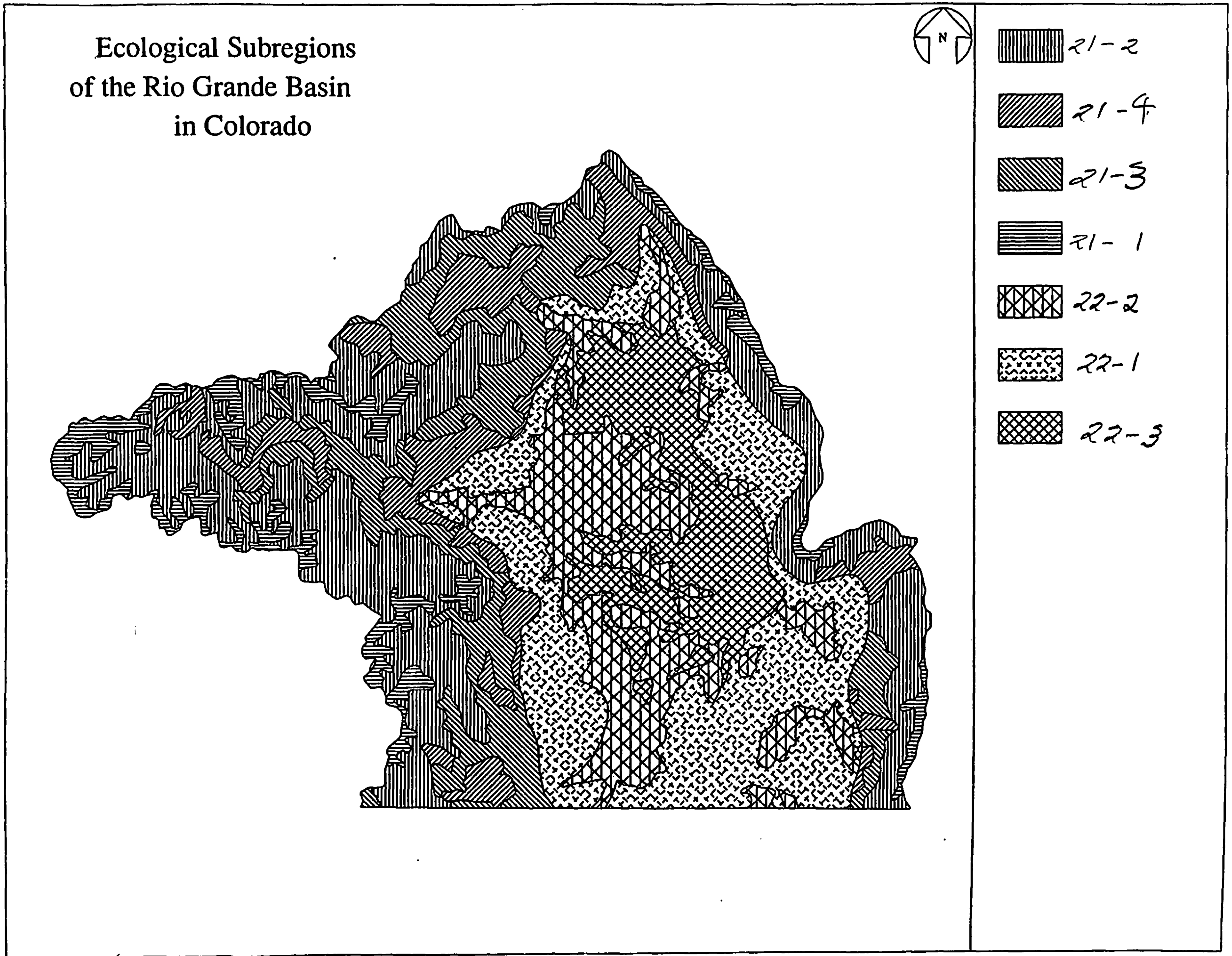
Omernick's descriptions of the subregions does not provide information for water chemistry, aquatic life, or recreational uses of water. This information has been added as a result of the Division's one year assessment of the Rio Grande basin, and from data collected by others for the basin. The Rio Grande basin is the first of a multi-year program planned by the Division to evaluate the applicability of using the ecoregion approach for water quality classifications and standards, thus the results presented are preliminary and reports only what was found in the Rio Grande basin.

Water chemistry for streams in the five subregions is compared in Figure 11. Each graph shows the maximum, minimum, 85th percentile, 15th percentile and mean concentration observed for each subregion, exclusive of sites known to be directly contaminated by metals. No graphs are presented for lead, mercury, selenium, or silver because none of these metals were detected at any site. Only one water sample exceeded the lowest reportable value for nitrate.

Southern Rocky Mountain (21)

Most of the streamflow in the Southern Rocky Mountain (SRM) ecoregion comes from melting snow. Within the SRM region the annual peak flow or bankfull flow occurs between mid-May and mid-June depending on elevation. The duration of the runoff season is relatively short. Thunderstorms, during some years, may produce a second peak later in the summer. The lowest flows occur in the winter, lasting from November

Figure 10



Ecological Subregions of the Rio Grande Basin in Colorado through February. Water from the lower reaches of some of the larger second order streams is used to irrigate pastures and hay meadows; producing a late summer low flow. Second order streams in the Closed Basin portion of the San Luis Valley, are an important source of recharge to the unconfined aquifer. Streams in the SRM ecoregion support cold water aquatic life, except where limited by water quality.

21-1 High Elevation Tundra

Tundra divides the Rio Grande basin on the east and west sides from the other basins in Colorado. The climate of this subregion is cold. Average annual precipitation ranges from 25 to 60 inches, most of which occurs as snow. Treeline in the Basin begins around 11000 feet and relief locally extends to over 14000 feet. Vegetation consists of low shrubby willows, grasses, and forbs. Soils, formed from crystalline rocks, belong to the Umbrept soil group. Accessibility limits land use during most of the year as the snow free period lasts from mid-June through October. Wildlife habitat, recreation, and summer sheep range are the major land uses. The Summitville Mining District in the Alamosa River drainage and several other minor mining districts are located in this subregion.

Land in this subregion, except for a few scattered mining claims, is a part of the Rio Grande National Forest; some is managed as wilderness. Portions of the La Garita, Weminuche, and South San Juan Wilderness areas are contained within this subregion.

Most streams are first order. They are small, shallow, and extremely cold which limits their use for class 1 recreation. Many of the small the natural lakes in the basin are found in this subregion.

Cutthroat and brook trout are the principal fish found in this subregion in the Rio Grande basin. The most common taxon of benthos are mayflies (Ephemeroptera).

Although no water chemistry stations were located in this subregion, downstream stations suggest that chemically the waters of this subregion have low alkalinity, hardness, and total dissolved solids that varies little with streamflow. Hardness is typically less than 25 mg/l, resulting in low threshold toxicity to aquatic life for several metals including cadmium, copper, lead, silver, and zinc. The presence of these metals in the dissolved form at detectable concentrations, however is relatively rare. Fecal coliform bacteria densities are low and typically are of nonhuman origin.

21-2 Cool and Moist Forests of the Middle to High Elevations

This subregion begins at around an elevation of 9000 to 9500 feet and extends to the tundra. Dense forest dominated by Englemann

Figure 11
Comparison of Water Quality Among Sub-regions in the Rio Grande Basin of Colorado

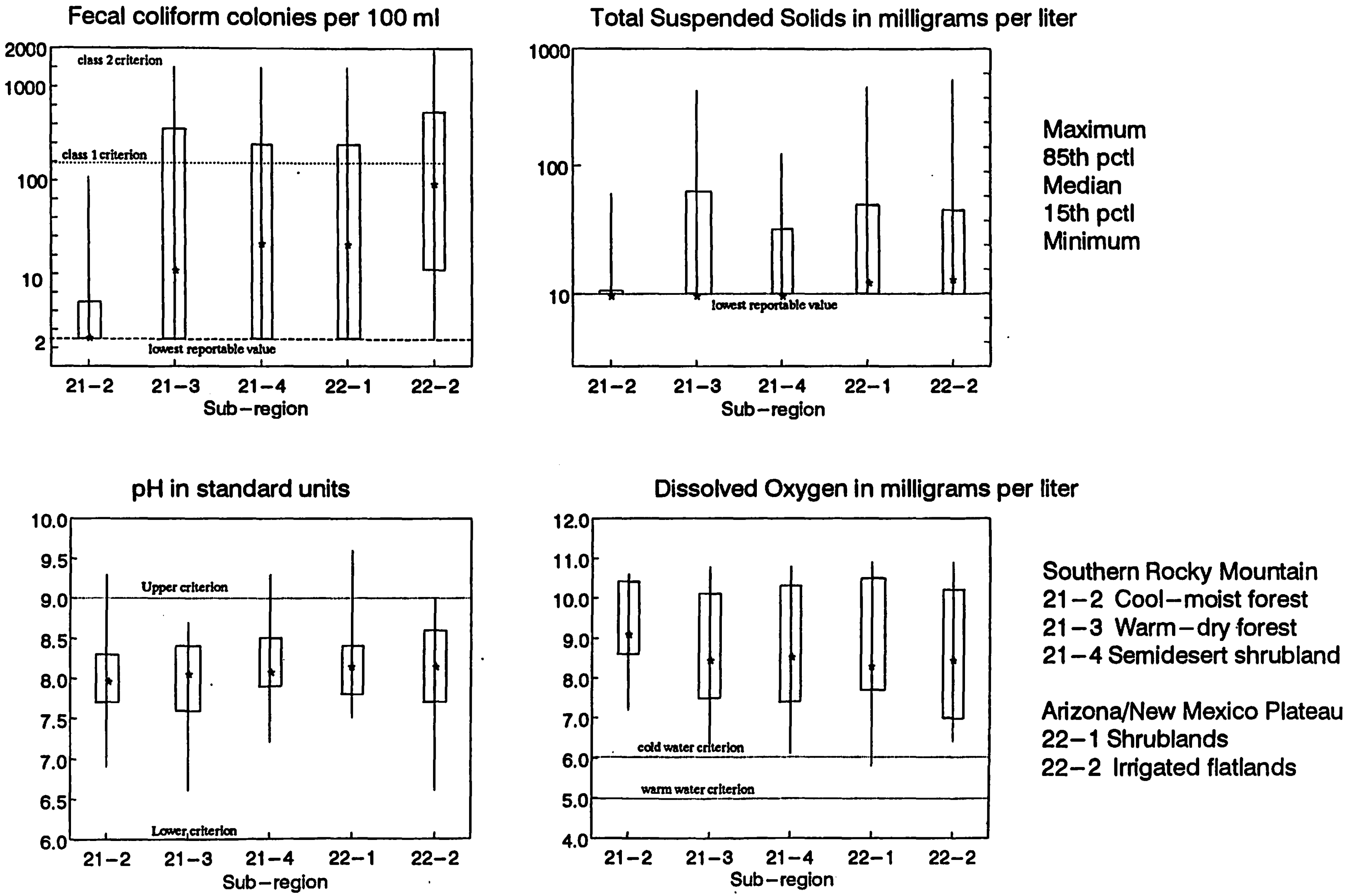


Figure 11
Comparison of Water Quality Among Sub-regions in the
Rio Grande Basin of Colorado

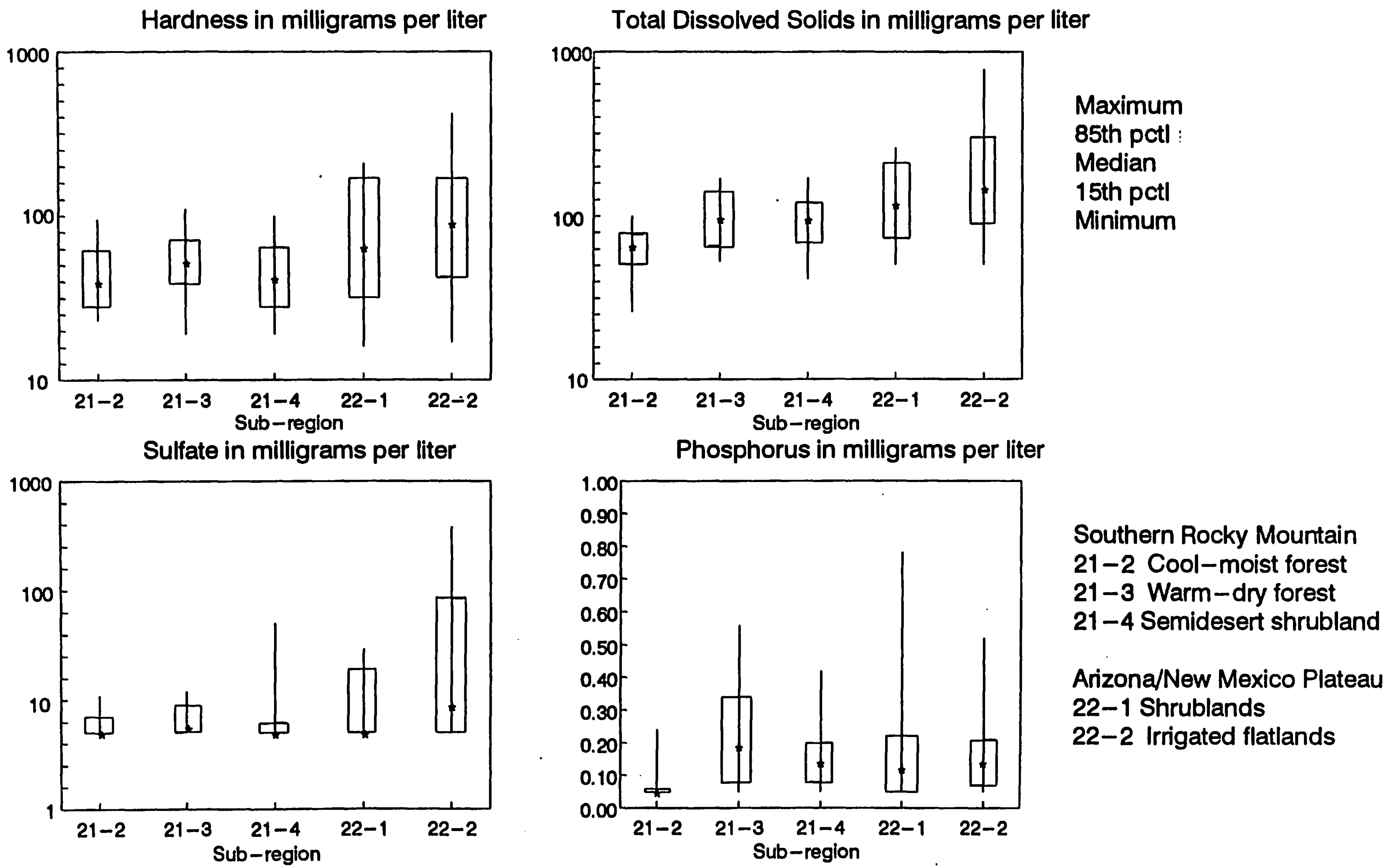
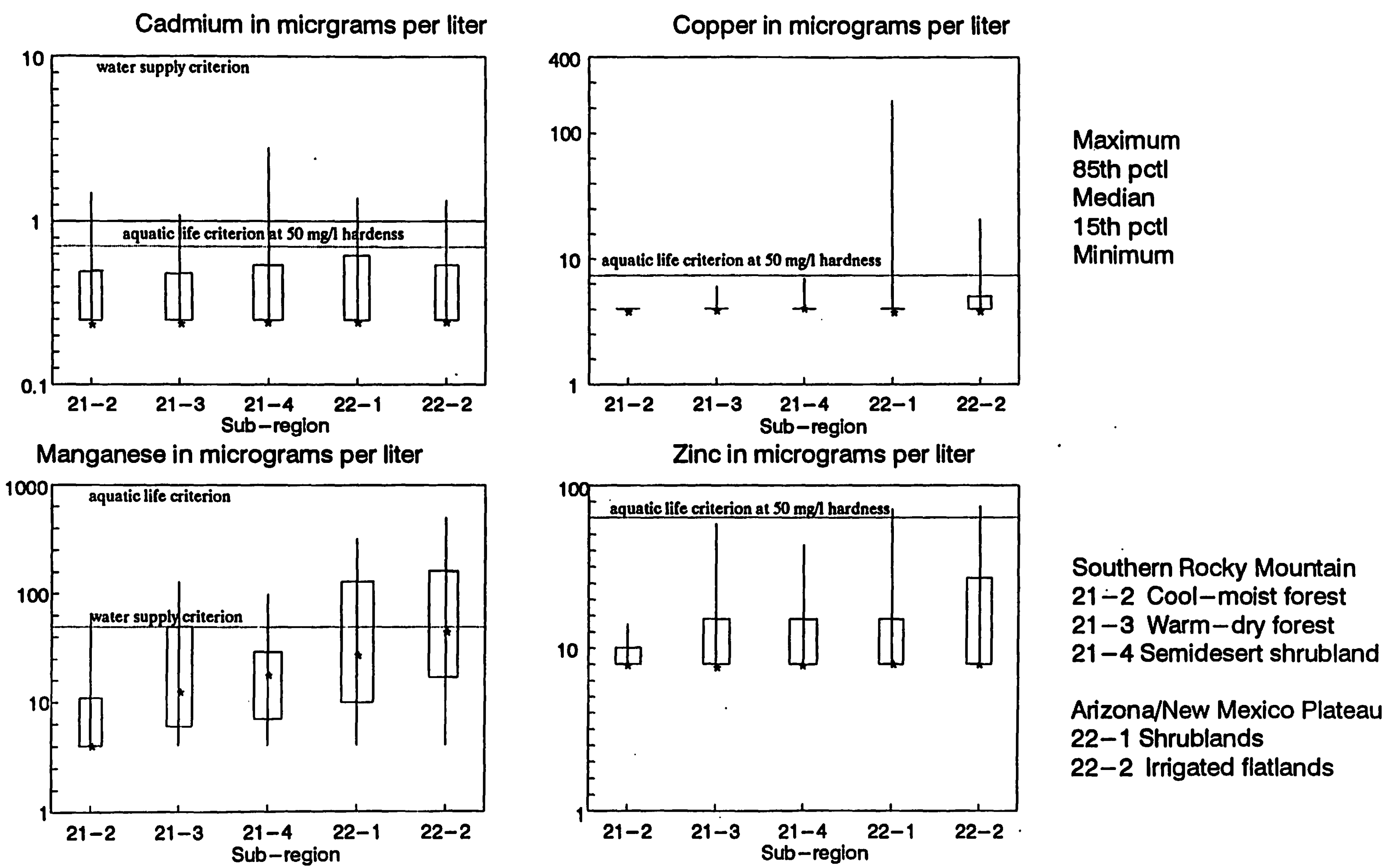


Figure 11
Comparison of Water Quality Among Sub-regions in the
Rio Grande Basin of Colorado



spruce and subalpine fir with locally dense stands of aspen characterize this subregion. Forest understory is sparse. The climate of is cold. Average annual precipitation ranges from 25 to 60 inches, much occurring as snow. Locally the relief is steep and often inaccessible. Soils have been weathered from a variety of crystalline and sedimentary materials and belong to the Boralf group. Land use is primarily wildlife habitat and recreation, however some logging and mining may also occur.

Most of the land is a part of the Rio Grande National Forest, some of which is administered as wilderness areas. Engleman spruce and subalpine fir are the principal species logged from the Rio Grande National Forest. Logging has occurred where relief allows. The Platoro Mining district is located in this subregion. Domestic livestock grazing is limited because of lack of forage vegetation and inaccessibility.

Streams in this subregion are generally first and second order. Channel substrate consists gravel, cobbles, and boulders, and most have a high gradient. Most of the runoff occurs in response to melting snow during May, June, and July. Low flow occurs between November and March. Smaller streams may have portions that are entirely frozen during the winter.

These streams are too small and too cold to support class 1 recreational uses. Data from four streams indicate that daily high July water temperatures range from 11 to 18 degrees celsius. The Conejos River below Platoro Reservoir, which is a third order stream, is the only one to support class 1 recreational uses.

Brook and rainbow trout are the main fish species found in this subregion. Some brown trout may be found in the Rio Grande and Conejos. The dominant taxon of benthos is mayflies.

Water chemistry for streams in this subregion, Figure 10, shows that overall they have a mean hardness of 44 mg/l and that hardness is invariant with flow. The 85th percentile of total dissolved solids from sites monitored in 1992-93 averaged 77 mg/l. Bacteriological analysis shows that fecal coliform are present at low levels. Total suspended solids, nitrate, and total phosphorus were all less than detection at the 85th percentile of the sites monitored. The 85th percentile sulfate concentration averaged 3 mg/l. Cadmium and zinc were commonly detected, but rarely at concentrations exceeding TVS for aquatic life. Manganese was usually detected but was less than the recommended drinking water criterion.

21-3 Warm and Dry Forests of the Middle to Low Elevations

This subregion begins around an elevation of 8000 feet in the Rio Grande basin and extends upward to the 21-2 subregion. Average annual precipitation ranges from 12 to 25 inches, about half of which is snow. Soils are borolls and boralfs derived from crystalline and sedimentary rocks under a variety of conditions. Local relief can be steep. A variety of plant communities are represented by this subregion in the Rio Grande basin. Pinon pine-juniper woodlands grade into gamble oak along the base of the Sangre de Cristo Mountains on the east side of the basin whereas douglas fir and ponderosa pine more commonly grade into lodgepole pine on the west side of the basin. These forests are more open than those in the 21-2 subregion, and support an herbaceous understory that is grazed by both domestic livestock, usually during the summer, and wildlife. There are many developed recreation sites (i. e. cabins, commercial campgrounds, and guest ranches), particularly along the Conejos River, near South Fork, and near Creede.

Most of the land in this subregion is a part of the Rio Grande National Forest, however ownership is predominately private adjacent in the larger valleys. The Creede (Willows Creek) and Kerber Creek mining districts are located in this subregion.

First order streams flow during spring runoff, whereas second and higher order streams flow year-a-round. Runoff in this subregion comes mainly from snowmelt during May, June, and early July. Low flow occurs between November and March, and on the smaller streams, portions may be entirely frozen during the coldest part of the winter. Stream channels are comprised mainly of gravel and cobble. There are few natural lakes in this subregion.

The Rio Grande and Conejos, both fourth order rivers, are the only two large enough to support class 1 recreation. Both are used commercially and privately for rafting, kayaking, and canoeing. Daily high July water temperatures for streams in this subregion range from 19 to 22 degrees celsius, thus body immersion is accidental or only for brief periods.

The fish composition in this subregion is dominated by brown trout and Rio Grande cutthroat trout. Benthic composition dominated by taxon from the mayflies (Ephemeroptera), caddisflies (Trichoptera) and true flies (Diptera) orders.

The 85th percentile water hardness for streams in this subregion averaged 70 mg/l, Figure 11. Total dissolved solids and sulfate averaged 118 and 6 mg/l, respectively. Nitrate plus nitrite was always less than 0.5 mg/l and the 85 percentile total phosphate average 0.11 mg/l. Fecal coliform averaged 12/100ml.

<u>21-4 Low to Middle Elevation Semi-Desert Shrublands</u>

Topographically this subregion is only a few hundred feet lower in elevation than the 21-3 subregion, however the average annual precipitation ranges from 8 to 12 inches resulting in more arid conditions. Relief is moderate. Soils are from the Boroll group, derived from a variety of sedimentary and crystalline rocks. The overstory vegetation is dominated by sagebrush, four-winged saltbush, and greasewood. Understory is grasses. Cottonwood, alders, and willows grow along riparian corridors. Domestic livestock and wildlife grazing and foraging is the primary land use. Deer and antelope are commonly observed.

Most of the land is federally owned and is administered by the Bureau of Land Management. Small parcels of state, national forest, and private lands are interspersed throughout the subregion.

First order streams are seasonal or ephemeral. The headwaters of second and higher order streams lie outside of the subregion. Water is diverted from most of the second and third order streams to irrigate riparian pastures and hay meadows resulting in the seasonal dewatering of many of them.

The Conejos River and the Rio Grande are the only rivers large enough to support boating uses. Afternoon high water temperatures during July average about 17 degrees.

The fish composition is dominated by brown trout and Rio Grande cutthroat trout, however numbers and biomass of white suckers, long nose suckers and dace increases. Benthic composition dominated by taxon from the mayflies (Ephemeroptera), caddisflies (Trichoptera) and true flies (Diptera) orders.

Water chemistry for streams is similar to the 21-3 region, Figure 10. Hardness is in the 50 to 60 mg/l range while total dissolved solids average slightly over 100 mg/l. The 85th percentiles of total phosphorus averages 0.15 mg/l and sulfate averages 4.5 mg/l. Nitrate plus nitrite, selenium, lead, mercury, or silver were always below their respective detection limits. Cadmium and manganese were routinely present but at concentrations less than the chronic aquatic life and water supply standards, respectively. Geometric mean fecal coliform for eight sites average 24/100ml.

<u>Arizona/New Mexico Plateau (22)</u>

First and second order streams with headwaters in the Arizona/New Mexico Plateau (ANMP) ecoregion are ephemeral, with few exceptions. Although they may flow briefly during spring snowmelt, most of the runoff comes from thunderstorms. Single runoff events will last from less than a day up to several weeks. Third and fourth order streams in the ANMP ecoregion have headwaters located in the SRM ecoregion. Third and fourth order streams include the Rio Grande and Rio San Antonio; Conejos and Alamosa Rivers; and Saguache and La Jara Creeks. They provide irrigation water for the San Luis Valley.

The agricultural economy of the San Luis Valley depends on the water diverted from the Rio Grande, Conejos, Alamosa, and Rio San Antonio. Large diversions occur in the transition zone between the SRM ecoregion and the ANMP ecoregion, altering the natural flow pattern. Low flow pattern generally changes from the winter to the irrigation season, generally April 15 to October 15 with the lowest flows occurring in the spring at the start of the irrigation season and in the fall near the end of the season. The low flow pattern also becomes site-specific depending on which water rights or ditches are in priority to divert.

22-1 Shrublands

The Arizona/New Mexico Plateau Shrubland subregion is slightly more arid than the 21-4 subregion in the San Luis Valley. Relief ranges from moderate to flat plains. Soils are from the Orthid and Argid groups, with plant communities dominated by big rabbitbrush, winterfat, and big sagebrush. Greasewood is found in low lying moist areas. A grass understory is common. Low density grazing is the chief land use. Land ownership is mostly federal, administered by the Bureau of Land Management.

All of the first order and most of the second order streams are seasonal or ephemeral. Only the Rio Grande, Conejos, La Jara, and Alamosa Rivers flow year a round. Hot Creek is a special case. Streams that flow seasonally include lower portions of Trinchera and Sangre de Cristo Creek and the lower Rio San Antonio. Streams in this subregion, except for the Rio Grande mainstem, lack the depth and flow to support boating uses. July high water temperatures approach 20 degrees.

Although a few streams have a gravelly substrate, most of the channels are characterized by a sand or silt bottom. A few brown trout and northern pike are found in this subregion, however the fish numbers and biomass are dominated by white and long nose suckers. Chubs, dace, and fathead minnows are also found. Stream benthos are dominated by genera from the Coleoptera, Hemiptera, and Diptera orders.

Figure 10 shows that hardness (85th percentile) increases to around 100 mg/l and total dissolved solids increase to 146 mg/l. Sulfate increases to 10 mg/l, however total phosphorus remains at a relatively low 0.11 mg/l. Fecal coliform likewise remains low at 21/100ml. Like the other subregions nitrate plus nitrite, selenium, mercury, lead, and silver never exceeded detection limits any time at any site. Cadmium, manganese, and zinc were usually present, but manganese was the only metal to occasionally exceed drinking water criterion.

22-2 Irrigated Flatlands

Irrigated lands in the Rio Grande basin are quite variable. Alluvial stream valleys adjacent to uplands in the 21-3, 21-4, 22-1 subregions are irrigated for native hay and pasture. Soils are mostly from the Argid group. These lands are flood irrigated from early June through mid-October, depending on the availability of water from adjacent streams, and yield one to two cuttings of hay. Commercial fertilizers and pesticides are rarely, if ever used on these lands. These lands are usually grazed from late fall to early spring when access to public lands is restricted.

Most of the Rio Grande basin's population resides in the irrigated portion of the Valley. The valley floor, at an average elevation of 7500 feet, is the largest alpine valley in the world. It receives only 7 to 8 inches precipitation annually. Soils are from the Argid and Aquents soil groups. Most of the irrigated land is very flat and distant from stream courses, so water is supplied from large canals diverting water from the Rio Grande or Conejos River. Wells are an important source of water and many are artesian or free flowing, their aquifers being recharged by streams flowing from the surrounding mountains. Among the more important crops grown in this subregion are alfalfa hay, potatoes, barley, wheat, oats, and a variety of vegetable crops including carrots, spinach, and lettuce. Fertilizers and pesticides are used on these crops.

The Rio Grande, Conejos, La Jara, Alamosa, and Trinchera Creek are the only streams to traverse the valley floor. Within this subregion flow is dominated by return flow for a large part of the year. San Luis Creek in the Closed Basin alternates between a flowing stream and a wetland for its entire length. The low flow period within this subregion shifts from the winter to the spring and summer when major diversions are operating at capacity. The substrate of these streams consists of sand, silt, and clay.

Most of the Valley's wetlands are found in this subregion. There are few if any first or second order streams. Only the Rio Grande mainstem has sufficient flow to support boating uses. Water courses in this subregion drain the adjacent irrigated land. They have flat gradients resulting in low velocity and occasional deep pools. Because this region is closer to towns and farms, some areas may be used by local children for swimming. Summer afternoon high water temperatures in excess of 30 degrees celsius are not unusual.

Aquatic life is composed of benthos from the Annilida (worms) order and other pollution tolerant orders. Fish are mainly carp, suckers and fathead minnows, although occasionally brown trout and northern pike may be found.

Water chemistry reflects the use of water. Hardness increases to 157 mg/l on average, Figure 10. Total dissolved solids rise to 270 mg/l and sulfate increases to 74 mg/l. Fecal coliform average 90/100ml and the only site in the Rio Grande basin to exceed a geometric mean of 200 is within this subregion. Although total phosphorus remains relatively low at 0.15 mg/l, the only sites with detectable nitrate plus nitrite is in this sub-ecoregion. Selenium, silver, mercury, or lead did not exceed detection limits at any time. Manganese was often found and usually at concentrations exceeding drinking water criterion. Cadmium, copper, and zinc, although found, do not approach water quality standards other than in the Alamosa River where man-induced pollution has elevated their levels.

22-3 Salt deserts

The salt desert subregion is very similar to the 22-1 sub-ecoregion except that the soils are quite saline. Soils generally belong to the Aquoll group. Plant communities are comprised of salt tolerant species such as shadscale, greasewood, rabbitbrush, alkali sacaton and saltgrass. In the Rio Grande basin of Colorado this subregion is very flat possessing almost no surface drainage.

Streams in this subregion are ephemeral. Water may pond in depressions in a few areas creating wetlands. Channel substrate is consists of sand, silt, and clays. These streams are not used for recreation owing to their small size and flashy nature of the flow.

Aquatic life is limited to forms found in ephemeral environments.

Because of the intermittent availability of water to sample, no water chemistry data was collected in this subregion.

RESULTS

Trends

Long term water quality monitoring has been conducted on the mainstem of the Rio Grande above Creede, near Wagonwheel Gap, at Del Norte, at Alamosa, and by the U. S. G. S. at Lobatos. No water quality trends or changes over time have been observed at these locations. Long term monitoring has also been done on the South Fork at South Fork and on the Conejos River at Mogote. No water quality trends or changes over time have been noted at either of these stations.

303(d) Waters

The 303(d) waters in the Rio Grande Basin are shown in Appendix C.

DESIGNATED USE SUPPORT

One of the objectives of the Rio Grande Assessment is to evaluate the chemical, physical, and biological status of classified stream segments in the Basin relative to adopted use classifications and standards. Table 14 summarizes the water quality status of stream segments in the Basin.

Table 15
Designated Use Support for the Rio Grande Basin

Segment Description	WBID	Evaluated/ Monitored	Status	Criteria	Constituents	Comments
Weminuche Wilderness	CORGRG01	E		J		
Rio Grande above Willow Creek	CORGRG02	M		Q, B		
Upper Rio Grande Reservoirs	CORGRG03	E		J		
Rio Grande, Willow Creek to Rio Grande/Alamosa Co.	CORGRG04	M	Part support	Q	Cadmium Zinc	Impacts are from Willow Creek
Rio Grande tributaries	CORGRG05	M		Q, B		
West Willow Creek above Park Regent Mine	CORGRG06	M		Q, B		
Willow Creek	CORGRG07	M	No aquatic life class.	Q, B, J	Cadmium Lead Zinc	Inactive or abandoned mine discharges
Goose Creek	CORGRG08	M		Q, B, J		
South Fork Rio Grande	CORGRG09	M		Q, B		
Pinos Creek	CORGRG10	M		Q		
San Francisco Creek	CORGRG11	M		Q, B		
Rio Grande, Alamosa to Lobatos	CORGRG12	M	WQLA	Q, B, J	Ammonia	Alamosa discharges to segment
Rio Grande, Lobatos to New Mexico	CORGRG13	M		Q, B, J		
Rio Grande tributaries, National Forest	CORGRG14	E		J		

Table 15 continued
Designated Use Support for the Rio Grande Basin

Segment Description Rio Grande Basin	WBID	Evaluated/ Monitored	Status	Criteria	Constituents	Comments
Rio Grande tributaries	CORGRG15	E	No Aquatic life class.	J	None	Segment includes only ephemeral channels
Alamosa Wildlife Refuge	CORGRG16	M		Q, B		
Monte Vista Wildlife Refuge	CORGRG17	M		Q, B		
Rio Grande tributary wetlands	CORGRG18	E		J		
Rock Creek	CORGRG19	M		Q, J		
Cat Creek	CORGRG20	E		J		
Ute Creek above Hwy. 160	CORGRG21	M		Q		
Ute Creek below Hwy. 160	CORGRG22	E		J		
Sangre de Cristo Creek above Hwy 159	CORGRG23	M		Q, B		
Sangre de Cristo Creek below Hwy 159	CORGRG24	E		J		
Trinchera Creek above Mountain Home	CORGRG25	M		Q, B		
Trinchera Creek below Mountain Home	CORGRG26	E		J		
Smith Reservoir	CORGRG27	M		Q, J		
Rito Seco above Salazar Reservoir	CORGRG28	E		J		
Rito Seco below Salazar Reservoir	CORGRG29	M		Q		
Culebra Creek (Sanchez Reservoir)	CORGRG30	M (M)	(Part support)	Q, B (B)	(Mercury)	(Posted fish advisory)

Table 15 continued
Designated Use Support for the Rio Grande Basin

Segment Description	WBID	Evaluated/ Monitored	Status	Criteria	Constituents	Comments
South San Juan Wilderness	CORGAL01	E		J		
Alamosa River above Alum Creek	CORGAL02	M	Part support	Q	Iron	Natural
Alamosa River above Wightman Fork	CORGAL03A	M	Part support	Q	pH Aluminum Copper Iron Manganese	Natural
Alamosa River above Terrace Reservoir	CORGAL03B	M	Not supporting	Q	Aluminum Copper Iron Manganese Zinc	Summitville via the Wightman Fork
Alum, Bitter, Burnt, and Iron Creeks	CORGAL04	M	No aquatic life class	Q	pH Aluminum Copper Iron Zinc	Natural
Wightman Fork, Upper	CORGAL05	M	Part support	Q, B	Copper Iron Zinc	Summitville
Wightman Fork, Lower	CORGAL06	M	No aquatic life class	Q, B	Cadmium Copper Lead Manganese Iron Zinc	Summitville
Jasper Creek	CORGAL07	E	Part Support	J	Cadmium Copper Iron Zinc	Inactive and abandoned mines
Terrace Reservoir	CORGAL08	M	Not supported	Q, B	Copper Iron Zinc	Summitville

Table 15 continued
Designated Use Support for the Rio Grande Basin

Segment Description Alamosa/La Jara/ Conejos Basins	WBID	Evaluated / Monitored	Status	Criteria	Constituents	Comments
Alamosa River above Hwy 15	CORGAL09	M	Not supported	Q	Copper	
Alamosa River below Hwy 15	CORGAL10	M	No aquatic life class	J		
La Jara Creek above gage (La Jara Reservoir)	CORGAL11	M (M)	 (Part support)	Q, B (Q, B)	 (Trophic status)	
La Jara Creek below gage	CORGAL12	M		Q, B		
Hot Creek	CORGAL13	M		Q, B		
Conejos River above Fox Creek	CORGAL14	M		Q, B		
Conejos above Rio San Antonio	CORGAL15	M		Q, B		
Conejos below Rio San Antonio	CORGAL16	M		Q, B		
Rio de los Pinos and Rio San Antonio	CORGAL17	M		Q, B		
Rio San Antonio below Hwy 285	CORGAL18	M		Q, B		
Rio Chama	CORGAL19	M		Q, B		
Rio Grande tributaries, National Forest	CORGAL20	E		J		
Rio Grande tributaries	CORGAL21	E	No aquatic life class	J	None	
Tributary wetlands	CORGAL22	E		J		

Table 15
Designated Use Support for the Closed Basin

Segment Description Closed Basin	WBID	Evaluated/ Monitored	Status	Criteria	Constituents	Comments
La Garita Wilderness	CORGCB01	E		J		
La Garita and Carnero Creeks	CORGCB02	M		Q, B		
Closed Basin tributaries	CORGCB03	E		J		
San Luis Creek, upper	CORGCB04	M		Q, B		
San Luis Creek, lower	CORGCB05	M		Q, B		
San Luis Lake	CORGCB06	M		B, J		
Head Lake	CORGCB07	M		B, J		
Kerber Creek and Squirrel Creek, upper	CORGCB08	M		Q		
Kerber Creek, Squirrel Creek, lower	CORGCB09A	M	No aquatic life class	Q	Cadmium Copper Zinc	
Kerber Creek, lower	CORGCB09B	M	Not supported	Q, B	Cadmium Copper Zinc	Aquatic life class adopted as a goal
Sand Creek and Medano Creek	CORGCB10	E		J		
Closed Basin tributaries, National Forest	CORGCB11	M		Q, B		
Saguache Creek, upper	CORGCB12	M		Q, B		
Saguache Creek, lower	CORGCB13	E		J		
Tributary wetlands	CORGCB14	E		J		

Causes and Sources of Nonsupport

High concentrations of metals from several natural sources and areas that have been mined for base and precious metals preclude the attainment of aquatic life uses for several segments. Division personnel observed instances of channel instability and erosion of stream banks within the 21-4, 22-1, and 22-2 subregions which we attributed to livestock grazing. However, neither the areal extent or the severity of impairment was quantified.

Willow Creek near Creede, the Alamosa River and several of its tributaries, and Kerber Creek in the northern part of the Closed Basin have had water quality problems since the early part of the century. The aquatic life use in these segments is not present owing various combinations of low pH and high concentrations of cadmium, copper, iron, lead, and zinc. Willow Creek is the only one of the three streams to contributes metals to the Rio Grande. Portions of the Alamosa River have recently worsened. Changes in water quality have occurred or are impending in each of these areas since the last reporting period.

The Summitville district, located on the Wightman Fork a tributary of the Alamosa River, has been mined for gold, silver, and copper since before the turn of the century. The most recent operation, an open pit mine which used a cyanide heap leach process for gold recovery, ended in bankruptcy in 1992. Low pH water, copper, zinc, and manganese were released from the site degrading the Alamosa River. The U. S. EPA took over the operation the treatment plant and begun remediation under an emergency response action when the operator abandoned the site.

Prior to the EPA takeover to the site, the heap leach operation had a devastating impact on the Alamosa River. Terrace Reservoir located on the Alamosa River downstream of the Wightman Fork supported a limited put and take fishery. Below Terrace Reservoir the Alamosa River reportedly contained brook trout prior to 1986. Releases of copper, manganese, and zinc together with a lowering of the pH from the mid 6's to 3 and 4 in the Wightman Fork, eliminated aquatic life in the Alamosa River and Terrace Reservoir. Additionally, the low pH water was damaging water management structures and crop land. High concentrations of copper and manganese posed a long term threat to the agricultural use of water from the Alamosa River.

Studies of the Alamosa River Basin related to remediation at Summitville identified several first order tributaries, Alum and Bitter, Burnt, and Iron Creeks, that are naturally high in aluminum and iron. They do not support aquatic life and are not classified for that use. These streams impair the Alamosa River above the Wightman Fork for aquatic life. The Colorado Water Quality Control Commission adopted ambient standards for aluminum and iron for the Alamosa River between Alum Creek and the Wightman Fork to protect the limited forms of aquatic life that may be present.

Remediation at Summitville is expected to improve the quality of the Wightman Fork impacted by the mine, however it is not expected to achieve full aquatic life uses. Aquatic life use classifications have been adopted for Terrace Reservoir and the Alamosa River below the Wightman Fork, however those uses are not supported for this reporting period.

Mining, primarily for silver, in the Willow Creek basin near Creede began in the late 1800's and lasted until about 1976. The Homestake Bulldog Mountain Mine was the last mine to close. Although the mine still has an active discharge permit, the wastewater treatment facility has been removed from the site. Some reclamation of tailings piles along Willow Creek has taken place in recent years. Several previous studies have described the impacts of mining to water quality of Willow Creek and the Rio Grande below Willow Creek. No new data were collected for the Willow Creek basin.

The most significant water quality impacts are on West Willow Creek and the mainstem below West Willow. Neither of these segments support aquatic life, and are not classified for aquatic life. Water quality impacts on East Willow Creek are not as severe, and in 1991 a remediation project financed through a Section 319 grant was implemented. The aquatic life classification was added to the lower reach of East Willow Creek in 1993.

Willow Creek has a measurable impact on the water quality of the Rio Grande. Cadmium, copper, iron, and zinc are higher in the Rio Grande at Wagonwheel Gap, about 5 miles below Creede than above Willow Creek. Zinc is the only metal to exceed aquatic life standard. Gold medal trout waters begin at the Coller State Wildlife area a few miles downstream from Wagonwheel Gap. This designation could extend further upstream, as the Rio Grande is an outstanding fishery above Willow Creek.

Kerber Creek and two tributaries, Squirrel Creek and Rawley Gulch, located in the Closed Basin, is the third water body that lacks an aquatic life use owing to water quality. Drainage from the Rawley #12 adit and mine and mill waste deposited along the water course in the early 1900's prevent the attainment of aquatic life and water supply uses.

The affected portions of Kerber Creek were resegmented in 1994, establishing a goal of attaining the water supply use on the upper segment near the Rawley mine and the goal of aquatic life and water supply for the segment between Brewery Creek and San Luis Creek. A voluntary clean up action is expected to begin along Kerber Creek during the summer of 1994.

LAKES AND RESERVOIRS

Lakes Water Quality Assessments

Six lakes/reservoirs were assessed for water quality in the Rio Grande Basin. They include La Jara Reservoir, Platoro Reservoir, Sanchez Reservoir, San Luis Lake, Smith Reservoir, and Terrace Reservoir. These lakes are located among the various watersheds in the Rio Grande Basin, and also represent several of the ecological subregions.

San Luis Lake

San Luis Lake was the only lake monitored in the Closed Basin watershed. It is the third largest natural lake in Colorado, and forms part of the Closed Basin Sump, which also includes Head Lake and other wetlands and intermittent sloughs. This sump is located in the 22-3 subregion, and is the lowest point in the Closed Basin. San Luis Lake is a highly productive system which is managed as a coldwater fishery by the Colorado Division of Wildlife (CDOW).

San Luis Lake has no natural outlet and inflows from the tributary streams have, until 1988, evaporated and percolated down into the ground water. This evaporation caused salts and other constituents to accumulate in the water and lead to saline conditions, poor water quality and, depending on the amount of runoff, to extreme fluctuations in water level in San Luis Lake.

These conditions were improved in 1988 when the U.S. Bureau of Reclamation completed its Closed Basin Project and began stabilizing the water levels in San Luis Lake. Water is now pumped from San Luis Lake to the Rio Grande via the Franklin Eddy Canal. As water is pumped out of the lake, it is replaced by inflows of less saline water from surface tributaries and ground water.

Based on the monitored water quality, in June, August, and September of 1992, San Luis Lake can be classified as eutrophic based on average chlorophyll *a*, total phosphorus and Secchi depth TSI's. This classification is also supported by the dense growths of aquatic weeds and is supported by dissolved oxygen concentrations which were above saturation and met the aquatic life cold water standard on all the sampling dates. Trophic state data is summarized in Table 15.

Based on data from 1990-1993, San Luis Lake is now meeting water quality standards for the monitored parameters, except for pH. Values of pH ranged from 9.4 to 10.1 for all sampling dates, and although the standard was exceeded, the high pH's are most likely due to the strong diel fluctuations in pH which are caused by photosynthesis, and do not result in aquatic life impairment.

Nutrient loadings to the reservoir have not been quantified, but are likely to be primarily from background sources and from nonpoint agricultural sources in the watershed. No point sources discharge directly to San Luis Lake.

Data collected by the Bureau of Reclamation in 1989 and in 1990 show that concentrations of mercury in rainbow trout fillets from San luis Lake range from 0.052 μg/g to 0.032 μg/g (wet weight). These are below the action level of 0.5 μg/g suggested by the CDH.

Smith Reservoir

Smith Reservoir, Mountain Home Reservoir and Sanchez Reservoir are the three irrigation reservoirs in the Rio Grande Basin which collect and store from the Sangre de Cristo Range. All three reservoirs are located in the 22-1 subregion, and have their upper watersheds located in higher subregions up through the high elevation tundra of 21-1. Smith and Sanchez reservoirs were monitored by the Division in 1992.

Overall, Smith Reservoir can be classified as eutrophic based on average chlorophyll *a*, and Secchi depth. Total phosphorus concentrations suggest a hypertrophic system, although the high phosphorus concentrations were not associated with high chlorophyll concentrations, and are likely due to sediments being resuspended near the bottom by wind mixing in this shallow reservoir. Trophic state data is summarized in Table 15.

Smith Reservoir is meeting the water quality standards for its classified uses with the exceptions of dissolved oxygen, pH and manganese. Values of pH were slightly above the standard of 9.0 in June and August. Manganese (dissolved) slightly exceeded the water supply standard of 50 μg/l on one occasion.

Because Smith Reservoir is shallow, wind mixing probably prevents stratification for significant periods of time during ice free conditions. This wind mixing may also prevent the reservoir from experiencing severe periods of dissolved oxygen depletions. Nevertheless, dissolved oxygen concentrations were below the aquatic life cold water standard in the entire water column on the August and September sampling dates. In June, dissolved oxygen met the standard in the entire water column, except for just above the bottom.

The effect of these conditions on the aquatic life use is not known. According to water quality criteria, low dissolved oxygen concentrations should result in stress to the fish which may lead to slowed growth or even to lethality if prolonged conditions of low (3.5 mg/l) DO exist. The Division is not aware of reports of fish kills or other adverse impacts to the fishery.

Nutrient loadings to the reservoir have not been quantified, but are likely to be primarily from background sources and from nonpoint agricultural sources in the watershed. No point sources discharge directly to Smith Reservoir nor to its two tributaries.

Sanchez Reservoir

Overall, the reservoir was classified as eutrophic based on average chlorophyll *a*, which is the primary trophic state indicator. Total phosphorus and Secchi depth TSI's suggest a mesotrophic condition but when considered in light of the small phosphorus data set, the large particulate algae observed and dissolved oxygen concentrations, it is reasonable to describe the overall trophic state as eutrophic. Trophic state data is summarized in Table 15.

Sanchez Reservoir appears to be meeting the water quality standards except for dissolved oxygen and pH. Values of pH were slightly above the standard of 9.0 in September, and reflect transient fluctuations in pH caused by photosynthesis.

Dissolved oxygen concentrations met the aquatic life cold water standard in June, but were below the standard for some depths in August and September. The effect of these conditions on the aquatic life in Sanchez Reservoir has not been determined, but according to water quality criteria, low DO concentrations should result in stress to the fish which may lead to slowed growth or even to lethality if prolonged conditions of low (3.5 mg/l) DO exist. However, the Division is not aware of reports of fish kills or other adverse impacts to the fishery.

Nutrient loadings to the reservoir have not been quantified, but are likely to be from background sources and from nonpoint agricultural sources in the watershed. No point sources discharge directly to Smith Reservoir or to the tributaries and Sanchez Canal.

The results of fish tissue analysis by several agencies revealed mercury contamination. Several species including walleye and yellow perch contained levels higher than the 0.5 μg/g action level. Based on these results a fish consumption advisory will be posted at the reservoir in 1994.

Platoro Reservoir

Platoro Reservoir was the only reservoir monitored in the 21-2 subregion of the SRM ecoregion. It is the largest reservoir in the Rio Grande Basin and situated at 9970 feet, it is the highest elevation reservoir in North America.

The Division monitored water quality in Platoro Reservoir in June, August, and September of 1992. Overall, the reservoir was classified as lower mesotrophic based on average chlorophyll *a*. total phosphorus and Secchi depth TSI's. Trophic state data is summarized in Table 15.

Platoro Reservoir meets the water quality standards, with the exception of dissolved oxygen. Dissolved oxygen concentrations met the aquatic life cold water standard in June, but were slightly less than the standard in portions of the water column in August and September.

Platoro Reservoir does not appear to be experiencing water quality problems or nutrient loadings that are causing excessive growth of algae. Oxygen concentrations are adequate to support cold water species, including lake trout. A small sample of brown trout fillets was analyzed for mercury and found to contain levels less than 0.1 μg/g mercury. These levels are well below the action level of 0.5 μg/g suggested by the CDH.

Nutrient loadings to the reservoir have not been quantified, but are likely to be from background sources and from nonpoint agricultural sources in the watershed. No point sources discharge directly to Platoro Reservoir.

La Jara Reservoir

La Jara Reservoir impounds La Jara Creek, which drains a small watershed confined to the lower elevations in the 21-3 subregion. This watershed sits on the east edge of the San Juan Mountains and is hydrologically isolated from the major watersheds in the San Juan Mountains. The lake itself is located in the 21-4 subregion, and was the only lake in the 21-4 subregion of the Rio Grande Basin that was monitored.

The Division monitored water quality in La Jara Reservoir in June, August, and September of 1992. The reservoir can be classified as hypertrophic based on average chlorophyll *a* and total phosphorus TSI's. Secchi depth TSI's suggest a very eutrophic condition but when considered along with other information, including dissolved oxygen and the extreme peaks of chlorophyll *a*, it is reasonable to describe the overall trophic state as hypertrophic. Trophic state data is summarized in Table 15.

La Jara Reservoir appears to be meeting the water quality standards for the monitored parameters, with the exceptions of dissolved oxygen, pH, manganese, and iron. Values of pH were slightly above the standard of 9.0 in June and August. Total recoverable iron exceeded the aquatic life standard of 1000 μg/l, and dissolved manganese exceeded the water supply standard of 50 μg/l in September. Fecal coliforms were less than 2 per 100 ml. Dissolved oxygen concentrations met the aquatic life cold water standard in June, but were below the standard at the deepest site in August and September.

La Jara Reservoir is a highly productive system that experiences severe algal blooms and periods of low dissolved oxygen. In both August and September, severe nuisance blooms of Aphanizominon sp. were observed over the entire reservoir. These conditions have probably contributed to the winter kill of fish that occurs at the reservoir during ice cover.

Nutrient loadings to the reservoir have not been quantified, but are likely to be from background and from nonpoint agricultural sources, such as the numerous cattle which are grazed in the local watershed. No point sources discharge directly to the reservoir.

Terrace Reservoir

Terrace reservoir impounds the Alamosa River. The reservoir and its local watershed are in the 21-3 ecological subregion, but the main watershed of the reservoir is found in the 21-2 and 21-1 subregion.

Terrace Reservoir has historically been somewhat degraded by metals and pH from natural mineralized areas and from early mining activities in the Alamosa River watershed. This did not preclude the CDOW from managing Terrace Reservoir as a coldwater fishery. However, recent metals pollution from the Summitville mining operations eliminated all aquatic life in the reservoir by the late 1980's. In 1975, for example, the CDOW collected rainbow trout, cutthroat trout, white suckers and Rio Grande Chubs. However, in 1989, a CDOW survey concluded that there were no fish remaining in the reservoir and that they were probably killed by metals pollution, and recommended that stocking of trout be discontinued until the reservoir met water quality standards for aquatic life.

The Division monitored water quality in Terrace Reservoir from two sites in June, August, and September of 1992. Terrace Reservoir could possibly be classified as oligotrophic based on average chlorophyll a, total phosphorus and Secchi depth TSI's. However, the use of common descriptors of trophic state, or on indexes such as the Carlson TSI, for Terrace Reservoir is not appropriate. The productivity of the reservoir is extremely low and is apparently controlled by toxic levels of metals and low pH, and not primarily by nutrient inputs. Trophic state data is summarized in Table 15. Dissolved oxygen concentrations met the aquatic life cold water standard at all depths at all sampling dates.

No point sources discharge directly to Terrace Reservoir, but a significant impact to the reservoir has occurred from discharges from the Summitville mining area and from natural mineralized areas in tributaries upstream of the reservoir. These have caused Terrace Reservoir to exceed the Table Value Standards for pH, Cd, Cu, Fe, Zn, and Mn. Except for the Fe, these parameters are at concentrations which are acutely toxic to aquatic life.

Nutrient loadings to the reservoir have not been quantified, but are likely to include natural background sources, agricultural nonpoint sources, and mining activities at the Summittville area. Information collected by the USGS in 1993 reveals that in addition to the metals monitored by the Division, aluminum is present in the reservoir at toxic levels.

WETLANDS

Wetlands are areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Riparian wetlands, important in the Rocky Mountain region, parallel stream channels. They are described as bottomland, floodplains, or streambank vegetation. Riparian wetland ecosystems have a high species diversity, high species density, and high productivity. Not all streamside habitats are riparian wetlands. Nonriparian streamside habitat include areas where sagebrush or other nonhydric community types reach the water's edge or where streamside habitat is composed of bedrock, steepsided canyon lands, or boulder and rubble that extends to the terrestrial zone.

Wetlands are found at all elevations of the Rio Grande basin. Wetlands in the SRM ecoregion are different from the San Luis Valley, ANMP ecoregion, because of different geologic origins, weather, and resulting soil types of these two major topographic areas.

Wetlands at the higher elevations of the SRM ecoregion are dominated by sedges, rushes, willows, and other hydrophytes. Riparian wetlands in the narrow valleys in this ecoregion are dominated by narrow leaf cottonwood, Colorado blue spruce, alder, river birch, and willows. Plains cottonwood, box-elder, and different species of willows replace narrow-leaf cottonwood and Colorado blue spruce at the lower elevations.

Although much is known about the physical characteristics of wetlands in the SRM ecoregion quantification of the location and extent of riparian wetlands in the SRM ecoregion of the Rio Grande Basin has not been undertaken to date.

Ponds, marshes, and seasonally flooded agricultural lands comprise the majority of wetlands in the ANMP ecoregion, or San Luis Valley. A Colorado Division of Wildlife (1968) survey of wetlands estimated that 230,782 acres or roughly 9% of the San Luis Valley consisted of wetlands. Most of the wetlands were found in Alamosa and Saguache counties with ponds and marshes over five acres in area accounting for most of the wetland acreage. Ponds and marshes less than five acres in area was the predominant wetland category in terms of numbers of wetlands. Historically many of the wetlands in the San Luis Valley were probably wet only during spring runoff.

Today canals, irrigation return flows, and artesian wells contribute to the formation and maintenance of wetlands.

Evaporation exceeds precipitation in the arid San Luis Valley. As a result, soluble salts liberated from the soils of the basin accumulate. Where the water table is close to the surface, evaporation from the surface horizons of the soil during dry weather, lifts salts to the soil surface and leaves a salt crust. Greasewood, big rabbitbrush, rushes, and alkali sacaton are a few of the species that proliferate in this highly alkaline environment. Cattails are abundant along roads, ditches, streams, and ponds that are seasonally flooded in the San Luis Valley.

Russell Lakes, Mishak Lakes, and San Luis Lake, all within the Closed Basin, are the only lakes of a permanent nature. All other wetlands are seasonally flooded.

The Alamosa and Monte Vista National Wildlife Refuges and the Russell Lakes state wildlife area are wetland areas receiving special protection in the San Luis Valley because of their importance as habitat for wildlife.

GROUNDWATER

Ground water in the San Luis Valley is obtained from confined and unconfined aquifers. The shallow unconfined ground water occurs nearly everywhere in the Valley, and the depth to water in approximately half the area is less than 12 feet (Davis Engineering Service, 1975). Recharge to the unconfined aquifer is from applied irrigation water and leakage from canals and ditches.

The principal source of recharge to the confined aquifer is seepage from mountain streams flowing across the alluvial fans that flank the Valley floor. These streams have significant losses as they cross the porus surface of the fans. Davis Engineering Service (1975) report that losses from streams located on the west flank of the Sangre de Cristo's range from about 35 percent to nearly 95 percent.

The Water Quality Control Division Groundwater Unit sampled ninety-three domestic wells in the San Luis Valley in the summer of 1993. All wells were sampled once between June and August, 1993. Wells were selected from sampling based on the following factors: permitted for domestic or household use, located within the unconfined valley fill aquifer, and cooperation of the well owner. Field sampling procedures followed the protocol developed by the Ground Water Quality Monitoring Working Group of the Colorado Nonpoint Task Force.

All samples were analyzed for fifteen basic constituents such as pH, hardness, cations, and anions and for a suite of twelve metals. In addition to the inorganic parameters, all of groundwater samples collected were analyzed for selected pesticides. The pesticide analysis was performed by the CDPHE and Colorado Department of

Agriculture laboratories. A listing of pesticides was compiled for analysis based on those substances that have recently been, or are currently being utilized in the San Luis Valley according to agricultural officials there. Budget restrictions would not allow testing for all pesticides used in the study area. To reduce the analysis cost, each pesticide was weighted according to its chemical properties of persistence and mobility in the environment, amount of active ingredient used per acre, and the amount of acreage within the study area that pesticide was used on. Pesticides were then selected according to their final score and the ability of the laboratory to detect their presence.

The results from this sampling program have been entered into the CDPHE Groundwater Quality Data System recently developed at CDPHE. A detailed report describing the area sampled, the protocol for sampling and analysis, and the results of the analysis will be available in 1994.

At the time of this report, a complete analysis of all laboratory results for the San Luis Valley has not been completed. Preliminary analysis of nitrate and some of the pesticide data indicates that groundwater in parts of the study area has been impacted by various agricultural chemicals. The major inorganic contaminant of concern is nitrate. Thirteen of the ninety-three (14%) domestic wells sampled showed nitrate levels in excess of the standard for drinking water (10 mg/l). Three different pesticides were detected, about only one well contained a pesticide at a level higher that the drinking water standard. This pesticide, Lindane, was detected at a level of 0.29 μg/l; the MCL for lindane is 0.2 μg/l. No single pesticide was detected in more than one well.

POLLUTION CONTROL PROGRAMS

POINT SOURCES

This section describes the point sources found in the Rio Grande Basin in Colorado. It includes an assessment of the adequacy of existing facilities to meet applicable effluent limits or adopted water quality standards and to identify additional measures which may be required to meet the goals of the Colorado Water Quality Act and the federal Clean Water Act.

The Rio Grande basin has thirty-one (31) permitted waste water treatment facilities. Twenty-two facilities treat primarily domestic waste; five facilities treat waste from agricultural processing plants; there are three hardrock mines; and one municipal water treatment plant. Alamosa and Monte Vista are the only domestic facilities classified as majors (i. e. have the capacity to treat more than one million gallons per day (mgd) effluent). The agricultural facilities, except the Rakhra Mushroom Farm, are all potato washing plants. Hardrock mines with active permits include Summitville, the Homestake Bulldog Mine, and the Union Mine. A fourth mine, Battle Mountain Gold near San Luis does not have a surface discharge, and therefore does not require a CPDS permit. None of the three permitted mines is actively mining.

Several facilities are reaching their rated capacity for flow and biochemical oxygen demand. Improvements to enable the facilities to meet secondary treatment requirements and discharge permit limits on a continuous basis are underway at Alamosa, Monte Vista, Center, and Saguache.

Three metal mines have discharge permits. Galactic Resources at Summitville has declared bankruptcy and the U. S. Environmental Protection Agency is operating the treatment plant and directing cleanup activities on an interim basis. The Homestake Bulldog Mountain Mine has been closed and the treatment plant removed from the site. Exploration activities at the Union Mine at Platoro have ceased and the site is being reclaimed.

Several potato washing plants and a mushroom farm are located between Del Norte and Alamosa. These are small facilities with intermittent discharges. There are no toxics associated with these discharges. Concentrations of BOD, TSS, and fecal coliform limited in the discharge permits are sufficiently low as to not cause significant problems.

A total maximum daily load (TMDL) for ammonia has been established for ammonia for Alamosa's discharge to the Rio Grande. A total maximum daily load for arsenic, cadmium, copper, and zinc has been proposed for the Conejos River at Platoro. The latter TMDL has been proposed to address closure of the Union Mine and to allocate the metal load between point and nonpoint sources at the mine site.

Table 16
Permitted Wastewater Treatment Facilities
in the Rio Grande Basin

Facility	Type	Current flow/ Capacity MGD	Receiving Water	Effluent Limits
Rio Grande Sub-basin				
Wolf Creek Ski	Domestic	/0.008	Pass Creek	Secondary
Mack Henson	Domestic	0.02/0.025	South Fork	Secondary
Creede	Municipal	0.12/	Willow Creek	Secondary
Homestake Bulldog	Hardrock Mine	0/2.5		BAT
South Fork	Municipal	/0.13	Rio Grande	Secondary
Del Norte	Municipal	/1.38	N. A.*	Secondary
Del Norte WTP	Water Tmt.	/n.a.	Pinos Creek	BAT
Del Norte Potato Growers	Industrial	/n.a.	N. A.	BAT
Monte Vista	Municipal	1.32/3.09	N. A.	Secondary
Monte Vista Veterans	Municipal	0.02/0.11	Rio Grande	Secondary
Grower Shippers				
Potato	Industrial	/n.a.	N. A.	BAT
Alamosa				
	Municipal	1.1/1.95	Rio Grande	Secondary plus
Rakhra Mushroom				Ammonia
Costilla County	Industrial	/n.a.	N. A.	BAT
San Luis	Municipal	0.05/0.13	Culebra Creek	Secondary
	Municipal	0.25/0.077	N. A.	Secondary
Alamosa/Conejos/La Jara Sub-basin				
Summitville Mine	Hardrock Mine		Wightman Fork	
Union Mine	Hardrock Mine	0.16/n.a.	Conejos River	BAT
La Jara	Municipal	/0.17		Secondary
Romeo	Municipal	0.02/0.04		Secondary
Sanford	Municipal	0.04/0.13		Secondary
Manassa	Municipal	0.45/0.50		Secondary
Antonito	Municipal	0.13/0.205	Rio San Antonio	Secondary
Closed Basin				
Saguache	Municipal	0.07/0.077		Secondary
Baca Grande	Municipal	/0.034		Secondary
Baca Grande	Municipal			Secondary
Center	Municipal	0.50/0.25		Secondary
Canon Potato	Industrial	0.25/n.a.		BAT

* Receiving waters marked N. A. are unclassified ditches or ephemeral channels.

V. LAKES AND RESERVOIRS

Background

Colorado has a total of approximately 3,258 significant publicly owned lakes according to preliminary figures provided by the EPA (1991). These range in size from one surface acre to greater than 500 acres. Other estimates of the total number of lakes range from 2,400 (Colorado Division of Wildlife 1992) to 4,069 (Chappell 1985). Total acreage has been estimated at 143,019 by the EPA (1991).

Significant publicly owned lakes are defined as those waterbodies where the public has access to recreational activities such as fishing and swimming or where the beneficial uses such as water supply affect the public. In previous Section 305(b) reports the definition of significant also included a lower limit on lake size of 25 acres. The limit is no longer included because there are a number of lakes which are significant to the public which are less than 25 acres. The term lakes, as used in this report, means any significant publicly owned natural lake, reservoir or pond.

Section 314(a)(2) of the Clean Water Act requires the states to report on the status of lake water quality as part of the section 305(b) report. Colorado has conducted lakes assessment under the Lake Water Quality Assessment grant assistance from EPA since 1989. This has included the monitoring of 19 lakes by the WQCD from 1989 through 1991 and the monitoring of eight lakes in 1992.

As part of the Lake Water Quality Assessment program, the WQCD also includes trophic assessment based on data collected by agencies other than the WQCD. Routine monitoring is being or has been performed on at least 13 of the publicly owned reservoirs by the USGS, Army Corps of Engineers, Denver Water Board and various other entities including cities, regional council of governments and basin associations.

Trophic State Assessment

Trophic state is a classification of lakes based on the nutrient status and level of biological productivity (especially algae). Those lakes with few available nutrients and a low level of biological productivity are termed oligotrophic; those with high nutrient levels and a high level of productivity are termed eutrophic. Those lakes between oligotrophic and eutrophic are termed mesotrophic. Lakes in an advanced eutrophic state are termed hypertrophic. These terms are descriptive and are not exact. Commonly used indicators of nutrient status and productivity include water transparency as measured by Secchi disc, the amount of algae as measured by chlorophyll α and in-lake phosphorus concentration.

Trophic status, per se, is not an indicator of water quality problems. Trophic status is an index of water quality only to the extent that trophic condition limits the desired use of a lake, such as for water supply or for recreation. Generally, as a lake becomes eutrophic, effects are considered to be negative especially if the eutrophication is accelerated by human activities. Negative effects include taste and odor problems for water supplies, reduction in water clarity which is important for many recreational uses, and a reduction in dissolved oxygen in bottom waters to concentrations which are lethal to fish. Eutrophication often leads to increased fish production but often with a loss of species such as trout, that inhabit cold deep areas.

The WQCD used the Trophic State Index (TSI) equations developed by Carlson (1977) to estimate trophic state. Data for the epilminion, collected during the summer/fall growing season (June through October) was used for calculating the mean total phosphorus, mean chlorophyll α, and mean Secchi disc transparency for each lake. These three values were used to calculate the TSI's for each lake according to Carlson. These individual TSI's for each lake were compared to the categories presented below to determine an overall trophic status (Olem and Flock 1990). These categories of TSI are slightly different than those used in the 1990 305(b) report.

TSI	TROPHIC STATE
0-40	Oligotrophic
41-50	Mesotrophic
51-65	Eutrophic
> 65	Hypertrophic

When there were differences among individual TSI's (>5 units) for a lake, they were averaged to obtain an overall TSI. Where differences among the TSI's were substantial or where TSI's were on a boundary between two trophic categories, the overall trophic category was determined by using chlorophyll *a* as the primary indicator.

The WQCD has assessed 87 of the 176 lakes entered into the WBS. Table 3 provides a summary of trophic status by river basin of the 87 lakes, and includes evaluated and monitored lakes. The trophic status on monitored lakes (all agencies) is shown in Table 15 for individual lakes. There are several changes to Table 15 from that presented in the 1990 report, and they are shown in Table 16. These include the deletion of those lakes where trophic state is based on evaluated data, the updating of TSI's due to new data or to changes in trophic category definition, the inclusion of new lakes and the listing of the ecological region and subregion.

As can be seen from Table 3, over half of the 87 assessed lakes were classified eutrophic. Since most of the lakes which were not assessed are at high elevations and in relatively unimpacted watersheds it is anticipated that the percentage of lakes within the oligotrophic and mesotrophic categories should increase as more data are collected.

TABLE 17

1994 Colorado Lakes Trophic Assessment for Monitored Lakes

Lakes	County	Long/Lat	Surf Acres	Rec Uses	Chlor α µg/l	TSI Chlor	Total Phos µg/l	TSI Phos	Secchi Depth m	TSI Secchi Depth	Est Trophic Status	Elev	Eco-Region
Arvada R	Jefferson	105 13 39 49	250	F	3.9	44	9	36	3.0	44	Meso	5775	25-3
Barr L	Adams	104 45 39 56	1600	B,SK,F	128.0	78	673	98	0.6	67	Hyper	5100	25-3
Bear Cr. R	Jefferson	105 07 39 42	109	B,F	37.7	66	111.0	74	1.7	52	Hyper	5600	25-2
Berkeley L	Denver	105 05 39 45	35	B,F	89.5	75	90	69	0.4	73	Hyper	5350	25-3
Blue Mesa R	Gunnison	107 20 38 27	9040	B,S,SK,F	4.5	45	49	60	4.5	38	Meso	7516	20-1
Brainard L	Boulder	105 34 40 04	15	F			10	37			Oligo	10350	21-2
Carter L	Larimer	105 13 40 19	1158	B,F,SK,S	2.1	48	21	40	2.4	47	Meso	5759	21-4
Chatfield R	Jefferson	105 04 39 33	1410	B,F,SK,S	2.3	39	9	36	1.7	52	Meso	5430	25-3
Cherry Cr R	Arapahoe	104 51 39 40	900	B,F,SK,S	10.7	54	35	55	1.1	59	Eutro	5550	25-3
Dillon R	Summit	106 03 39 37	3153	B,F	8.2	51	9	36	2.7	46	Meso	9200	21-4
Electra L	La Plata	107 48 37 33	780	B,F,SK,S	4.7	46	4	24	6.3	33	Oligo	8320	21-4
Evergreen L	Jefferson	105 17 39 38	55	F	5.2	47	32	54	1.9	51	Eutro	7500	21-3
Granby L	Grand	105 52 40 10	6943	B,F,SK	5.5.	47	19	46	2.1	49	Meso	8260	21-3
Grand L	Grand	105 51 40 13	800	B,F,SK,S	8.7	52	11	39	2.8	45	Eutro	8367	21-2
Grasmere L	Denver	104 57 39 42	17	NM,F	2.8	41	<50		3.2	43	Eutro	5300	25-3
Green Mtn R	Summit	106 19 39 52	2175	B,F,SK,S	2.3	39	8	34	3.3	43	Meso	7870	21-4
Gross R	Boulder	105 20 39 55	420	F	2.0	37					Oligo	7287	21-3
Henry L	Crowley	103 45 38 15	1120	B,F,S			65	64			Eutro	4360	26-1
Horsetooth R	Larimer	105 10 40 36	1875	B,SK,S,F	2.6	40	16	44	2.1	49	Meso	5430	25-2
Jackson R	Morgan	104 00 40 10	2967	B,SK,S,F	22.2	61	127	74	2.0	50	Eutro	4438	25-3
Kendrick L	Jefferson	105 06 39 41	33	F	17.7	59	65	64	0.8	63	Eutro	5490	25-3
La Jara R	Conejos	106 20 37 14	800	F,B,SK	294	86	153	77	0.8	63	Hyper	9698	21-4
Lonetree R	Larimer	105 07 40 19	500	B,F	13.7	56	40	57	1.5	54	Eutro	5130	25-3
Platoro R	Conejos	106 32 37 21	947	B,F	3.3	42	14	42	3.4	42	Meso	9970	21-2
Pueblo R	Pueblo	104 45 38 16	1400	B,SK,S,F	9.3	52	31	54	1.7	52	Eutro	4800	26-1
Quincy R	Arapahoe	104 45 39 40	160	NM,F	70.0	72	49	60	1.6	53	Eutro	5600	25-2
Rio Grande R	Hinsdale	107 15 37 45	1500	B,F	7.2	50	28	52			Eutro	9400	21-2
Rocky Mtn L	Denver	105 05 39 45	27	F	46.0	68	200	81	0.7	65	Hyper	5300	25-3
San Cristobal	Hinsdale	107 15 38 00	350	B,F	1.1	32	8	35	5.4	36	Oligo	8997	21-2
Sanchez R	Costilla	105 25 37 06	2800	B,F,SK	23.7	62	23	49	3.5	42	Eutro	8317	22-1
San Luis L	Alamosa	105 43 37 40	890	B,F,SK,S	8.8	52	68	65	1.7	52	Eutro	7520	22-3
Shadow Mtn L	Grand	105 51 40 12	1337	B,SK,S,F	9.6	53	22	49	1.7	53	Eutro	8367	21-3
Sloan L	Denver	105 03 39 45	177	B,SK,F	120.0	78	90	69	0.3	77	Hyper	5300	25-3
Smith L	Denver	104 57 39 42	18,	NM,F	57.1	70	<50		0.7	65	Hyper	5300	25-3
Smith R	Costilla	105 33 37 23	700	B,F,SK,S	16.6	58	74	128	1.2	58	Eutro	7721	22-1
Soda Lake So	Jefferson	105 10 39 39	73,	B,F	31.8	65	60	63	1.2	57	Eutro	5650	25-2
Stagecoach R	Routt	106 50 40 17	780,	B,F,S	31.5	64	53	61	2.1	49	Eutro	7160	21-3
Standley L	Jefferson	105 07 39 52	1230	B,SK,F	4.8	46	7	32	2.7	46	Meso	5500	25-2
Sterling R	Logan	103 16 40 47	3080	B,S,SK,F	92.4	75	144	76	0.5	70	Hyper	4065	25-3
Terrace R	Conejos	106 17 37 21	300		< 1.0	-	8	34	4.6	38	-	8526	22-3
Twin Lakes R	Lake	106 25 39 04	2450	B,SK,S,F	2.9	41	2	12	8.7	29	Oligo	9190	21-2
Williams Fork R	Grand	106 12 40 02	1530	B,F	16.9	58	19	47	1.9	51	Eutro	7995	21-4

B = Boating, S = Swimming, SK = Skiing, NM = Non-motorized boating
F = Fishing, R = Reservoir, L = Lake

Table 18

Types of Changes to the 1992 305(b) Trophic Assessment
for TSI and Trophic State Categories for Monitored Lakes

Lake or Reservoir	Revised TSI's	Lake Added to Table 15	Changes in definitions of categories	Changes in trophic Status 1992	to 1994
La Jara Reservoir		X			
Platoro Reservoir		X			
Sanchez Reservoir		X			
San Luis Lake		X			
Smith Reservoir		X			
Standley Lake	X				
Terrace Reservoir		X			

Control Methods

Three lakes (Cherry Creek Reservoir, Chatfield Reservoir and Dillon Reservoir) in Colorado have numeric phosphorus standards in place in order to maintain the existing trophic status. These standards are being implemented through nonpoint and point source controls on phosphorus loading from the watersheds to the reservoirs.

The control regulations for implementing the phosphorus standards on both Dillon Reservoir and Cherry Creek Reservoir include wasteload allocations for point sources of phosphorus and an aggregate assignment of loading to nonpoint phosphorus. The point source allocations are implemented through discharge permit limitations, and the nonpoint allocations through the implementation of Best Management Practices (BMPs). Nonpoint BMPs include artificial wetland construction, grasses waterways, check dams, drop structures, infiltration ponds and trenches, and detention basins.

The Cherry Creek Basin Water Quality Authority is assessing the feasibility of a constructed wetland above the reservoir. Studies are being conducted on light limitation and resuspension of bottom sediments.

The control regulation for Chatfield Reservoir requires that a nonpoint source control plan for the basin be developed by 1992. Compliance with the point source phosphorus effluent limit of 0.2 mg/l was required by 1991 but several dischargers have not been able to obtain the necessary financing to achieve this limit. The commission triennial review of the regulation indicated that a wasteload allocation for phosphorus with less stringent effluent limitation was the preferred option of entities in the basin.

The phosphorus loadings to Dillon reservoir have decreased significantly since the adoption of the control regulation in 1984. This is due to tertiary treatment plants which have in excess of 95% phosphorus removal and nonpoint source control practices required by local ordinance. Septic systems phosphorus loading in the basin is a major concern.

The commission adopted a narrative phosphorus standard and phosphorous control regulation for Bear Creek Reservoir in July, 1992. The intent of the standard is to improve the trophic state from a hypertrophic/eutrophic classification to a eutrophic classification. The standard is to be implemented by a control regulation which would call for 70 percent reductions in external phosphorous loadings to the reservoir. Point sources would be required to achieve effluent concentrations of 1 mg/l at loadings equivalent to 75 percent of current loads. Nonpoint sources will also be addressed. Reservoir management including hypolimnetic aeration and withdrawal are also proposed.

Restoration Efforts

The Phase 1 study of the Bear Creek Reservoir was completed in 1992. The report identified the reservoir as primarily eutrophic with periods of hypertrophy. These trophic categories are based on the 1988 total phosphorous concentrations during the summer growing season of 111 ug/liter, average and peak summer chlorophyll α of 19 ug/liter and 98 ug/liter, respectively, and average Secchi disc readings of 1.7 meters. The water quality problems associated with trophic state include excessive algae, anoxic hypolimnion and a limited cold water fishery.

Excessive loading of phosphorus appears to be responsible for the current trophic state. On an annual basis, approximately 32,000 pounds of phosphorus are input to the reservoir, with 47 percent from point sources and 53 percent from nonpoint. During the summer growing season there is approximately 23,000 pounds entering the reservoir from point sources.

The Sloan Lake Phase II project was completed in 1991. The primary techniques to restore water quality are to increase nutrient flushing by ensuring allocated flows are diverted through the lake, and by periodic relocation of waterfowl at Sloan Lake to other places. The City of Denver is also conducting limited dredging to deepen inflow areas of the lake.

The Cities of Arvada, Golden, Northglenn, Thornton and Westminster and Jefferson County are evaluating water quality in Standley Lake which could lead to the development of a phosphorus standard or control regulation. They are also currently exploring various nonpoint source control options and best management strategies which would result in protection of lake uses. The potential effectiveness of these options or strategies as related to stormwater runoff is also being evaluated. The cities of Northglenn, Thornton and Westminster are planning to present a lake protection strategy, which could include a lake phosphorus standard, to the WQCC at a June, 1992 briefing, in preparation for the June 1993 Rulemaking Hearing.

In 1991, the U.S. Geological Survey completed the Methods of Data Collection and Water Qualities Data for Standley Lake, Jefferson County, Colorado, 1989-90 in cooperation with the cities of Arvada, Golden, Northglenn, Thornton and Westminster and Jefferson County. Physical, chemical and biological water quality data were collected at sites within the lake, primary inflows and the outflow. Data Collection was designed to assess nutrient availability, processes affecting nutrient availability, compounds causing taste and odor problems, potential sources of these compounds and factors limiting algal growth in the lake. In December, 1991, a draft U.S. Geological Survey Open File Report titled Limnological characterization, Nutrient Loading and Limitation, and Potential Sources of Taste and Odor Problems in Standley Lake, Colorado was released for review.

Toxics

Colorado has identified seven lakes which are impacted by toxics. Derby, Ladora and Mary which are on the Rocky Mountain Arsenal are impacted by bioaccumulation of organics in fish. Fish consumption is banned at these lakes. Fish in Teller Reservoir, on the Fort Carson military reservation, are contaminated by mercury and fish consumption is banned there also. Some species of fish collected in Narraguinnep Reservoir, McPhee Reservoir, and Navajo Reservoirs have mercury levels exceeding 0.5 μg/g. These lakes are posted with health advisories which recommend limiting the number of meals of fish per month, especially for children and pregnant women. An advisory is being for considered for Sanchez Reservoir. Sweitzer Lake has an advisory on fish consumption due to selenium bioaccumulation in fish. Terrace Reservoir is severely impacted by metals.

Acid Rain

Studies conducted by EPA (1986) on acid rain problems in Colorado indicate that 132 lakes were sampled in Colorado of an estimated 1,476 in the area covered by the survey. Of the estimated 1,476 lakes, (70 %) are believed to be very sensitive to acid precipitation and 521 (35%) sensitive to acid precipitation. The very sensitive lakes have an acid neutralizing capability (ANC) of not more than 50 ueq/l and the sensitive have a range of 50 to 200 ueq/l ANC. At this time EPA has not identified any lakes impacted by acid precipitation and there are no lakes being treated for the effects of acid precipitation.

The Air Pollution Control Division has funded the USGS to conduct a follow up study in 1994, of acid deposition patterns in the Yampa River Valley. Earlier work by the USGS indicates that the snowpack contains 250% more acidity and about twice the sulfates and nitrates of other high-elevation snowpack in the state. Lakes located near the snowpack show elevated levels of sulfate also.

In the Rio Grande National Forest, the Forest Service has established a network of high elevation lakes in wilderness areas. Monitoring began in these lakes in 1992 for long term trends in acidification.

Trends

At least seven lakes in Colorado have long-term monitoring programs (over three years of nutrient and other trophic status indicators). These lakes include Cherry Creek, Bear Creek, Chatfield, Standley, Dillon, Green Mountain and Arvada Reservoirs. Most trophic state indicators for these man-made reservoirs show considerable variability from year to year, which is believed to be due primarily to hydrologic and climatic variability. Because obvious trends are not apparent for these lakes, it is the WQCD's judgement that no serious problems in shifts in trophic status have arisen, and that the trophic condition in these lakes is stable.

VI. RELATIONSHIP OF WATER QUALITY PROGRAMS TO INSTREAM QUALITY

Water quality management in Colorado has evolved from a technology based program into one which relates specific control actions to water quality problems. Expected measurable improvements or maintenance of existing water quality is the goal. The attainment of secondary treatment for virtually all domestic treatment facilities and Best Available Technology for industrial plants has been achieved. Emphasis has changed from technology based minimums to treatment required to protect adopted stream classifications and numeric water quality standards. Additionally, more attention is being given to nonpoint controls where it can be shown that stream standards will still not be attained by additional point source controls at reasonable cost levels. This section describes how the state's water quality management program relates to instream quality, and how programs to control nonpoint sources may be blended with the existing program to complete the attainment of water quality goals.

Discharge Permits

Colorado has been delegated the responsibility of issuing discharge permits in conformance with the NPDES provisions of the Clean Water Act. Priority stream segments are identified to determine which segments may require discharger to treat beyond technologically based minimums to meet water quality standards. Wasteload allocation studies are designed to specify effluent limits need to meet water quality standards are then initiated. Segments are prioritized by extent of degradation or how seriously threatened with degradation in the future. Although high priorities may also be assigned to segments based on the WQCD schedule for basin-wide sampling.

Construction Grants and Loans

The State currently administers the Water Pollution Control Revolving Fund (WPCRF), which is capitalized with Federal funds. The Federal EPA Construction Grants Program has essentially been phased out, although a small amount of funds remain to complete a few projects approved for funding prior to the initiation of the WQCRF program.

As required by State and Federal regulations, the Financial Assistance Programs Unit of the Water Quality Control Division implements a priority system which serves as the basis for determining grant/loan eligibility of governmentally sponsored projects. The priority system currently in use awards points to a project for the following components: Severity of Pollution, Quality of Receiving Waters, Financial Need, Regionalization, Beneficial Use of Sludge, and Water Conservation. Facilities discharging to "threatened" or "impaired" waters, as defined in this 305(b) report, receive points which are a major component of a composite score for determining ranking in relation to other facilities.

WATER POLLUTION CONTROL REVOLVING FUND (WPCRF)
SUMMARY as of 7-31-92

EXISTING LOANS

- LEVERAGED LOAN PROGRAM -

	BORROWER	LOAN AMOUNT	LOAN TERM	EFFECTIVE INTEREST RATE	FEDERAL GRANT
1989A	DENVER SOUTHEAST SUBURBAN	6,905,000	22 YEARS	4.63%	3,073,382
1990A	TOWN of CASTLE ROCK	4,319,911	20 YEARS	5.20%	2,147,505
1991A	CITY of ENGLEWOOD	12,750,000	22 YEARS	4.64%	6,464,024
1991A	CITY of LITTLETON (GEN. OBLIG.)	7,750,000	22 YEARS	4.64%	3,929,113
1991A	CITY of LITTLETON (REVENUE)	5,000,694	22 YEARS	4.64%	2,535,263
1991B	METRO WASTEWATER RECLAM. DISTRICT	21,910,000	20 YEARS	4.58%	11,125,000
1992A	CITY of FORT LUPTON	4,200,000	21 YEARS	5.17%	1,151,000
1992A	FRISCO SANITATION DISTRICT	4,500,000	20 YEARS	5.17%	1,455,800
1992A	UPPER EAGLE VALLEY CONS. SN DISTRICT	7,368,840	21 YEARS	5.17%	1,737,300
1992B	CITY of FORT COLLINS	24,540,580	23 YEARS	4.05%	9,548,700
1992B	CITY of LONGMONT	3,500,000	20 YEARS	3.96%	1,729,200
	TOTAL LEVERAGED LOANS	$102,745,025			$44,896,287

- DIRECT LOANS -

	BORROWER	LOAN AMOUNT	LOAN TERM	EFFECTIVE INTEREST RATE	FEDERAL GRANT
1989	LARIMER COUNTY - MTN. RANGE SHDW	1,721,489	21 YEARS	3.15%	1,207,770
1990	MTN. WATER & SANITATION DISTRICT	200,000	20 YEARS	1.43%	166,667
1990	TOWN of WELLINGTON	375,000	20 YEARS	1.43%	312,500
1991	DURANGO WEST METRO DISTRICT #2	500,000	20 YEARS	4.50%	416,667
1992	NUCLA SANITATION DISTRICT	180,000	20 YEARS	1.50%	150,000
1992	DIVIDE WATER & SANITATION DISTRICT	69,000	9 YEARS	4.50%	57,500
1992	CITY of OURAY	800,000	20 YEARS	4.50%	666,667
	TOTAL DIRECT LOANS	$3,845,489			$2,977,771

Table 19

The following table is a summary of WQCRF direct and leveraged loans as of July 31, 1992.

Enforcement

The State's Compliance Strategy Report, June, 1984, established the philosophy and criteria the state uses to enforce discharge permit conditions. The linkage between priority stream segments and enforcement priorities is made when "...those facilities located in high priority stream segments will be given an overall higher emphasis than those facilities in low priority stream segments" (page 35). The "Guidance for Assessing Civil Penalties" categorizes the degree of impact that an effluent violation produced in either a severe, moderate, or minor category, and establishes a distinctive financial penalty among the categories. A "potential damage" percentage of the severity classification further emphasizes the relationship between the penalty and the environmental/public health damage or risk.

Fish Kills

During the 1992-1994 reporting period, there were three reported fish kills. The first occurred on the Big Thompson River in August 1992 and was probably caused by the use of copper sulfate as an algaecide in the Charles Hansen Feeder Canal by the Northern Colorado Water Conservancy District. Just after the fish kill was reported, the pH of the Big Thompson River was reported to be 5.92 S. U. which may have contributed to the toxicity of the copper. Approximately 1.9 miles of stream were affected and 1,200 to 2,000 trout were estimated to have been killed.

The second occurred on the Alamosa River below Terrace Reservoir, Segment 22 of the Rio Grande (CORGRG22), and in Terrace Reservoir, Segment 21 of the Rio Grande (CORGRG21), and was caused by metals and possibly cyanide released by Galactic Resources at their mining and heap leach operation that discharges to the Wightman Fork of the Alamosa River. Fish kills related to this discharge may recur at any time until a water quality based permit is in place for this facility. Although the Environmental Protection Agency has taken over the operation of this site, fish kills are still reported because a water quality based permit can not yet be written even though clean up of the site is continuing.

The third occurred on La Jara Creek in April of 1994. There is currently not much information available on this fish kill. As more information becomes available, it will reported in this section of the 305(b) report.

Discharge of Dredged or Fill Material (401 Certification)

The 401 certifications are administered under regulations promulgated by the state in the fall of 1985 and revised in 1987. Instream water quality plays a major role in determining whether to grant or deny water quality certification to projects requiring a 404 permit. If a project cannot provide reasonable assurance that water quality standards will be maintained even with a full list of conditions attached to it, the WQCD must deny 401 certification and the project cannot proceed. The status of the stream's quality in relation to the stream standards is vital in these determinations, and the findings of this report will be used as a portion of the factual basis for making these decisions.

Groundwater

Many streams and lakes in Colorado are sustained during dry periods by inflow from groundwater. During wetter periods, aquifers may be recharged from water in the same streams and lakes. The quality of the two resources are closely linked; however, until recently most monitoring and control has focused on surface water. There is increasing reliance on groundwater for many of the same purposes for which surface water was used, thus more monitoring and control emphasis is now directed toward its preservation. For more information on groundwater, see Section 2 of this report.

Superfund/NRDS

Colorado has six sites where major impacts to surface water quality have been identified under superfund authority.

Yak Tunnel - California Gulch and Arkansas River
Idarado - San Miguel River and Red Mountain Creek
Eagle Mine - Eagle River
Uravan - San Miguel River
Globeville - South Platte River
Clear Creek - Central City

Remediation is underway at all sites. The Globeville and Idarado sites were litigated by Colorado under the Natural Resources Damage Suite (NRDS) law.

VII. NONPOINT SOURCE CONTROL PROGRAM - Section 319 Efforts in Colorado

Introduction

Colorado became actively involved in Section 319 Nonpoint Source Control efforts shortly after the amendments to the Clean Water Act in 1987. Colorado's response to control nonpoint source problems through Section 319 efforts, has been to create a voluntary program which is designed to provide education in order to prevent nonpoint sources, and as well administer watershed programs which are intended to restore water quality and demonstrate nonpoint source treatment techniques.

In 1987, the Water Quality Control Division established the Colorado Nonpoint Source Task Force. The Task Force is comprised of agencies and interest groups which are involved in nonpoint source control issues. The Task Force advises the Water Quality Control Division, and Water Quality Control Commission, on issues pertaining to nonpoint source policy, and direction of the control efforts in the state. The Task Force has been essential in editing the Colorado Nonpoint Assessment Report , and the Colorado Nonpoint Source Management Program. The Task Force meets every other month, and is governed by adopted rules, which are used to determine membership, leadership, and decision making.

Colorado Nonpoint Assessment Report

Colorado's assessment report was initially completed in April 1988. The report was updated in November, 1989. The report documents nonpoint source impacts in 3,395 miles of stream in Colorado, and 29,027 surface acres of lakes and reservoirs.

The Division and the Task Force have decided that future updates to the assessment report will occur through the 305(b) process. Therefore, Table 20 listed segments and lakes and reservoirs are included in the Colorado Nonpoint Assessment Report through this 1994 305(b) effort.

Colorado Nonpoint Source Management Program

Colorado's management program was initially completed in May 1989. The management program was updated in October 1990, and is currently in the process of being updated again. Programs for control of agriculture and silviculture, urban and construction runoff, and abandoned and inactive mining, have been approved by EPA. A program for the control of nonpoint sources which are the result of hydrologic modifications, has been adopted by the Task Force and the WQCC and is currently under review by EPA. It is anticipated that the hydrologic modification program will be approved during 1992.

Table 20 Additions to the Nonpoint Assessment Report

Name	Category	County	Basin	Pollutant	Area	Status[32]
Palmetto Gulch	Mining	Hinsdale	Colorado	Metals	3 miles	M
Middle Fork Mineral Creek	Mining	San Juan	Colorado	Metals	3 miles	M
Strawberry Creek	Agriculture	Rio Blanco	Green	Sediment	6 miles	E
Sheep Creek	Agriculture	Rio Blanco	Green	Sediment	9 miles	E
Flag Creek	Agriculture	Rio Blanco	Green	Sediment	10 miles	E
Morgan Gulch	Agriculture	Moffat	Green	Sediment	9 miles	M
Grape Creek	Agriculture	Custer	Arkansas	Sediment	5 miles	E
Montezuma Creek	Agriculture	Archuleta	Colorado	Sediment	7 miles	E

32 M or E in the Status column indicates either monitored or evaluated information was used in making the determination for inclusion in the list.

In addition to listing these segments in this section of the report, these new segments plus all the other waters listed in the Colorado assessment report are listed in WBS (Waterbody Tracking System), and accounted for in other portions of this report.

Nonpoint Source Program Highlights

Colorado's nonpoint source program is quite broad in its scope of activities. Several features of the state program which have been very helpful in terms of combating unusual water pollution problems include the following:

1. Abandoned Mine Water Quality Projects--Colorado struggled with a means to deal with these problems, but found no solution until the nonpoint source program. To date ten projects have been funded to determine appropriate solutions to these historic water quality problems. Projects to determine appropriate treatments from both draining tunnels, and old tailings have been carried out. Targeting efforts and information and education efforts have also been funded.

2. Riparian Areas/Streambank Corridors--Colorado's assessment report documented significant water quality and stream habitat problems which result from bad management of riparian areas. Several projects have been funded which promote good riparian management practices. These projects have been funded in both urban and rural settings.

3. Groundwater Information--Colorado's assessment report recognized the lack of groundwater data statewide. As a result, several groundwater sampling programs have been funded for key aquifer areas in the state. Additionally, the nonpoint source program has provided funds to assist in the establishment of wellhead protection efforts in Colorado. A groundwater workgroup was also established by the Nonpoint Source Task Force to establish groundwater monitoring protocols, data sharing, and a statewide groundwater data base.

4. Federal Consistency--Colorado has signed an agreement with the Bureau of Land Management, and is working on a similar agreement with the US Forest Service to review water quality efforts on Federal Lands in the state. The primary thrust of the agreements is to insure that BMP's applied by Federal agencies are effective in controlling nonpoint sources which result from activities such as grazing, timber harvest, and road construction.

VIII. PUBLIC HEALTH CONCERNS

Fish Consumption Advisories

The issuance of fish consumption advisories, whether for wild fish or commercially cultured fish, is the responsibility of Colorado Department of Public Health and Environment in conjunction with Division of Wildlife (DOW) . The presence of contaminants in fish tissue influencing its suitability for human consumption, or concerning the levels of pollutants in water samples which might similarly affect the suitability of fish for consumption, are now referred to the Ad Hoc fish advisory committee consisting of representatives from WQCD, DOW, and Disease Control and Epidemiology at the Department of Public Health and Environment.

Sweitzer Reservoir in Delta County was posted seven years ago by the DOW to advise anglers of potentially high concentrations of selenium in fish tissue. Soils in the region characteristically exhibit high selenium concentrations. Irrigation return flows may tend to exacerbate the already high levels of selenium transported in snowmelt and rainfall induced runoff.

Several lakes and reservoirs located on federally owned property have been subject to restrictions placed on fishing by the Federal government. Contamination by a variety of organic contaminants, primarily pesticide residues, and by heavy metals, has prompted the Army to restrict fishing at the Rocky Mountain Arsenal to three lakes, Mary, Lower Derby and Ladora. Angling at those three lakes is restricted to catch and release. High mercury levels in several species of fish collected from Teller Reservoir, on the Fort Carson Military Reservation in Pueblo County, has prompted the Army to place similar restrictions on angling at that location. Several other water bodies which are also located in the Turkey Creek drainage are subject to ongoing monitoring although no action has been taken at this time.

In June, 1989 an advisory was posted at Narraguinnep Reservoir due to high levels of mercury in fish. The Colorado Department of Public Health and Environment advised all consumers to restrict their consumption of fish in relation to their risk group and the species of fish. A tissue level of 0.5 ppm rather than the FDA action level of 1.0 ppm was used in assessing the health risks.

In June of 1991, McPhee and Navajo reservoirs were also posted with advisories to limit consumption of certain species of fish due to mercury contamination. Sanchez reservoir was posted with an advisory notifying anglers about preliminary results of tissue sampling which revealed high mercury levels in fish.

In 1991 the Disease Control and Environmental Epidemiology Division issued a position paper entitled Health Advisory for Consumption of Fish Contaminated with methylmercury. This position paper is the basis of the posted advisories for mercury at McPhee, Navajo and Narraguinnep Reservoirs. Recommended number of meals per month are provided separately for non pregnant adults and for women who are pregnant, nursing or planning to become pregnant.

Closed Swimming Areas

In recent years the only known instance of a closure of a natural swimming area was Fruit Growers Reservoir in Delta County, which was closed due to high coliform counts in the reservoir.

PART 2

GROUND WATER QUALITY IN COLORADO

1994

IX. INTRODUCTION

Overview

Ground water in Colorado is highly variable in quality and availability because of the diverse environmental and hydrogeologic conditions across the state. Ground water occurs in a wide variety of geologic media including unconsolidated silt, sand, and gravel deposited by wind, by streams, and as talus along mountain slopes; in consolidated sedimentary bedrock formations; and in fractured igneous and metamorphic rocks of mountainous regions. Hydrologic conditions range from shallow unconfined alluvial aquifers along stream and river valleys to confined artesian aquifers within deep structural basins. In general, ground water quality in Colorado ranges from excellent in mountain areas where snow fall is heavy, to poor in alluvial aquifers of major rivers where surface and ground water are used and reused for multiple purposes. Naturally occurring soluble minerals along with man's activities are responsible for significant degradation in some aquifers. Climate, hydrogeologic conditions, and man's activities are major factors affecting ground water quality throughout the state.

Ground water supplies 18 percent of the water used in the state. Approximately 96 percent is consumed by agriculture. The rest is used for public and private water supplies. In some area ground water is the only source of water available.

Water quality data reported from PWS ground water systems throughout the State have been compiled. In many areas of the State, data from PWS wells indicate differences in the ground water quality between shallow and deep aquifers. The most common contaminants in the state are: nitrate, fluoride, selenium, iron, manganese, alpha radiation and uranium. Nitrate, fluoride, selenium, gross alpha, and radium often exceed standards in many aquifers in the eastern plains. In some area, TDS, hardness, sulfate, and sometimes sodium exceed standards, but the water is still used as a potable source. Some constituents, such as fluoride, arsenic, iron, manganese, selenium, sulfate, sodium, radium and uranium occur naturally in ground water.

Shallow, unconfined aquifers in Colorado are very susceptible to contamination from surface activities. Many have become contaminated, especially with nitrate and salts resulting from agricultural activities. Deeper bedrock aquifers tend to show higher levels of natural constituents but lower levels of surface contaminants, especially if they are under confined conditions.

Based on the PWS data files, counties in Colorado that have the best quality ground water used for PWS are: Archuleta, Clear Creek, Conejos, Custer, Dolores, Grand, Gunnison, Hinsdale, Jackson, Mineral, Pitkin, Rio Grande, San Juan and Summit. Park County tends to have high quality ground water with the exception of radiation in some cases. In some areas of the State, the amount of data available is limited due to lack of monitoring and testing. The quality of the ground water in the confined Denver basin aquifers is excellent with the exception of an increasing level of TDS in deeper beds (Colorado Department of Public Health and Environment, Publ. 2 Water Supply Files).

Although time-series trends for contaminant concentrations have not been analyzed, long-term trends have occurred in Colorado. Human-induced, elevated levels of nitrate and sulfate occur in many Colorado aquifers, and nitrate is now appearing anonymously in some deep aquifers. In mining areas, acidic water and metal contaminants are present in aquifers. These contaminants probably did not occur in the aquifers at elevated levels prior to settlement, farming, and mining in Colorado. An increasing concentration trend for many contaminants has probably occurred during the past one-hundred years. The increasing trend may continue, decline or reach an equilibrium, depending upon the future of ground water protection strategies in the State. In addition, there may be natural geochemical fluctuations and trends occurring in ground water, in response to changing ground water chemistry.

Currently, the State of Colorado is active in the control and cleanup of point sources of ground water contamination. The Colorado Department of Public Health and Environment regularly issues cease-and-desist orders to owners/operators of sites polluting State waters, including ground water primarily through its authorities under RCRA statutes. Colorado is engaged in the Nonpoint Source Program and has established a ground water pesticide and agricultural chemicals testing program. Most ground water contamination occurs as a result of human activities, and many such activities result in nonpoint sources. The most important of these practices is crop fertilization, especially where irrigation is practiced. At some locations in the State, numerous animal feedlots are concentrated in relatively small areas, and have become important nonpoint sources. These feedlots, and irrigation practices, have been impacting ground water for many years.

The development of ground water protection programs in the State of Colorado is ongoing and significant legislation and programs have been adopted. "The Basic Standards for Ground Water", 3.11.0 (5 CCR 1002-8), provides the framework under which ground waters are classified and protective standards are set. The Basic Standards were originally adopted in 1987, and have been amended several times since then, the most recent amendments occurring early in 1994. The Basic Standards assign maximum concentrations for a host of organic pollutants applicable to all ground waters. The application of the classification system occurs in a separate regulation, "Classification and Water Quality Standards for Ground Water" 3.12.0 (5

CCR 1002-8), and it too has been amended several times, most recently in late 1993. These recent amendments extended the application of the narrative standard to all ground waters except those with very high TDS. This action by the WQCC was very significant in the overall structure for ground water protection because it establishes a ceiling for contamination at ambient quality where some degradation has already occurred, and at "table values" or MCLs where existing quality is relatively uncontaminated. In addition, the Division has embarked on a plan to propose drinking water and agricultural classification for ground waters within the capture zone of many of the state's largest public drinking water supply wells. Twelve such wellhead area classifications have been adopted to date with eighteen additional supplies scheduled for adoption in June, 1994, and five more later in the year.

A number of programs exist both within the WQCD and in other state agencies for the purpose of implementing the classifications and standards adopted by the WQCC. A recently revised feedlot regulation requires large feedlots to submit plans for water quality protection to the Division for approval. A ground water data base has been developed to organize and store ground water data from a variety of sources. An active Wellhead Protection program has been in place for several years, and a number of communities are developing WHPA plans although formal EPA approval of the program is still pending. The nonpoint source program developed pursuant to Section 319 of the federal Act has funded a number of demonstration and education projects expressly aimed at ground water protection. Perhaps the most significant new initiative in the Division is the implementation of a permitting program for point source discharges to ground water. In July, 1993, the revisions to the Discharge Permit Regulations went into effect requiring leaking impoundments and land application systems to obtain a discharge permit the same as any other discharger to state waters. The first permits under this new program are expected to be issued later in 1994 with a major surge of applications slated for mid-1995.

Other state agencies with a role in ground water protection have made significant progress in fulfilling their responsibilities as well. SB89-181 identifies specific state agencies and their authority to promulgate rules and regulations to protect water quality for areas that they have statutory responsibilities. Under this act the implementing agencies have established memorandums of agreement with the Colorado Water Quality Control Commission, and they are in the latter stages of promulgating the required rules and regulations. Senate Bill 126, enacted in 1990, authorizes the Commissioner of Agriculture to take various measures ranging from education to regulation in agricultural areas where manufactured chemicals are threatening ground water quality. Along with the Department of Agriculture, the Water Quality Control Division and the Extension Service comprise the team of agencies who are to cooperate in the control of agricultural chemical use. Ground water monitoring is a responsibility of the WQCD under SB 126, and the Division has collected extensive data in the South Platte alluvial system in 1992 and 1993, and in the San Luis Valley in

1993. The Arkansas Valley alluvial system will be monitored in 1994 with extensive resampling also scheduled for the San Luis Valley.

<u>Ground Water Use</u>

Ground water comprises approximately 18 percent of the water used in the State. About 96 percent of the ground water used is for irrigation, 2 percent for public water supply (PWS), 1 percent for rural, domestic supplies, and 1 percent for livestock and industrial uses (U.S. Geological Survey, 1985, p. 153). Ground water provides PWS for about 428,000 people, or about 13 percent of the State's 1990 population of 3,294,394 (U.S. Bureau of Census, 1991). An additional 100,000 people are estimated to be using private wells. In 1991, approximately 557 PWS ground water systems existed in Colorado, compared to about 252 PWS surface-water systems. Additional PWS use a combination of surface and ground water.

Appendix B shows the distribution of PWS ground water systems by County. Tables 22 and 23 list the communities in the State that use either surface or ground water as their main supply (as determined from the State's drinking water files), and Table 24 is a profile of PWS ground water systems. In addition to the communities listed, many small PWS ground water systems provide water to mobile home parks and outlying subdivisions in the State. The use of either surface water or ground water for public supply is usually dictated by the size of the community and geographical location. Metropolitan areas normally utilize surface-water sources when available. In smaller communities, however, where treatment budgets are low, PWS systems utilize infiltration galleries or wells placed in alluvium adjacent to a stream, especially in the mountains and the western plains. Such systems utilize the geologic media to filter out solids and bacteria, and restrict movement of contaminants through absorption.

Where surface-water quality is poor, as in the eastern plains and the San Luis Valley, PWS systems generally utilize only ground water sources. Twenty-nine of the State's sixty-three counties rely solely upon ground water for their public water-supplies.

Numerous private water-systems also exist in the State. These serve entities such as churches, small businesses and private residences where the number of users is small or the supply is not continuous. Such systems do not qualify as a PWS. Permits are not required under the State's Water Quality Control Act and no reports concerning water quality are required by the State for such systems. The number of private systems relying upon ground water is large, but unknown.

In rural areas, domestic water is supplied almost entirely from ground water sources. In most areas of the State, each farmstead has at least one water well. These wells are used for domestic supply, livestock watering and kitchen-garden irrigation. Stock-watering wells are common where surface-water resources are unreliable or absent. Private, potable-water wells are common in many small towns and subdivisions where PWS systems have not been developed. Information concerning water use and water quality for such systems is usually not reported to the State. Often, after a PWS becomes available, the use of individual wells for domestic purposes is discontinued.

In Weld County, surface-water distribution systems have been installed in the rural areas near Windsor, Greeley, Kersey, and Gill, so that farmsteads use treated surface-water instead of well water. In Morgan County, the towns of Weldona, Goodrich, and Fort Morgan use ground water from a distribution system that employs a centralized well field.

Crop irrigation constitutes the largest use of ground water in Colorado utilizing approximately 96 percent of all ground water consumed. Extensive use of surface water irrigation has been developed through an elaborate system of canals and ditches diverting

Table 21
Communities Utilizing Surface Water Entirely or Principally For Public Water Supply

Alma
Arvada
Aspen
Aurora
Avon
Black Hawk
Breckenridge
Broomfield
Buena Vista
Canon City
Central City
Cherry Creek
Colorado Springs
Cortez
Craig
Crested Butte
Cripple Creek
Denver
Dillon
Durango
Eagle
Empire
Englewood
Erie
Evergreen
Florence
Fort Collins
Frederick
Frisco
Genesee
Georgetown
Glenwood Springs
Golden
Granby
Grand Junction
Greeley
Gypsum
Hayden
Hot Sulphur Springs
Idaho Springs
Johnstown
Kremling
Lafayette
Lakewood
Leadville
Littleton
Longmont
Loveland
Lyons
Minturn
Montrose
Morrison
Naturita
Nederland
North Weld County
Nucla
Oak Creek
Olathe
Ophir
Owl Creek
Palmer Lake
Penrose
Pueblo
Rangely
Red Cliff
Rifle
Snowmass
Steamboat Springs
Telluride
Thornton
Victor
Walsenburg
Wellington
Westminster
Wheat Ridge
Windsor
Winter Park
Woodland Park

Reference:Colorado Department of Public Health and Environment, Public Water Supply Files, 1988

Table 22
Communities Utilizing Ground Water or Part Ground Water For Public Water Supply

Agate	Del Norte	Hugo
Aguilar	Dinosaur	Idledale
Akron	Dove Creek	Iliff
Alamosa	Eads	Indian Hills
Antonito	Eastlake	Jamestown
Aguilar	Eckley	Julesburg
Arapahoe	El Jebel	Keensburg
Arriba	Elbert	Kim
Aurora (Part)	Eldorado Springs	Kiowa
Avondale	Elizabeth	Kit Carson
Baca Grande	Erie	La Jara
Bailey	Fairplay	La Junta
Basalt	Flagler	La Salle
Bennett	Fleming	La Valle
Bethune	Florissant	Lake City
Blanca	Fort Lupton	Lamar
Bond	Fort Lyon	Larkspur
Boone	Fort Morgan	Las Animas
Brandon	Fountain	Lazear
Branson	Fowler	Limon
Briggsdale	Fraser	Lochbuie
Brighton	Frisco	Log Lane Village
Bristol	Fruita	Louviers
Brush	Fruitland	Manassa
Buena Vista	Galton	Manzanola
Burlington	Garcia	Marble
Byers	Garden Valley	Marino
Calhan	Gardner	McClave
Campo	Garfield	Meeker
Capulin	Genoa	Mesa
Carbondale	Gilcrest	Milner
Castle Pines	Glendale	Minturn (Part)
Castle Rock	Granada	Model
Cheraw	Grand Lake	Monte Vista
Cheyenne Wells	Grandview	Montrose (Part)
Coal Creek	Grover	Monument
Collbran	Guadalupe	Morrison Creek
Colorado City	Gunnison	Mount Werner
Colorado Springs (part)	Gypsum (part)	New Raymer
Commerce City	Hartman	Newdale
Conejos	Hasty	Norwood
Crawford	Haswell	Nunn
Creede	Hillrose	Oak Meadows
Crested Butte (part)	Haxtun	Olney Springs
Crook	Holly	Orchard City
Crowley	Holyoke	Ordway
Deer Trail	Hudson	Otis

TABLE 22 (Continued)
Communities Utilizing Ground Water or Part Ground Water For Public Water Supply

Ouray
Ovid
Palisade
Paoli
Paonia
Parachute
Paradox
Parkdale
Parker
Parkville
Peetz
Perry Park
Peyton
Phippsburg
Pierce
Pitchett
Platteville
Poncha Springs
Ponderosa
Ramah
Red Feather
Rico
Ridgeway
Rio Cucharas
Rockvale
Rocky Ford
Romeo
Rye
S. Adams Co.
Saguache
Salida
San Luis
San Acacio
Sanford
Sawpit
Security
Sedgwick
Seibert
Sheridan Lake
Silt
Silverthorne
Simla
Somerset
Springfield
Starkville
Stmbt. Sprgs. (Part)
Sterling
Strasburg
Stratton
Sugar City
Swink
Telluride (Part)
Two Buttes
Uravan
Vilas
Vona
Walden
Walsh
Ward
Westcliff
Whitehorse Springs
Widefield
Wiggins
Wiley
Winslow
Winter Park West
Woodland Park
Wray
Yampa
Yuma

References:

Colorado Department of Public Health and Environment, Public Water Supply Files, 1991

Table 23 Profile of Colorado's Ground Water Systems

General Statistics:

Number of Counties - 63

Number of counties using ground water as a drinking water source - 59

Number of counties solely reliant on ground water for drinking water - 29

Number of public ground-water systems - 557

Estimated population served by public ground water systems - 428,000

Number of public ground water systems serving 10,000+ population - 10

Number of Public ground water systems serving 3,300-9,999 - 19

Number of public ground water systems serving < 3,300 - 528

Breakdown of Public Ground Water systems: *

Entity	Number	Resident Population Served
Municipalities	122	189,169
Special Districts	105	160,881
Mobile Home Parks, Trailer Courts & Subdivisions	161	23,606
Water Companies	42	21,817
Associations, Water Users & Homeowners	48	10,193
Institutions & Resorts (schools, retreats, clubs)	15	1,535
Federal Facilities	5	1,360
Water Supplies/Systems	9	5,542
Miscellaneous (campgrounds, pipelines, dispensers, etc.)	75	13,897

*Source:Colorado Health Department, Drinking Water Unit Water Quality Control Division, June, 1991 water from rivers, streams, and reservoirs. Use of ground water has developed in recent years to supplement surface water irrigation and provide alternate points of diversion for crop areas overlying alluvial aquifers. In other areas non-tributary aquifers provide non-renewable sources of ground water for irrigation resulting in ground water mining situations. The use of spray irrigation systems is increasing and now common in many agricultural areas of the state. They permit the efficient use of surface and ground water, and allow automatic rate-application chemigation. The acreage irrigated by well water within the state has not been determined although each well must be permitted through the State Engineers Office and a water right adjudicated for ground water use. Table 24 shows the amount of irrigated acreage by county for Colorado.

Major Aquifers in Colorado

Figure 12 shows the major aquifers in Colorado. Shallow river-alluvium or terrace aquifers occur along most of the important rivers and streams in the State. Areas of older, high-level terrace gravels also occur over much of the eastern plains. In areas where the gravels are fairly thick and permeable, they are extremely important sources of ground water. The eastern plains are also mantled with wind-blown sand. Large fluctuations in water levels occur, resulting in a seasonal source of water. Many of the intermontane basins and mountain valleys have accumulated thick alluvial deposits. The Alamosa Formation in the San Luis Valley is one such deposit of alluvium, and serves as one of the major aquifers in the State. In the high mountains the valley fill tends to be glacial, glacial-fluvial or glacial-lacustrine in origin, and is generally classified as till. Tills can be very permeable and act as important local sources of ground water. In a few mountain areas, talus, landslide, or slump debris form aquifers.

Bedrock aquifers occur in geologic structural basins within the state such as the Denver-Julesburg Basin, Paradox - San Juan Basin, Piceance Basin, Raton Basin and San Luis Valley. Bedrock aquifers occur in sedimentary formations of the eastern high plains, and western slope of the state. The state is divided by the Southern Rocky Mountains that extend north-south through the west-central part of Colorado.

The major bedrock aquifers in Colorado are:

- High Plains (Ogallala) Aquifer in eastern Colorado
- Dakota Aquifer in southeastern Colorado
- White River Aquifer in northeastern Colorado
- Denver Basin aquifer system near Denver
- Paleozoic aquifer system in west-central Colorado
- Piceance Basin aquifer system in northwestern Colorado
- Paradox-San Juan Basin aquifer system in southwestern Colorado.

-San Luis Valley confined aquifer system in south central Colorado.

Minor bedrock aquifers are: the Dakota, Fountain and Lyons formations near the Front Range; the Raton Formation near Trinidad; the Vermejo Formation near Walsenburg; and the Troublesome and Browns Park Formations in some of the intermontane basins. Locally minor, bedrock aquifers often occur wherever there are sedimentary rocks. Fractured or weathered igneous or metamorphic rocks also serve as localized aquifers.

Figure 12

MAJOR AQUIFERS IN COLORADO

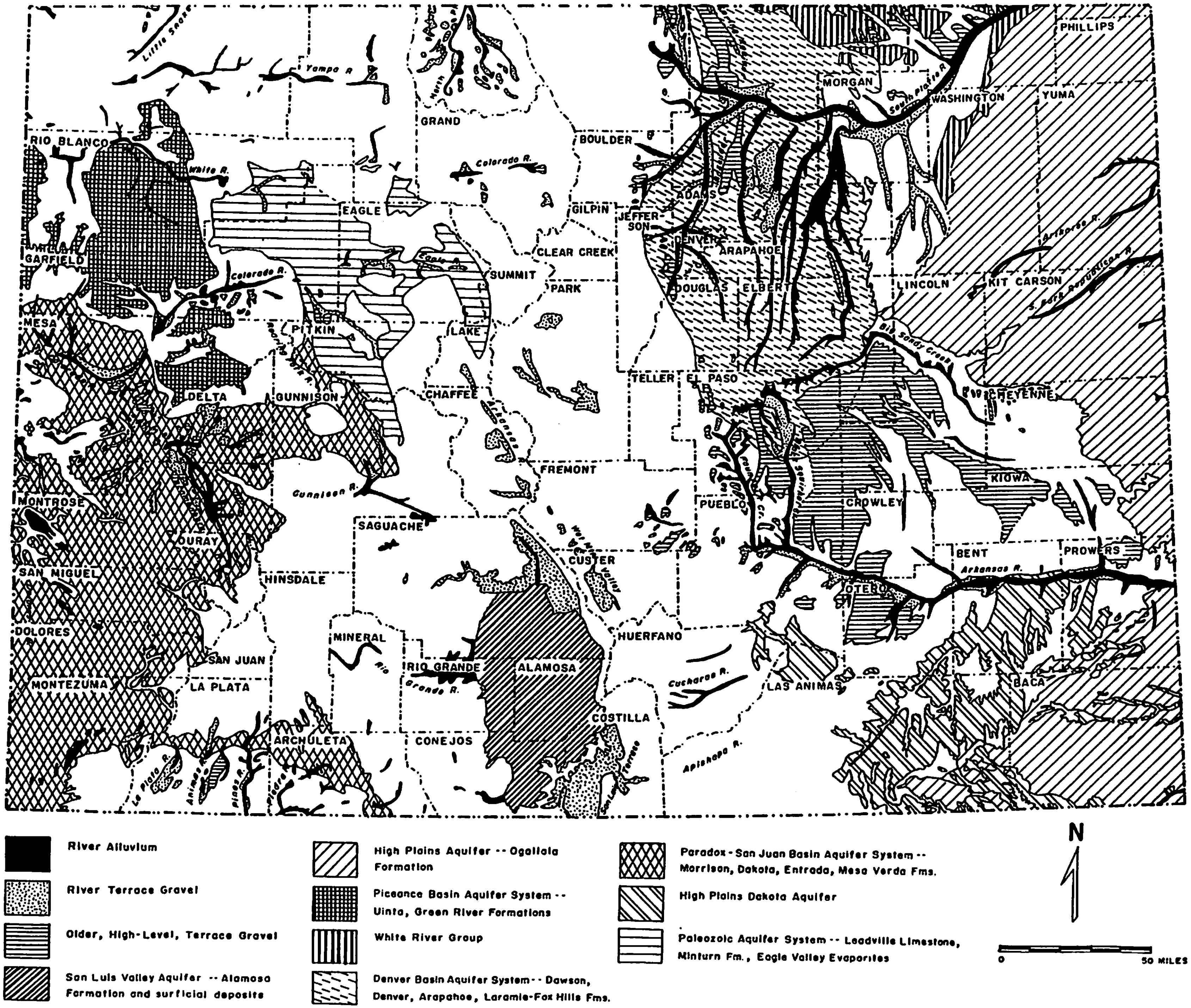


Table 24 Irrigated Acreage

County	Acreage Irrigated	Percent of County Area
Adams	12,350	1.56
Alamosa	60,600	13.25
Arapahoe	700	.12
Archuleta	300	.03
Baca	47,200	2.92
Bent	115,300	11.83
Boulder	13,370	2.85
Cheyenne	14,600	1.30
Conejos	26,800	3.31
Costilla	18,500	2.37
Crowley	12,800	2.49
Delta	7,100	.97
Elbert	100	.01
El Paso	400	.03
Fremont	8,890	.14
Garfield	2,600	.14
Jefferson	100	.02
Kiowa	2,500	.22
Kit Carson	91,300	6.67
La Plata	1,400	.13
Larimer	35,420	2.11
Las Animas	4,700	.16
Lincoln	700	.04
Logan	113,680	9.67
Mesa	17,000	.81
Montrose	18,800	1.34

Table 24 Irrigated Acreage (Continued)

County	Acreage Irrigated	Percent of County Area
Morgan	144,780	17.66
Otero	154,500	19.17
Phillips	62,300	13.31
Prowers	175,300	16.91
Pueblo	113,500	7.49
Rio Grande	37,700	6.46
Saguache	50,000	2.56
San Miguel	200	.03
Sedgwick	33,300	9.63
Washington	23,450	1.48
Weld	332,230	13.55
Yuma	181,300	12.20
Total Irrigated Acreage Listed	1,835,770 acres	
Total Reported for State	3,200,000 acres	
Unaccounted for*	1,364,230*	

*Unaccounted for acreage was unreported in Colorado Agricultural Statistics, 1987, and may be assignable to fruit crops on the Western Slope, to hay, alfalfa, and some truck farming.

Total area in irrigation 3,200,000 acres (4.83 percent of land area)

Compiled from: Colorado Agricultural Statistics, 1987, Colorado Department of Agriculture

Within the mountainous regions of Colorado, ground water occurs in the fractured igneous and metamorphic rocks that make up the core of the uplifted areas. Ground water is limited to open fractures within these rocks. These aquifer systems produce small quantities of water to wells. However, they are important sources of water to individual and small PWS because this maybe the only source of water in the area. They are also the most vulnerable to surface contamination due to their exposed nature and limited filtering potential.

X. GROUND WATER QUALITY

General

The primary source of data for this section is public water supply data collected from 1978 through 1988. Additional information from CERCLA and RCRA programs and from the Agricultural Chemicals program were also consulted. Constituents reported usually include metals, fluoride, sodium, chloride, nitrate, sulfate, total dissolved solids (TDS), calcium, coliform bacteria and radioactivity. Documentation of time-series variations was not possible, because most of the data available consisted of composite samples from numerous wells. System averages from the ten year database were used to characterize the ground water for each location. Since PWS systems are sparsely located, the characterization was integrated regionally, on a county-by-county basis. In many areas of the State, data from PWS wells indicate differences in the ground water quality between shallow and deep aquifers. Shallow ground water aquifers include unconsolidated deposits and bedrock units extending from the surface down to 100 feet. Deep aquifers are classified as bedrock units that extend below 100 feet. Coliform bacteria data were not included in the analysis, as high coliform counts may be indicative of improper well construction rather than actual ground water quality.

Table 25 lists the major ground water contaminants in Colorado, and the areas affected. The relative importance of a contaminant was determined based on toxicity to humans and on the degree to which standards are exceeded. The most common ground water contaminants in the State are: nitrate, fluoride, selenium, iron, manganese, alpha radiation and uranium. Nitrate, fluoride selenium, gross alpha, and radium often exceed standards in many aquifers in the eastern plains. In some areas, TDS, hardness, sulfate, and sometimes sodium exceed standards, but the water is still used as a potable source. Some constituents, such as fluoride, arsenic, selenium, radium, and uranium occur naturally in ground water.

Table 26 shows the major human activities that often result in the contamination of ground water, their capacity to pollute and their relative priority. Shallow unconfined aquifers in Colorado are very susceptible to contamination from surface activities. Many have become contaminated, especially with nitrate and salts resulting from agricultural activities. Deeper bedrock aquifers tend to show higher levels of natural constituents but lower levels of surface contaminants, especially if they are under confined conditions.

Table 25 Substances Contaminating Ground Water

SUBSTANCE	IMPORTANCE*	AREA
Organic Chemicals		
Volatiles	Very important at numerous sites	Local**
Synthetic	Important at several sites	Local
Inorganic Chemicals		
Nitrates	Important contaminant in state	Widespread
Fluorides	Important contaminant in state	Widespread
TDS	Often high	Widespread
Sulfates	Often high	Widespread
Sodium/Chlorides	High in some areas	Shallow aquifers
Brine	Seldom	Local or none
Cyanide	Very Important	Two sites
Pesticides	Never found above Drinking Water Standards	Local
Herbicides	Never found above Drinking Water Standards	Local
Petroleum Products	Very important at numerous sites	Local
Metals		
Arsenic	Important at several sites	Local
Antimony	Rare	Local
Barium	Never above standards	Local
Cadmium	Important at several sites	Local
Chromium	Reported at several sites	Local
Copper	Mining sites	Local
Lead	Mining sites & mill tailings	Local
Iron	Mining sites, others	Local to Widespread
Manganese	Mining sites	Local
Mercury	Rare	Local
Selenium	Often exceeds standards	Widespread
Silver	Mining sites, rarely exceeds standards	Local
Zinc	Mining sites, often exceeds standards	Local
Radioactivity		
Gross Alpha	Sometimes exceeds standards	Regional
Gross Beta	Occasionally exceeds standards	Regional
Radium	Important at several sites	Regional
Radon	High in private ground water systems	Local to Regional
Uranium	Often exceeds standards	Regional

* Importance was determined as follows: Toxic contaminants were considered to be important if they occur at one or more sites at levels hazardous to human health and are available in ground water used for domestic purposes. Generally distributed contaminants are considered to be important if they approach or exceed standards and are available in ground water used for domestic purposes. Generally distributed contaminants are considered to be important if they approach or exceed standards and are available in ground water for potable uses. In a few cases a contaminant is considered to be important at a location if it prevents the use of ground water where it otherwise would have been or might have been used for domestic or agricultural use.

** "Local" indicates that at a limited number of small sites contamination has occurred.

Table 26
Major Sources of Ground Water Contamination

SOURCE	POLLUTION CAPACITY	RELATIVE PRIORITY*
Septic Tanks	High in some areas	Low
Municipal Landfills	High at some sites	High
On-Site Industrial Landfills (excluding Pits, lagoons, surface impoundments)	High for mine tailings High for superfund sites	High for mine tailings (1) High for hazardous waste
Other landfills		Low
Surface Impoundments (excluding oil & gas brine pits)	Usually medium to low	Usually medium to low
Oil and gas brine pits	Medium to low	Low
Underground Storage Tanks	High	High (4)
Injection wells	Moderate	Moderate
Abandoned Hazardous Waste Sites	High	High when discovered (2)
Regulated Hazardous Waste sites	Low	High (3)
Salt water intrusion	Not applicable except for highway salt piles	Low
Land application treatment (sludge)	Low	Moderate
Agricultural Activities	High	High** (5)
Road Salting	Low	Low
Mining	Medium to high depending on site	Low to high,
Cyanide heap leaching	High, but local	High

* Relative priority was set subjectively based upon the pollutant's capacity to damage or prohibit ground water use, and upon the Colorado Health department's financial and staffing ability to respond to or regulate an activity.

** State and Federal regulations generally do not allow regulation of agricultural activities.

( ) Ranking of five highest priorities.

Based on the PWS data files, the counties in Colorado that have the best quality ground water used for PWS are: Archuleta, Clear Creek, Conejos, Custer, Dolores, Grand, Gunnison, Hinsdale, Jackson, Mineral, Pitkin, Rio Grande, San Juan and Summit. Park County tends to have high-quality ground water with the exception of radiation in some cases. In some areas of the State, the amount of data available is limited due to lack of monitoring and testing. The quality of the ground water in the confined Denver Basin aquifers is excellent with the exception of an increasing level of TDS in deeper beds.

Fluoride

Fluoride is a natural constituent occurring in ground water throughout the State. Generally, fluoride occurs in higher concentrations in deep aquifers, especially the Denver Basin aquifers (Denver, Arapahoe, Dawson, Laramie-Fox Hills) and the Dakota Aquifer. In the Dakota, fluoride often exceeds the 2.4 mg/l drinking water standard. In the Piceance Basin, high fluoride levels are associated with the water-bearing members of the Green River Formation, but have not impacted human usage because of the sparse population in the area. In Alamosa County, high fluoride levels are found in the deeper members of the Alamosa Formation. In Logan County, fluoride sometimes exceeds standards but, the source formations were not identified in the records. In Kiowa, Cheyenne and Kit Carson counties, relatively-high fluoride levels are found both in the shallow and deeper zones of the High Plains (Ogallala) Aquifer. Mixing between the shallow and deeper zones can occur because the Ogallala is fairly homogenous and provides little resistance to vertical migration.

Nitrate

Nitrate contamination of ground water usually is the result of surface activities. The most abundant sources for nitrate in Colorado are agricultural fertilization, animal feedlots, individual septic systems, and incompletely treated rapid-infiltration municipal-sewage lagoons. Table 21 shows the irrigation acreage per county most subject to nitrate contamination.

Vulnerability to nitrate contamination occurs when (a) nitrates are applied to the surface, (b) no nitrification - denitrification mechanism is available, and (c) no aquitard is present to limit vertical migration. About 300 cattle, along with a number of other livestock feedlots, exist in the State (Colorado Agricultural Statistics, 1993). Also, there were 1,500 dairy operations, 1,800 sheep operations, and 1,600 hog operations in the State in 1992, which are similar to feedlots in their impacts to ground water. In 1986, the number of cattle feedlots were:

Feedlot Capacity	Number of Lots
Under 1,000 head	120
1,000 - 1,999	61
2,000 - 3,999	48
4,000 - 7,999	31
8,000 - 15,999	17
16,000 - 31,999	10
over 32,000	8
TOTAL	295

Municipal-sewage lagoons are subject to State Public Health and Environment Department inspection and correction, whereas fertilization, and small feedlots are not regulated. Runoff is controlled from feedlot operations with more than 1,000 head of cattle under the CPDES program. The operation and construction of individual septic discharge systems (ISDS) are also regulated. Shallow, unprotected aquifers usually are more susceptible to contamination by nitrate than are deeper aquifers. At the town of Eaton in Weld County, use of shallow ground water for a PWS was discontinued due to nitrate levels that exceeded the 10 mg/l human health standard. At some locations, deeper lower-nitrate ground water is mixed with nitrate-contaminated shallow ground water to reduce the nitrate concentration to a level that complies with ground water standards.

Elevated nitrate levels occur in the High Plains (Ogallala) Aquifer, in the Dakota Aquifer in the southeast, and in the San Luis Valley aquifer system (Alamosa Formation). High nitrate levels have been identified in the South Platte Alluvium. Both the shallow and deep aquifers on the eastern plains and the San Luis Valley should be considered sensitive, since they are the sole-source of water for the local residents. Careful control of the application of nitrate to the land surface and irrigation rates should be considered to reduce leaching.

Other deep aquifers in the State (Denver Basin, Paradox-San Juan Basin, and the Piceance Basin) appear to be unaffected by nitrate contamination. The variation in permeability of the layered beds of these formations can help restrict the vertical migration of nitrate. The Paleozoic aquifer system in Eagle County has not been affected, partly because of fortuitous layering, but mainly because the beds outcrop as rugged highlands that are unsuitable for farming.

In the mountain counties, a tendency to concentrate communities and resorts into narrow valleys containing highly-permeable gravely sediments has caused some localized shallow-ground water nitrate contamination. Especially susceptible are areas where septic systems are used for waste disposal instead of community waste-treatment systems. Fracture rock aquifers of the mountainous area are exceptionally vulnerable to nitrate contamination through use of individual septic systems. Nitrate contamination will probably continue to be the most-widespread ground water contamination problem in Colorado.

Selenium

Selenium is a naturally-occurring constituent in ground water in many areas of the State. Selenium tends to occur in higher concentrations in the Great Plains alluvial and terrace aquifers suggesting that it may result from weathering processes or perhaps from the evapotranspiration of surface water. Selenium most often occurs in higher concentrations in areas where there is sedimentary bedrock, especially on the eastern plains. On the eastern plains, selenium occurs in excess of the 0.01 mg/l standard in nineteen counties.

Sodium and Chloride

Generally, higher chloride and sodium levels occur in shallow aquifers because of the weathering of soluble salts in the bedrock, or through the infiltration of surface water containing salts. Salts are concentrated in surface water as a result of evaporation and plant transpiration, a process enhanced in Colorado's semi-arid and arid climates. Human-induced salinity occurs mostly in shallow unconfined aquifers in agricultural regions where irrigation is used extensively. Alluvial aquifers along major streams and rivers are most vulnerable to human induced salinity problems due to concentrated irrigated agriculture in river valleys, shallow water table, and unconfined aquifer conditions. In eastern Colorado salinity is highest in alluvial aquifers along major streams with the concentration increasing in the downstream direction. In the western part of the state salinity is generally lower in alluvial aquifers in part due to less irrigation. However, in some downstream areas salinity increases as a result of phreatophyte evapotranspiration and leaching of near-surface salt deposits in the bedrock. In the Denver Basin aquifers, salinity increases with depth or distance from recharge outcrop areas.

Road-salt piles, oil-field brine pits, and improperly-plugged, abandoned oil wells are also potential sources of salinity. A saline ground water plume resulting from a road-salt pile was mapped in Arvada. About 600 road-salt piles exist in Colorado. In oil-producing areas, it is estimated that 3,500 brine pits are unlined and could be leaking saline water. While State regulations strictly control oil-well abandonment at present, wells abandoned prior to regulation may be leaking salt water.

Sulfate

Sulfate in ground water generally comes from two sources, acid weathering of sulfide-minerals in hard-rock mining areas or coal mines, or the erosion and weathering of gypsum (calcium sulfate) often enhanced by agricultural irrigation and concentrated through use and reuse of surface and ground water. In mining areas, the occurrence of sulfate usually is localized, and has impacted only shallow alluvial-aquifers downstream of mining sites. Where gypsum weathering occurs, such as in the eastern plains and some areas in the west, sulfate levels tend to be highest in shallow aquifers. High sulfate concentration can also result from evapotranspiration, especially in irrigated regions.

High sulfate levels also are common in the Dakota Aquifer in southeastern Colorado. The reason for this anomalous occurrence of sulfate is unknown. However, sulfate from the surface may have migrated vertically to the deeper Dakota beds. Sulfate levels regularly exceed the 250 mg/l secondary drinking water standard in shallow aquifers along the Arkansas, South Platte, Eagle and Colorado Rivers. Sulfate concentrations exceed secondary drinking water standards regularly in deep aquifers in southeastern Colorado.

Total Dissolved Solids (TDS)

TDS levels are reported regularly for most PWS ground water systems. Usually, high TDS reflects high sodium or high sulfate concentrations. The causes for high concentrations of dissolved solids are similar to those for sodium and chloride. The highest TDS levels occur in alluvial aquifers on the eastern plains, especially in irrigated regions. Regularly, the secondary standard of 1000 mg/l is exceeded in the eastern plains. In deep aquifers, the highest TDS (approximately 2,700 mg/l) levels occur in the Dakota Aquifer in southeastern Colorado. Elsewhere in the State, deep aquifers showed TDS levels of approximately 200 to 400 mg/l.

Calcium

Calcium concentrations are not always reported for PWS ground water systems. Data are available for approximately 25 percent of the samples. The highest levels of calcium occur in shallow alluvial aquifers, with concentrations increasing downstream. Shallow aquifers along the South Platte and Arkansas Rivers show the highest hardness levels in the State, followed by the Colorado, Yampa and White River systems.

Radiation

PWS systems must report radiation levels to the State regularly. Radiation levels are reported approximately every two years, and are usually reported as gross alpha, gross beta, and uranium, in pCi/l. State Regulations specify that when gross alpha exceeds 10 pCi/l, radium 226 must also be measured. When radium 226 exceeds 3 pCi/l, radium 228 must also be measured. Standard limits are 15 pCi/l for gross alpha, 50 pCi/l for gross beta, and 5 pCi/l for radium 226 plus radium 228. Standard limits are not set for uranium, but it is treated similarly to gross alpha radiation.

High gross-alpha and gross-beta levels usually are more common in shallow aquifers, although the reverse is true in some mountain and western areas. Concentrations often are highly variable even in a local area, sometimes ranging from non-detected to rather high levels in the same aquifer among nearby PWS systems. Gross alpha standards regularly are exceeded in shallow aquifers along the Arkansas, South Platte and lower Colorado Rivers and in the Dakota aquifers in Baca, Prowers, Otero, Pueblo, Fremont and Park Counties. Gross beta standards are exceeded only occasionally.

High uranium concentrations occur mainly in shallow aquifers along rivers on the eastern plains, where concentrations often reach rather high levels. The highest levels occur in alluvium in Morgan, Logan and Boulder counties. High uranium concentrations also occur in intermountain park deposits in Park, Clear Creek and Grand counties. Elsewhere in the State, uranium usually is detectable, but at low levels.

High radium concentrations usually occur more often in deeper bedrock aquifers, excepting Montrose and La Plata counties, where higher levels occur in shallow aquifers in association with uranium mining and milling operations. A belt of high radium content occurs in the Dakota aquifer from Pueblo to Prowers counties, suggesting a zone of radium enrichment. Drinking water standards for radium are exceeded regularly in PWS ground water systems in Park, Pueblo, Otero and Prowers counties.

Iron and Manganese

Iron and manganese concentrations occasionally were reported for a few PWS ground water systems. The data were insufficient to merit statistical analysis or mapping. Iron and manganese concentrations are usually reported for systems that experience taste or stain problems. When reported, iron and manganese often exceeded secondary drinking water standards.

Phosphate

Phosphate concentration was not reported regularly for PWS ground water systems. The data were insufficient to merit statistical analysis or mapping. Often, the reported phosphate levels were high. In the Upper Blue River and Lake Dillon area of Summit County, phosphate allocations are assigned to domestic waste generators in order to control the phosphate levels in Lake Dillon. The allocations apply to both surface treatment systems and to leach fields. The most common method used to remove phosphate from sewage is base-exchange removal by the clays in the soil. The appearance of high phosphate levels in some PWS ground waters systems may indicate that the clays have reached saturation and are unable to remove any additional phosphate. In other cases, high phosphate levels may result from the weathering of high-phosphate bedrock, such as bone beds, glauconitic zones, phosphate nodules, or the mineral apatite in mining areas. The behavior of phosphates in ground water is not well understood, and requires further study.

Other Metals

Often, the concentration of minor metals such as arsenic, barium, boron, cadmium, chromium, lead, mercury, copper and zinc were reported for PWS systems. Concentration of minor metals rarely exceeded the detection level in any of the systems. When the metals were detected, the levels usually were well below drinking water standards and just above detection limits. The data were insufficient to merit statistical analysis or mapping. However, there were numerous reported instances of high arsenic levels (in excess of drinking water standards) in the deeper parts of the Alamosa aquifer. Also, at Telluride several PWS wells were never used because of high levels of chromium. These wells were located immediately downgradient of a mine tailings pile. In mine-disturbed areas proximal to or downgradient of tailings ponds or cyanide heap leaches, wells often exhibit high concentrations of metals. At the Eagle Mine near Minturn, sufficiently high levels of cadmium and zinc appeared in the downgradient Pierson well to force discontinued use of the well and the substitution of bottled water. At Stringtown, downgradient from Leadville, the use of several private wells was discontinued because of cyanide contamination from a mill site.

Pesticides

Under amendments to the Safe Drinking Water Act, about 700 public water systems are required to test for pesticides in their water supplies. Only one confirmed observance of atrazine has been reported to date, although several others supplies have recorded detectable amounts of pesticides. The vast majority of systems have reported nondetectable levels. Under SB 126, nearly 200 domestic wells along the South Platte alluvium and in the San Luis Valley were tested for a host of pesticides and herbicides. Seven atrazine and one alachlor observations were recorded and several other detectable amounts were found along the South Platte, and several pesticides were detected in the Rio Grande basin, but only one exceedance of an MCL (Lindane) was recorded. From the sampling conducted recently, the initial conclusion is that pesticide and herbicide levels are rare and at very low levels in Colorado ground water, but the threat of their occurrence is rising and should be closely monitored in the future.

Hazardous Organic Constituents

Volatile organics are known to occur in ground water in industrialized areas, especially in the South Platte alluvium in South Adams County and near the Rocky Mountain Arsenal. Because of the high degree of contamination, slurry walls were installed downgradient from the Rocky Mountain Arsenal to stop contaminant migration. In 1987, the Army constructed a treatment plant to remove the organics from PWS serving the residents of Adams County.

Petroleum product spills are the cause of ground water contamination in alluvium at some locations such as the Conoco Refinery in Commerce City, the Stapleton International Airport, and the Gary Refining Company in Grand Junction. In all three cases, hydrocarbons are leaking to nearby streams via ground water transport. At Stapleton, jet fuel has been recovered from the Concourse B area by shallow recovery wells, and only a small quantity still remains in the soil. At Hudson and Platteville in Weld County, methane contamination in ground water has resulted in accumulations of gas in buildings, and at least one explosion. The source of the methane is attributed either to abandoned oil/gas wells or to coal mines in the areas. Methane contamination as a result of gas wells in La Plata County has become a very serious matter at this time, and high level investigations into solutions for this problem are ongoing.

About 8,000 underground storage tanks throughout Colorado have the potential to leak and impact shallow ground water with hydrocarbon products, although that threat is continually being eliminated via the UST program implemented in the Health Department. Some hydrocarbon leakage problems are beyond the purview of the UST program, however, and an alternative program for their remediation is needed. Hydrocarbon leaks in oil fields have been reported to the State, and may represent a potential source of contamination in ground water. The Oil and Gas Commission is scheduled to revise their Exploration and Production Rules by year's end, and additional controls on the discharge of oil field wastes to ground water will be addressed in those revisions.

Other Contaminant Sources

Contamination of ground water from coal mines (mainly sulfate and acidic water) may potentially occur in several areas of the State, but is not reported. Areas potentially impacted include: Trinidad, Colorado Springs and Lakewood where old mines were abandoned and the areas were later urbanized; Weld and Larimer Counties; Hayden, Oak Creek, Craig, Paonia, Carbondale, and Durango.

Landfills and hazardous-waste disposal sites are recognized as potential sources of ground water contamination unless they are properly located, built and maintained. At the Lowry Landfill southeast of Denver, hazardous materials were disposed of improperly, without providing protection to the ground water. The State Public Health and Environment Department, Hazardous Materials and Waste Management Division, is administering the CERCLA and RCRA programs aimed at remediating past contamination, and imposing controls on new disposal sites.

Chemical manufactures and handlers have a potential impact upon the ground water in Colorado. Substances of concern include: tanning chemicals, solvents and other materials. Such problems require study on a case-by-case basis. Urban areas are the most likely to be impacted by industrial-chemical contamination, although specific staging areas for concentrating, storing and disposing of chemicals, such as the Pueblo Army Depot, also have high potential.

Ore mill or ore concentration sites are numerous in Colorado, especially near Denver, Pueblo, Leadville, Minturn, Canon City, Grand Junction, Durango, and Gunnison. Often, contaminant plumes have developed in local shallow aquifers. Generally, the contamination does not extend more than a mile downgradient of a site. Many such sites cause acidic water and corresponding heavy metal contaminants such as: zinc, copper, iron, manganese, cadmium, and sometimes molybdenum. At uranium mills, uranium, radium, thorium and strontium may be present, along with other heavy metals. Occasionally the processing chemicals, cyanide, mercury and copper are found as contaminants. Some sites are the subject of UMTRA, or NRDS studies and clean-up programs because of the impact they have upon surface waters, ground water, aquatic biota or public drinking-water supplies. Many other small, point-source and nonpoint-sources for ground water contamination also occur within the State.

XI. GROUND WATER PROTECTION PROGRAMS

Ground water protection in Colorado is a shared responsibility of many agencies at all levels of government. Under the Colorado Water Quality Control Act, the Water Quality Control Commission is charged with the most comprehensive responsibilities for all state water quality including ground water. However, the amendments to the Act brought about by SB 181 clearly envisions a partnership in ground water quality protection, and activities since SB 181 have been designed to implement that perspective.

The foundation for any ground water protection program lies in classifications and standards, and, in Colorado, that responsibility rests solely with the Water Quality Control Commission. In 1987, the WQCC adopted "the Basic Standards for Ground Water", 3.11.0 (5 CCR 1002-8), as the beginning point for all subsequent classification and standards setting. The Basic Standards establish a long list of maximum concentration levels for organic and radioactive pollutants, and a system for assigning use classifications and standards to protect those uses. The companion regulation, "Classifications and Water Quality Standards for Ground Water", 3.12.0 (5 CCR 1002-8), is a compilation of the actions taken to date in implementing the Basic Standards, and includes site-specific classification for thirteen areas of the state and accompanying water quality standards. The Ground Water Classifications also includes the narrative standard for most ground waters in the state. The narrative standard requires that ground water be maintained at current ambient quality where past activities have elevated concentration of pollutants to levels above "table values"

(MCLs in most cases), or at "table values" where the quality is relatively uncontaminated. Eighteen additional areas of ground water surrounding well fields for public water supplies are scheduled to be adopted by the Commission in June, 1994, and five more scheduled for later in the year. The combination of statewide numeric standards to protect public health from organic chemical pollution, a narrative standard to maintain ambient or MCL level quality for inorganic and metal parameters, and drinking water/agricultural use classifications and standards for wellhead areas is a very comprehensive and workable foundation for additional source control programs to implement.

The primary source control program in the Water Quality Control Division is the point source discharge permitting program authorized under the "Regulations for State Discharge Permit System", 6.1.0 (5 CCR 1002-8). Under that regulation, the Division is authorized to issue permits for discharges to ground water from wastewater treatment impoundments and land application systems. The program is just now becoming functional, but promises to be the primary mechanism for protecting ground water from degradation from wastewater. The voluntary nonpoint source program established by Section 319 of the Federal Act has performed a number of educational and demonstration projects directed towards ground water protection, principally in the area of improved irrigation efficiency and Best Management Practices for agriculture. Although the NPS program is not regulatory, it does play an important role in protecting ground water through voluntary and educational means. The same can be said for the Wellhead Protection program and the data base development activities of the WQCD. The WHP program has developed a guidance document outlining the necessary components of a plan to protect public water supply wellhead areas from contamination by all possible sources, and the Division offers technical assistance to communities and districts who wish to establish WHPAs and plans. The ground water data base gathers data from all reputable sources and compiles it in a standardized format for use by all ground water protection programs both internal and external.

Senate Bill 181 adopted in 1989 recognized and authorized other state agencies as partners in the business of ground water protection. The four named "implementing agencies" are the Mined Land Reclamation Board, The Oil and Gas Commission, the State Engineer (Division of Water Resources), and the Hazardous Materials and Waste Management Division of the Health Department (CERCLA and RCRA agency). Each of the implementing agencies has developed regulations to protect ground water within the area of authority each agency has been charged with, and they annually report on their progress to the WQCC, the agency with final authority for protecting the resource. Although progress is somewhat uneven among these partner agencies, considerable progress has been made in developing ground water protection as part of the mission of each agency, and more progress in that direction is expected.

The other state agency with a major role in ground water protection is the state Department of Agriculture. Although not part of the SB 181 authorization, the

Department of Agriculture has been factored into the ground water protection business via another statutory amendment to the WQ Act, Senate Bill 126 passed in 1990. Under that statute, the Commissioner of Agriculture can take various measures to alter or curtail agricultural practices that have been shown to be damaging to ground water. It is the responsibility of the WQCD to collect the data demonstrating problems in the ground water from agricultural chemicals and relay those findings to the Commissioner. This monitoring responsibility was first addressed by establishing 100 testing wells along the South Platte alluvium for sampling in 1992. That data collection revealed several "hot spots" for nitrates and sporadic observations of atrazine. In 1993, a subset of the South Platte wells were retested and a new batch of ninety three wells in the San Luis Valley was monitored during the summer of 1993. That testing revealed high nitrate levels in the ground water near Center, but an absence of contamination from pesticides and herbicides. In 1994, some of the San Luis Valley wells will be retested, and about 150 wells in the agricultural area along the lower Arkansas River will receive comprehensive testing.

At the local level of government, counties and local health departments assist in the job of ground water protection by exercising good judgement in zoning and siting decisions, establishing ordinances restricting the improper disposal of possible hazardous materials, and by closely regulating the location and design of individual sewage disposal systems (ISDS systems). Although poorly functioning ISDS systems still plague a few areas in the state, their role as a significant source of pollution is declining. As mentioned earlier, establishing wellhead protection areas administered by a municipality or county promises to be an important additional means of controlling those activities that might threaten community water supply wells.

The federal government also has an important role to play in protecting ground water in Colorado. EPA has worked diligently in partnership with the state in pursuing cleanup of contaminated sites through the CERCLA program, and in administration of the deep well injection (UIC) program. The agencies under the federal Department of Agriculture have taken their responsibilities to protect ground water very seriously in the area of educating producers about proper chemical and fuel usage. The land management agencies, primarily the Forest Service and Bureau of Land Management, are increasing their participation in the Nonpoint Source Program by instituting Best Management Practices directly related to protecting ground water as well as surface water.

Remaining Issues of Concern

As discussed above, many of the threats to ground water quality are being addressed by a variety of programs at all levels of government. This section summarizes those concerns that remain, and in some cases, suggests how they may be resolved:

-A comprehensive ground water quality data base must be established to provide a convenient single source for information. A great deal of ground water quality data exist for the state but the data is scattered among many sources, and very little coordination occurs between agencies collecting and using ground water quality data.

-Responsibility for ground water quality protection is divided among a number of state and local agencies. Agencies and responsibilities need to be identified and a comprehensive state-wide ground water protection plan developed to coordinate their activities as part of a state strategy.

- Ground water aquifers are inadequately mapped for large areas of the state and ground water quality information is unavailable or nonexistent.

- Very few of the sites that may potentially impact ground water are monitored or regulated. In some cases, especially near urbanized areas, land-use protection measures for sensitive aquifers and ground water supplies are needed. Currently only a few counties, such as Boulder County, have adopted planning and land-use zoning restrictions that consider ground water protection.

-Implementation of a public water supply wellhead protection area program is a necessary component of a comprehensive ground water protection program and must continue to be implemented.

- Nitrate contamination from agricultural areas or from feedlots is common, and protection strategies now in place need to be closely monitored for effectiveness.

- Pesticides and herbicides also pose a threat to ground water quality, and should continue to be addressed through increased public water supply monitoring and an aggressive agricultural chemicals control program via SB 126.

- Volatile organics, especially those derived from petroleum products, have a potential for polluting ground water wherever they are stored, transported, or processed. Additional regulatory control over these possible avenues of release to ground water should be explored.

- Oil-field brines also have the potential for causing significant damage to ground water in some areas of the State, and continued strengthening of the OGCC role in ground water protection must be stressed.

- Discharges to ground water from numerous point sources such as wastewater lagoons, mining and milling sites, land application systems, landfills, etc., must continue to be controlled via ground water permits or reclamation activities under RCRA and CERCLA.

- Adequate well-construction and well-abandonment practices are of great concern to the State, along with wellhead protection, to safeguard aquifers from the migration of hazardous constituents.

- In some areas, naturally-occurring impurities in ground water, such as arsenic, selenium, fluoride, sulfate, sodium, iron, manganese, total dissolved solids (TDS) or hardness, or high radiation levels have created problems for PWS systems. An unknown number of private water supplies also may be affected by these contaminants. A means to inform and assist the public about the hazards of using these contaminated waters should be devised.

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APPENDIX A

MACROINVERTEBRATES

Macroinvertebrates were collected and processed in accordance with procedures described in: Rapid Bioassessment Protocols For Use In Streams and Rivers--Rapid Bioassessment Protocol III--Benthic Macroinvertebrates. Protocol III focuses on the riffle/run habitat as the most productive habitat available in stream systems.

Two riffle samples were collected at each station: one from an area of fast current velocity and one from an area of slower current velocity. A kick net (mesh size 500 um) was used to collect the sample from an approximately 1 square meter area. Samples from each kick net were labeled by station, habitat (i. e. fast riffle/slow riffle) date, and preserved in 90% alcohol for laboratory analysis.

The macroinvertebrate samples were processed at the C. P. Gillette Entomological Museum at Colorado State University. Subsamples were processed sufficient to characterize the entire sample and totaling a minimum of 100 organisms plus or minus 10 percent. All benthic macroinvertebrates in the subsample were identified to the lowest positively identified taxonomic level (generally genus or species) and enumerated. Taxonomic identification is based on keys listed in Clark (1991).

FISH

All fish were obtained by electrofishing with a backpack shocker in first and second order streams. Fish were sampled in accordance with requirements of the Scientific Collecting Permits issued by the Colorado Division of Wildlife. Data for most third order streams and all higher order rivers was obtained from the Colorado Division of Wildlife or the U. S. Fish and Wildlife Service. Priority was given to data obtained in the last five years.

Collected fish were identified to species and measured to the nearest half centimeter (total length). Five fish per size class and per species were weighed to the nearest gram using spring loaded scales. Average weight per individual per size class was assigned to individuals in each size class to estimate biomass. Individuals of doubtful taxonomy were preserved in the field and referred to appropriate specialists. The Seber LeCren two pass method was used for population estimates.

HABITAT

The habitat evaluation protocol followed modified qualitative field scoring procedure described in Habitat Assessment and Physicochemical Parameters (Rapid Bioassessment Protocols, May 1989). The habitat assessment form was modified by the Colorado Nonpoint Assessment Project because oftentimes metrics were judged confusing or inappropriate when applied to the Southern Rocky Mountain ecoregion.

The habitat protocol evaluates nine variables, which when summed gives a maximum score of 136. A complete analysis of this score will not be done until reference conditions have been evaluated for the entire State, however a raw score is presented for each of the sites evaluated. Principal habitat factors we focused on for the Rio Grande aquatic life classification are streamflow, substrate, and maximum water temperature.

WATER CHEMISTRY

All water samples were "grabs," taken from the main current of the stream. Monitored parameters are shown in Table 14. Temperature, dissolved oxygen, total alkalinity, and pH were measured in the field. Fecal coliform analysis was begun the same day of collection by San Luis Valley Analytical Laboratories in Alamosa. Water samples for metals analyzed as dissolved were filtered through a .45 micron filter in the field prior to acidification. Iron and selenium are analyzed as total recoverable and mercury is total. Except for the field parameters, samples were cooled and shipped to the Colorado Department of Public Health and Environment Laboratory Chemistry Section in Denver for analysis.

OTHER DATA

Besides the data collected by the Division, several other governmental and private entities have recently engaged in collecting surface water quality data in the Rio Grande Basin. These include the U. S. Geological Survey, U. S. Fish and Wildlife Service, U. S. Bureau of Reclamation, U. S. Forest Service, Conejos County, U. S. Environmental Protection Agency, Colorado Division of Wildlife River Watch Program, Alamosa/La Jara Water Users, Summitville Mine, and Professors Mary and Ted Mueller of Adams State College.

Table A-1

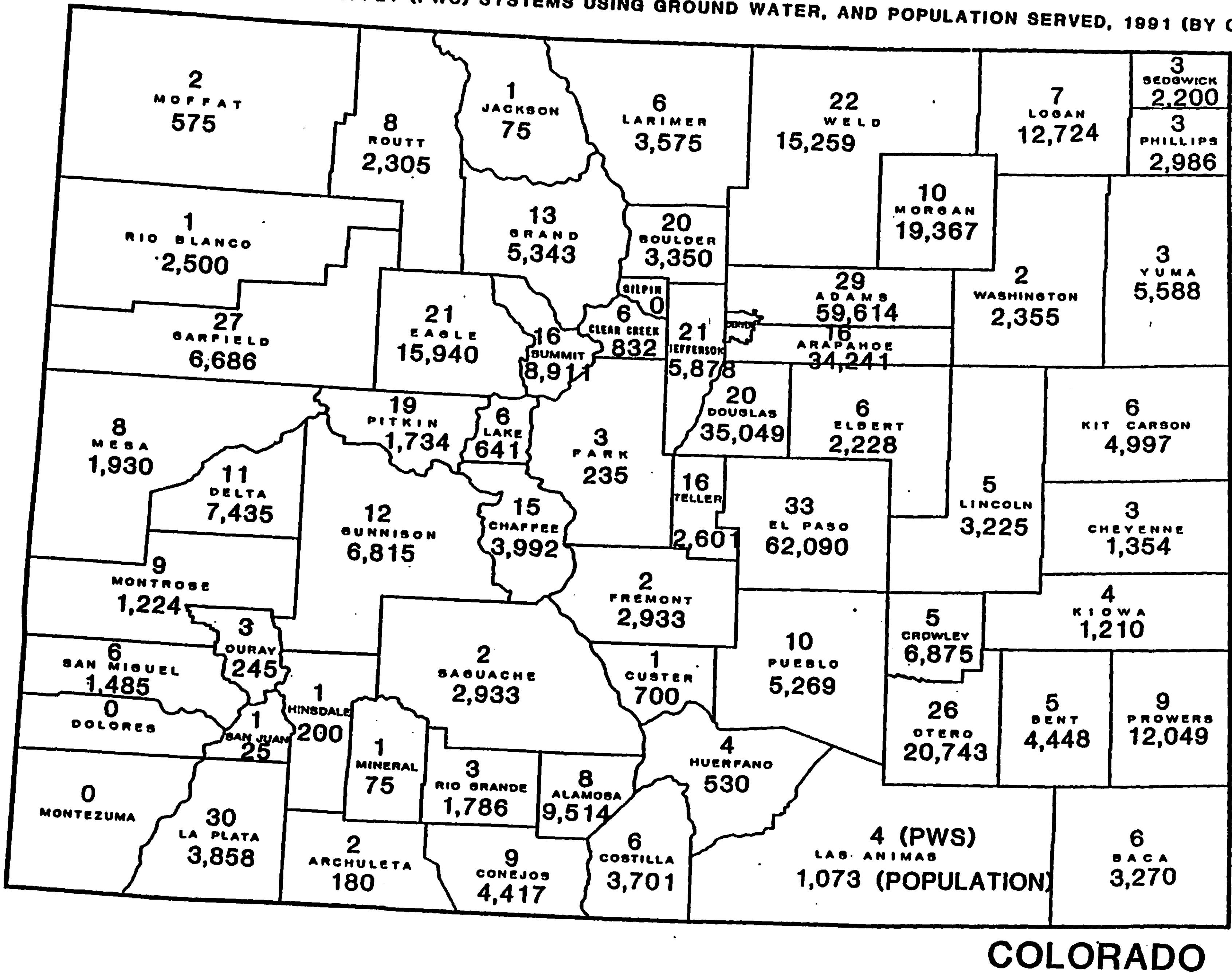
Data Quality Objectives for Precision and Detectability for Selected Constituents

Constituent	Test Method	Precision	Units	Lowest Reportable Value	Lowest Expected Standard
Key Parameters					
Dissolved oxygen			mg/l	0	5.0
pH	EPA 150.1	0.2	s.u.	NA	6.0
Fecal coliform			MPN	2	200
Cadmium, dis	EPA 213.2	10%	ug/l	0.3	0.4
Copper, dis	EPA 200.7	10%	ug/l	4	4
Iron, tot. rec.	EPA 200.7	10%	ug/l	10	1000
Lead, dis	EPA 239.2	10%	ug/l	5	0.6
Manganese, dis	EPA 200.7	10%	ug/l	4	50
Mercury, tot.	EPA 245.1	10%	ug/l	0.2	0.1
Selenium, tot rec.	EPA 270.3	10%	ug/l	1	10
Silver, dis.	EPA 272.2	10%	ug/l	0.2	0.01
Zinc, dis.	EPA 200.7	10%	ug/l	8	33
Supplemental Observations					
Alkalinity			mg/l		NA
Hardness	EPA 130.2	10%	mg/l	10	NA
Temperature			celsius	NA	NA
Tot Dissolved Solids			mg/l		NA
Tot Suspended Solids			mg/l		NA
Sulfate			mg/l		NA
Nitrite+nitrate	EPA 353.2	10%	mg/l	0.5	10
Phosphorus, tot.	EPA 365.2	10%	mg/l	0.005	NA

APPENDIX B

Number of Public Water Supply Systems Using Ground Water

NUMBER OF PUBLIC WATER SUPPLY (PWS) SYSTEMS USING GROUND WATER, AND POPULATION SERVED, 1991 (BY COUNTY).



APPENDIX C

303(d) LIST

303(d) List
Platte River Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COSPUS01A 3/1a	Mainstem of S. Platte above North Fork Confluence	E	Partially Supporting	N	Sediment	Low
COSPUS02B 3/2b	Mosquito Creek source/Middle Fork	M	Non Supporting	B,Q,T	Cu, Zn, Pb	Medium
COSPUS02C 3/2c	S. Mosquito Creek source/Mosquito Creek	M	Not Supporting	B,Q,T	Zn, Cd, Fe	Medium
COSPUS04 3/4	North Fork S. Platte source/S. Platte	E	Partially Supporting	N	Cu, Mn	Low
COSPUS05A 3/5a	Geneva Creek above Scott Gomer Creek	E	Partially Supporting	N	Metals	Low
COSPUS015 3/15	South Platte Burlington Ditch, Big Dry Creek	M M	WQL WQL	Q Q	Dissolved Oxygen Others	High
COSPUS016 3/16	South Platte tribs, Chatfield/Big Dry Creek	M M	Partially Supporting	N B	Toxicity W.E.T.	High
COSPUS016L1 3/16	Mary Lake	M	Partially Supporting	B	Toxics	Low
COSPUS16L2 3/16	Ladora Lake	M	Partially Supporting	B	Toxics	Low
COSPUS16L3 3/16	Derby Lake	M	Partially Supporting	B	Toxics	Low
COSPCH03 3/3	Cherry Creek below Reservoir	M M	Partially Supporting WQL	N,Q,J J	Fecals	Low
COSPCL02 3/2	Clear Creek, I-70 bridge/Argo Tunnel	M	Partially Supporting	N	Metals	High
COSPCL03b 3/3b	Leavenworth Creek, source/Clear Creek	E	Partially Supporting	N	Metals	High

B- Indicates biological information.
J- Indicates direct observation or professional judgement.
N- Nonpoint Source Assessment.
Q- Indicates chemical or microbiological water quality data.
T- Temporary Modification

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COSPCL05 3/5	West Clear Creek, Woods Creek/Clear Creek	M	Not Supporting	Q,B,T	Metals	High
COSPCL07 3/7	Woods Creek	M	Not Supporting	Q,B,T	Metals	High
COSPCL09 3/9	Fall River and Tribs	E	Partially Supporting	N	Metals	High
COSPCL11 3/1	Clear Creek, Argo Tunnel F/HC	M	Not Supporting	Q	Metals	High
COSPCL13 3/13	North Fork Clear Creek	M	Not Supporting	Q	Metals	High
COSPCL14 3/14	Clear Creek, FHC/Youngfield	M	WQL	B,T	Metals	High
COSPB005 3/5	Streams on Rocky Flats property	M	WQL	T	Radionuclides Metals Organics	Medium
COSPCL17 3/17	Ralston Creek above Arvada Reservoir	E	WQL	T	Metals	High
COSPB009 3/9	Boulder Creek South Boulder Creek/Coal Creek	M	Partially Supporting	B,Q	Un-Ionized Ammonia	Medium
COSPB010 3/10	Boulder Creek, Coal Creek/Saint Vrain	M	Partially Supporting	Q	Un-ionized Ammonia	Medium
COSPSV03 3/3	Saint Vrain Longmont/S. Platte	M	WQL	Q	Un-ionized Ammonia	Medium
COSPBT09 2/9	Little Thompson Culver Ditch/Big Thompson	M	Not Supporting	Q	Fecals Iron	Low

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J- Indicates direct observation or professional judgement.
N- Nonpoint Source Assessment.
Q- Indicates chemical or microbiological water quality data.
T- Temporary Modification

303(d) List
Arkansas River Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COARUA1B 13/1b	East Fork Arkansas River source to Birdseye Gulch	M	Partially Supporting	T	Metals	High
COARUA02 13/2a	East Fork Arkansas River Leadville/California Gulch	M	Partially Supporting	Q,B,T	Metals	High
COARUA02B 13/2b	East Fork Arkansas River California/Lake Fork	M	Not Supporting	Q,B,T	Metals	High
COARUA02C 13/2c	Arkansas River, Lake Fork, Lake Creek	M	Partially Supporting	Q,B	Metals	High
COARUA03 13/3	Arkansas River, Lake Creek/Canon City	M	Partially Supporting	Q B	Metals	High
COARUA04 13/4	Arkansas River, Canon City/Pueblo Reservoir	M	Partially Supporting	B	Metals	High
COARUA05 13/5	Arkansas River tribs above Browns Creek	M	Partially Supporting	Q,B	Metals	High
COARUA09 13/9	Iowa Gulch Paddock #1 Ditch/Arkansas River	M	Partially Supporting	T	Metals	High
COARUA11 13/11	South Fork Lake Creek	M	Not Supporting	Q	Metals	High
COARUA14L1 13/14	Teller Reservoir	M	Partially Supporting	Q	Mercury	High
COARUA15 13/15	Grape Creek above DeWeese outlet	E	WQL	N	Sediment	High
COARUA20 13/20	Fourmile Creek and other Tributaries	M	WQL	Q,N,B	Metals	High
COARUA23 13/23	Wilson Creek above Fourmile Creek	E	WQL	J	Metals Un-ionized Ammonia	High

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Arkansas River Basin (Continued)
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COARF002 4/2	Fountain Creek Monument Creek/Arkansas River	M	Not Supporting	N T	Sediment Ammonia	Low
COARLA01 6/1	Arkansas River, Fountain Creek/Stateline	E	Not Supporting Not Supporting	N N	Sediment[1] Salinity	Low
COARLA07 6/7	Purgatorie River I-25 Arkansas River	E E	Partially Supporting Partially Supporting	N J	Sediment Metals	Low

---

[1] The sediment problem is first detected by monitoring data as total recoverable iron, a good indicator of sediment, at the Nepesta sampling station. The total recoverable iron increases in a downstream direction to John Martin Reservoir. The salinity is also first detected increasing at the Nepesta gaging station is caused by non-point sources, including agricultural return flows. The salinity also increases in a downstream direction.

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T- Temporary Modification

Colorado River Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COGUUG12&13 10/12&13	Coal Creek	M	WQL	T	Metals	Low
COGUUG32 10/32	Palmetto Gulch	E	Not Supporting	N	Metals	Low
COGUUN02 10/2	Uncompahgre River, source/Red Mountain Creek	E	Partially Supporting	Q	Metals	Low
COGUUN03 10/3	Uncompahgre River, Red Mountain Hwy. 550	M	Not Supporting	Q	Metals	Low
COGUUN04 10/4	Uncompahgre River Hwy 550/Gunnison River	M	WQL	N	Sediment Salinity	Low
COGUUN09A 10/9a	Canyon Creek above Waterhole Slide	E	Partially Supporting	N	Metals	Low
COGUL02 10/2	Gunnison River, Uncompahgre/Colorado	M	Partially Supporting	Q	Sediment	Low
COGUSMN3a&3b 10/3a&3b	San Miguel River	M	Partially Supporting	T	Metals	Low
COGSM6a&6b 10/6a&6b	Marshall and Ingram Creeks	M	Partially Supporting	T	Metals	Low
COUCUC004 12/4	Colorado River Tributarires Lake Granby/Roaring Fork	E	WQL	N	Sediment	Low
COUCUC05A 12/5	Colorado River, State Bridge/Roaring Fork	E	WQL	N	Sediment	Low
COUCUC06c 12/6c	Willow Creek Tributary	M	WQL	T	Un-ionized Ammonia	Low
COUCUC07A 12/7a	Muddy Creek	M	WQL	Q	Sediment	Low
COUCUC7b 12/7b	Rock Creek	M	WQL	T	Mercury	Low
COUCBL01 12/1	Blue River above Breckenridge WWTP	M	Partially Supporting	Q,B	Metals	Low

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303(d) List
Colorado River Basin (Continued)
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COUCBL02 12/2	Blue River, French Gulch to Swan River	M	WQL	T	Metals	Low
COUCBL06 12/6	Snake River Above Dillon Reservoir	M	Partially Supporting	Q	Metals	Low
COUCBL07 12/7	Peru Creek above Snake River	M	Not Supporting	B,Q,T	Metals	Low
COUCBL09 12/9	Deer Creek	E	Partially Supporting	N	Metals	Low
COUCBL17L1 12/17	Green Mountain Reservoir	E	WQL	N,J	Nutrients	Low
COUCBL18 12/18	Straight Creek	M	WQL	Q	Sediment	Medium
COUCEA02 12/2	Eagle River source/Belden	M	Not Supporting	Q	Metals	Low
COUCEA05 12/5	Eagle River, Belden/Gore Creek	M	Partially Supporting	Q,B,T,	Metals	Low
COUCEA07 12/7	Cross Creek source/Eagle River	M	Not Supporting	Q	Metals	Low
COUCEA09 12/9	Eagle River, Gore Creek/ Colorado River	M	Partially Supporting	Q,T	Metals	Medium
COUCEARF09 12/9	Coal Creek	M	Partially Supporting	T	Metals	Low
COUCEARF08 12/8	Crystal River Source/Roaring Fork	M	WQL	N	Sediment	Low
COLCLC01 11/1	Colorado River, Roaring Fork/Parachute	M	WQL	Q	Sediment	Low
COLCLC02 11/2	Colorado River, Parachute Creek,/Gunnison River	M	WQL	Q	Sediment	Low
COLCLC03 11/3	Colorado River, Gunnison River Stateline	M	WQL	Q	Sediment	Low
COLCLC1 11/14	Roan Creek Source/Clear Creek	E	WQL	N	Sediments	Low

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303(d) List
Green River Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COLCLC13 11/13	Colorado River Tribitaries Parachute Creek/Stateline	E	WQL	N	Sediment	Low
COYCYA02A 12/2a	Yampa River above Elkhead Creek	E	WQL	N,Q	Un-ionized Ammonia	Medium
COUCYA02BL 12/2b	Stagecoach Reservoir	M	Partially Supporting	B,Q	Dissolved Oxygen	Medium
COLCLY02 11/2	Yampa River, Lay Creek/Green River	M	WQL	Q	Sediment	Low
COLCLY16 11/16	Little Snake River, Powder Wash/Yampa River	E	Partially Supporting	N	Sediment	Low
COLCWH12 11/12	White River, Piceance Creek/ Douglas Creek	E	WQL	N	Sediment	Low
COLCWH13A 11/13a	White River tribs Piceance Creek/Douglas Creek	E	WQL	N	Sediment	Low
COLCWH21 11/21	White River, Douglas Creek/Stateline	E	WQL	N	Sediment	Low
COLCWH22 11/22	White River Tribs Douglas Creek/Stateline	E	WQL	N	Sediment	Low

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T- Tempo--ry Modification

303(d) List
San Juan Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COSJSJ07L	Navajo Reservoir (Portion in Colorado)	M	Partially Supporting	B	Mercury	Low
COSJAF03 9/3	Animas River, Elk Creek/Junction Creek	M	Partially Supporting	Q,B	Metals	Medium
COSJAF04 9/4	Animas River Junction Creek/Stateline	M	WQL	N	Sediment	Medium
COSJPL01 9/1	La Plata River above Hay Gulch	E	Partially Supporting	N	Metals	Low
COSJLP08L1 9/8	Narraguinnep Reservoir	M	Partially Supporting	B	Mercury	Medium
COSJD004 9/4	Dolores River Bear Creek/Bradfield Ranch	E	WQL	N	Metals	Low
COSJD004L 9/4	McPhee Reservoir	M	Partially Supporting	B	Mercury	Medium
COSJD009 9/9	Silver Creek	M	Partially Supporting	Q	Metals	Low

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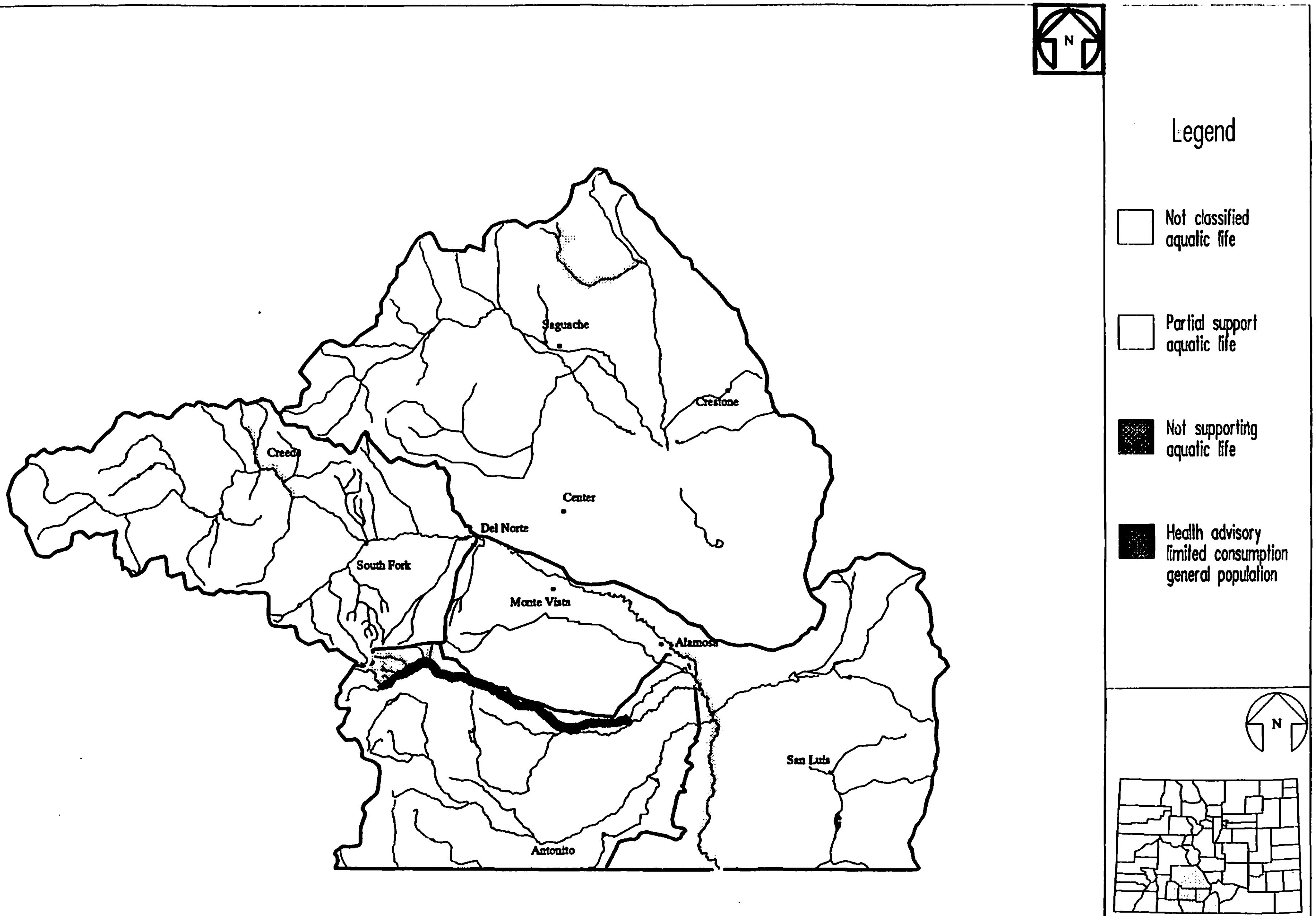
T- Temporary Modification

Figure 13



Rio Grande Basin in Colorado
Scale 1:1,250,000

303(d) List
Rio Grande Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
CORGRG03 8/3	Rio Grande, Willow Cr./Rio Grande/Alamosa Cnty. Line	M	Partially Supporting	Q,B	Zinc	Medium
CORGRG12 8/12	Rio Grande, Rio Grande/Alamosa County/Lobatos Gage	M	WQL	Q,B	Sediment	Low
CORGRG13 8/13	Rio Grande, Lobatos/Stateline	E	WQL	Q,B	Sediment	Low
CORGRG18 8/18	Alamosa Creek Iron Creek/Terrace Reservoir	M	Not Supporting	Q	Metals	Medium
CORGRG21 8/21	Terrace Reservoir	M	Not Supporting	Q	Metals	Low
CORGRG22 8/22	Alamosa Creek Terrace Reservoir/Gunbarrel Road	M	Not Supporting	Q	Metals	Low
CORGRG23 8/23	Alamosa Creek Gunbarrel Road//final Div.	M	Not Supporting	Q	Metals	Low
CORG41L	Sanchez Reservoir	M	Partially Supporting	B	Mercury	Medium

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303(d) List
Republican River Basin
1993

WBID Region/Segment	Segment Description	Evaluated/ Monitored	Status	Criteria	Constituent(s)	Priority
COSPRRE03 5/3	North Fork Republican River source/stateline	M	Partially Supporting	Q,B	Sediment	Low

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T- Tem[illegible]ry Modification

Designated Use Impairment Conventional Pollutants

Intensity of Designated Use Impairment	Water Quality Information	Biological Information	Direct Observation/ProfessionalJudgement
FULLY SUPPORTING: Designated uses are not measurably impaired due to water quality.	The water quality standard is exceeded in not more than 10% of the analyses and the mean measured value is less than the standard.	The designated uses of the water body are not impaired due to water quality, and data indicate full supporting of aquatic life, including survival, propagation, production, dispersion, community structure, species diversity within the limits of the physical habitat.	The water body is being used as designated, based on observation, and professional judgement indicates no reason why it should not be.
WATER QUALITY LIMITED, ALLOCATED (WQLA): Designated uses not measurably impaired due to water quality, but the assimilative capacity of the segment has been allocated. If additional growth occurs in the areas served by the current treatment facilities or an additional wastewater plant will discharge to the same more restrictive limits will be required for some or all dischargers.	The water quality standard is exceeded in 10-15% of the analyses and the mean measured value is less than the standard and the dischargers are all meeting their permit limits for conventional pollutants.	The designated uses of the water body are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life including survival, propagation, production, dispersion, community structure and/or species diversity.	Water quality based effluent limits, which may include an approved wasteload allocation, are in effect on the segment.
WATER QUALITY LIMITED: (WQL) Designated uses not measurably impaired due to water quality but assessment information or segment specified water quality based controls indicate the potential for impairment of the designated uses in the near future.	The water quality standard is exceeded in 10-15% of the analyses and the mean measured value is less than the standard or data indicate a trend of deteriorating water quality which could impair uses(s).	The designated uses of the water body are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life including survival, propagation, production, dispersion, community structure and/or species diversity.	The segment has been identified as in need of study through a 208 plan, a site application process, or a State permitting process; OR population or industrial siting increases indicate a probable downward trend in water quality which may lead to impairment of uses in the absence of additional management.
PARTIAL SUPPORT: Some interference with designated uses, but use is not precluded.	The standard is exceed in 15-25% of the analyses and the mean measured value is less than the standard; OR the standard is exceeded in not more than 15% of the analyses and the mean measured value exceeds the standard.	The designated uses of the water body are present, but it is uncertain that these are at attainable levels, or some impact on the uses has been noted.	The use exists in the water body based on observation, but professional judgement, which may be based on limited data, indicates that the uses in not fully supported
NOT SUPPORTING: Designated uses measurably impaired because of water pollution. Use may be present but at significantly reduced levels from full support in all or some portion of the water body.	The standard is exceeded in more than 25% of analyses and mean measured value is less than the standard; OR the standard is exceeded in more than 15% of analyses and mean measured value exceeds the standards.	There is some certainty that the water body can not be fully used as designated because the survival, propagation, production dispersion, community structure, or species diversity of aquatic life is impaired.	No evidence exists that the entire water body can be used as designated; or known or suspected water quality impacts prevent anything but minimal use of all or a major portion of the water body.

Designated Use Impairment Toxic Pollutants (Continued)

Intensity of Designated Use Impairment	Water Quality Information	Biological Information	Direct Observation/Professional Judgement
FULLY SUPPORTING: Designated uses are not measurably impaired due to water quality.	An acute water quality standard is exceeded in not more than one sample in the previous three year period and the mean of all the samples is less than the chronic standard.	The designated uses of the waterbody are not impaired due to water quality, and data indicate full support of aquatic life use, including survival, propagation, dispersion, community structure, and/or species diversity within the limits of the physical habitat.	The water body is being as designated, based on observation and professional judgement indicates no reason why it should not be.
WATER QUALITY LIMITED, ALLOCATED (WQL): Designated uses not measurably impaired due to water quality, but the assimilative capacity of the segment has been allocated. If additional growth occurs in the areas served by the current treatment facilities or and additional wastewater plant will discharge to the same more restrictive limits will be required for some or all dischargers.	A chronic water quality is exceed in two or more samples in the past three years, but acute standard exceeded more than once in the last three years, the mean is less than the chronic standard, and all dischargers are meeting the limits specified in their permits.	The designated uses of the waterbody are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life use including survival, propagation, dispersion, community structure and/or species diversity.	Water quality based effluent limits, which may include an approved wasteload allocations, are in effect on the segment.
WATER QUALITY LIMITED (WQL): Designated uses not measurably impaired due to water quality, but assessment information or segment specific water quality based controls indicate the potential for impairment of the designated uses in the near future.	A chronic water quality standard is exceeded in two or more samples in the past three years, but an acute water quality standard is not exceeded more than once in the same period, and the mean is less than the chronic standard OR the data indicate a downward trend toward deteriorations in water quality which could impair uses(s).	The designated uses of the waterbody are not impaired, but data indicators indicate a probable downward trend that may impair aquatic life use including survival, propagation, dispersion, community structure and/or species diversity.	The segment has been identified as in need of study through a 208 plan, a site application process, or a State permitting process; OR population or industrial siting increases indicate a probable downward trend in water quality which may lead to impairment of uses int he absence of additional management.
PARTIAL SUPPORT: Some interference with designated uses, but use is not precluded.	An acute water quality standard is exceeded in two or more samples in the past three years, but the mean measured value is less than the chronic standard.	The designated uses of the waterbody are present, but it is uncertain that these are at attainable levels, or at least some impact on the uses has been noted.	The use exists in the waterbody based on observation, but professional judgement, which may be based on limited data, indicates that the use is not fully supported.
NOT SUPPORTING: Designated uses measurably impaired because of water pollution. Use may be present but at significantly reduced levels from full support in all or some portion of the waterbody.	An acute water quality standard is exceeded in two or more samples in the previous three years and the mean measured value is above the chronic standard.	There is some certainty that the waterbody can not be fully used as designated because the survival, propagation, production, dispersion community structure, or species diversity of aquatic life is impaired.	No evidence exists that the entire waterbody can be used as designated; or known or suspected water quality impacts prevent anything but minimal use of all or a major portion of the waterbody.

JS:jb\c:305B\303D.fnl

HYDROLOGIC MODIFICATION NONPOINT SOURCE MANAGEMENT PROGRAM

prepared by

COLORADO NONPOINT SOURCE TASK FORCE

JUNE 1992

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

JUL 16 1992

Ref: 8WM-WQ

Honorable Roy Romer
Governor of Colorado
Executive Chambers
136 State Capitol
Denver, CO 80203-1792

Re: Hydrologic Modification Program; Nonpoint Source Management Program

Dear Governor Romer:

You submitted to EPA Region VIII a Hydrologic Modification Program (Program) for approval under the State's Nonpoint Source Management Program which was received September 20, 1991. EPA approved the process submitted as a Best Management Practice, but requested certain conditions be met before we fully approved the Program. A revised Program was approved by the Colorado Water Quality Control Commission and submitted by the Commission to EPA on June 17, 1992.

We find that the revised Program meets the conditions for an approvable program. We are pleased to inform you that we approve the Hydrologic Modification Program for the Colorado Nonpoint Source Management Program. This is the first hydrologic modification program approved for a State nonpoint source management program in the nation. We look forward to working with the Colorado Nonpoint Source Task Force on demonstration projects which implement the principles described by this Program for water resource enhancement and protection.

Sincerely,

Jack W. McGraw
Acting Regional Administrator

cc: Paul Frohardt, Colorado Water Quality Control Commission
Dave Holm, Colorado Department of Health
Jon Scherschligt, Colorado Department of Health
Greg Parsons, Colorado Department of Health

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Hydrologic Modification Nonpoint Source Management Program

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INTRODUCTION

This Management Program is intended to identify and develop programs for minimizing adverse nonpoint source water quality impacts associated with hydrologic modifications. The emphasis of the Hydrologic Modification Subcommittee will be on identifying and developing programs to employ physical, structural, or other solutions. The focus of concern is the interaction between sources of pollution and hydrologic modifications which may cause adverse nonpoint source water quality impacts. These adverse water quality impacts are to be addressed through the voluntary implementation of economically reasonable alternatives.

Implementation of BMP's to correct nonpoint source water quality problems, where such BMP's are identified solely as part of the state Section 319 program, is voluntary in Colorado. Thus, in the absence of independent statutory or regulatory authority, reference in other state and federal enactments to Colorado's Section 319 program, including BMP's developed thereunder, shall not establish an enforceable requirement that BMP's be implemented other than voluntarily. Thus, any entity which attempts to impose BMP's must have independent regulatory authority.

The Hydrologic Modification Subcommittee of the Colorado Nonpoint Source Taskforce will focus its efforts on developing management programs which address the following areas.

1. Identification of adverse nonpoint source water quality impacts associated with hydrologic modifications.
2. Identification of economically and technically reasonable alternative control measures, treatment measures, design concepts, operational procedures or other solutions which will result in a reduction of the identified adverse nonpoint source water quality impacts.
3. Identification of benefits and costs of the alternative solutions.
4. Identification and recommendation of correction measures which may be appropriate to implement.

Potential adverse nonpoint water quality impacts associated with hydrologic modifications are listed on Table 1.

Definitions used in this program are listed on Table 2.

Best Management Practice

The best management practice suggested in this management program is a process to review identified adverse nonpoint source water quality impacts associated with hydrologic modifications and determine the most reasonable approach to achieve water quality improvement in a cost-effective manner. This process allows for two approaches:

1. If an individual has an interest in correcting an identified impact, a list of references is attached.
2. If the identified impact is the result of the interaction from multiple pollution sources in a basin, the program develops a process by which the impacts can be reviewed, data can be collected, project sponsors can be identified and recommendations for correction can be made to the Colorado Nonpoint Source Taskforce for action.

A watershed as a whole must be taken into consideration. The implementation of an action at one point may create or increase a nonpoint source water quality impact elsewhere in the watershed. Specific actions may need to be recommended or developed for each problem identified within a watershed.

This program shall not supersede, abrogate, impair or cause material injury to water rights in accordance with §25-8-104 C.R.S. or be inconsistent with §33-U.S.C. 1251(g).

The following steps describe the BMP to be used in identifying and developing programs to minimize nonpoint source water quality impacts resulting from hydrologic modifications. Figure 1 shows the BMP in flowchart format.

HYDROLOGIC MODIFICATION SUBCOMMITTEE's NONPOINT SOURCE WATER QUALITY BMP

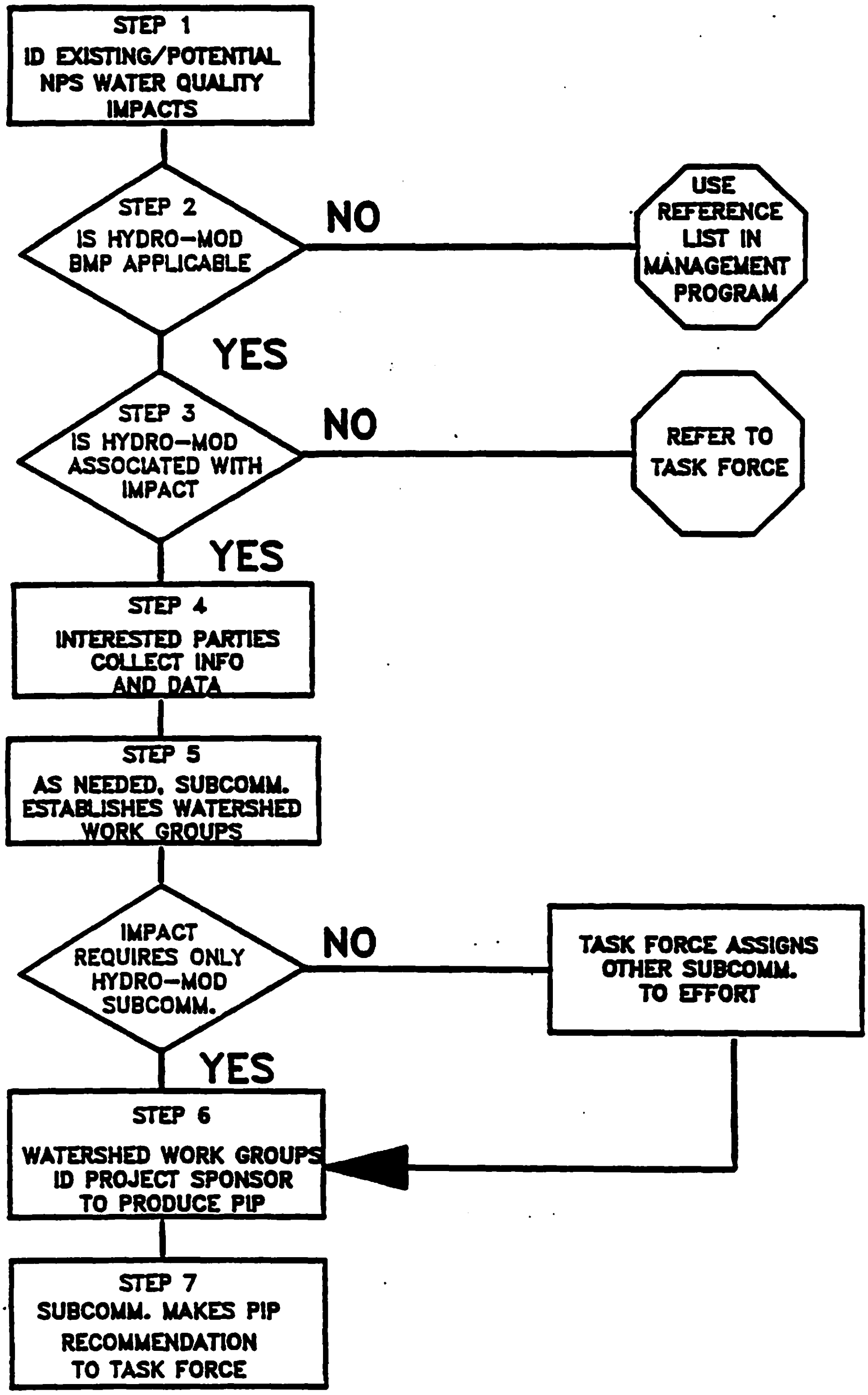

FIGURE 1 12/15/90

Participation by any interested party in the BMP process is voluntary and may be withdrawn at any time.

The BMP allows for consideration of the interaction between multiple pollution sources (point and nonpoint), determination of cost-effective control strategies, and provision for input from all affected or interested parties.

Step 1: IDENTIFICATION OF EXISTING OR POTENTIAL NONPOINT SOURCE WATER QUALITY IMPACTS ASSOCIATED WITH A HYDROLOGIC MODIFICATION WHICH MAY CAUSE EXCEEDENCE OF APPLICABLE NUMERIC AND NARRATIVE STREAM STANDARDS.

This step will be initiated by a party interested in a particular situation, including the Water Quality Control Commission using information received during the Water Quality Control Commission's Triennial Review of Stream Standards and Classifications.

Step 2: THE INTERESTED PARTY THAT IDENTIFIED AN EXISTING OR POTENTIAL NONPOINT SOURCE WATER QUALITY IMPACT DETERMINES IF THE HYDROLOGIC SUBCOMMITTEE'S NONPOINT SOURCE WATER QUALITY BMP SHOULD BE USED.

If the interested party is looking for information related to the adverse nonpoint source water quality impacts associated with hydrologic modifications, they will be referred to the reference list contained in the Hydrologic Modification Nonpoint Source Management Program.

If the interested party decides that the Hydrologic Modification Subcommittee's nonpoint source water quality BMP should be used, he/she will contact the Hydrologic Modification Subcommittee.

Step 3: THE HYDROLOGIC MODIFICATION SUBCOMMITTEE DETERMINES WHETHER HYDROLOGIC MODIFICATION IS PRIMARILY ASSOCIATED WITH THE POTENTIAL NONPOINT SOURCE WATER QUALITY IMPACT.

If the Subcommittee decides that the potential impact is primarily from an area other than hydrologic modification, it will be referred to the Nonpoint Source Task Force for reassignment to one of the other subcommittees.

Step 4: EXISTING DATA AND INFORMATION REGARDING THE NATURE AND EXTENT OF THE POTENTIAL NONPOINT SOURCE WATER QUALITY IMPACTS WILL BE COLLECTED.

Data will be compiled and activities reviewed which may be relevant to the existence and/or solution of the problem. Collection of this pertinent information will most likely be done by interested parties. The Subcommittee will determine if the impact has been identified in the Colorado Nonpoint Source Assessment Report. When the Subcommittee determines that the assessment report should be updated to include the nonpoint source water quality impact, the proposed update will be forwarded to the Nonpoint Source Task Force for action.

Step 5: AS NEEDED, THE HYDROLOGIC MODIFICATION SUBCOMMITTEE WILL ESTABLISH WATERSHED WORK GROUPS TO ASSESS THE POTENTIAL IMPACTS.

The watershed work groups will work with the Hydrologic Modification Subcommittee and will include representation from interested parties, representatives of activities which may be relevant to the problem and/or a solution, the

Colorado Department of Health, other appropriate federal/state agencies, and the responsible 208 agency. The watershed work groups will be responsible for further characterizing the issue, identifying additional information regarding violations of standards, sources of pollution, and types of activities which may be relevant to the issue according to the reference list contained in this management program. The subcommittee or watershed work groups will utilize all the information developed in the Task Force's other subcommittees as needed. If the Hydrologic Modification Subcommittee determines that the potential impact may require the expertise of other Task Force Subcommittees, the Hydrologic Modification Subcommittee will make that recommendation to the Nonpoint Source Task Force for further action.

Step 6: WATERSHED WORK GROUPS WILL ATTEMPT TO IDENTIFY A PROJECT SPONSOR OR SPONSORS TO DEVELOP A PROJECT IMPLEMENTATION PLAN (PIP).

The PIP will be developed according to the guidelines in the Colorado Nonpoint Source Management Program and submitted to the

Hydrologic Modification Subcommittee for review. Other parties willing to undertake activities to minimize the water quality impacts will be identified by the project sponsor or sponsors and included in the analysis of the effectiveness of the proposed remedial efforts.

Step 7: HYDROLOGIC MODIFICATION SUBCOMMITTEE WILL DECIDE IF THE PIP SHOULD BE RECOMMENDED TO THE COLORADO NONPOINT SOURCE TASK FORCE FOR ACTION.

If the Subcommittee mutually agrees that the PIP should be recommended to the Nonpoint Source Task Force, it will send the recommendations and all supporting information to the Nonpoint Source Task Force for consideration. A PIP shall not include a recommendation for action by a particular party not a member of the Subcommittee, without that party's explicit agreement.

The Water Quality Control division will be responsible for the maintenance and update of the statewide list of references provided at the end of this management program. Public education programs and involvement of the division are necessary to ensure that the references and the BMP are understood by the public and other users. Data which may be available as a result of the implementation of the BMP may be used to determine the necessity for modification to or improvements in the reference list. The reference list is not all inclusive. The Water Quality Control Commission may make deletions and or additions as may be necessary based on an annual evaluation report, emerging technologies, innovative practices or requests for special practices. Implementation of the BMP to correct nonpoint source water quality problems, or where the BMP is identified solely as part of the state's Section 319 program is voluntary in Colorado.

MILESTONES FOR THE HYDROLOGIC MODIFICATION PROGRAM

This management program is intended to provide a framework for addressing nonpoint source water quality impacts associated with hydrologic modifications. The milestones identified below represent additional program needs which are necessary to more fully address the issue.

Milestone		Proposed Completion
1.	Review existing program priorities and, identify additional watersheds through Treinnial Review hearings and individual project submittals.	beginning 10/92; Lower Colorado Triennial Review.
2.	Seek additional membership for Hydrologic Modification Subcommittee, particularly agencies with technical expertise and government and private interests involved with hydrologic modifications.	begin 6/92; contacts by 9/92; annual reviews begin 6/93.
3.	Amend BMP process to reflect field experience and additional information gathered.	annual review; beginning 9/93.
4.	Review existing and addditional references for inclusion, deletion, or modification of the references.	review by 12/92; include undisputed by 3/93; annual reports beginning 6/93.

PRIORITY WATERSHEDS AND PROJECTS

Since only three water bodies in Colorado have been identified as having adverse nonpoint source water quality impacts associated with hydrologic modification (Table 3), it is difficult to determine the severity and resultant priority of these water bodies from a statewide perspective. One of the milestones in the management program reflects the need to further investigate and identify as appropriate additional water bodies which may have adverse nonpoint source water quality impacts associated with hydrologic modifications. The results of this milestone should be used to update this management program and its priority water bodies. The water bodies which are found in Table 1 may require additional study to determine the magnitude of the adverse nonpoint source water quality impact associated with the hydrologic modification and reasonable actions which may be effective in controlling these sources. Listed below are the acronyms of various agencies and funding sources which may assist in additional study or implementation of appropriate actions.

319 - Section 319 Nonpoint Source Funds

201(G) - Construction grant funds transferred to nonpoint source purposes

SRF - State Revolving Loan Fund, administered by Water Quality Control Division

COE - Army Corps of Engineers

BOR - Bureau of Reclamation

TABLE 1
POTENTIAL NONPOINT SOURCE WATER QUALITY IMPACTS ASSOCIATED WITH HYDROLOGIC MODIFICATIONS[1]

I. Reservoirs

- A. Concentration of Nutrients
- B. Changes in Dissolved Oxygen
- C. Temperature
- D. Chemical Concentration (Organic and Inorganic)
- E. Chemical Changes (pH, Alkalinity Effects)
- F. Turbidity

II. Releases from Reservoirs

- A. Release of lower dissolved oxygen water to the downstream channel than would occur without the reservoir.
- B. Release of warmer or colder water to the downstream channel than would occur without the reservoir.
- C. Due to the concentration effect or anaerobic condition in reservoir, releases of chemical concentrations (organic or inorganic) to the downstream channel at higher levels than would occur without the reservoir.
- D. Due to the concentration effect of reservoir, releases of nutrient-rich water to the downstream channel at higher levels than would occur without the reservoir.

III. Diversions

- A. Increase or decrease in chemical concentration (organic and inorganic) below the diversion.
- B. Increase or decrease in nutrient concentration below the diversion.
- C. Change in temperature below the diversion.
- D. Change in dissolved oxygen below the diversion.
- E. Increases or decreases in turbidity below the diversion.

? Sediment Transport Capability Erosion Inc or Dec

[1]This program shall not supersede, abrogate, impair or cause material injury to water rights in accordance with §25-8-104 C.R.S. or be inconsistent with §33 U.S.C. 1251(g).

TABLE 2
Definitions

Hydrologic modification: The following activities constitute hydrologic modifications:

a. reservoirs

b. releases from reservoirs

c. diversions

d. other spatial and temporal changes of the movement and circulation of flow of water

TABLE 3
Priority Waterbodies and Potential Projects
for Hydrologic Modifications FY 89-92

Project Watershed	County	Category	Agencies Involved	Planning	Implementation	Funding Source
Boulder Creek	Boulder	HydroMod	City of Boulder	FY 89	FY 89-92	201(g), 319 SRF, Local
Bear Creek Reservoir	Jefferson	HydroMod	COE, DRCOG, Jefferson County	FY 89-90	FY 91-92	201(g), 319 Highway Department Local, COE
Fraser River	Grand	HydroMod	Grand County Denver Water Board	FY 91-92	---	---

TABLE 4
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Humphrey, J. H., R. C. Hunn, and G. B. Shea. 1985. Hydraulic characteristics of steep mountain streams during low and high flow conditions, and implications for fishery habitat. Pages 207-214 in F. W. Olson, R. G. White, and R. H. Hamre, eds. Proceedings of the symposium on small hydropower and fisheries. The American Fisheries Society, Bethesda, Maryland. Shields, F. D., Jr. 1982. Environmental features for flood-control channels. U.S. Army Corps of Engineers. Technical reports E-82-7.

Simons, D. B. 1979. Effects of stream regulation on channel morphology. Pages 95-111 in The ecology of regulated streams. J. V. Ward and J. A. Stanford, eds. Plenum Press, New York.

United States Environmental Protection Agency, 1989. Report to Congress: Dam water quality study. EPA 506/2-89/002.

Wesche, T. A. 1985. Stream channel modifications and reclamation structures to enhance fish habitat. Pages 106-163 in J. A. Gore, ed. The restoration of rivers in streams. Theories and experience. Butterwirth Publishers, Boston.

Binns, N. A. 1986. Stabilizing eroding stream banks in Wyoming. Wyoming Game and Fish Department. Cheyenne, Wyoming. 42 pages.

Cooper, C. O., and T. A. Wesche. 1977. Stream channel modification to enhance trout habitat under low flow conditions. Water Resources Series No. 58. Water Resources Research Institute, University of Wyoming, Laramie, Wyoming.

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Dillon Reservoir Phosphorus Control Regulations, Colorado Water Quality Control Commission (phosphorus trading procedures).

Fontane, D. G. and J. W. Labadie. 1982. "Optimal Control of Discharge Quality Management Model for Reservoirs." In Proc. Symp. on Surface Water Impound, ASCE H. Stefan, ed. 1:624-633.

Harned, D. A., C. C. Daniel III, and J. K. Crawford. 1981. "Methods of Discharge Compensation as an Aid to the Evaluation of Water Quality Trends." Wat. Resour. Res. 17(5):1389-1400.

Ward, J. V. 1976. "Effects of Flow Patterns Below Large Damson Stream Benthos: A Review." in Instream Flow Needs, 2:235-253. J. F. Osborn and C. H. Allman, Eds. Am. Fish Soc. Washington, D.C.

Ward, J. V. and J. A. Stanford, eds. 1979. The Ecology of Regulated Streams. Plenum Press, New York.

Proceedings of Streambank Erosion Symposium (Colorado Soil Conservation Board, Snowmass Conference, 1989).

Gore, J. A. 1985. The Restoration of Rivers and Streams.

U.S. Army Corps of Engineers. 1988. Metropolitan Denver Water EIS, Barfield, D. J., Werner, R. C., and Haanct 1983, Applied Hydrology and Sedimentology for Disturbed Areas, Oklahoma Press, 815 Hillcrest, Saltwater, Oklahoma, 74074.

See Streambank and Streambed Stabilization in the U.S. Army Corps of Engineers, Mid-Pacific Region, Regional Permit No. CO-OYT-0530, Drop Structure (Don Reichmuth's design).

Proceedings of Streambank Erosion Symposium (Colorado Soil Conservation Board, Snowmass Conference, August 1989).

REFERENCES RELATING TO:

DEGRADATION AND LATERAL MIGRATION OF CHANNELS BELOW IMPOUNDMENTS OR DIVERSION STRUCTURES

Issues Addressed by References:

The references listed below describe techniques which minimize the adverse impacts resultant from the release of water from impoundment structures in excess of the greater of either natural inflows, or the capacity of the downstream channel, or the discharge of excessive quantities of sediment from an impoundment or diversion structure.

Purpose of the Reference:

The techniques cited in the references may reduce water quality impacts caused by releases of water from an impoundment structure in excess of the greater of either natural inflows or the capacity of the downstream channel.

The techniques cited may minimize adverse water quality impacts caused by sediment flushing from an impoundment or diversion structure.

Possible Benefits of the References:

The references may be helpful when operation of an impoundment or diversion structure results in adverse water quality impacts (for example, degradation caused by release of high flows).

Potential Additional Benefits:

Though not within the scope of the Hydrologic Modification program, the implementation of techniques found in the references may have additional or ancillary benefits which may include beneficial impacts to aquatic habitat and recreational uses of water.

Possible Applications of Techniques Cited in the References:

- Coordinate releases of sediment with other beneficial uses of water within the basin;
- Remove or dispose of sediment stored behind an impoundment or diversion structure in a manner which does not cause an adverse water quality impact;
- Identify and protect areas of channels below an impoundment or diversion structure which are susceptible to degradation or lateral migration.

Suggested References:

Proceeding of Streambank Erosion Symposium, Colorado Soil Conservation Board, 1989.

Gore, J.A., The Restoration of Rivers and Streams, 1985.

U.S. Army Corps of Engineers, Metropolitan Denver Water EIS, 1988; Barfield D.J. & Warner R.C., and HAANCT 1983, Applied Hydrology and Sedimentology for Disturbed Areas, Oklahoma Press, 815 Hillcrest, Saltwater, Oklahoma, 74074.

REFERENCES RELATING TO:

OFFSITE MITIGATION

Issues Addressed by References:

The references listed below describe how participation with interested or responsible parties may lead to minimization of the water quality impacts created by the discharge of pollutants from a hydrologic modification. Both structural and nonstructural solutions are noted in the references.

Purpose of the References:

To provide information about ways to reduce or mitigate adverse water quality impacts caused by a hydrologic modification.

Possible Benefits of the References:

The references may be helpful in determining how reducing pollution from sources other than a hydrologic modification may be a more effective approach to offsetting the impacts of a hydrologic modification.

Potential Additional Benefits of the References:

Though not within the scope of the Hydrologic Modification program, the implementation of techniques cited in the references may have additional or ancillary benefits which may include beneficial impacts to aquatic habitat and recreational uses of water.

Possible Applications of Techniques Cited in the References:

- Coordinate with or modify existing point sources of pollution;
- Mine reclamation (see Mining Management Program);
- Streambank improvements (see Agriculture Management Program)
- In-stream improvements (sediment traps, drop structures, etc.)
- Stormwater controls (see Urban and Construction Program)

Suggested References:

Colorado Nonpoint Source Management Program BMP Appendix

Dillon Reservoir Phosphorus Control Regulations, Colorado Water Quality Control Commission, (phosphorus trading procedures).

REFERENCES RELATING TO:

SITING AND DESIGN OF DIVERSION STRUCTURES

Issues Addressed by References:

The references listed below address the proper location and design of diversion structures for the purpose of minimizing adverse water quality impacts created by the construction, operation, and maintenance of such structures.

Purpose of the References:

To provide information about ways to reduce adverse water quality impacts associated with the instream construction, operation, and maintenance of diversion structures.

Possible Benefits of the References:

The references may be helpful in assisting in the location of a diversion structure to avoid adverse water quality impacts, such as flooding potential sources of water pollution.

The references may assist in the design of diversion structures in order to minimize adverse water quality impacts associated with the structure.

Potential Additional Benefits of the References:

Though not within the scope of the Hydrologic Modification program, the implementation of techniques found in the references may have additional or ancillary benefits which may include beneficial impacts to aquatic habitat and recreational uses of water.

Possible Applications of Techniques Cited in the References:

- Arched drop structure
- Coordination of siting and design with other beneficial uses of water within the basin.

Suggested References:

See Streambank and Streambed Stabilization in the U.S. Army Corps of Engineers, Mid Pacific Region, Regional Permit No. CO-OYT-0530, Drop Structure (Reichmuth design).

Proceedings of Streambank Erosion Symposium, Colorado Soil Conservation Board, 1989.

REFERENCES RELATING TO:

IN-CHANNEL RECLAMATION TREATMENTS

Issues Addressed by the References:

The references listed below address instream practices which may be used to avoid or offset an adverse water quality impact caused by a hydrologic modification.

Purpose of the References:

To provide information about ways to either avoid or offset adverse water quality conditions which may be caused by a hydrologic modification.

Possible Benefits of the References:

The references may assist in considering instream improvements designed to improve water quality through the modification of hydraulic conditions. Channel modification requires careful study during the planning process by a variety of disciplines, particularly hydrology, hydraulic engineering, soil science, and biology.

Potential Additional Benefits of the References:

Though not within the scope of the Hydrologic Modification program, the implementation of the techniques cited in the references may have additional or ancillary benefits which may include beneficial impacts to aquatic habitat and recreational uses of water.

Possible Applications of Techniques Cited in the References:

Deflectors, dams, boulder placement, and other in-channel structures are examples of techniques cited in the references which may, if properly designed and installed, be beneficial in mitigating adverse water quality impacts. Examples of applications include:

- Directing stream current to key locations such as bank cover;
- Developing meander patterns within a channel;
- Deepening and narrowing channels;
- Creating pools;
- Modifying water velocities;
- Protecting streambanks from erosion;

REFERENCES RELATING TO:

OPTIMIZATION OF PROJECT OPERATIONS

Issues Addressed by References

The references listed below address operational measures which can serve to reduce adverse water quality impacts from sources unrelated to hydrologic modifications.

Purpose and Benefit of the References:

To provide information about the operation of water projects designed to reduce unrelated sources of pollutants through the release or bypass of water where the water can be diverted at an alternate decreed location without diminishing or adversely affecting the amount, timing, or location of the yield of a project or increasing the cost of the project.

Potential Additional Benefits of the References:

Though not within the scope of the Hydrologic Modification program, the implementation of techniques cited in the references may have additional or ancillary benefits which may include beneficial impacts to aquatic habitat and recreational uses of water.

Possible Applications of Techniques Cited in the References:

- Coordinating operation of dams with the timing of releases from sources of pollution in the basin;
- Coordinating operation of storage facilities to minimize impacts to other beneficial uses of water;
- Avoiding excessive releases from dams which may cause scour or other adverse water quality impacts;

Suggested References:

Fontane, D.G. and Labadie, J.W., "Optimal Control of Discharge Quality Management Model for Reservoirs", 1982; published in Proc. Symp. on Surface Water Impound, ASCE H. Stefan, ed. 1:624-633, 1982

Harned, D.A., Daniel, C.C.III, and Crawford, J.K., Methods of "Discharge Compensation as an Aid to the Evaluation of Water Quality Trends"; Water Resour. Res. 17 (5) :1389-1400, 1981.

Ward, J.V., "Effects of Flow Patterns Below Large Dams On Stream Benthos: A Review", in Instream Flow Needs, 2:235-253, 1976. Osborn, J.F. & Allman, C.H., ed. Am. Fish. Soc. Washington, D.C.

Ward, J.V., and Stanford, J.A., The Ecology of Regulated Streams, Plenum Press, New York, 1979.

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WATER QUALITY CONTROL COMMISSION

HANDBOOK

JANUARY, 1994

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I. Introduction

This Handbook has been prepared to provide general information to members of the public regarding Colorado water quality control programs. The Handbook starts with a brief history of the Water Quality Control Commission and the Colorado Water Quality Control Act. The Handbook provides both a description of current Commission regulations and policy statements and an explanation of the informal and formal processes used in connection with Commission rulemaking efforts. It also includes descriptions of the roles of the Water Quality Control Division and several other State agencies involved in the implementation of Colorado water quality control programs.

The Commission hopes that this Handbook will help facilitate public involvement in Colorado's water quality management efforts. For further information regarding any of the topics addressed in the Handbook, please contact the Commission's Administrator, Paul Frohardt, at 692-3526.

II. Water Quality Control Commission History

The Federal Water Pollution Control Act (now commonly referred to as the Clean Water Act) was originally adopted in 1948. Amendments to this Act in 1965 for the first time required states to adopt water quality criteria for interstate waters and a plan for implementation and enforcement of the criteria. The Colorado Water Pollution Control Act was adopted in 1966, creating authority to establish water quality standards consistent with the Federal Act.

The 1966 Act created an eleven-member State Water Pollution Control Commission. Four ex officio members were to be representatives of the Board of Health, the Game, Fish and Parks Commission, the Water Conservation Board, and the Natural Resources Coordinator. Seven citizens appointed by the Governor were to include one representative of industry, one from municipal or county government, one from agriculture and four from the public at large. Commission members were appointed for terms of six years.

In 1972, Congress adopted a major overhaul of the Federal Water Pollution Control Act. The 1972 Act:

(1) Established the National Pollutant Discharge Elimination System (NPDES)* permit program to regulate point source discharges of pollutants;

(2) Authorized the Environmental Protection Agency (EPA) to establish technology-based effluent limitations for categories of dischargers;

*A list of common abbreviations is included as Appendix F of this Handbook.

(3) Required states to develop a comprehensive and continuing planning process for water quality management, including the adoption of "areawide waste treatment management plans" (section 208 plans); and,

(4) Authorized EPA to establish water quality standards where any state fails to adopt standards that meet the requirements of the Federal Act.

In 1973, the Colorado Water Quality Control Act was completely rewritten (and renamed), to bring it into compliance with the new federal law. The composition of the Commission remained largely unchanged, except that the seven appointed members were no longer required to represent any specific interests, and members' terms were changed from six years to three years. The name was changed to Water Quality Control Commission.

A second total rewrite of the Colorado Water Quality Control Act was adopted by the Legislature in 1981 (Senate Bill 10). Senate Bill 10, which retained the basic features of the previous Act, changed the Commission's composition to nine members, each appointed by the Governor. Appointments are to "achieve geographical representation" and "reflect the various interests in water in the state." At least two members are to be from west of the continental divide.

III. <u>Colorado Water Quality Control Act History</u>

The major elements of the Colorado Water Quality Control Act largely pattern the major features of the federal Clean Water Act--the establishment of water quality classifications and standards, implemented principally through a point source discharge permit program. As mentioned above, the last major rewrite of the Colorado Act was Senate Bill 10, adopted in 1981.

Senate Bill 10 moved for the first time to a largely cash-funded discharge permit system. Among the other innovations of Senate Bill 10 were provisions requiring that "economic reasonableness" be taken into account at various points in the water quality regulation process. EPA objected that certain provisions--for example, variances from water quality standards based on economic impact--were inconsistent with provisions of the federal Clean Water Act, and could result in EPA withdrawing authority for the State to administer the discharge permit program in lieu of a federal program.

In 1985, the Legislature amended the State Act by adopting Senate Bill 83, which was aimed in large part at eliminating the deficiencies in Senate Bill 10 alleged by EPA. One result of the 1985 amendments was the adoption of section 25-8-207, creating a new basis for reconsideration of water quality classifications and standards, in part because the Senate Bill 10 water quality standards variance provision was deleted. Section 25-8-207 creates an automatic right to a rulemaking hearing to review classifications and standards in certain circumstances. Senate Bill 83 also eliminated the Commission's authority to hear certain permit appeals, to avoid a conflict of interest concern (since Commission members include persons employed by dischargers).

In 1989, the Legislature further amended the State Act by the adoption of Senate Bill 181. Among other changes, this bill included new provisions regarding the relationships between the Water Quality Control Commission and Division and other state agencies. Section 25-8-104(2)(d) now requires the Commission and Division to consult with the State Engineer and the Colorado Water Conservation Board before taking any actions that have "the potential to cause material injury to water rights." In addition, new section 25-8-202(7) identifies four "implementing agencies" (Mined Land Reclamation Division [now the Division of Minerals and Geology], State Engineer, Oil and Gas Conservation Commission and the Hazardous Materials and Waste Management Division) that have the initial responsibility for implementing water quality classifications and standards adopted by the Commission for activities subject to their jurisdiction, except for point source discharges to surface waters. The roles of these other agencies are discussed further in section XII of this Handbook.

In 1990, the Legislature adopted Senate Bill 126, establishing new provisions in the State Act to address potential ground water quality contamination from agricultural chemicals (pesticides and commercial fertilizers). Section 25-8-205.5 of the Act now gives the Department of Agriculture authority to adopt voluntary best management practices and, if necessary, mandatory agricultural management plans to control this potential pollution source, subject to ultimate authority of the Water Quality Control Commission to adopt regulatory requirements if necessary.

In 1992, the Legislature adopted House Bill 1200, which established a new section 25-8-209 regarding water quality designations. This section provides for: (1) an "outstanding waters" designation for certain waters for which no degradation will be allowed, and (2) a "use-protected waters" designation for waters whose quality may be altered so long as applicable water quality classifications and standards are met. All waters not given one of these two designations are subject to antidegradation review requirements before any new or increased water quality impacts are allowed.

IV. Summary of Commission Functions

A. Rulemaking Hearings

Rulemaking hearings undoubtedly consume the greatest amount of time and effort, and probably have the greatest impact, of all functions undertaken by the Commission. Rulemaking is the formal process by which control regulations, water quality classifications and standards, and all other binding regulations are adopted. A description of the various steps in the rulemaking process is contained in section VIII of this Handbook.

B. Informational Hearings

Informational hearings are informal Commission hearings, not subject to the formal legal requirements of rulemaking hearings. Notice of such hearings is not published in the Colorado Register, there is no formal "party status", no prehearing conference is held, and generally no transcript is prepared. The major types of informational hearings are described below.

1. Section 208 Plan Approval

As described in the Colorado Continuing Planning Process document (which is discussed in section X of this Handbook), regional planning agencies--or the State for areas where there is no authorized agency--are responsible for preparing "areawide waste treatment management plans" under section 208 of the federal Clean Water Act. These plans are variously referred to as "section 208 plans", "regional wastewater management plans," and "water quality management plans." Pursuant to section 25-8-105 of the State Act, the Commission holds informational hearings to approve, conditionally approve, or reject proposed section 208 plans and amendments. If approved by the Commission, such plans are forwarded to the Governor, for the Governor to certify the plans to EPA.

Approved section 208 plans are not legally binding on regulatory decisions (such as site approvals, construction grants, or point or nonpoint source control decisions) unless adopted by the Commission after a formal rulemaking hearing. Generally, the Commission does not adopt section 208 plans as binding regulations. However, even when not adopted as regulations, such plans are heavily weighted in regulatory decisions. Therefore, the contents of an approved plan can have a major practical impact on cities and counties, among others.

2. Triennial Review of Regulations

Section 25-8-202(f) of the State Act requires the Commission to review control regulations and water quality classifications and standards at least once every three years. The Commission's current practice is to conduct triennial reviews by holding an informational hearing to solicit comments regarding whether particular regulations should be retained, repealed or revised. If, as a result of the informational hearing, the Commission decides that changes should be formally considered, a rulemaking hearing is scheduled for that purpose.

3. Other

Informational hearings may be scheduled for any other purpose that the Commission feels would be beneficial. For example, informational hearings sometimes are scheduled to address an issue on which the Commission is considering adopting regulations, prior to formulating a specific regulatory proposal for a rulemaking hearing. In such instances, the informational hearing provides an opportunity to receive public input regarding a proposal, without the time and expense required for a rulemaking hearing. See the discussion of the informal, pre-rulemaking process in section VIII.C. of this Handbook.

C. Adjudicatory Hearings

Adjudicatory hearings are quasi-judicial proceedings by the Commission to review specific types of decisions by the Division with respect to individual regulated entities. Procedures for adjudicatory hearings are spelled out in sections 2.1.4, 2.1.6, 2.1.9, 2.1.10, 2.1.12 and 2.1.16 of the Procedural Rules. The current categories of adjudicatory hearings are described below.

1. Civil Penalty Appeals

Any person who violates the State Act, a permit issued under the Act, or a final cease and desist order or clean-up order is subject to a civil penalty of up to $10,000 per day of violation. Section 25-8-608, C.R.S. Civil penalties are assessed by the Division, but may be appealed to the Commission.

2. Site Application Appeals

Pursuant to section 25-8-702, C.R.S., the Division approves the location and the design for the construction or expansion of domestic wastewater treatment works. The Division's decision concerning approval may be appealed to the Commission.

3. 401 Certification Appeals

Issuance of certain federal licenses or permits requires the Division to issue a "section 401 certification" that authorization of the activity will not result in a violation of State water quality standards. The Division's decisions regarding such certifications may be appealed to the Commission.

4. Antidegradation Review Appeals

Pursuant to section 3.1.8(3)(b) of the Basic Standards and Methodologies for Surface Waters, the Division is initially responsible for conducting antidegradation reviews for applicable activities. However, the Division's determinations are subject to de novo review by the Commission.

5. Other

Although no such hearing has yet been requested or held, pursuant to section 25-8-401(5)(b), C.R.S., a variance decision by the Division concerning discharge permit conditions not required by the federal Clean Water Act may be reviewed by the Commission.

D. Policy Statements

In addition to holding the types of hearings described above, the Commission also sometimes takes formal action by adopting "policy statements" on particular issues. The adoption of such documents does not require compliance with any specific procedures--although public input typically is solicited. Policy statements have no binding regulatory effect, but are adopted to provide guidance to the Division, the public, and other agencies regarding the Commission's views and intentions on a particular issue. The Commission's currently adopted policy statements are described in section VI of this Handbook.

V. Summary of Current Commission Regulations

The following summary of current Commission regulations is just that--a summary. No attempt is made to comprehensively explain all details of the regulations. For more information, see the regulations themselves or call the Commission's Administrator at (303) 692-3526 with specific questions. An Index of Commission regulations is available free of charge from the Commission Office--(303) 693-3520--and copies of individual regulations may be purchased at prices ranging from $2.00 to $5.00 each.

A. Surface Water Quality Standards

1. Basic Standards

a. Overview

"The Basic Standards and Methodologies for Surface Water", 3.1.0 (5 CCR 1002-8), (1) establishes a system for classifying state waters, for assigning numeric standards and for granting temporary modifications, (2) establishes certain statewide standards that are applicable to all state waters, (3) establishes a statewide antidegradation rule, and (4) includes certain provisions unique to wetlands.

The system for assigning surface water quality classifications and standards is discussed further in section V.A.2. of this Handbook, regarding Site-Specific Standards. The Basic Standards regulation constitutes the framework that is applied on a site-specific basis to adopt classifications and standards in each of the State's river basins. (Note: As used in Colorado, "classifications" refers to the use categories for which specific state waters are to be protected, while "standards" refers to the narrative or numeric criteria that are adopted to protect the classified uses.)

b. Statewide Standards

Statewide numeric standards have been adopted for radioactive materials and organic chemicals. The radioactive materials standards apply to all state surface waters, unless alternative site-specific standards have been adopted. Section 3.1.11 (2). The "water supply" and "aquatic life based" standards for organic chemicals apply to all surface waters for which the corresponding use classifications have been adopted, unless alternative site-specific standards have been adopted. Section 3.1.11 (3). The "water + fish" standards for organic chemicals are intended to provide human health protection where fish consumption is a consideration. These standards apply to all class 1 aquatic life segments and any class 2 aquatic life segments where the Commission has decided after rulemaking that fishing is a significant activity.

c. Antidegradation Provisions

The antidegradation provisions of the Basic Standards and Methodologies for Surface Water: (1) set forth provisions regarding the adoption of water quality-based designations for certain surface waters: and (2) establish an antidegradation review process applicable to certain activities impacting the quality of surface waters. See generally, section 3.1.8.

Either of two water quality-based designations may be adopted in appropriate circumstances. Section 3.1.8(2). An "outstanding waters" designation may be applied to certain high quality waters that constitute an outstanding natural resource. No degradation of outstanding waters by regulated activities is allowed. A "use-protected waters" designation may be applied to waters with existing quality that is not better than necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water. The quality of these waters may be altered so long as applicable water quality classifications and standards are met.

Waters that are not given one of these designations are subject to antidegradation review requirements before any new or increased water quality impacts are allowed. Section 3.1.8(3). The activities that are subject to these requirements are those that: (1) require a discharge permit; (2) require water quality certification under section 401 of the federal Act; or (3) are subject to control regulations. The first step in the antidegradation review process is a determination, in accordance with criteria specified in the regulation, whether "significant degradation" would result from the activity. If not, the review ceases. If significant degradation would result, a determination is made whether the degradation is necessary to accommodate important economic or social development in the area in which the waters are located. This determination is based on an assessment of whether there are water quality control alternatives available that would result in less degradation of state waters and which are economically, environmentally, and technologically reasonable. The proposed degradation is allowed only if no such alternatives are available.

d. Wetlands Provisions

In 1993, the Commission added provisions to the Basic Standards regulation to address water quality classifications and standards for wetlands. Note that these provisions are not intended to affect the determination whether specific wetlands may be filled in, pursuant to section 404 of the Federal Act. Rather, these provisions address the water quality to be maintained in wetlands that will continue to exist as wetlands. Waters in wetlands are state waters, except for waters in "constructed wetlands", which are wetlands designed, constructed and operated for the primary purpose of wastewater or stormwater treatment or environmental remediation. Section 3.1.5 (11).

New narrative standards have been adopted that are applicable to all wetlands that are state waters. Section 3.1.11 (1)(b). Site-specific water quality classifications and standards may be adopted to protect wetland functions. Section 3.1.13 (1)(e)v), 3.1.7 (1)(b)(iv). The regulation defines three subcategories of wetlands to help distinguish which classifications and standards apply prior to adoption of any site-specific classifications and standards.

"Compensatory wetlands" are those created to provide mitigation for adverse impacts to other wetlands. Section 3.1.5 (10). These wetlands initially have the classifications and standards of the water body segment in which they are located.

"Created wetlands" are wetlands other than compensatory wetlands that are created in areas which would not be wetlands in the absence of human modifications to the environment. Section 3.1.5 (12). Unless a site-specific wetlands classification and corresponding numeric standards have been adopted, only the statewide narrative standards apply to created wetlands.

"Tributary wetlands" are wetlands that serve as the headwaters of surface waters or that are located within a floodplain, and which are thereby hydrologically connected to other surface waters. Section 3.1.5 (29). These wetlands are initially subject to most of the water quality classifications and numeric standards of the segment in which they are located, except where the existing ambient quality is worse than those standards. Wetlands that are not tributary wetlands are often referred to as isolated wetlands and are initially subject only to the statewide narrative standards.

2. Site-Specific Standards

Use classifications and numeric water quality standards have been adopted for streams, lakes and reservoirs throughout each of the State's river basins. Within each basin, waters are divided into individual stream segments for classification and standard-setting purposes. Currently, water quality standards are applied in a regulatory context principally through NPDES discharge permits, as discussed further in section V.C., below.

Site-specific classifications and standards (all codified at 5 CCR 1002-8) have been established for the following basins:

a. Arkansas River Basin (3.2.0)

b. Upper Colorado River Basin and North Platte River (3.3.0)

c. San Juan River and Dolores River Basins (3.4.0)

d. Gunnison and Lower Dolores River Basins (3.5.0)

e. Rio Grande River Basin (3.6.0)

f. Lower Colorado River Basin (3.7.0)

g. South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin (3.8.0)

In addition, salinity standards have been adopted for the Colorado River (3.9.0). In conjunction with these latter standards, the Commission also has adopted "Regulations for Implementation of the Colorado River Salinity Standards through the NPDES Permit Program" (3.10.0).

Site-specific water quality classifications are intended to protect all existing uses of state waters, and any additional uses for which waters are suitable or are intended to become suitable. Section 3.1.13. The current use classification categories are: (1) recreation, class 1 or class 2; (2) agriculture; (3) aquatic life, cold or warm water, class 1 or class 2; (4) domestic water supply; and (5) wetlands. A "seasonal" qualifier can be adopted to limit applicability of a classification to certain periods of the year. A "goal: qualifier can be adopted to indicate waters that are not yet fully suitable for a classified use.

The concern regarding appropriate classifications is heightened by the State and EPA downgrading rules. Section 3.1.6(2)(b) precludes downgrading "unless it can be demonstrated that the existing classification is not presently being attained and cannot be attained within a twenty year time period."

For each classified stream segment, numeric water quality standards are adopted that are intended to maintain water quality at a level sufficient to protect the classified uses. Even where classified uses can be agreed upon, there can be substantial debate over the appropriate numeric standards for a site-specific segment, largely because more stringent numeric standards can have a major impact on dischargers' treatment costs.

There are three potential approaches to the adoption of site-specific numeric standards. Section 3.1.7 (1)(b). First, table value standards (TVS) are based on criteria set forth in three tables contained in the Basic Standards regulation. These are levels of pollutants determined to be generally protective of the corresponding use classifications, and are applied in most circumstances, unless site-specific information indicates that one of the following approaches is more appropriate.

Second, ambient quality-based standards--i.e. standards based on the existing in-stream quality--may be adopted where pollutant levels are higher than would be allowed by table value standards, but are determined adequate to protect classified uses. The third option is to adopt site-specific-criteria-based standards where a bioassay or other site-specific use attainability analysis indicates that alternative numeric standards are appropriate for protection of classified uses.

Temporary modifications to numeric standards may be adopted where an underlying standard is not being met at the present time, but the Commission determines that the conditions causing lower water quality are correctable. Section 3.1.7 (3). For example, if the Commission believes that the existing quality of a segment can be significantly improved with additional, feasible point or nonpoint source controls, it may adopt a temporary modification based on existing quality, with a more stringent underlying standard to encourage clean-up. Temporary modifications are re-examined not less than once every three years.

As a final note, major fact of life for the Commission is that EPA, pursuant to the federal Clean Water Act, has established requirements that define acceptable state surface water quality standards. All classifications and standards adopted by the Commission are submitted to EPA for review and approval. If EPA disapproves specific classifications and standards, and appropriate modifications are not made, EPA has authority to adopt standards that will then apply within the State. Although EPA has never exercised this authority in Colorado, the potential has had a major impact on Commission decisions in a number of instances.

B. Ground Water Quality Standards

1. Basic Standards

In 1987, the Commission adopted "The Basic Standards for Ground Water", 3.11.0 (5 CCR 1002-8). This regulation establishes a system to be applied on a site-specific basis to classify and set numeric standards for ground water. This regulation also contains statewide ground water quality standards for radioactive materials and organic chemicals, which are similar to the statewide surface water quality standards for these constituents, except that aquatic life protection is not a consideration.

2. Site-Specific Standards

In contrast to the comprehensive classifications and standards in place for Colorado surface waters, site-specific ground water quality classifications and numeric standards have been established to date only in ten specific areas, in most instances to protect public water supply systems relying on ground water, 3.12.0 (5 CCR 1002-8). Due in part to the fact that it is likely to take many years before more comprehensive site-specific ground water quality classifications and standards are in place, and the Commission has adopted an "interim narrative standard" to provide an initial level of protection of existing ground water quality throughout the State. Section 3.12.5. This interim standard is intended to assure that: (1) in clean areas, ground water quality adequate to protect all potential uses is preserved, through the application of table value standards; and (2) in contaminated areas, ground water quality is not allowed to get any worse than its existing quality. This interim standard defines the protection provided unless and until overridden by site-specific use classifications and numeric standards adopted at a later date.

The major issue left open by the interim narrative standard is the determination as to what level of remediation, if any, may be appropriate in the variety of circumstances where existing quality does not meet table value standards, such as the 10 mg/l nitrate standard. Therefore, this standard provides an interim level of protection of the quality of the State's ground water, while leaving open the issue of how much, if any, improvement of ground water quality may be appropriate and realistic in areas already impacted.

3. Implementation Policy

In April, 1987 the Commission approved a "Policy Regarding Implementation of The Basic Standards for Ground Water." WQCC Policy 87-1. The implementation policy authorizes the Water Quality Control Division, whenever the Commission has not yet adopted site-specific classifications and standards, to apply the framework established in the Basic Standards to determine beneficial uses of ground water that need to be protected (and appropriate corresponding numerical protection levels) when regulating an activity. Such determinations do not constitute classifications and standards and are not binding on any other entities. Such regulation will occur only when authorized by separate, applicable Commission regulations, such as the ground water discharge permit provisions discussed below.

C. Discharge Permit Regulations

1. Overview

The federal Clean Water Act prohibits the discharge of pollutants from a point source to regulated water bodies without a permit. The NPDES permit program was established by the Act to regulate such discharges. Because the State has developed a program that meets the requirements of the federal Clean Water Act, the discharge permit program in Colorado is administered by the Water Quality Control Division rather than by EPA (subject to certain EPA review and oversight authority). The Commission has adopted "Regulations for the State Discharge Permit System", 6.1.0 (5 CCR 1002-2) to govern this program.

The Discharge Permit Regulations principally define the permit issuance process. The substantive conditions included in permits are determined primarily by other regulations. These substantive conditions fall into two principal categories: (1) technology-based effluent limitations; and (2) water quality-based effluent limitations. Technology-based effluent limitations are intended to attain certain minimum levels of pollution control determined to be technologically achievable by dischargers within identified categories. These effluent limitations are based principally on nationally applicable, EPA effluent limitations guidelines, and on the Colorado "Regulations for Effluent Limitations" 10.1.0 (5 CCR 1002-3).

Water quality-based effluent limitations are intended to assure compliance with site-specific water quality classifications and standards, as well as statewide narrative and numerical standards. To implement standards, the Division performs a "mass balance" analysis that determines what concentration of pollutants can be contained in a discharge of a particular volume so that water quality standards are still met instream during specified low flow conditions. In general, this allows dischargers to take advantage of any assimilative capacity (dilution) available in complying with standards. However, this opportunity may not be available where antidegradation review requirements apply, as discussed in section V.A.1.C. of this Handbook.

2. Whole Effluent Toxicity

The Commission adopted the first Colorado whole effluent toxicity (WET) testing--also referred to as aquatic life biomonitoring--requirements as part of the Discharge Permit Regulations in 1988. Rather than measuring the levels of specific pollutants in discharges, this form of testing assesses the acute or chronic toxicity of effluent for certain aquatic test organisms. Thus, this technique may be beneficial in detecting toxicity from pollutants for which no specific standards exist or from the interaction of multiple pollutants.

A several-year disagreement with EPA regarding the validity of Colorado's regulatory provisions governing WET testing and how such requirements would be enforced was resolved by major revisions to these provisions in February, 1993. See section 6.9.2(5). The WET testing provisions in the regulation are now quire brief, with most of the detail regarding implementation of these requirements set forth in separate Water Quality Control Division policy guidance documents.

3. Stormwater Discharges

New provisions to establish requirements applicable to point sources discharges of stormwater runoff were added to the Discharge Permit Regulations in August, 1993. See particularly, sections 6.4.2, 6.5.3, and 6.9.4(8)-(10). Stormwater discharge permits are required for municipalities exceeding 100,000 population (currently Denver, Aurora, Lakewood and Colorado Springs) and for industrial facilities with certain SIC codes. Most industrial stormwater discharges are covered by general, rather than individual, permits. The principal substantive requirement of all stormwater permits is the development of a stormwater management plan. The major element of such plans is the identification of best management practices (BMPs) that will be implemented to reduce the amount of pollutants entering state waters from stormwater runoff.

4. Ground Water Discharges

In December, 1990, the Commission added provisions to the Discharge Permit Regulations to address discharges to ground water. Section 6.15.0. The effective date of these provisions was delayed until July 1, 1993, due to concerns regarding a source of funding to administer this portion of the program.

These regulations, which are tailored in a manner to avoid overlap with other existing regulatory programs, require permits for land disposal, land treatment, and discharges to ground water from impoundments. One of three alternative levels of permit conditions may be established by the Division, depending on the site-specific facts. These three levels are: (1) effluent limitations at a point of compliance, with verification monitoring; (2) ground water monitoring only; and (3) discharge monitoring only.

D. Site Application Regulations

Pursuant to section 25-8-702, C.R.S, the Division approves the location and design for the construction or expansion of domestic wastewater treatment works. The Commission has adopted "Regulations for Site Applications for Domestic Wastewater Treatment Works" 2.2.0 (5 CCR 1002-12), that govern this process.

E. 401 Certification Regulation

Pursuant to the federal Clean Water Act, issuance of a federal license or permit for an activity which may result in any discharge into waters of the United States requires a certification from the state (under section 401 of the Federal Act) that authorization of the activity will not result in a violation of water quality standards. The 401 certification process in Colorado is governed by a Commission regulation entitled "Certification of Federal Licenses and Permits (401 Certifications)." The principal federal permits that currently require 401 certifications in Colorado are (1) section 404 permits issued by the

Army Corps of Engineers, for the discharge of dredged or fill material, and (2) Federal Energy Regulatory Commission licenses and permits.

F. Pretreatment Regulations

The federal Clean Water Act and EPA regulations establish pretreatment requirements applicable to non-domestic sources of pollutants that discharge wastes into a publicly owned treatment works (POTW). The Commission has adopted Colorado Pretreatment Regulations, 4.3.0 (5 CCR 1002-20). The primary purpose of these regulations is to prevent industrial discharges to domestic sewer systems that would interfere with the POTW's treatment process, interfere with the POTW's use or disposal of sludge, or pass through the POTW without receiving effective treatment.

G. Control Regulations

Section 25-8-205 of the State Act authorizes the Commission to adopt "control regulations" for a variety of water quality control purposes. Control regulations may be adopted to establish prohibitions, standards, effluent limitations and/or precautionary measures applicable to facilities or activities that may adversely impact water quality. The following control regulations are currently in effect:

1. Regulations for Control of Water Quality in Dillon Reservoir, 4.1.0 (5 CCR 1002-17).
2. Cherry Creek Reservoir Control Regulation, 4.2.0 (5 CCR 1002-19).
3. Pretreatment Regulations, 4.3.0 (5 CCR 1002-20).
4. Cheraw Lake Control Regulation, 4.4.0 (5 CCR 1002-23).
5. Passive Treatment of Mine Drainage Regulation, 4.5.0 (5 CCR 1002-22).
6. Bear Creek Control Regulation, 4.6.0 (5 CCR 1002-19).
7. Chatfield Reservoir Control Regulation, 4.7.0 (5 CCR 1002-19).
8. Confined Animal Feeding Operations Control Regulation, 4.8.0 (5 CCR 1002-19).
9. Biosolids Regulation, 4.9.0 (5 CCR 1002-19).
10. Regulations Controlling Discharges to Storm Sewers, 5.1.0 (5 CCR 1002-7).

11. Regulations for Effluent Limitations, 10.1.0 (5 CCR 1002-3).

H. Procedural Rules

The conduct of Commission hearings and meetings is governed by the "Procedural Rules" 2.1.0 (5 CCR 1002-1). This regulation contains both general rules applicable to all rulemaking and adjudicatory hearings and special rules applicable to particular types of hearings (e.g. site application appeals, classification and standards reviews under section 25-8-207, and civil penalty appeals). The informal and formal aspects of the Commission's rulemaking process are described in section VIII of this Handbook.

I. Other

Current Commission regulations not described above are:

1. State of Colorado Federal Construction Grant Priority System and Grant Administration Procedures, 5.3.0 (5 CCR 1002-6).

This regulation governed the administration in Colorado of the federal construction grant program for publicly owned wastewater treatment plants, which has been phased out. It also establishes rules for setting priorities for the use of Clean Water Act section 201(g) funds for nonpoint source projects.

2. State of Colorado Water Pollution Control Revolving Fund Priority and Eligibility System and Administrative Procedures, 5.2.0.

This regulation governs the administration of the revolving loan fund program that has replaced the federal construction grant program for publicly owned treatment works. In addition, nonpoint source management program projects under section 319 of the Federal Act may also be funded by this program.

3. State of Colorado State Construction Grant Priority System, 5.5.0 (5 CCR 1002-15).

This regulation governs the administration of a state construction grant program that provides funding for domestic wastewater treatment plants in small communities. Funding for this program has been sporadic over the last several years.

4. Nonpoint Source Project Priority Lists, 5.16.0 (5 CCR 1002-16).

This regulation establishes priorities for project funding with federal funds under section 201(g) of the federal Clean Water Act for each fiscal year.

5. State of Colorado Intended Use Plans, 5.17.0 (5 CCR 1002-24).

This regulation sets forth the State's priorities for revolving loan program funding, and is revised each year.

6. Regulations for State of Colorado Continuing Planning Process, 5.4.0 (5 CCR 1002-14).

This regulation states the Commission's intent to implement a Continuing Planning Process for water quality management. The current State Continuing Planning Process document is described in section XI of this Handbook.

7. Exemption for Nuclear or Radioactive Wastes from the Requirement for a Permit Under C.R.S. 1973, 25-8-506 (supp. 1981)(5 CCR 1002-4).

Section 25-8-506 of the State Act requires a permit to discharge, deposit, or dispose of any radioactive waste underground. This regulation provides an exemption from this permit requirement for certain activities subject to Colorado Rules and Regulations Pertaining to Radiation Control, 6 CCR 1007-1-3.

VI. Summary of Current Commission Policy Statements

Three policy statements adopted by the Commission currently are in effect, as follows:

Policy 87-1 Policy Regarding Implementation of the Basic Standards for Ground Water. (Expires May 31, 1995)

This policy is discussed in section V.B.3 of this Handbook.

Policy 87-2 Policy Concerning Approval of Section 208 Water Quality Plan Amendments. (Expires May 31, 1997)

This policy discusses the timing of Commission consideration of section 208 plan amendments.

Policy 88-1 Policy Regarding Antidegradation Reviews. (Expires May 31, 1996)

This policy discusses actions to be taken if it is determined during an antidegradation review that an existing use has not been classified.

The Commission has adopted a practice of establishing an expiration date for each policy, to assure that periodic review occurs.

VII. Description of Colorado Nonpoint Source Control Program

The principal federal and state water quality regulatory programs have focused to date on discharges of pollutants from point sources. Pollution from less discrete sources, such as diffuse storm water runoff from agricultural operations and inactive mining activities, is referred to generally as nonpoint source pollution. The federal Clean Water Act originally envisioned that nonpoint source pollution would be dealt with at the state and local level pursuant to "areawide waste treatment management plans" mandated by section 208 of the statute. However, in general the section 208 planning process resulted in little real action with respect to nonpoint sources of water pollution.

The 1987 amendments to the Clean Water Act included a new section 319, providing for the development of nonpoint source management programs by the states. States are to identify waters not attaining water quality standards without additional nonpoint source controls, and to identify best management practices for categories of nonpoint source problems, along with programs to implement BMPs. This section is intended to operate principally through financial incentives, providing federal matching funds for nonpoint source projects in states with approved management programs. Colorado was one of the first states in the country to have an approved nonpoint source management program under section 319. Adoption of this management program was preceded by adoption of a Nonpoint Source Assessment Report, evaluating the extent of current nonpoint source pollution in Colorado.

In 1989, the Commission exercised its discretion to make approximately $1.5 million of construction grant funds pursuant to section 201(g) of the federal Clean Water Act available for nonpoint source control projects, over a three-year period. The first federal funds appropriated directly under section 319 for such projects were for FY90. Through FY93, Colorado projects have received approximately $3 million in federal section 319 funds. The Commission holds an annual informational hearing to approve the Division's proposed use of section 319 funds for nonpoint source control projects. Determination of the amount of funding actually made available will be up to the EPA Regional Office.

As indicated by the preceding, in contrast to the point source discharge permit program, the current approach to nonpoint sources of water pollution in Colorado is largely nonregulatory. The advisability of nonregulatory v. regulatory approaches in this area is likely to be a continuing subject of debate on both the state and national levels for the next several years.

VIII. Description of Rulemaking Process

The major elements of the Commission's rulemaking process are described briefly below. A flow chart summarizing this process is included as Appendix B to this Handbook. An information sheet providing Information for Parties to Rulemaking Hearings is included as Appendix C to this Handbook. An information sheet providing Recommendations for

Non-Parties for Participation in Rulemaking Hearings is included as Appendix D to this Handbook.

A. <u>Commission Initiative v. Public Petition</u>

Some rulemaking proceedings are initiated by the Commission. For example, rulemaking may be undertaken to fill a perceived gap in existing regulations, to revise existing regulations as a result of information submitted in a triennial review hearing, or to effect changes necessitated by new federal or state legislation. Many rulemaking proceedings initiated by the Commission are the result of proposals and recommendations advanced by the Division staff.

The Commission's Procedural Rules provide that any interested person may petition the Commission for the issuance, amendment or repeal of a rule. In most instances it is within the Commission's discretion whether to proceed with rulemaking in response to a petition, although the Commission has usually held a hearing whenever requested to do so.

B. <u>Written Comment Only Proceedings</u>

In response to a recommendation from the Water Quality Forum, in 1993 the Commission began to conduct some rulemaking proceedings through a written comment only process. To date, this rulemaking process has been used only for proposals that are believed to be largely noncontroversial.

C. <u>Informal Pre-Rulemaking Process</u>

The period prior to formal notice of a public rulemaking hearing often is critical in the regulatory development process. The Commission's Procedural Rules state:

> Whenever time and resources permit, it is the intention of the Commission to provide for and encourage informal comment and discussion regarding potential rulemaking issues prior to commencement of the formal rulemaking process.

After the Commission has identified a topic on which it intends to consider rulemaking, it may proceed in a variety of fashions prior to issuance of formal notice.

When a potential rulemaking proposal or rulemaking topic comes to the Commission's attention, a threshold decision is made regarding what, if any, informal pre-rulemaking *process* is appropriate prior to the commencement of formal rulemaking. Where a proposal appears to be relatively noncontroversial--or where external time constraints preclude an informal pre-rulemaking process--proposals are simply formulated by Division staff, discussed preliminarily with the Commission, and revised as necessary into a form to include with the notice of a hearing.

A second category of proposals is those that may be controversial, but are of interest principally to a narrow segment of the public. An example might be a proposal to revise site-specific water quality standards on a particular stream segment. In these circumstances the Commission encourages informal discussions by the Division staff with all interested persons prior to finalizing a rulemaking proposal, to the extent that time and resources permit, but typically there will be no broad-based effort to involve the public in formulation of the proposal.

The third category of proposals is those for which there is more general interest by multiple groups or entities, and about which there is a likelihood of significant controversy. In these circumstances, a more extensive informal pre-rulemaking process will be initiated. The Commission intends to retain flexibility as to the precise form that such informal processes take, to be able to tailor particular efforts to the issue at hand, taking into account the scope of likely interest in an issue, the degree of technical complexity presented, any external timing constraints, and the availability of staff resources.

In general, such an effort will begin with a discussion by the Commission to identify potential "stakeholders"--i.e. those persons, entities or groups likely to have an interest in the issue at hand. An informal announcement of the pending consideration of the proposal will then be provided in the monthly Water Quality Information Bulletin and sent to any additional stakeholders identified that do not receive the monthly bulletin. This announcement will provide a simple, non-technical description of the proposal or issue under consideration, with a goal of providing adequate information for potentially interested persons, entities or groups to determine whether they have an interest in participating in the informal process. The announcement may also include a request for information, data, or comments.

Although numerous variations are possible, the informal process itself typically will include one or more of the following elements:

(1) An informational hearing by the Commission to receive public comment regarding a proposal or issue under consideration;

(2) Informal public outreach meetings by Division staff with interested constituency groups and/or the public at large to describe the proposal or issue, and to receive comments;

(3) Solicitation of informal written comments regarding a proposal or issue under consideration;

(4) Appointment of a "blue ribbon panel" of experts to develop a proposal for consideration by the Commission;

(5) Initiation of an informal work group effort to provide input to the staff in formulation of a proposal.

Use of a blue ribbon panel of experts is relatively rare, and is usually reserved for issues dominated by complex technical considerations. For example, such panels were appointed in the mid-1980s to reassess Colorado's approach to water quality standards for metals and for nitrogen compounds. Although these are normally volunteer efforts, in one instance an expert panel was retained by the parties and the Department of Health to provide advice to the Commission during a rulemaking proceeding.

An informal work group effort generally is open to participation by any interested members of the public. Such an effort is likely to consist of a series of meetings with Division staff and attorneys, often in combination with the formulation of multiple draft proposals and an opportunity to submit informal written comments.

It should also be noted that while the goal is to achieve as much consensus as possible prior to the formal rulemaking, the informal process need not, and typically does not, end with the initiation of the formal rulemaking process. Informal meetings and/or discussions between parties, other interested members of the public, and the Division staff may occur at any time up to (and sometimes during) the actual rulemaking hearing. In rare instances the Commission has actually requested that an informal process be commenced or continued after the close of testimony in a rulemaking hearing.

The Commission believes that a well-conceived and carried-out informal pre-rulemaking process can expedite formal rulemaking proceedings, and lead to better water quality management decisions. However, the Commission also notes that participation in such processes is often time-consuming and can be difficult for some interested members of the public. Therefore, while the Commission strongly encourages participation in such informal processes by all interested persons, it will always consider a rulemaking hearing the views of those that may have been unable to participate in the informal phase.

Finally, note that this discussion is applicable principally to rulemaking proposals initiated by the Commission or the Division. For rulemaking proposals initiated by a member of the public through a petition to the Commission, the Commission has no authority to mandate an informal pre-rulemaking process. However, the Commission strongly encourages thorough informal examination of a proposal advanced by a third party, with input from all interested stakeholders, prior to the commencement of formal rulemaking.

A flow chart summarizing the informal pre-rulemaking process options is included as Appendix A to this Handbook.

D. Notice and Party Status

Official notice of rulemaking hearings is accomplished by publication in the Colorado Register. In addition, notices or notice summaries are included in the Water Quality Information Bulletin compiled monthly by the Water Quality Control Division and mailed to a list of subscribers.

Hearing notices are prepared by the Administrator, with input from the Attorney General's Office, and generally submitted to the Commission for review prior to publication, although no formal Commission approval is required. The Colorado Administrative Procedure Act requires at least twenty days notice prior to rulemaking hearings. Pursuant to the Water Quality Control Act, hearings to classify state waters, set water quality standards or adopt control regulations require sixty days notice. Because of the timing of Commission meetings and Colorado Register publication, this generally results in a four-month period from the date the Commission reviews a notice to the date of a hearing.

Commission rulemaking notices typically include the specific rulemaking proposal to be considered, although the APA provides that a notice is only required to contain "a description of the subjects and issues involved." Similarly, Commission notices usually include a proposed Statement of Basis, Specific Statutory Authority, and Purpose, although the APA only requires that this document be available at least five days prior to the hearing.

The hearing notice includes a deadline for requesting party status to a hearing. Persons with party status must meet certain prehearing deadlines for the submission of documents. They receive copies of documents from other parties, and at the hearing have the right to cross-examine witnesses. An information sheet providing Information for Parties to Rulemaking Hearings is included as Appendix C to this Handbook.

E. Prehearing Procedures

Prehearing procedures are intended to focus and resolve issues to the maximum extent feasible prior to the hearing, so that the hearing itself can be conducted more quickly and efficiently. The deadline for requesting party status is usually set approximately two months prior to the hearing date. Immediately after the party status deadline, a list of those requesting party status is sent to all such persons.

A prehearing conference generally is scheduled approximately one month prior to the hearing. Current practice is to require that a prehearing statement, including any exhibits, written testimony or alternative proposals, be submitted to the Commission Office and exchanged among the party status applicants approximately one week prior to the prehearing conference. Based upon these documents, an effort is made at the prehearing conference to narrow and resolve the issues. The results of this effort are reflected in a Prehearing Order prepared after the conference. Generally, one to two weeks following the prehearing conference is allowed to submit rebuttal statements.

Pursuant to the APA, any person may request, at least fifteen days prior to a rulemaking hearing, that a regulatory analysis of the proposed rule be prepared. The specific topics to be addressed in this analysis are set forth in section 2.1.3(J) of the Procedural Rules. When requested, the Regulatory Analysis must be available at least five days before the rulemaking hearing.

F. Hearing

The hearing itself is run principally by one of the Commission members, acting as the Hearing Chair. Generally, either the Division or the party proposing a rule will present their case first, followed by other parties and interested members of the public who wish to comment. Those with party status are allowed to cross-examine other witnesses. In recent years the Commission has attempted to limit direct oral testimony, focusing on questions regarding written material submitted prior to the hearing. In some cases, time is allowed following the close of the hearing for parties to submit written summations of their positions. However, recently the Commission sometimes allows only brief oral summations, so that it can begin deliberations immediately.

G. Deliberations

After the hearing is closed and all written material has been received (including any written summations if allowed, and sometimes a written transcript of the hearing) the Commission begins its deliberations to determine what action to take. Depending on the degree of complexity and controversy regarding the issues, deliberations may take only a few minutes or may continue over several successive monthly Commission meetings. Recently, the Commission has attempted to begin deliberations immediately following the close of a hearing whenever possible, while the material is still fresh in Commissioners' minds.

H. Final Action

Final action is taken by formal motion and vote of the Commission. In addition to the language of the rule or regulation, final action requires preparation of and agreement on a Statement of Basis, Specific Statutory Authority, and Purpose. Pursuant to the APA, final action is required within 180 days of the final hearing on a proposal.

I. Administrative Reconsideration

Although seldom invoked, the State Act allows affected parties to petition the Commission for reconsideration of any rulemaking determination. Such petition must be submitted during the period allowed for seeking judicial review. The Commission is required to act on such requests within ten days, unless this deadline is waived by the petitioner (which is often the case if the Commission does not have a regularly scheduled meeting within the ten-day period; otherwise, Commissioners must be polled by phone).

IX. Other Opportunities for Public Input and Information

A. Annual Public Hearing on Water Pollution Problems within the State

The State Act provides that the Commission "shall hold a public hearing during the month of October of each year in order to hear public comment on water pollution problems within the state." C.R.S. 25-8-202(3). This hearing is typically held during the evening of the first day of the Commission's regulation October meeting.

Although this formal opportunity for public input is scheduled annually, the Commission welcomes public input regarding Colorado water quality issues at any time. The Commission recommends that interested persons contact the Commission's Administrator, Paul Frohardt, at (303) 692-3526, to discuss options for bringing issues to the Commission's attention.

B. Monthly Water Quality Information Bulletin

The Water Quality Control Division is required by statute to "[m]aintain a mailing list of persons requesting notice of actions by the Division or by the Commission and notify persons on the list of such actions, for which service the Division shall assess a fee to cover the costs thereof." C.R.S. 25-8-302(1)(e). The current fee for the Bulletin is $40.00 per year.

The information contained in the Bulletin includes:

(1) Commission meeting agendas;

(2) Commission rulemaking and informational hearing notices, or summaries thereof;

(3) The Commission's long-range schedule of hearings (updated quarterly);

(4) Notices of final actions taken by the Commission in rulemaking;

(5) An abbreviated Summary of Proceedings/Motions from prior Commission meetings;

(6) Periodic "Major Issues Summaries";

(7) Announcements of informal pre-rulemaking processes initiated by the Commission; and

(8) Lists of permit actions, site approval decisions, and water quality certification actions taken by the Division.

X. State Planning and Reporting Documents

This section briefly describes several planning and reporting documents relating to Colorado's water quality management process.

A. Continuing Planning Process

The State Continuing Planning Process (CPP) document has been developed to comply with section 303(e) of the federal Clean Water Act, which requires that such a process be developed by each state and approved by EPA. The CPP is to be reviewed and updated "from time to time". The current Colorado CPP document was finalized in July, 1983. The CPP contains a description of the roles of the Commission and Division, and other state and local agencies involved in the water quality management process. It also describes the major elements of that process, including stream classification and standard setting, the 208 planning process, wasteload allocations and the permit process, the domestic treatment works site approval process, and the construction grants process. Although the information contained in the 1983 CPP is still largely accurate, it is now out-of-date in a number of respects.

B. Biennial Section 305(b) Reports

Section 305(b) of the federal Clean Water Act requires each state to submit to EPA biennial reports regarding the status of state water quality. The most recent Colorado Section 305(b) report, entitled Water Quality in Colorado, was prepared in 1992. This report provides a helpful overview of water quality conditions within each of the State's river basins. Copies are available from the Commission Office upon request.

C. Division Annual Report to Commission

Section 25-8-305 of the State Act requires the Division, by October 1 of each year, to submit an annual report to the Commission. The report is to address the effectiveness of the Act's provisions, current information obtained from the Division's monitoring efforts, and any recommendations with respect to regulatory or legislative changes. The report also typically summarizes the previous year's activities.

D. Commission Annual Report to Governor and General Assembly

Section 25-8-202(5) of the State Act requires the Commission, by November 1 of each year, to submit a report to the Governor and the General Assembly. This report is to address the effectiveness of the provisions of the Act in carrying out the legislative intent and is to include any recommendations the Commission may have as to legislative changes. The report also typically summarizes Commission accomplishments for the preceding year and its agenda for the following year.

XI. Water Quality Control Division Information

The duties of the Water Quality Control Division are set forth in section 25-8-302 of the State Act. Generally, the Division is the agency responsible for implementing and enforcing the regulations adopted by the Commission. Moreover, the Division provides the principal source of technical expertise available to the Commission in its rulemaking and other policy-setting activities. By statute the Division is authorized to act as staff to the Commission in proceedings other than adjudicatory or appellate proceedings in which the Division is a party.

The Division assists the Commission in developing stream classifications and standards, regulates discharges for compliance with those standards through discharge permits issued, performs site application and design and specification reviews of new or expanding domestic wastewater treatment facilities, and undertakes monitoring and enforcement of the statutes and permits. The Division also oversees water quality management planning, manages State and Federal construction grant and loan assistance programs which provide financial support to municipalities for construction or improvement of wastewater treatment facilities, manages the ground water protection program with the goal of protecting the public health and beneficial ground water uses, and provides technical assistance to local governments regarding water and wastewater treatment.

The Division currently is organized into the Office of the Division Director and three sections: (1) the Ground Water/Standards Section, (2) the Field Support Section, and (3) the Permits and Enforcement Section. A current Water Quality Control Division Organizational Chart is included as Appendix E of this Handbook.

Note that the Division's Drinking Water program, along with responsibilities relating to individual sewage disposal systems, are governed principally by Board of Health regulations issued under separate statutory authority.

XII. Other State Agency Roles

Section 25-8-202(7) of the State Act identifies four "implementing agencies" that have the initial responsibility for implementing water quality classifications and standards adopted by the Commission for activities subject to their jurisdiction, except for point source discharges to surface waters. These agencies are: the Division of Minerals and Geology (formerly the Mined Land Reclamation Division), the State Engineer, the Oil and Gas Conservation Commission, and the Hazardous Materials and Waste Management Division. Certain residual authority is preserved for the Commission to step if it determines that an implementing agency is not assuring compliance with water quality classifications and standards.

Memoranda of Agreement with each of the implementing agencies have been in place since 1990, to better define the interagency relationships. Pursuant to these MOA's, each agency has submitted annual reports to the Commission, describing the status of their efforts to implement water quality protection requirements. These reports are discussed and an opportunity for public comment provided at a regular Commission meeting. Contact the Commission Office to obtain copies of these reports, or information regarding the timing of the next Commission discussion of an implementing agency's annual report.

Similarly, the Department of Agriculture has the initial responsibility to address potential ground water contamination from agricultural chemicals (pesticides and commercial fertilizers). Pursuant to section 25-8-205.5 of the State Act, that Department is to adopt voluntary best management practices and, if necessary, mandatory agricultural management plans to control this potential pollution source. Again, some residual authority is preserved for the Commission to act if it determines that additional regulatory requirements are necessary.

Finally, it should be noted that the Commission and the Division are required by section 25-8-104(2)(d) to consult with the State Engineer and the Water Conservation Board "before making any decision or adopting any rule or policy which has the potential to cause material injury to water rights." These agencies receive copies of all Commission rulemaking hearing notices, and all notices include a provision requesting information from the public regarding potential impacts on water rights.

APPENDIX A

INFORMAL PRE-RULEMAKING PROCESS

FLOW CHART

APPENDIX B

FORMAL RULEMAKING PROCESS

FLOW CHART

APPENDIX C

INFORMATION FOR PARTIES TO RULEMAKING HEARINGS

A. WQCC Procedural Rules

The Water Quality Control Commission (WQCC) has adopted "Procedural Rules" (2.1.0) codified at 5 CCR 1002-1. The Procedural Rules are available for review in the WQCC office, 4300 Cherry Creek Dr. South, B-2, Denver, Colorado and a copy may be obtained at a charge of $5.00 pursuant to 24-4-103(9), C.R.S.

The Procedural Rules (principally section 2.1.3) govern all WQCC rulemaking hearings and should be carefully reviewed by all parties. This informational statement is intended to provide supplemental, practical information to assist in hearing preparation. It in no way supersedes the Procedural Rules. PERSONS PETITIONING THE COMMISSION TO AMEND USE CLASSIFICATIONS OR WATER QUALITY STANDARDS SHOULD NOTE THE REQUIREMENT OF SECTION 2.1.3 B(2)(c), REGARDING 208 AGENCY REVIEW OF PROPOSALS.

B. Prehearing Conference

The prehearing conference is intended as an opportunity to narrow and resolve the issues, and to minimize the time required at the hearing itself. Prehearing statements, any alternative proposals, written testimony and exhibits are required to be exchanged prior to the prehearing conference (see the hearing notice). All documents submitted should be clearly identified by party (e.g. "Prehearing Statement of ________"). An original and 13 copies should be submitted to the Commission office. (The Certificate of Service should only be attached to the original.) This requirement is not satisfied by electronic transmission of a facsimile copy. One copy should be sent to each party listed on the party status request list and to each Assistant Attorney General on that list.

All parties should review the prehearing statements and related documentation from other parties prior to the prehearing conference. PARTIES SHOULD BE REPRESENTED AT THE PREHEARING CONFERENCE BY PERSONS PREPARED TO ENTER INTO STIPULATIONS POTENTIALLY NARROWING OR RESOLVING THE ISSUES RAISED BY THE RULEMAKING PROPOSAL. Where scheduling permits and it appears that an additional prehearing discussion would be useful, a decision may be made at the prehearing conference to schedule an additional status conference prior to the hearing.

C. Preparation of Testimony

In order to minimize the time required at the hearing, the WQCC strongly encourages testimony to be written and to be submitted prior to the prehearing conference (see the Procedural Rules). Generally, written rebuttal statements are allowed for a limited time after the prehearing conference (see the hearing notice). LATE SUBMISSIONS MAY BE REFUSED AT THE HEARING.

Parties are strongly encouraged to keep testimony as concise as possible. Shorter presentations often are more effective than longer presentations. AN INTRODUCTORY SUMMARY IS STRONGLY RECOMMENDED, TO SUCCINCTLY SUMMARIZE THE PARTY'S SPECIFIC PROPOSALS OR POSITIONS ON THE ISSUES. Parties are encouraged to coordinate their efforts whenever practical, to minimize duplication of testimony.

Parties should be particularly careful to provide appropriate explanation as to how the various written documents submitted--alternative proposals, written testimony, appendices, exhibits--fit together. For example, if an expert witness' written testimony on technical issues is submitted without any explanation of how it relates to the overall position advanced by the party, much of its impact may be lost. Where multiple documents are submitted, parties should consider including a summary document that provides a "road map" to the overall set of documents.

D. Preparation of Exhibits

Exhibits submitted should be clearly labelled and numbered (e.g. "Division Exhibit 1", "Division Exhibit 2", etc.). Where data is at issue, appropriate data summaries should be submitted as exhibits along with appropriate statistical analysis. For example, data summaries may be included for each sampling point and/or stream reach, identifying 50th or 85th percentiles, or other relevant statistics. Analytical techniques and units of measurement should be clearly indicated. Raw data sheets generally should not be submitted as exhibits.

Parties are encouraged to provide appropriate maps as exhibits whenever they would be helpful to understanding the issues. Both general location maps and maps showing the site in question in greater detail are helpful. Maps are particularly important for water quality classification and standard-setting hearings (e.g. the locations of all relevant sampling stations and discharge points should be shown).

E. Other Prehearing Procedures

Rules regarding prehearing motions, discovery and subpoenas are contained in the Procedural Rules and should be reviewed by the parties.

F. The Hearing

Direct oral testimony at the hearing may be limited. The principal focus of the hearing should be on questions regarding written testimony already submitted, and on cross-examination of witnesses. Additional written material generally will not be accepted at the hearing unless such material could not reasonably have been submitted earlier. Cross-examination may be limited. Parties with similar positions are encouraged to coordinate their cross-examination to minimize duplication.

Audio tapes will be available for review in the WQCC Office following the hearing. The tapes may also be purchased for $5.00 each, with a week lead time. A transcript of a hearing may be ordered directly from the court reporter for the payment of his/her fee.

G. Additional Information

The Colorado Department of Health building, where the WQCC is located, locks all doors for security reasons promptly at 5:00 p.m. Except in rare situations where there are extenuating circumstances that would delay you getting the required documents delivered, and advance arrangements have been made with the WQCC Office staff, documents delivered after 5:00 p.m. will be stamped in as received the following business day.

Parties with additional questions regarding WQCC rulemaking practices and procedures should contact the WQCC Administrator, Paul D. Frohardt at: (303) 692-3526 or the Staff Assistant, Marla L. Biberstine at: (303) 692-3525, Colorado Department of Health building, 4300 Cherry Creek Dr. South, Building B, Denver, Colorado 80222.

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APPENDIX D

RECOMMENDATIONS FOR NON-PARTIES FOR PARTICIPATION IN RULEMAKING HEARINGS

Those choosing not to participate formally as parties to rulemaking hearings are not subject to the requirements and deadlines for submitting prehearing statements, written testimony, etc. Any interested person may submit written or oral comments.

Written comments are generally accepted up to and including the day of the hearing. However, whenever possible it is recommended that written comments be received in the Commission Office 12 days prior to the hearing to send out in the Commission's packet, so that Commission members have ample opportunity to read the comments before the hearing. Concise written comments generally are more effective than very lengthy submissions.

All documents submitted by the parties are available for review in the Commission Office as outlined in the hearing notice. All documents are also available for purchase at a charge of $ .25 per page pursuant to 24-4-103(9).

There generally is a specific time scheduled for public comment during a rulemaking hearing. You may contact the Commission Office before the hearing to find out what time has been scheduled. For hearings that are anticipated to be lengthy, a time limit--e.g., five minutes per person--may be set for public comments.

Non-parties do not have the right to cross-examine other witnesses at the hearing. If you wish to consider participation as a party, please request a copy of "Information for Parties to Rulemaking Hearings".

Persons with additional questions regarding practices and procedures should contact the Water Quality Control Commission's Administrator, Paul D. Frohardt at (303) 692-3526 or the Staff Assistant, Marla L. Biberstine at (303) 692-3525, Colorado Department of Health Building, 4300 Cherry Creek Drive South, B-2, Denver, Colorado 80222.

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nonparty

APPENDIX E

WATER QUALITY CONTROL DIVISION

ORGANIZATIONAL CHART

APPENDIX F

COMMON ABBREVIATIONS

APA	Administrative Procedure Act
BAT	Best Available Technology
BMP	Best Management Practice
BPJ	Best Professional Judgment
BPT	Best Practicable Technology
CACI	Colorado Association of Commerce and Industry
CDH	Colorado Department of Health
CDPS	Colorado Discharge Permit System
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CMA	Colorado Mining Association
CWA	Clean Water Act
CWC	Colorado Water Congress
CWCB	Colorado Water Conservation Board
DIMP	Diisopropyl methylphosphonate
DMG	Division of Minerals and Geology
DOW	Department of Wildlife
DRCOG	Denver Regional Council of Governments
EPA	Environmental Protection Agency
GC/MS	Gas Chromatography/Mass Spectrometry

ISDS	Individual Sewage Disposal System
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/l	milligrams per liter
MLRB	Mined Land Reclamation Board
NPDES	National Pollutant Discharge Elimination System
NWCCOG	Northwest Colorado Council of Governments
OGCC	Oil and Gas Conservation Commission
pCi/l	picocuries per liter
POTW	Publicly Owned Treatment Works
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SEO	State Engineer's Office
SDWA	Safe Drinking Water Act
SIC	Standard Industrial Classification
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TVS	Table Value Standards
ug/l	micrograms per liter
UIC	Underground Injection Control
UST	Underground Storage Tanks

WET	Whole Effluent Toxicity
WQCC	Water Quality Control Commission
WQCD	Water Quality Control Division