III. Surface Water Assessment

Colorado periodically evaluates the quality of its surface waters to determine the degree to which it is suitable for its designated uses, such as water supply, support of aquatic life, and recreation. Assessments of Colorado's streams, reservoirs, and lakes are conducted to identify chemical, physical, and biological impairments.

The surface water assessments help the state to identify high quality waters, as well as those that are being impaired by natural or anthropogenic conditions. By collecting water quality data over time, the Division can identify causes and sources of pollution in certain water bodies and use the state's water quality control programs (such as Colorado Discharge Permits System (CDPS) permits to begin to improve the quality of impaired waters. The water quality data are also used to evaluate nonpoint-source pollution and develop Total Maximum Daily Load (TMDL) analyses for specific water bodies. The remainder of Part III is structured as follows.

1. Surface Water Monitoring Program: describes Colorado’s surface water quality monitoring program of all surface waters.

2. Assessment Methodology: describes the methodology used for assessing surface waters in Colorado

3. Determination of Use Support: describes Colorado’s classified uses and attainment of these uses.

4. Rivers and Stream Water Quality Assessment: evaluates the assessed streams and rivers in the state divided into seven watershed basins.

5. Lakes and Reservoirs Water Quality Assessment: describes the designated use support and causes/sources of impairment for the states lakes and reservoirs, including trophic status, summarized by the seven major river basins.

1. Surface Water Monitoring Program

The goal of Colorado's monitoring program is to provide information needed to assess the surface waters and provide information for the state's water quality management activities. Specific objectives for monitoring are addressed below.

In order to conveniently track information about individual stream segments and lakes, Colorado has adopted the Water Body Identification (WBID) system. The WBID consists of an eight- to ten-character alphanumeric series that represents the state, major river basin, minor river basin, and river segment number for each location. All WBIDs for Colorado surface water bodies start with the letters CO signifying Colorado. The third and forth letters denote the major river basin (i.e. Arkansas, Rio Grande, Colorado, South Platte, etc.) and the fifth and sixth letters denote the minor river basin (i.e. Upper, Middle or Lower part, Clear Creek, Cherry Creek, Boulder Creek, etc.). The seventh through tenth numbers, and sometimes letters (L = lakes, S = streams, or A, B, and C), designate the specific segment number. These segment numbers identify the names of the tributaries of the minor stream basins and correspond to those in the Classifications and Numeric Standards for each major basin. The key to Colorado's WBIDs is presented in Table 1: Key to Colorado's WBIDs.

Example: COARUA01A = Colorado, Arkansas River Basin, Upper Arkansas River Basin, segment 1A.

Table 1: The Key to Colorado's WBIDs

Letters 1-2 = Colorado	***Letters 3-4 = Major River Basin***	***Letters 5-6 = Minor River Basin***
CO	**SP** South Platte Basin	**US** Upper South Platte River Basin **CC** Cherry Creek **BE** Bear Creek Basin **CL** Clear Creek Basin **BD** Big Dry Creek Basin **BO** Boulder Creek Basin **SV** St Vrain Creek Basin **MS** Middle South Platte River Basin **BT** Big Thompson River Basin **CP** Cache La Poudre River Basin **LA** Laramie River Basin **LS** Lower South Platte River Basin **RE** Republican River Basin
CO	**UC** Upper Colorado and North Platte Basin	**UC** Upper Colorado River Basin **BL** Blue River Basin **EA** Eagle River Basin **RF** Roaring Fork River Basin **NP** North Platte River Basin **YA** Yampa River Basin

Table 1: The Key to Colorado's WBIDs (Continued)

Letters 1-2 = Colorado	***Letters 3-4 = Major River Basin***	***Letters 5-6 = Minor River Basin***
CO	**LC** Lower Colorado Basin	**LY** Lower Yampa/Green River Basin **WH** White River Basin **LC** Lower Colorado river Basin
CO	**AR** Arkansas Basin	**UA** Upper Arkansas River Basin **MA** Middle Arkansas River Basin **FO** Fountain Creek Basin **LA** Lower Arkansas River Basin **CI** Cimarron River Basin
CO	**RG** Rio Grande Basin	**RG** Rio Grande River Basin **AL** Alamosa River/La Jara Creek/ Conejos Creek Basin **CB** Closed Basin/San Luis Valley Basin
CO	**GU** Gunnison and Lower Dolores River Basins	**UG** Upper Gunnison River Basin **NF** North Fork of the Gunnison River Basin **UN** Uncompahgre River Basin **LG** Lower Gunnison River Basin **SM** San Miguel River Basin **LD** Lower Dolores River Basin
CO	**SJ** San Juan River and Dolores River Basins	**SJ** San Juan River Basin **PI** Piedra River Basin **PN** Los Pinos River Basin **AF** Animas and Florida Rivers Basin **LP** La Plata River, Mancos River, McElmo Creek and San Juan **DO** (Upper) Dolores River Basin

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A. Monitoring Partnerships

In 1999, the Colorado Water Quality Monitoring Council was established by a group of interested stakeholders, including the Water Quality Control Division (WQCD). The council was patterned after newly formed councils at the state and national level. The Monitoring Council serves as a statewide collaborative body to help achieve effective collection, interpretation, and dissemination of water-quality data and information.

The goals of the Monitoring Council are to:

* Provide a forum for effective communication, cooperation, collaboration, and documentation among individuals and organizations involved in monitoring.
* Promote the development of collaborative and cost effective watershed-based monitoring strategies.
* Promote the use of quality assurance procedures and protocols related to sample collection, analytical methods, assessment, data management, and distribution.

* Provide strategic direction for a statewide water quality monitoring network.

Over seventy entities are now members, including a diverse group of policy-level individuals; government, academic, citizen, and industry organizations; consultants, and watershed groups who are involved in water quality or quantity issues. In 2000 the council hired a part time coordinator and reestablished its long-term goals and objectives by organizing its committee structure to better accomplish its charter goals. Important projects completed in 2000 and 2001 included the development of a web site, participating in a jointly sponsored first annual conference in March 2001, holding the first “data swap” where entities involved in monitoring in a particular watershed were invited to a council meeting to share why, what, when, where and how they were monitoring water quality and quantity. The Clear Creek Basin and a single site on the S. Platte River were the areas included in the first swap, which was very successful in identifying where there were monitoring gaps as well as duplication of monitoring efforts.

There are over fifty local watershed groups across Colorado, a number of which are involved in monitoring activities. The Division has partnered with several of these groups by providing laboratory analysis of samples collected by the watershed group. The Division funded the sorting and identification of macroinvertebrate samples collected by the Big Thompson Watershed Forum, the Roaring Fork Conservancy, and the Colorado Division of Wildlife. The Division also funded the analytical costs for nutrient sampling conducted by the N.F. Gunnison River Improvement Association in 2001.

B. Monitoring Networks and Programs

The WQCD's surface water monitoring strategy has many specific program objectives, which can be grouped into four categories: routine monitoring, lakes and reservoir monitoring, biological and habitat monitoring, and special studies monitoring. The Division uses this data to evaluate the overall surface water quality of each river basin.

1. Routine Monitoring

Routine monitoring is the collection of water quality samples at a network of fixed sites on a regular schedule, such as monthly or bimonthly. These sites are sampled for multiple purposes, including reviewing and developing water quality standards for rulemaking hearings, water quality assessments, trend detection, and TMDL development. The Division's routine water quality samples are collected by four technicians stationed in Denver and one stationed in Grand Junction. Samples are analyzed by the Colorado Department of Public Health and Environment (CDPHE) Laboratory and Radiation Services (LARS) Division.

a. Standards Review

The primary focus of the Division's routine monitoring network in 2000 and 2001 has been to provide an adequate, representative, and current water chemistry database to verify and support changes to water quality classifications, designations, and standards for surface water segments. Since 1992, the Division’s routine monitoring has been concentrated in a different major watershed each year, to provide a complete data set for the triennial review of water quality standards. This approach involved retaining a minimum number of permanent fixed sites in all watersheds and sampling an additional set of sites in the watershed of focus. Each year monitoring efforts are rotated to the watershed next on the schedule for standards review. This approach was continued in 2000 and 2001 when The Division completed monitoring efforts for the San Juan, Dolores, Lower Colorado and Gunnison River watersheds and the Arkansas River and Rio Grande watersheds. Major watershed monitoring to the Upper Colorado River Basin in spring of 2001. The Division continued to maintain a fixed network of 75 permanent routine water quality sites; these are included in the total of 314 sites in the network.

b. Trend Monitoring

Another important purpose for maintaining the statewide routine monitoring network is to obtain water-quality data for the analysis of trends. Sites established to analyze trends are permanent and ensure that there is an adequate database to identify and evaluate long-term changes in water quality, especially in relation to anthropogenic causes. These sites are usually located on streams that are affected by point or nonpoint pollution sources. A few trend sites, however, are allocated to more pristine waters; these act as reference stations which may aid in identifying subtle changes in quality due to changes in climatic patterns, atmospheric pollution, or land use.

2. Lakes and Reservoir Monitoring

The Division conducts monitoring at a limited number of reservoirs and lakes around the state to determine their trophic status, develop TMDLs, and support changes to standards and classifications during triennial reviews. A more detailed description of the lake and reservoir monitoring activities in 2000 through 2001 is found in Part II of this report. Resources for lake monitoring are limited, as funds for such monitoring originate from the overall surface water-monitoring program.

3. Biological and Habitat Monitoring

The Division conducted biological and habitat studies primarily to obtain data for use in stream standards and classification reviews and for the future development of biocriteria.

In 2000, the Division conducted approximately 115 one-time surveys at stream sites in the San Juan River, Lower Colorado and Gunnison River basins. This monitoring typically includes fish population surveys (where data is not available from the Colorado Division of Wildlife (CDOW)), macroinvertebrate sampling, chemical sampling, and habitat evaluation.

This work focused primarily on determining and updating the correct aquatic life classifications for a number of class 2 aquatic life stream segments in the triennial reviews of stream standard sand classifications for these basins. Macroinvertebrtaes were also collected at sites on Black Gore Creek, the North Platte River basin, and on the Yampa and tributaries.

The Division participated over the past several years in a cooperative study of sediment impacts to the Fraser River. Final results and an evaluation of the sediment guidance were presented by U.S. Forest Service (USFS) staff to the Water Quality Control Commission and at a statewide monitoring symposium in March 2001. This in-depth critique of the sediment guidance recommended that overall the guidance was found to be a useful approach for determining attainment of the narrative sediment standard but that additional work is needed on developing methods and techniques for evaluating data.

The Monitoring Unit continued to assist in the design of a sediment study to determine whether segments listed in Appendix C of the 1998 303d list were attaining the narrative sediment standard. This is a cooperative effort by the Bureau of Land Management (BLM) and the Division to evaluate stream segments on BLM property. Fieldwork by the contractor to assess sediment impacts on selected segments began in September 2001.

4. Special Study Monitoring

Special studies include synoptic studies for the development of TMDLs, site-specific criteria development studies, spill investigations, measurement of contaminants in fish tissue, fish-kill investigations, compliance sampling inspections of dischargers, special water quality investigations, and in-depth monitoring below specific wastewater treatment plants to develop information about effluent mixing zones.

a. Synoptic Studies

Synoptic studies provide a “snapshot” of water quality conditions and constituent loadings in a particular geographical area (watershed), during constant conditions, over a short period of time. Synoptic studies are typically conducted on targeted watersheds to determine pollutant concentrations and loadings for the development of TMDLs. Watersheds were targeted for study based on their priority in the schedule to complete TMDLs, if assessments are needed to develop the 303(d) or Monitoring and Evaluation lists, to develop effluent limits, on the detection of nutrient related water quality problems, and to detect water quality problems.

In early 2000, the number of synoptic studies was reduced substantially to two small-scale studies planned for late 2000. Reduced synoptic sampling allowed resources to be shifted to the routine monitoring required for triennial review of water quality standards. In 2000 and 2001 the Division conducted synoptic studies on the Fraser River, Boulder Creek and Little James Creek.

In anticipation of the new EPA requirement for states to adopt nutrient criteria for their water bodies, the Division conducted a synoptic study of phosphorus and nitrogen concentrations on the Upper Yampa River and tributaries near Steamboat Springs in the fall and spring of 2001. To enhance the Division’s technical capabilities in assessing nutrient impacts, we incorporated the analysis of attached algae in streams as a new component of our monitoring activities in the Yampa River study.

b. Point-Source Monitoring

Under the CDPS, the state collects water quality data to use in calculation of waste-load allocations on stream segments before discharge permits are issued or renewed. These allocations ensure that the discharge of constituents to the stream segment will not affect the beneficial uses of the water.

c. Probability-Based Monitoring

Colorado is currently involved in a probability-based approach to monitor and assess the status and trends of ecological aquatic systems. In a cooperative effort between Environmental Protection Agency (EPA), WQCD, and CDOW, a program called "Western Pilot" will use probability design to measure ecological indicators in wadeable streams across Colorado. EPA's Office of Research and Development is using this effort to refine methods and techniques used in other ecosystems to assess the Intermountain Region aquatic ecosystem. This effort should result in statistically based comprehensive assessment of the condition of Colorado streams by 2004.

C. Assessment Cycle and Plan for Comprehensive Assessments

Colorado's surface water assessment cycle is based on the triennial review of the water quality standards and designated use classifications for the six river basin groups used in Colorado's surface water regulations. The current surface water assessment schedule is shown in Table 2: Basin Monitoring Schedule.

Table 2: Basin Monitoring Schedule

Major River Basin	***Monitoring (end of period)***	***Assessment (September through March)***	***Hearing Date***
Gunnison, Dolores, San Juan, and Lower Colorado	August 2000	2000-2001	July 2001
Colorado and Upper Green	August 2002	2002-2003	July 2003
South Platte and Republican	August 2003	2003-2004	July 2004
San Juan, Gunnison, and Dolores	August 2005	2005-2006	July 2006
Rio Grande and Arkansas	August 2001	2001-2002	July 2002

This assessment schedule allows the Division to assess each river basin or river basin group once every five years. The assessment plan and schedule does not, however, provide for comprehensive assessment of these river basins; i.e. not every portion of every waterbody is monitored and assessed. Monitoring and assessment are biased in several ways. the first and fundamental bias is that toward analyzing water quality problems with the goal of determining how to control the problem. For instance, since Colorado has a rich mining history, the water quality impacts of the natural and anthropogenic disturbance in the mineral belt are more frequently assessed than those high elevation areas outside of the mineral belt. Some waterbodies are assessed repeatedly because they are located in areas where changes are occurring (threatened by population growth, discharges, improvements through remediation of historic mining sites, etc.).

WQCD currently uses monitoring and assessment funds to conduct the assessments necessary for the triennial reviews of the standards, use classifications, and special studies such as TMDLs. Additional surface water bodies will be added to the assessment cycle if more resources become available. The Division is currently reviewing all available sources of surface water data, including that collected by cities, local districts, volunteer monitoring groups, and state and federal agencies, and developing a plan to maximize the number of river miles and lake acres that can be assessed using this data.

D. Monitoring Quality Assurance/Quality Control Program

The Division's monitoring programs follow standard operating procedures for sample collection, sample processing, field data analysis, and quality assurance/quality control (QA/QC). The Division completed a revised quality management plan (*Quality Management Plan (QMP) for the Collection and Utilization of Environmental Data, December 2000*) for the entire Division in 2001. This document represents an update of our QA/QC procedures including the development of a process for updating and developing Quality Assurance Project Plans, Sample Analysis Project Plans and Standard Operating Procedures. It defines the quality assurance goals, and the methodology and criteria for attaining the goals. The QMP is an "umbrella" under which all activities involving the collection, manipulation, and utilization of environmental data are controlled. This QMP satisfies EPA's requirement for an approved agency-wide quality system for all EPA funded or sponsored activities generating or using environmental data (as described in EPA documents, EPA QA/R-2 and EPA Order 5360.1). The QMP will be used to ensure that all data used by the Division, not just that connected to EPA programs, is reliable and of a defined level of quality. Mandatory use of Quality Assurance Project Plans and the associated Sampling and Analysis Plans and Standard Operating Procedures, will be key elements in implementing this QMP. The Unit is presently updating and revising the surface water monitoring Quality Assurance Project Plans. All activities that use or generate environmental data will be subject to the requirements outlined in the Division's QMP.

2. Surface Water Assessment Methodology

Surface waters are assessed for a variety of reasons, the primary one being to prepare for the review and revision of water quality standards. The Clean Water Act (CWA) requires review and revision (if necessary) of water quality standards every three years. Colorado's surface water quality standards are very site-specific, with the water quality standards divided into four administrative basins that each cover approximately one-quarter of the state. The State is furthered divided into 7 regulations based on hydrologic basins. Colorado follows a triennial review schedule, with the Commission holding two informational hearings (an Issues Scoping hearing for early identification of issues and an Issues Formulation hearing for more detailed proposals). Waterbodies targeted for assessment are those that have site-specific standards, temporary modifications of standards, and known areas where changes might be expected, such as growing population centers and sites where remedial actions are in progress.

Surface water quality assessments are also conducted in conjunction with preparation of the 303(d) list or issuance or renewal of CDPS permits. Water bodies targeted for assessment for the 303(d) list are those that were on previous lists or have suspected impairment. Since most CDPS permits in Colorado contain water-quality based effluent limits, an assessment of upstream water quality is necessary to determine the assimilative capacity of the waterbody at the point of discharge.

The water quality assessment process depends on sufficient and reliable data. Attainment of water quality standards or designated use support are evaluated based on biological, chemical, or physical data. The Division assesses a waterbody by considering all chemical, physical, and/or biological information that meets required sampling, analytical, and interpretive protocols. Factors to be considered may include analytical detection limits, sample size, spatial and temporal distribution, variability within the data set, and the use of clean methodologies. Representative data of each type will be sought and utilized whenever possible, especially where a determination of non-attainment is the potential outcome.

When conducting an assessment, the Division uses specific criteria:

- Only data for which sample collection and laboratory analysis methods are known will be used. Quality assurance requirements must be met by all data, and must be made available to the Division for review.
- Chemical data should be supported by a Sampling and Analysis Plan (SAP).
- In-situ bioassay test results, or other ambient toxicity test results, must demonstrate adverse effects as measured by a statistically significant response relative to a representative reference or control.
- Sufficient information is available to show the data represent existing conditions;
- The data was collected within the last five years, or the Division has determined the data is representative.
- Physical and biological assessments must be preformed in accordance with scientifically sound methodologies by a trained observer.
- Anecdotal information, in absence of chemical, physical, or biological data, will not be adequate to support a non-attainment.

- Data collected during or immediately after events that are temporarily impacting a waterbody, which are not representative of normal conditions, will not be used to support a non-attainment decision.

The Division will accept other methodologies and protocols for physical and biological assessments based upon the Division's review of the methodology and protocol along with its site-specific application. The Division will generally accept methodologies and protocols by other state and federal agencies: United States Geologic Survey (USGS), USFS, BLM, EPA, and CDOW.

Water quality assessment information is managed in the Assessment Database (a Microsoft Access database built by EPA), which is used to generate the tables used in this and many other reports.

The Division conducts several different assessments of surface water bodies in Colorado; these include river and stream, lake, biological, and sediment. These assessments are then used to determine the designated use support for rivers/streams and lakes/reservoirs. Each type of assessment is discussed in more detail below.

A. River and Stream Assessment

The WQCD document Guidance on Data Requirements and Data Interpretation Methods Used in Stream Standards and Classification Proceedings (WQCD 1993) will be used for data assessment for list development. Data considered in assessment decisions must be representative of the waterbody and account for seasonal and diel variation. When the assessment utilizes third party data, the WQCD may require submittal of a SAP, or other documentation, to assure sample results are representative for these conditions.

Attainment of chronic chemical standards, in both lotic (streams and rivers) and limnic (lakes and reservoirs) systems, is based upon the 85^{th} percentile of the ranked data, except as otherwise noted below. Percentile values are calculated by ranking individual data points in order of magnitude). Hardness based metal standards are evaluated by comparing the 85^{th} percentile against the assigned hardness based equation using either the mean hardness at low flow or, when available, paired hardness and flow data. Total recoverable iron is evaluated against the median value, or the 50^{th} percentile. Dissolved oxygen is evaluated at the 15^{th} percentile. Minima pH is evaluated against the 15^{th} percentile, maxima at the 85^{th}.

B. Lakes and Reservoir Assessment

Section 314 of the CWA requires states to report the trophic status of lakes. Colorado completes this requirement in the 305(B) report.

The Division assesses the water quality of lakes and reservoirs by reviewing available data and comparing this data to the standards adopted for each waterbody. In addition, the trophic status of lakes and reservoirs is determined using the Carlson Trophic State Index. These water quality assessments are found in the basin rationale for standards review.

Attainment is assessed for metals, pH, dissolved oxygen (DO), nitrate (NO3), ammonia (NH3), and fecal coliform. Using available data for dissolved metals, NO3, NH3, and pH; the 85th percentile of the data is calculated and compared to the applicable water quality standard. For total recoverable metals, the 50th percentile is calculated from available data and compared to the applicable standard.

For DO, a different approach is used. According to the Basic Standards regulation for surface water, standards for DO are one-day minima, unless specified otherwise. To apply the DO standard to reservoirs and lakes, the Basic Standards state:

> "The dissolved oxygen criterion is intended to apply to the epilimnion and metalimnion strata of lakes and reservoirs. DO in the hypolimnion may, due to the natural conditions, be less than the table criteria. No reductions in dissolved oxygen levels due to controllable sources is allowed."

The Division has interpreted this to mean that during periods when the reservoir is mixed and therefore does not have a well-developed metalimnion and epilimnion, the DO standard applies to the entire water column. Under stratified or mixed conditions, attainment of the standard is evaluated by comparing the lower 15th percentile of values from profile measurements to the standard, for each day that measurements were collected.

Some lakes and reservoirs have site-specific numeric standards or goals for nutrients (mainly total phosphorus) and chlorophyll a. The period for application of site-specific standards usually is defined as the growing season and is described in the Statement of Basis and Purpose for that standard. Lakes and reservoirs are evaluated on an annual basis for attainment of site-specific standards. Growing season total phosphorus data are used to determine the seasonal mean, which is compared to the standard. The lakes in Colorado with site-specific standards include Lake Dillon, Cherry Creek Reservoir, and Chatfield Reservoir. Narrative standards that specify trophic state have been adopted for Standley Lake and Bear Creek Reservoir.

C. Biological Assessment

Biological monitoring techniques focus on biotic (presence/absence of fish and macroinvertebrate species and chlorophyll a data for special studies on streams and reservoirs) and abiotic (stream physical habitat, instantaneous stream flow, total phosphorus concentrations, and Secchi disk transparencies) factors. Information available from other agencies and entities is also gathered to supplement data collected by the WQCD. When conducting biological monitoring surveys, the Division collects the following information:

- **Identification of fish species present**: Collection procedure involves using a backpack electroshocking unit. Fisheries information (species presence, population estimates, and length-frequency distributions) is generally provided by the CDOW.
- **Identification and enumeration of macroinvertebrates present**: Collection procedure involves using a traveling kicknet in riffle microhabitats, which is equivalent to Level 3 of EPA's Rapid Bioassessment Protocols (RBP).

- **Assessment of physical habitat**: Habitats are assessed using modified EPA RBP habitat protocols, supplemented by standardized Wolman pebble counts, instantaneous stream flow measurements, and Rosgen stream channel classifications.

The biological monitoring program has recently been identified as a high priority in the WQCD's comprehensive monitoring plan. The Division is working with Region 8 EPA and their contractor to set-up and implement the Ecological Data Application System (EDAS)developed by Tetra Tech Inc. Macroinvertebrate data and habitat information collected by the Division have been entered for several watersheds. EDAS will be ready for the state to use by December 2001.

A statewide group of experts is assisting the state in the development of biological criteria and potential modifications to our aquatic life classifications definitions. These modifications may involve incorporating more specific criteria for evaluating aquatic-life use impairment.

The WQCD has also been working with the EPA's Region 8 Environmental Monitoring and Assessment Program (EMAP) to monitor and assess the ecological status and trends of Colorado streams. The first year of monitoring was completed by the CDOW and the USGS at 14 randomly selected sites, statewide. This monitoring included physical habitat assessment and collection of macroinvertebrates, periphyton, fish, and water chemistry samples. An additional three years of monitoring will be collected, followed by one year of data assessment. Data gathered through the EMAP process will assist the Division in developing bioassessment tools for streams in Colorado.

D. Sediment Assessment

In 1996, the Colorado Sediment Task Force formed to develop a guidance document that could be used by agencies and interested parties in implementing the state's narrative sediment standard for "clean sediment". The product of the Task Force was the "Implementation Guidance for the Determination of Impacts to Aquatic Life in Streams and Rivers Caused by the Deposition of Sediment" (Sediment Guidance). This provisional guidance was readopted by the Water Quality Control Commission in 2000 but still retains its provisional status. The procedures in the sediment guidance will be the key component in determining whether aquatic life uses within a stream segment are impaired due to excessive sediment. The Division, other state and federal agencies, and local entities have been implementing the sediment guidance on streams identified on the 303(d) list and Monitoring and Evaluation list. Agencies currently evaluating streams include WQCD, CDOW, USFS, BLM and various other municipal entities.

The approach of the sediment guidance is to compare a sediment-impacted stream to a reference condition for that stream. The reference condition is the stream condition (including sediment deposition and aquatic life) in the absence of sediment impacts. The following steps outline how the comparison of impacted stream to reference stream is made.

- Establish a stakeholder group of multidisciplinary members to design the study and assess endpoints.

- Identify candidate sediment-impacted segments by reviewing reports [305(b), etc.] and completing screening-level reconnaissance surveys

- Establish an expected or reference condition, considering physical, chemical, and biological attributes (such as watershed size, stream size, ecoregion, channel morphology, flow regime, and elevation)

- Identify reference conditions for comparison, by selecting a reference area that is representative of similar physical and ecological characteristics or is based on an upstream-downstream comparison or hypothetical condition.

- Complete habitat evaluations at the study and reference areas. The analyses must be quantitative for comparison and expressed as a percent of the reference condition. Analysis may include pebble counts, residual pool volume (V*), embeddedness measurements, and channel type.

- Assess the benthic macroinvertebrate and /or fish communities using biomass, abundance, and sediment tolerance endpoints. Impacts to aquatic life are expressed as the percent of reference condition.

- Determined attainment (attained, threatened, or exceeded) of the narrative standard by comparing the percent of reference condition for biological quality and physical habitat quality, according to the matrix in Table 3: Narrative Standard Attainment Matrix.

Table 3: Narrative Sediment Standard Attainment Matrix

	Biological Quality as a% of Reference Condition			
Substrate Habitat Quality as a Percentage of Reference Condition	**0%–17% Severely Impaired**	**18%–50% Moderately Impaired**	**51%–79% Slightly Impaired**	**80%–100% Nonimpaired**
0%–58% (Nonsupporting)	Exceeded	Threatened	Attained	Attained
59%–73% (Partially Supporting)	Threatened	Threatened	Attained	Attained
74%–100% (Supporting Comparable)	Attained	Attained	Attained	Attained

3. Determination of Use Support

Sufficient information and data should be available to indicate that measurements are representative of existing conditions. Assessments based upon limited data must provide clear and convincing evidence to support a determination of non-attainment.

Application of chemical, physical and biological information in assessment determinations requires consideration of the scientific rigor of the methodologies utilized to develop any such information, and the strength of that information. The WQCD will consider the rigor and strength of chemical, physical and/or biological information. Rigor refers to the demonstrated validity of sampling, analytical, and assessment protocols and the availability of meta-data in support of those protocols. Strength refers to the quantity of data and the extent to which such data demonstrates clear and convincing evidence of attainment or non-attainment of standards.

Physical or biological data may support a finding of non-attainment when chemical data is otherwise insufficient in and of itself. Greater weight is given data that provides direct, quantifiable documentation of non-attainment as opposed to data developed using surrogate indicators or parameters. Given the absence of duly promulgated biological and physical criteria within Colorado, and the need to avoid regulatory use of criteria which has not been subject of a properly noticed administrative rulemaking proceeding, the WQCD will base a finding of non-attainment based solely upon physical or biological information only where there exists clear and convincing evidence of such non-attainment.

There is a determination that, water quality standards on a river/stream segment have been attained, and the segment is "fully supporting" its designated uses, when the statistically calculated concentration of each parameter is below the applicable chronic numeric standard, there is no exceedance of an acute standard, and no physical or biological assessment indicate non-support. The Designated Use Support Matrix, which describes designated uses and support categories is presented in Table 4: Designated Use Support. As discussed previously, different standards may be applied to different segments of a river/stream, depending upon its ambient water quality and designated uses.

Table 4: Designated Use Support

Degree of Designated Use Support	***Water Chemistry Information***	***Physical and Biological Information***
Fully Supporting: Designated uses have been attained and are supported.	The 85th percentile [1] data point is below the applicable chronic stream standard [2]. No exceedances of the acute water quality standard.	Results of physical and biological assessments indicate the use is not impaired.
Not Supporting: At least one designated use is materially impaired.	The **85th perc**entile data point exceeds the chronic water quality standard [2]. Occasional or frequent exceedances of the acute water quality standard.(more than once in three years, or more than 5% of the data points exceed the acute standard.)	Results of physical and biological assessments indicate use impairment.

[1] "Percentile " The values obtained by (m÷n) x 100, where m = the rank of observation in the data set ordered from high (m=n) to low (m=1); and n = the number of data points.

[2] The 50th percentile point is used for metals in the total recoverable form (e.g. Iron).

4. River and Streams Water Quality Assessment

Colorado has over 100,000 miles of rivers and streams within its boundaries, ranging in size from large rivers like the Arkansas, Colorado, and Platte to small tributaries. Colorado is the headwaters for the Arkansas River, the Rio Grande, and the Colorado River. The Platte and Republican Rivers, two significant tributaries to the Missouri River, also originate in Colorado.

A. Designated Use Support

All rivers and streams in Colorado are assigned designated uses. The designated uses in Colorado are based on four categories of uses: aquatic life, recreation, water supply, and agriculture. The water bodies are assessed and it is determined to what extent these uses are being supported. The waterbodies can be fully supporting or not supporting their designated uses.

The designated use support of Colorado's rivers and streams is summarized in Table 5: Degree of Support for Colorado Rivers and Streams (miles). As the table shows, most rivers in the state are fully supporting their designated uses.

Table 5: Degree of Support for Colorado Rivers (miles)

Use	Size Assessed	Fully Supporting	Not Supporting	Not Attainable
Aquatic Life Cold 1	28,203	25,606	2,597	1,350
Aquatic Life Cold 2	6,604	6,512	92	0
Aquatic Life Warm 1	1,371	1,326	45	0
Aquatic Life Warm 2	33,081	30,989	2,092	0
Primary Contact (Recreation, Class 1)	34,255	34,138	118	0
Secondary Contact (Recreation, Class 2)	31,650	31,616	35	0
Drinking Water Supply	33,108	32,792	315	0
Agriculture	70,130	70,049	81	0

It is important to evaluate the causes and sources that result in waterbodies not fully supporting their designated uses. "Cause" means the pollutants and other stressors that contribute to the impairment of designated uses. Causes for not supporting can be high levels of metals, nutrients, pH, or pathogens. "Source" means the activities, facilities, or conditions that contribute pollutants or stressors. Sources of these pollutants can be municipal point sources, agriculture, silviculture, highway runoff, erosion and sedimentation, or resource extraction.

The leading cause of non-attainment on Colorado's waters is high levels of metals. With the exception of the mercury issues in fish tissue in lakes, the source of metals in the waters of

Colorado is historic mining. Mining, or resource extraction, alters the condition of the underlying rock formations, allowing air and water to combine with metals. The results are acidic, metal rich discharge from abandoned and inactive mines or runoff from old mining tailings piles. Table 6: Causes and Sources Affecting Water Bodies Not Supporting Designated Uses lists the total miles affected by the various causes and sources that results in a waterbody not supporting its designated uses.

Table 6: Summary of Causes and Sources Affecting Water Bodies Not Fully Supporting Classified Uses

Colorado Rivers		***Colorado Lakes***	
Cause Category	**Miles Affected**	**Cause Category**	**Acres Affected**
Metals and pH	1404	Metals and pH	6,762
Ammonia and organic enrichment	72	Pesticides	156
Pathogens	212	Ammonia	8
Nitrate and sulfate	212	Pathogens	8
Siltation	44		
Unknown	4056		
Colorado Rivers		***Colorado Lakes***	
Source Category	**Miles Affected**	**Source Category**	**Acres Affected**
Point sources	96	Point sources	164
Agriculture / silviculture	123 / 11	Agriculture and silviculture	134
Urban and road runoff	52	Resource extraction	142
Resource extraction	599	Unknown	5,819
Unknown	5227		

Notes:

"Source" means the activities, facilities, or conditions that contribute pollutants or stressors.
"Cause" means the pollutants and other stressors that contribute to the non-attainment of classified uses in a water body.
Sum of the acres or miles affected does not equal the total non-attained acres or miles since non-attainment may have more than one cause.

B. Trend Analysis

A trend analysis was done to evaluate the changes in water quality of each basin. Seven river basins were evaluated for trends in water quality over time. Water quality stations were chosen based upon size of the river system and proximity to the downstream state boundary. Stations were further selected based on the period of record and adequacy of flow and water quality data.

Parameters investigated for trends included: metals, nutrients, pathogens, and physical measurements. Dissolved metals and total nutrients were generally evaluated. Data sets with a period of record ending prior to 1985 were excluded from the reported results. Trend analysis results are presented with the water quality assessment for each river basin in the sections that follow.

<u>Methodology of the Trend Analysis</u>

Adjustments of less than detection limits. Several of the data sets required adjustments to account for censored data (data reported below a threshold value, such as the analytical method detection limit or laboratory reporting limit). These limits changed during different reporting cycles. Unadjusted censored data used in trend analysis results in inaccurate findings of trends. For instance, yearly dissolved cadmium results may be reported as less than 2 (<2), <2, 3, <4, <4, <2, 5, 7. Analysis of this unadjusted data might result in a finding of a trend (upward). One way to adjust for this is to change the less-than data to the highest detection limit, yielding <4, <4, <4, <4, <4, <4, <4, 5, 7 before analysis of trends. This was done in the trend analysis.

Adjustments based on the skewness of the data. The majority of water quality indicators are not normally distributed but rather have a skewed in distribution. This phenomenon is common in environmental data where many readings are less than the detection limit, there are no negative readings, and there are a few high readings. The choice of statistical procedures for a trend analysis is based upon the skewness of the data; nonparametric tests were chosen for this trend analysis.

Adjustments based on concentration variations due to flow. The concentrations of most parameters vary with flow. In order to get an accurate analysis of changing concentrations, the variation due to flow must be removed. This was accomplished by comparing flow-weighted concentrations of various parameters over time to establish trends. The statistical approach consisted of two parts: 1) Plotting the concentration versus flow and fitting a LOWESS (Locally Weighted Scatterplot Smoothing) curve to the relationship and storing the residuals and 2) Running the Mann-Kendall test on the residuals (the difference between the measured concentrations and the curve or the flow-adjusted concentrations) over time to test for trends. The test evaluates slopes significantly different from zero. If the Mann-Kendall test p-value results were less than 0.05, no trend exists. This result may mean that no trend exists or it may mean that the data available were not sufficient to conclude that there is a trend. A small data set is one such case. Analyses that resulted in trends were further investigated to verify the accuracy of the data. Judgment of an upward or downward trend was then made based on the slope of the data. More information on this approach may be found in Helsel and Hirsch (1992).

C. Water Quality Assessments of Basins

Seven watershed basins will be reviewed and the current status of assessment will be reported. The seven watershed basins of Colorado include:

1. Arkansas River Basin
2. Rio Grande Basin
3. San Juan River Basin
4. Colorado River Basin
5. Green River Basin
6. Platte River Basin
7. Republican River Basin

Each basin will be described, and will include an overview. The status of the water quality will be reported on, as well as the degree of support for the designated uses. Water quality concerns and trends will end the description of each basin.

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1. Arkansas River Basin

The Arkansas River Basin is the largest basin in Colorado (28,286 square miles), consisting of the Arkansas River and its major tributaries: Fountain Creek, Huerfano River, and Purgatoire River. The Arkansas River drains most of the southeastern part of Colorado, as well as a large portion of the central mountains.

About 20% of the State's population (850,280 people) resides in the Arkansas Basin, mostly in the Colorado Springs and Pueblo areas. The Colorado Springs area (Upper Fountain Creek Basin) is the major growth center in the Arkansas River region. The populations of El Paso, Pueblo, and Chaffee Counties have increased by an estimated 20% over the last ten years. The populations of the more rural portions of the basin have changed little.

Arkansas River Basin Overview

Counties: Baca, Bent, Chaffee (portion), Cheyenne (portion), Crowley, Custer, El Paso, Fremont, Huerfano, Kiowa, Lake (portion), Las Animas, Lincoln(portion), Otero, Prowers, Pueblo, Teller (portion)
Major Population Centers: Leadville, Colorado Springs, Pueblo, Las Animas, Lamar
Population[1]: 850,280

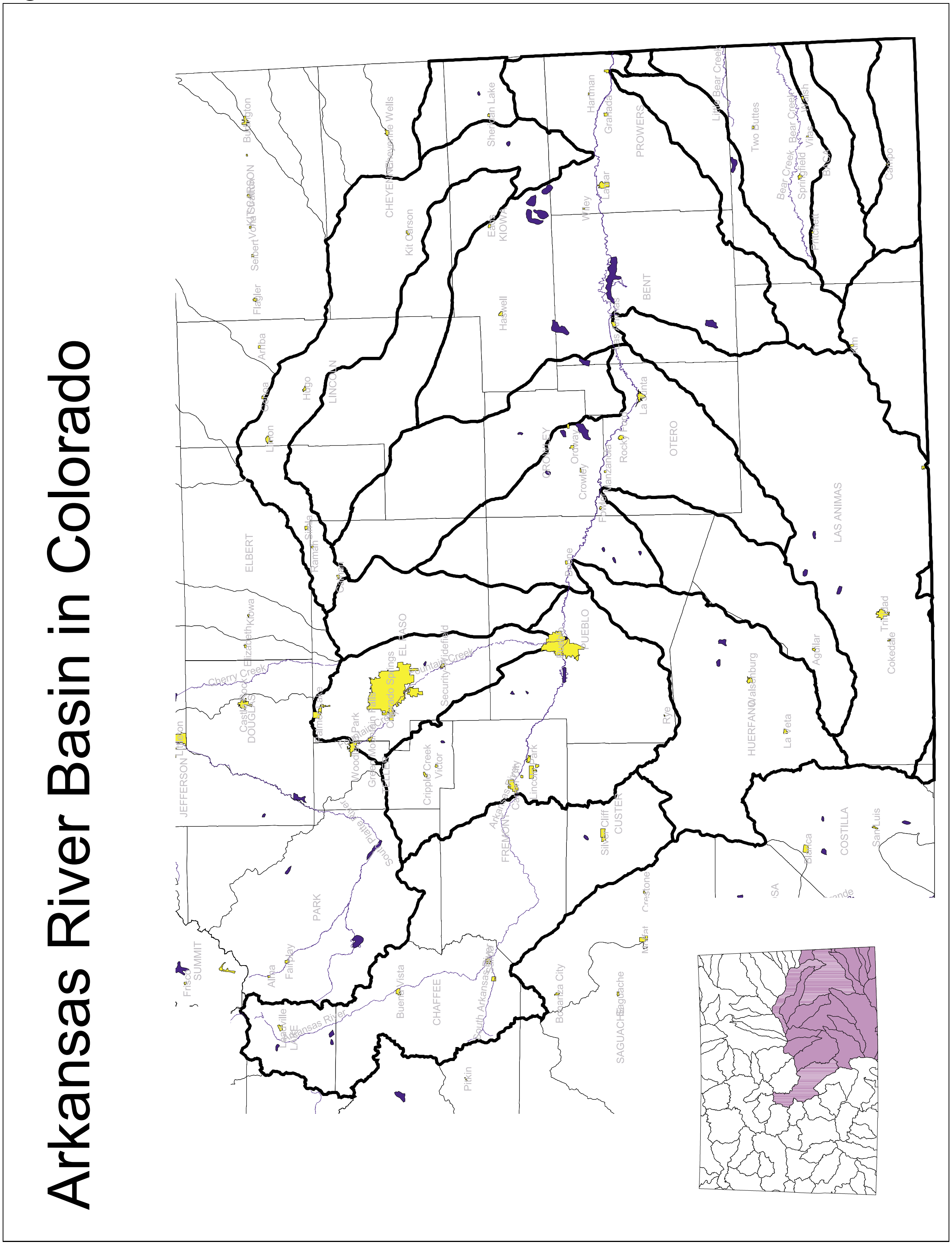
Surface Area (square miles): 28,286
Total Stream Miles: 25,592
Number of Lakes (Perennial lakes/reservoirs > 10 acres): 166
Lake Acres (Perennial lakes/reservoirs > 10 acres): 49,261

Major Land Use Types:
Forest and Range (square miles): 18,464
Agriculture (square miles): 7,506
Urban (square miles): 2,614
[redacted]

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

Water quality in the basin is generally good; portions of the headwaters have been designated Outstanding Waters, and most waters fully support their designated uses. The Upper Arkansas River is the most heavily used recreational river in the state, with many commercial rafting companies and individuals using it for rafting and kayaking. There are areas of the basin, however, where water quality concerns exits. The headwaters of the Arkansas River were subjected to intensive mining activities in the late 1800's. These activities significantly degraded several tributaries to the river, as well as the mainstem itself. After the Arkansas River leaves the mountains, it crosses geologic formations that are rich in soluble salts (iron, sulfate, and selenium). With the extensive irrigation in the lower basin, these naturally occurring constituents are concentrated in the soil and irrigation return flow. This high total dissolved solids (TDS) concentration lowers the water quality of the Arkansas River from La Junta to the Colorado/Kansas line.

Figure 1: Arkansas River Basin in Colorado



a. Basin Description

The Arkansas Basin encompasses a wide variety of conditions and settings. Colorado's highest point, Mt Elbert at 14,433 feet (4399 meters), and lowest point, where the Arkansas River crosses into the state of Kansas at 3,350 feet (1,021 meters), are both found in this basin. The headwaters of the region are generally high mountain areas, with tundra and alpine or sub-alpine forests. Fourteen of Colorado's mountains over 14,000 feet ("fourteeners") are along the Arkansas Basin's western boundary, which is the Continental Divide. The southern boundary in Colorado is formed by the stateline. Hydrologically, the basin divide on the southern side is Raton Mesa and Mesa de Maya in New Mexico, with elevations of 7,000 feet.

The western half of the basin is mountainous with streams on steep slopes and cool temperatures. About midway through the basin, the river and its tributaries exit the mountains and, after a transitional zone, become more gently sloped and warmer.

The Arkansas River Basin is very diverse and the precipitation trends reflect this diversity. In the higher elevations at the headwaters, the annual precipitation ranges from 25 to 60 inches (63-152 cm), most of which occurs as snow. The middle to lower elevations transition from forest to semi-desert. The warm dry forests have average annual precipitation from 15 to 25 inches (30 - 63 cm). The semi-desert region is only a few hundred feet lower in elevation; however, the average annual precipitation ranges from 8 to 12 inches (20 - 30 cm). The High Plains in the eastern portion of the basin are also quite arid and generally receive less than 12 inches (30 cm) of precipitation

Water quantity is highly managed in the Arkansas Basin. Water is diverted from many second and third order streams for irrigation, which may result in seasonal dewatering. Water management is also accomplished by large dams and reservoirs (Pueblo Reservoir and John Martin Reservoir), which store and release water in response to irrigation needs. A vast system of canals conveys water through the agricultural parts of the basin.

The two main geomorphological areas in the basin are the Rocky Mountains and the Eastern Plains. The Rocky Mountains of the Arkansas River Basin and the Eastern Plains of the Arkansas River Basin are divided into three major ecoregions: the Southern Rocky Mountains ecoregion (21), the Southwestern Tablelands ecoregion (26), and the Western High Plains ecoregion (25). Each ecoregion is summarized in Table 7**:** Ecoregions of the Arkansas River Basin.

Table 7: Ecoregions of the Arkansas Basin

Ecoregion		Basin Area	Land Surface Form [1]	Potential Natural Vegetation[2]	Land Use[3]
21	Southern Rockies	Upper and Middle Arkansas subbasins; headwaters of Fountain Creek and Lower Arkansas subbasins	High mountains and tablelands with high relief	Western spruce/fir, Douglas-fir, pine/ Douglas-fir, southwestern spruce/fir, alpine meadows (bentgrass, sedge, fescue, bluegrass)	Forest and woodland grazed
25	Western High Plains	Lower Arkansas and Fountain Creek subbasins	Smooth to irregular plains	Grama/buffalo grass	Cropland, cropland with grazing land, irrigated agriculture
26	Southwestern Tablelands	Lowest reaches of the Lower Arkansas and Cimarron River subbasins	Tablelands with moderate to considerable relief	Grama/buffalo grass, sandsage/bluestem prairie, mesquite/buffalo grass, bluestem grama prairie	Subhumid grassland and semiarid grazing land, some cropland with grazing land

[1] Hammond, E.H., 1970. "Classes of land-surface form," in *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. "Potential natural vegetation," in *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. "Major land uses," *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from "Ecoregions of the South Central States," by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987

Land Use: Approximately 10% of the basin is in publicly owned. Approximately 25% of the area is in irrigated or dry-land agriculture. The irrigated portion is restricted to the river bottom and terrace lands near the mainstem of the Arkansas. The largest metropolitan areas in the basin are Colorado Springs (estimated population of 350,000) located on Fountain Creek, and Pueblo (estimated population of 102,000) located on the Arkansas River mainstem.

The Arkansas headwaters have been subjected to more than a century of intensive mining activity, which has severely impacted some of these waters. The mainstem of the Arkansas River between Buena Vista and the Pueblo Reservoir is the most extensively used recreational river in Colorado. The Lower Arkansas and its tributaries are heavily regulated, with irrigation of about 500,000 acres (202,000 ha) and municipal water usage occurring between Pueblo and the Colorado/ Kansas state line.

b. Surface Water Quality Assessment:

The water quality in the Arkansas River Basin was comprehensively assessed in 1993-1994 in conjunction with preparation for the triennial review of water quality standards. This was WQCD's second basin-wide water quality assessment project. The Division typically operates seven water quality stations in the Arkansas Basin: five on the mainstem of the Arkansas and two on Fountain Creek. However, additional Division stations were monitored in preparation for the 2002 hearing, as well as many USGS, CDW, Colorado Department of Water Resources (CDWR), and private locations throughout the basin. The USGS operates a Hydrologic Benchmark Station on Halfmoon Creek (#07083000), near the headwaters of the Arkansas River, and until 1994, operated a National Stream Quality Accounting Network station (#07137500) at the Colorado/ Kansas border.

An Issues Formulation Information Hearing occurred in November 2001, and the Rulemaking Hearing is scheduled for July 2002. In preparation for these hearings, the Division has focused monitoring in this basin.

Designated Use Support: One of the objectives of the Arkansas River Basin assessment was to evaluate the chemical, physical, and biological status of classified stream segments in the basin relative to adopted use effluent classifications and standards. Each use was evaluated to determine the degree of support of the use. In the Arkansas River Basin, 2,4092 miles (99%) of streams and rivers fully support all assessed uses. The remaining percentage is impaired for one or more uses. The individual use support for the Arkansas Basin is summarized in Table 8: Individual Use Summary for the Arkansas River Basin.

Table 8: Individual Use Summary for Arkansas River Basin (in river miles)

Use	Size Assessed	Size Fully Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life Cold 1	4,571	4,503	68	11*
Aquatic Life Cold 2	2,512	2,512	0	0
Aquatic Life Warm 1	529	529	0	0
Aquatic Life Warm 2	16,731	16,546	186	0
Primary Contact (Recreation, Class 1)	3,412	3,412	0	0
Secondary Contact (Recreation, Class 2)	20,477	20,477	0	0
Drinking Water Supply	4,771	4,567	203	0
Agriculture	24,345	24,345	0	0

* No aquatic life use is designated for these miles

Of the streams assessed, 100% are suitable for agriculture. Aquatic Life can be supported in the majority of the streams assessed with: 98% fully supporting aquatic life in Aquatic Life Cold 1 streams, 100% fully supporting aquatic life in Aquatic Life Cold 2 streams, 100% fully supporting aquatic life in Aquatic Life Warm 1 streams, and 99% fully supporting aquatic life in Aquatic Life Warm 2 streams. All streams are fully supporting recreation use classifications.

Outstanding Waters in the Upper Arkansas River Basin: All streams, lakes and reservoirs within Mount Massive and Collegiate Peaks Wilderness Areas (WA) are currently considered under the designation of outstanding water (OW). They are use classified as: Cold Water Aquatic Life 1, Recreation 1, Water Supply, and Agriculture. Water quality data collected by the Division from four streams just below the wilderness area boundaries and one stream within the Collegiate Peaks WA indicate existing water quality within the wilderness areas is sufficient to meet the 12 parameter test for the OW designation. The wilderness areas are ecologically significant. The Collegiate Peaks WA and the Mount Massive WA provide habitat for the boreal toad, a state endangered species, and the Mount Massive WA also has greenback cutthroat trout, an endangered species at both the state and federal levels. The waters, because of their pristine nature and location in wilderness areas, are not candidates for new permitted sources of pollution .

Water Quality Concerns: The Arkansas headwaters have been subjected to more than a century of intensive mining activity, which has severely impacted some of these waters. The mainstem of the Arkansas between Buena Vista and the Pueblo Reservoir is the most extensively used recreational river in Colorado. The Lower Arkansas and its tributaries are heavily regulated, with irrigation of about 500,000 acres (202,000 ha) and municipal water resource usage occurring between Pueblo and the Colorado/Kansas state line.

Analysis of the assessment data showed that acid mine drainage was a significant problem in the Upper Arkansas River, particularly in Segment 2a (East Fork Arkansas River, COARUA02A) and Segment 6 (St. Kevin's and California Gulches, COARUA06). Although wastewater treatment plants have begun treating problem discharges from the Yak Tunnel and Leadville Drain, which discharge to California Gulch and the East Fork of the Arkansas River respectively, high metals concentration were still a problem in the Upper Arkansas River. Treatment of water from these discharges is expected to continue indefinitely. The waters of Cripple Creek and Fourmile Creek are also impacted by historic mining. The wealth of gold found in the Cripple Creek Mining district eclipsed even the wealth of Leadville.

Municipal and industrial effluent discharges are the most significant problems in the segments of the Middle Arkansas River. During high flows, the majority of water in the stream is stormwater runoff. During low flows, it is almost completely effluent from municipal and industrial discharges. The low-flow scenario is found on Fountain Creek Segment 2 (Mainstem of Fountain Creek from Monument Creek to the Arkansas River, COARFO02), where there are 21 facilities that discharge to Fountain Creek or its tributaries, including General Permits. The flows in Segment COARFO02 are heavily regulated, and effluent impacted because of urban development and heavy water resource usage. During the dry times of the year, the mainstem of Fountain Creek, in segment COARFO02, is effluent dominated. This effluent and runoff from urbanized area produces greater pollutant loading, and increased flow in the stream leading to erosion and higher sediment loads. Advanced Wastewater Treatment (AWT) is required of most domestic POTWs, to reduce inorganic nitrogen loading. High un-ionized ammonia loadings are a problem for aquatic life, while high nitrate levels are a problem for drinking water supplies. Completion of the Colorado Springs AWT plant has reduced the un-ionized ammonia in this segment.

There is heavy water usage in the Lower Arkansas River Basin. This is particularly true in Lower Arkansas Segment 1 (Arkansas River from Fountain Creek to the Colorado-Kansas state line, COARLA01), where there are 17 permitted point source discharges including General Permits. Extensive diversions for irrigation and the resulting irrigation return flow are the major anthropogenic impacts to this segment. The reuse of this water for irrigation causes the total dissolved solids (salts) in this segment to increase out of proportion to the number of stream miles.

c. Impaired Waters

Listed below in Table 9: Impaired Waters of the Arkansas River Basin, are the stream segments that are on the 1998 303(d) List, as well as their current TMDL Project Status (current as of November, 2001).

Table 9: Impaired Waters in the Arkansas Basin

Waterbody ID (WBID)	*Waterbody*	*Portion*	*Pollutant or Condition*	*Causes*	*TMDL Project Status*	*Project Completion Date*
COARLA01	Arkansas R. from above Fountain Ck. to stateline	All, problems increase downstream	Se, Fe, Mn, SO4	Natural, Agricul-ture	Mn to be resolved by de-listing, standards were changed	6/04
COARMA04	Teller Res.	All	Hg	Unknown	Pending	6/04
COARUA01	E. Fork Arkansas R., above Birds-eye Gulch	AMAX property and below	Pb, Mn, Zn	Mining	Preliminary Draft: Use Attainability Analysis	6/02
COARUA02	Arkansas R., above Lake Fork	All	Cd, Zn	Mining	Pending CERCLA action	6/08
COARUA02	Arkansas R., Lake Fork to Lake Ck.	All	Zn	Mining	Pending CERCLA action	6/08
COARUA09	Iowa Gulch, Paddock Ditch 1 to Arkansas R.	All	Zn	Mining	Pending	6/08

Table 9: Impaired Waters in the Arkansas Basin (Continued)

Waterbody ID (WBID)	***Waterbody***	***Portion***	***Pollutant or Condition***	***Causes***	***TMDL Project Status***	***Project Completion Date***
COARUA11	Sayres Gulch & S. Fork Lake Ck., Sayres Gulch to Lake Creek	All	Al, Cu, Fe, pH	Mining	Pending	6/08
COARUA12	Cottonwood Ck., Chalk Ck. & S. Fork Arkansas R. & tribs.	Chalk Ck.	Zn	Mining	Pending	6/08
COARUA21	Cripple Ck, Arequa Gulch to Fourmile Ck.	All	Mn, Fe	Mining	Resolved by delisting, standards were changed	6/00
COARUA22	Arequa Gulch, source to Cripple Ck.	All	pH, Al, Mn, CN, Fe, Zn	Mining	Al, CN, Fe, Mn, Zn Resolved by delisting, standards were changed	Metals-6/00 pH-6/02

d. Trend Analysis Results:

The Arkansas River flow is controlled by John Martin Reservoir (since 1949) before leaving the state downstream at Holly, Colorado. The USGS flow gage and water quality station on the Arkansas River at Lamar (halfway between the reservoir and Holly), USGS #07133000, was used to evaluate trends. Thirty-one parameters were evaluated with four showing recent trends. Total sulfates showed a long-term downward trend from the 1968 to 1996. Statistically significant trends are included in Table 10: Water Quality Trend Analysis for the Arkansas River Basin.

Table 10: Water Quality Trend Analysis for the Arkansas River Basin

Parameter	***Period of Record***	***No. of Data Points***	***Trend***
Total Sulfate	1968-1996	156	Downward
Hardness as CaCO3	1968-1996	211	Slight downward
Conductivity	1968-1992	212	Slight downward
Total Alkalinity	1978-1998	160	Slight upward

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2. Rio Grande Basin

The Rio Grande Basin, located in south-central Colorado, includes the Rio Grande and its tributaries and the Closed Basin. The Rio Grande Basin covers over 7,500 square miles, with elevations in the basin ranging from above 14,000 feet above sea level in the Sangre de Cristo Mountains to 7,400 feet above sea level where the Rio Grande crosses the Colorado – New Mexico border. The Rio Grande is the fifth longest river in North America, supplying water to several major urban centers in New Mexico, Texas, and Mexico.

The principal tributaries of the Rio Grande are the Alamosa River and the Conejos River. The Conejos River has two tributaries; the San Antonio River and the Los Pinos River. The Closed Basin, which lies in the northern portion of the San Luis Valley, is an area where numerous mountain fed streams, such as Saquache Creek and San Luis Creek, flow into the San Luis Valley and permeates into an aquifer. There is no natural surface outflow from the Closed Basin to the southern portion of the valley. However, a canal system conveys a limited quantity of water from the Closed Basin to the southern portion of the Rio Grande Basin as part of the Bureau of Reclamation's Closed Basin Project.

Rio Grande Basin Overview

Counties: Alamosa, Conejos, Costilla, Hinsdale (portion), Rio Grande, Mineral
Major Population Centers: Alamosa, Monte Vista
Population[1]: 46,160

Surface Area (square miles): 7,582
Total Stream Miles: 6,875
Number of Lakes (Perennial lakes/reservoirs > 10 acres): 81
Lake Acres (Perennial lakes/reservoirs > 10 acres): 5,427

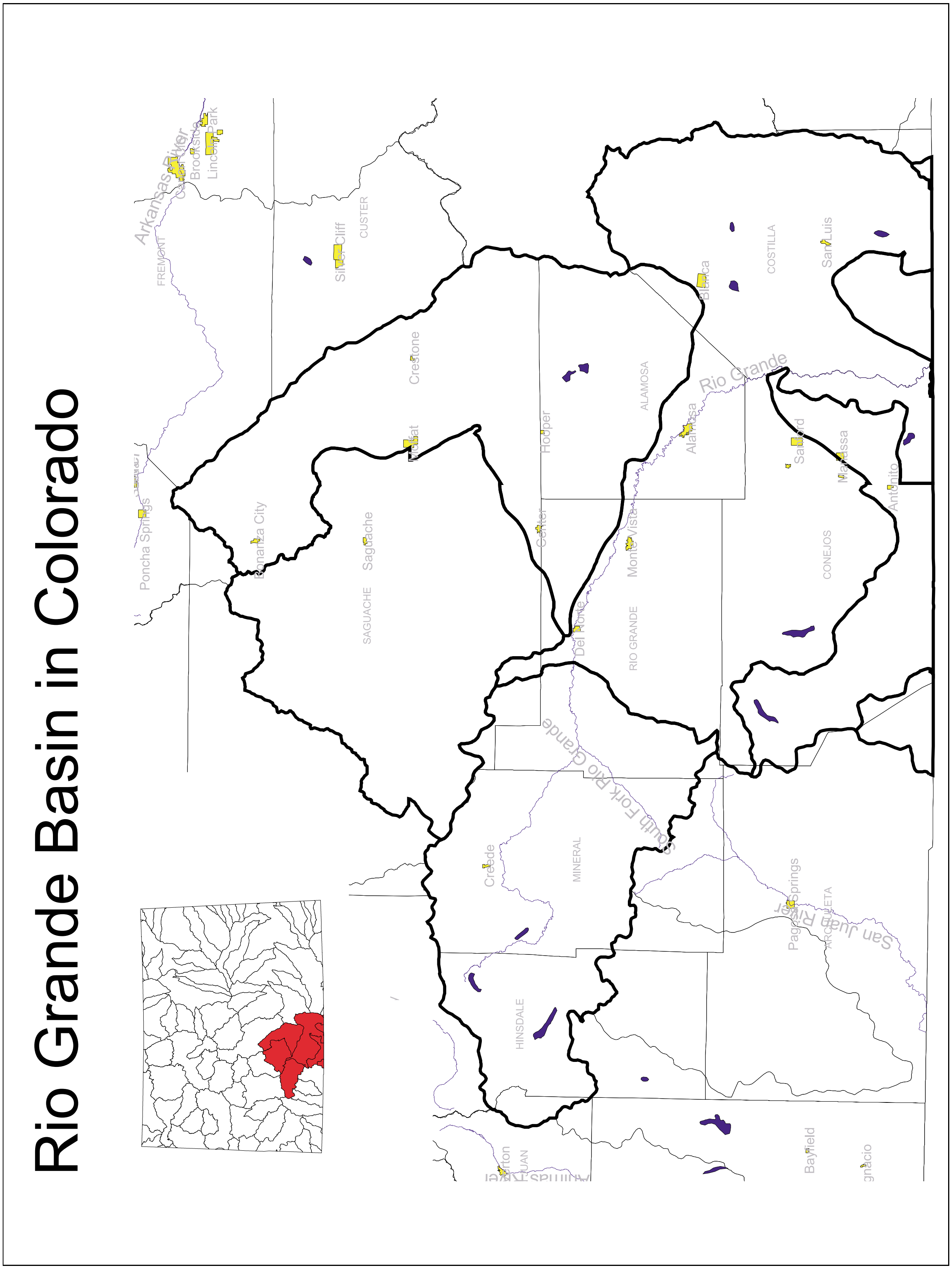
Major Land Use Types:
Forest and Range (square miles): 4888
Agriculture (square miles): 2682
Urban (square miles): 13
Estimated Public Land: 49%

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

Less than 2 percent (43,000) of the state's population lives in the basin. The towns of Alamosa, Monte Vista, Del Norte, and South Fork are the major population centers. The population of Alamosa, Conejos, and Costilla counties have increased 14.2% in the last ten years, whereas the state's population has increased 22.3%.

The San Juan Mountains, which form the western boundary of the San Luis Valley, has several historic mining districts, notably Bonanza, Creede, Platoro, and Summitville. These mining districts experienced intermittent mining and milling operations from the 1870's to the recent. As with other regions in the state with historic mining operations, water quality has been impaired by acid mine drainage from closed and abandoned mines. Acid mine drainage, or acid mine water, usually contains elevated concentrations of metals, which can significantly impair a waterbody's use and harm aquatic species.

Figure 2: Rio Grande Basin in Colorado



a. Basin Description

The San Juan Mountains form the western boundary of the basin, and the Sangre de Cristo Mountains form the eastern boundary. The San Luis Valley, which lies between the San Juan and Sangre de Cristo Mountains, is one of the largest high elevation alpine valleys in the world. The valley floor receives only 7 to 8 inches of precipitation annually, while the headwater regions of the Rio Grande and its tributaries receive more than 50 inches of precipitation annually.

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. The lower basin, beginning around Del Norte and extending to the Colorado border with New Mexico, is a highly productive agricultural area. Large diversions from the mainstem sustain agricultural production. The Rio Grande mainstem is the principle surface drainage in the lower basin. Other streams in the lower basin are small, most never reaching the mainstem due to diversion for irrigation or recharge to the valley alluvium.

Wetlands are found at all elevations of the Rio Grande Basin. The San Luis Valley 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 as part of the Closed Basin Project. Many small first and second order streams drain the Sangre de Cristo Mountains 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 southeastern 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 is diverted for irrigation most of the year.

Land ownership in the basin is a mix of federal, state, and private holdings. The majority of the San Luis Valley is privately owned and is used for agricultural operations. Federal land holdings include the Rio Grande National Forest, the Great Sand Dunes National Monument, the Alamosa and Monte Vista National Wildlife Refuges, and extensive tracts of land administered by the Bureau of Land Management. The ecoregions in the Rio Grande Basin are described below in Table11: Ecoregions in the Rio Grande Basin.

Table 11: Ecoregions in the Rio Grande Basin				
Ecoregion		Land Surface Form [1]	Potential Natural Vegetation[2]	Land Use[3]
21	Southern Rockies	High mountains and tablelands with high relief	Western spruce/fir, Douglas-fir, pine/ Douglas-fir, southwestern spruce/fir, alpine meadows (bentgrass, sedge, fescue, bluegrass)	Forest and woodland grazed
22	Arizona/New Mexico Plateau	Tablelands with considerable to high relief and plains with low mountains	Grama/galleta steppe, Great Basin sagebrush, saltbush/ greasewood	Subhumid grassland and semiarid grazing land, desert shrubland grazed

[1] Hammond, E.H., 1970. “Classes of land-surface form,” in *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. “Potential natural vegetation,” in *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. “Major land uses,” *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from “Ecoregions of the South Central States,” by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987

b. Surface Water Quality Assessment

The water quality in the Rio Grande Basin was comprehensively assessed in 1991-1992 in conjunction with preparation for the triennial review of water quality standards. This was the Division's first basin-wide water quality assessment project. Additional assessments have been conducted in preparation for individual projects and in preparation for the 1998 303(d) List. The next comprehensive Triennial Review Information Hearing for the Rio Grande Basin is scheduled for November 2001, and the Rulemaking Hearing is scheduled for July 2002. In preparation for these hearings, the Division has focused monitoring in this basin.

The 2002 individual designated use support summary of surface water quality for streams and rivers in the Rio Grande Basin is shown in Table 12: Individual Use Summary for Rio Grande River Basin. The assessment shows that over 98% of assessed streams are supporting their designated uses.

Outstanding Waters: There are no stream segments in the Rio Grande Basin that are currently designated as Outstanding Waters. This is because this designation was not available at the time of the last comprehensive triennial review. The Division will propose adding Outstanding Waters to various high-quality waters in the basin, such as those in Wilderness Areas, at the next triennial review.

Water Quality Concerns: The major water quality concerns in the Rio Grande Basin are the effects of historic mining activities. One concern is the Summitville Mine Superfund site in the Summitville mining district, which operated as a surface, heap-leach gold mine from 1984 until December 1992. During its operation, the mine and heap-leach operation leaked cyanide, and acidic, metal-laden waters (including dissolved aluminum, copper, iron, manganese and zinc) into the Wrightman Fork of the Alamosa River. The leakage from the Summitville operations resulted in serious contamination of the Alamosa River and Terrace Reservoir and had a severe impact upon aquatic populations and habitats. The EPA listed the Summitville Mine on the Superfund in May 1994. Since that time, EPA, CDPHE, and local citizens have been working together to rehabilitate waters degraded by the Summitville operation and remediate the site to prevent future water quality degradation. Currently, CDPHE is overseeing a four-year project, begun in 1999, to revegetate the mine site and improve storm-water controls. There has been an improvement in water quality in the Alamosa River in recent years.

East and West Willow Creek in the Creede mining district are degraded from legacy mining activities. A local stakeholders group called the Willow Creek Reclamation Committee, is working with local, state and federal agencies to conduct a comprehensive study and cleanup of the sites.

The Bonanza mining district is also listed as a Superfund site. Historic mining activities have also impacted streams in this area. The U. S. Forest Service is conducting an extensive cleanup of the Bonanza area. To date the Forest Service has reclaimed the Superior Mill Site and is treating acid mine drainage form the Rawley 12 adit. Cleanup is expected to be completed in 2002. The Platoro mining district is also listed as a Superfund site with similar water quality impacts.

Table 12: Individual Use Summary for Rio Grande River Basin (in river miles)

Use	Size Assessed	Size Fully Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life Cold 1	3,755	3,684	71	1,325*
Aquatic Life Cold 2	146	133	13	0
Aquatic Life Warm 1	53	53	0	0
Aquatic Life Warm 2	969	969	0	0
Primary Contact (Recreation, Class 1)	3,417	3,417	0	0
Secondary Contact (Recreation, Class 2)	2,828	2,828	0	0
Drinking Water Supply	3,509	3,481	28	0
Agriculture	6,243	6,207	36	0

* No aquatic life use is designated for these waters.

c. Impaired Waters

The 1998 303(d) List waters in the Rio Grande Basin are shown below in Table 13: Impaired Waters in the Rio Grande River Basin with their associated TMDL project status. There are currently 11 stream segments in the Rio Grande Basin that are on the 303(d) list. Other water quality concerns in the basin include the ongoing cleanup at the Summitville Superfund site, agricultural runoff in the San Luis Valley, and acid mine drainage from closed and abandoned mines in the San Juan and Sangre de Cristos Mountains.

Table 13: Impaired Waters in the Rio Grande River Basin (Continued)

Waterbody ID (WBID)	*Waterbody Description*	*Portion*	*Pollutant or Condition*	*Causes*	*TMDL Project Status*	*Projected Completion Date*
CORGCB12	Saguache Ck and tributaries above Ford Creek	Big Springs Creek	Sediment	Forest Roads	Delist, rehab. completed *	6/00
CORGRG04	Rio Grande R., below Willow Creek, to Alamosa County line	Upper 5 miles	Cd, Zn	Mining	Pending	6/06
CORGRG30L	Sanchez Res.	All	Hg	Unknown	Data collection ongoing	6/02
CORGAL03	Alamosa R., Alum Ck., to Wightman Fork	All	pH, Al, Fe, Cu, Mn	Mining	Pending	6/04
CORGAL03B	Alamosa R., Wightman Fork to Terrace Res.	All	pH, Al, Cu, Fe	Mining	Pending	6/04
CORGAL05	Wightman Fork, & tributaries, source to S30, T37N, R4E	All	Fe, Zn	Mining	Pending	6/04
CORGAL08	Terrace Res.	All	pH, Cu, Mn, Zn	Mining	Pending	6/04
CORGAL09	Alamosa R., Terrace Res. to CO Hwy.15	All	pH, Cu, Fe, Mn, Zn	Mining	Pending	6/04
CORGAL10	Alamosa R., below CO Hwy.15	All	Cu, Mn, Fe	Mining	Pending	6/04

CORGCB09	Kerber Ck., above Brewery Ck. and tributaries exc. 8	All	Cd, Cu, Mn, Ag, Zn	Mining	Pending	6/06
CORGCB09 B	Kerber Ck., Brewery Ck., to San Luis Ck.	All	Cd, Cu, Zn	Mining	Pending	6/06
* Indicates information obtained after the 1998 303(d) list was produced.						

d. Trend Analysis

The Rio Grande flows across the southern state boundary into New Mexico. The USGS flow gage and water quality station on the Rio Grande near Lobatos, Colorado, USGS #08251500, was used to evaluate trends. Fifty parameters were evaluated with nine showing recent trends. Several nutrients demonstrated downward trends as did dissolved oxygen. Statistically significant trends are included in Table 14: Water Quality Trend Analysis for the Rio Grande River Basin.

Table 14: Water Quality Trend Analysis for the Rio Grande River Basin

Parameter	Period of Record	No. of Data Points	Trend
Dissolved Aluminum	1982-1996	43	Slight downward
pH	1970-1996	210	Upward
Dissolved Oxygen	1969-1996	130	Slight downward
Total NH_3 + NH_4	1977-1993	74	Slight downward
Dissolved Phosphorus	1977-1997	105	Downward
Dissolved Ortho Phosphate	1969-1996	79	Downward
Alkalinity	1986-1993	38	Downward
Conductivity	1947-1997	203	Slight downward
Total Alkalinity	1969-1993	67	Downward

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3. San Juan River Basin

The San Juan and Dolores Rivers in southwestern Colorado are both tributaries of the Colorado River. The principal tributaries of the San Juan River are the Animas, Florida, La Plata, Los Pinos, Mancos, and Piedra Rivers. The main tributary of the Dolores River is the San Miguel River. The San Juan River and its tributaries pass through the Ute Mountain Indian Reservation and the Southern Ute Indian Reservation before exiting the state.

San Juan River Basin Overview

Counties: Archuletta, Montezuma, La Plata, Dolores, San Juan, portions of Montrose, Hinsdale, Mineral
Major Population Centers: Cortez, Durange, Pagosa Springs
Population[1]: 94,600

Surface Area (square miles): 6,667
Total Stream Miles: 7,103
Number of Lakes (Perennial lakes/reservoirs > 10 acres): 71
Lake Acres (Perennial lakes/reservoirs > 10 acres): 10,254

Major Land Use Types:
Forest and Range (square miles): 4888
Agriculture (square miles): 1755
Urban (square miles): 23
[redacted]

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

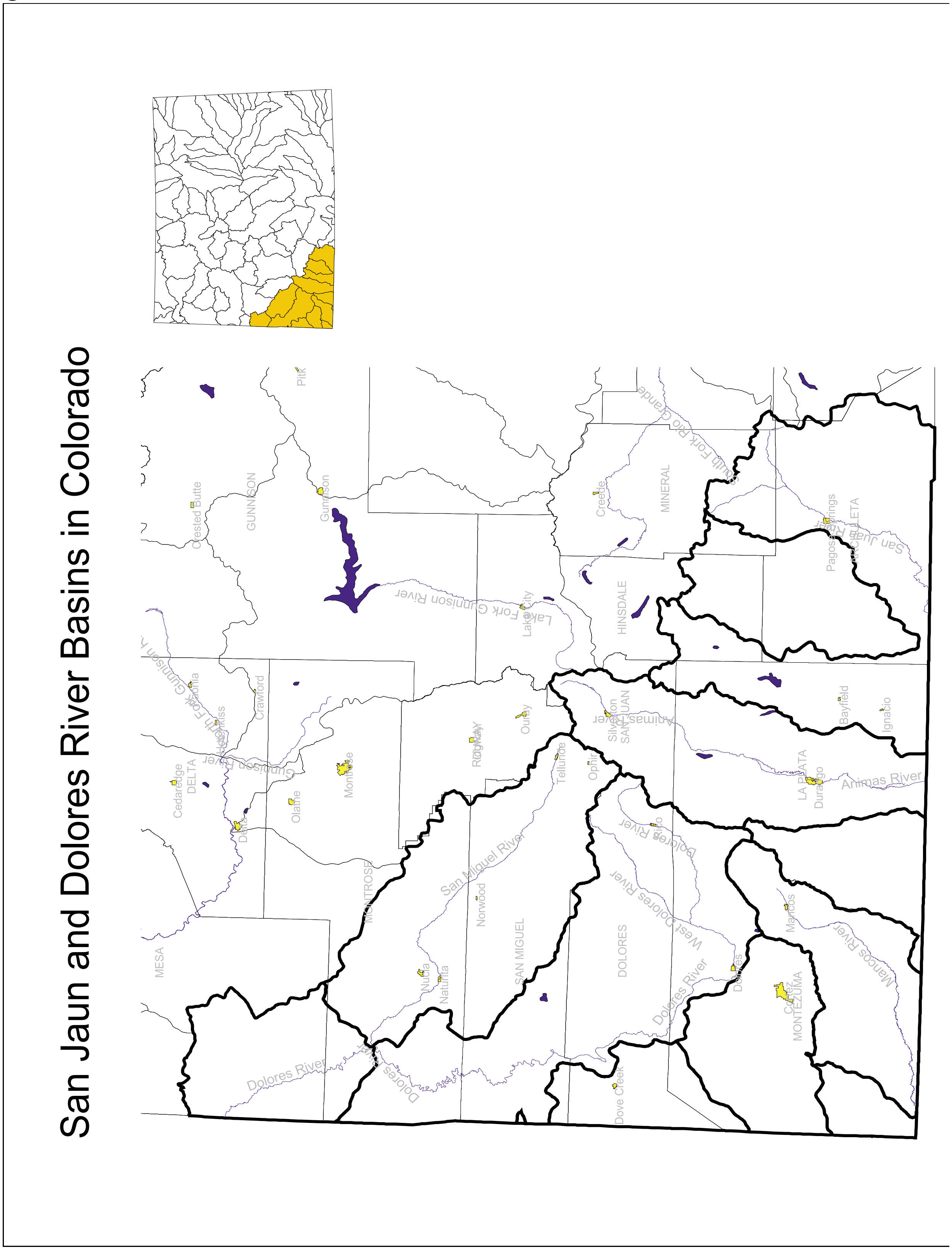
Both the San Juan and Dolores Rivers have their headwaters over 13,000 feet above sea level in the San Juan Mountains. They both exit the state below 7,000 feet above sea level, after having passed through seven distinct ecosystems.

Population growth is a major concern to water quality in the basin. Between 1990 and 2000, the basin's population rose 25% to a population of approximately 94,600. There is concern that the high growth rate will tax the ability of communities to provide adequate wastewater treatment.

The San Juan and Dolores Basin has high quality surface water except for areas in the headwaters of the Animas River near Silverton, Colorado and the Dolores River near Rico, Colorado. In these two areas, historic mining and milling operations have resulted in high metal loads being contributed to these rivers and their tributaries. The metal loading has significantly affected the ability of the upper reaches of these streams and rivers to support aquatic life. Local efforts to remove mine tailings and close mine adits and shafts are underway at both locations. Another water quality concern is salinity loading to the Dolores River from salt formations in the Paradox Valley. The U.S. Bureau of Reclamation operates a facility on the Dolores River near Paradox, Colorado that prevents groundwater brine from entering the Dolores River. The facility prevents up to 128,000 tons of salt from entering the Dolores River per year.

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

Figure 3: San Juan River Basin in Colorado



a. Basin Description

San Juan Basin: The San Juan Mountains form the eastern boundary of the San Juan Basin and the Colorado River forms the western. The Animas, Florida, La Plata, Los Pinos, Mancos, and Piedra Rivers, all tributaries to the San Juan River, flow southward out of Colorado and join the San Juan in northern New Mexico. The main population center is Durango on the Animas River.

Dolores Basin: The main tributary of the Dolores River is the San Miguel River. The San Miguel River flows north from the high mountains around Telluride and joins the Dolores near Uravan, Colorado. The Dolores River flows northwest and joins the Colorado in eastern Utah. The main population centers are Dolores (population 1,074) on the Dolores River and Telluride (1,988) on the San Miguel River.

Ecoregions: The two major ecoregions in the San Juan/Dolores Basins are the Southern Rocky Mountain (21) and the Arizona/New Mexico Plateau (22). These ecoregions are described in Table 15: Ecoregions in the San Juan River Basin.

Table 15: Ecoregions in the San Juan River Basin

Ecoregion		Land Surface Form [1]	Potential Natural Vegetation[2]	Land Use[3]
21	Southern Rockies	High mountains and tablelands with high relief	Western spruce/fir, Douglas-fir, pine/ Douglas-fir, southwestern spruce/fir, alpine meadows (bentgrass, sedge, fescue, bluegrass)	Forest and woodland grazed
22	Arizona/New Mexico Plateau	Tablelands with considerable to high relief and plains with low mountains	Grama/galleta steppe, Great Basin sagebrush, saltbush/ greasewood	Subhumid grassland and semiarid grazing land, desert shrubland grazed

[1] Hammond, E.H., 1970. “Classes of land-surface form,” in *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. “Potential natural vegetation,” in *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. “Major land uses,” *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from “Ecoregions of the South Central States,” by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987

b. Surface Water Quality Assessment

In Colorado, surface water quality is assessed primarily in conjunction with preparation for the review of water quality standards, as well as for special projects and preparation of the 303(d) List. Water quality standards for the waters comprising the San Juan and Dolores Basin are contained in two regulations: 1) Classifications and Numeric Standards for the San Juan and Upper Dolores River Basins, Regulation No. 34; and 2) Classifications and Numeric Standards for the Gunnison and Lower Dolores River Basins, Regulation No. 35.

The water quality of Gunnison and Lower Dolores Basin and the San Juan and Upper Dolores Basins was assessed in 1999 and 2000 for a standards review hearing in July, 2001.

Designated Use Support Summary: The following table summarizes the surface water quality assessment for streams and rivers in the San Juan and Dolores Basin (Table 16: Individual Use Summary for San Juan/Dolores River Basin). The assessment shows that 95% of stream miles assessed are supporting cold-water aquatic life.

Table 16: Individual Use Summary for San Juan/Dolores River Basin
(in river miles)

Use	Size Assessed	Size Fully Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life Cold 1	3,101	2,916	184	51*
Aquatic Life Cold 2	1,535	1,494	41	0
Aquatic Life Warm 1	317	317	0	0
Aquatic Life Warm 2	3,000	1,410	1,589	0
Primary Contact (Recreation, Class 1)	7,780	7,780	0	0
Secondary Contact (Recreation, Class 2)	99	99	0	0
Drinking Water Supply	4,415	4,412	2	0
Agriculture	7,495	7,470	25	0

* No aquatic life use is designated for these miles.

c. Impaired Waters

The 1998 303(d) List waters in the San Juan River Basin are shown below in Table 17: Impaired Waters in the San Juan/Dolores Basins with their associated TMDL project status. There are currently 13 stream segments in the San Juan River Basin that are on the 303(d) List. Other water quality concerns in the basin include the ongoing cleanup at the Uravan Superfund site, agricultural runoff, and acid mine drainage from closed and abandoned mines in the San Juan Mountains and Uncompahgre Plateau.

Table 17: Impaired Waters in the San Juan/Dolores Basins

Waterbody ID (WBID)	*Waterbody Description*	*Portion*	*Pollutant or Condition*	*Causes*	*TMDL Project Status*	*Projected Completion Date*
COSJAF02	Animas R. & Tribs., Denver Lake to Maggie Gulch	All	Al, Cd, Cu, Fe, Pb	Mining	Data collection ongoing	6/02
COSJAF03B	Animas R., Cement Creek to Mineral Creek	All	Al, Cd, Cu, Fe, Pb	Mining	Data collection ongoing	6/02
COSJAF04A	Animas R., Mineral Creek to Elk Creek	All	pH, Cu, Fe, Zn	Mining	Data collection ongoing	6/02
COSJAF04B	Animas R., Elk Creek to Junction Creek	All	Zn	Mining	Data collection ongoing	6/02
COSJAF07	Cement Creek, source to Animas River	All	Al, Cd, Cu, Fe, Pb	Mining	Data collection ongoing	6/02
COSJAF08	Mineral Creek, source to S. Mineral Creek	All	Al, Cd, Cu, Fe, Pb	Mining	Data c collection ongoing	6/02
COSJAF09B	Mineral Creek, S. Fork. Mineral Creek to Animas R.	All	pH, Cu, Fe, Zn	Mining	Data collection ongoing	6/02
COSJDO03	Dolores R., Horse Creek to Bear Creek	All	Mn	Mining	To be resolved by delisting*	--
COSJDO04L	Dolores R., Bear Creek to Bradfield Ranch Bridge	McPhee Res.	Hg	Unknown	Data collection ongoing	6/02
COSJDO05	Tribs. to Dolores R., above W. Dolores	Silver Creek above Rico H2O	Cd, Mn, Zn	Mining	Pending	6/04
COSJDO09	Silver Creek, from Rico's diversion to Dolores R.	All	Cd	Mining	*Cd in attainment of standard	6/04
COSJLP04	Mancos R. and tribs above Hwy 160	Box Canyon	Sediment	Roads and Silvicuture	Final TMDL Available	--

Table 17: Impaired Waters in the San Juan/Dolores Basins (Continued)

COSJLP08L	Narraguinnep, Puett and Totten Reservoir.	Narraguinnep Res.	Hg	Unknown	Data collection ongoing	6/02
Waterbody ID (WBID)	***Waterbody Description***	***Portion***	***Pollutant or Condition***	***Causes***	***TMDL Project Status***	***Projected Completion Date***
COSJSJ09a	Rio Blanco River	Lower Rio Blanco R.	Sediment	Other	Pending	6/30/06

* Indicates information obtained after the 1998 303(d) list was produced.

d. Trend Analysis

The San Juan River flows out of state downstream of Navajo Reservoir. The major tributaries to the San Juan have their confluences downstream of the state boundary. The USGS flow gage and water quality station on the Animas River near Cedar Hill, New Mexico (located in Colorado upstream of the stateline), USGS #09363500, was used to evaluate trends. Of the 34 parameters evaluated, only DO showed a trend. From 1973 to 1997, the 127 data points indicate an upward trend in DO.

4. Colorado River Basin

The Colorado Basin is the second largest basin in Colorado, covering 20% of the state. The flow of water through the basin is much greater than 20 percent; in fact, it is greater than the combined flow of all the other basins in the state. This basin includes the Colorado River and the tributaries that join it in Colorado. Major tributaries include the Blue, Eagle, Roaring Fork, Gunnison, Uncompahgre, and San Miguel Rivers. Grand Junction, located at the confluence of the Colorado and Gunnison Rivers is the largest population center (40,600) in the basin. The population within the major municipalities in the basin exceeds 364,600.

The natural quality of water in high mountain headwaters is generally extremely good. Portions of the headwaters of all major drainages have been designated as Outstanding Waters. Due to the very low concentrations of natural pollutants, the streams are very sensitive to man-made additions of pollutants, with little buffering capacity. Mining and growth can affect the beneficial uses of high mountain streams through their associated pollutant loadings, particularly in relation to the aquatic life use of streams. Since many high mountain streams are located in relatively narrow valleys, there is the additional high potential for affecting aquatic life simply through the loss of habitat.

Colorado River Basin Overview

Counties: Delta, Eagle, Grand, Ouray, Pitkin, San Miguel, Summit, Gunnison, Mesa, Moffat, Montrose, and portions of Dolores, Garfield, Hinsdale, Montezuma, Saguache and Routt

Major Population Centers: Aspen, Delta, Grand Junction, Glenwood Springs, Gunnison, Montrose, Vail

Population[1]: 364,600

Surface Area (square miles): 18,140
Total Stream Miles: 24,708
Number of Lakes (> 10 acres): 318
Lake Acres (> 10 acres): 28,644

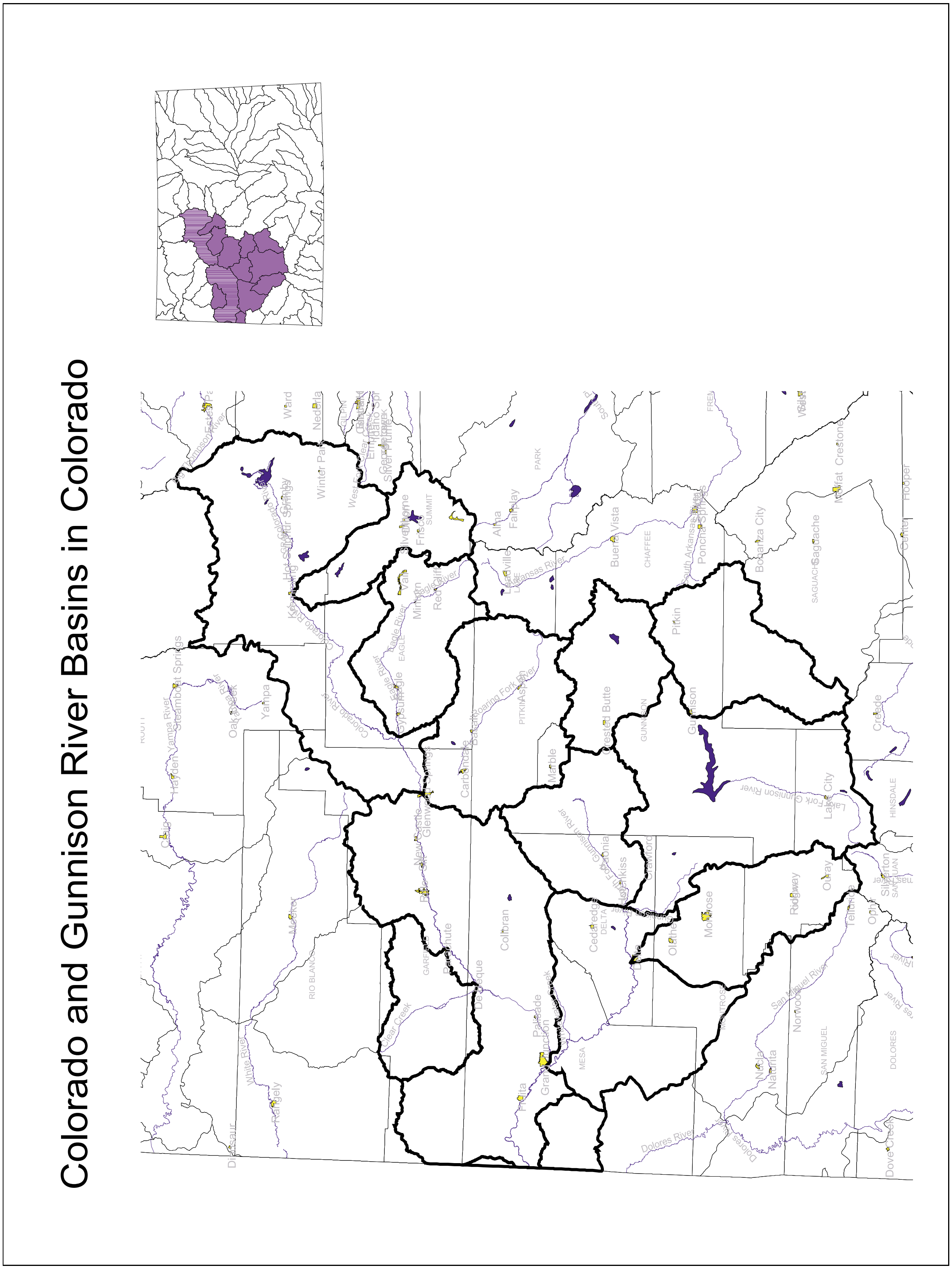
Major Land Use Types:
Forest and Range (square miles): 15,760
Agriculture (square miles): 1,320
Urban (square miles): 1,100
[redacted]

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

Population in the basin, as in the remainder of the State, continues to increase. This is especially true in the upper reaches of the basin where communities have expanded the local economic base from one based exclusively on skiing to one incorporating year round recreational opportunities. Garfield, Pitkin, Summit, and Grand Counties have experienced a combined 29% population increase from 1990 to 2000. The statewide percentage increase is 23%. These localities have experienced significant growth and, as a result, increased infrastructure needs include expanded wastewater treatment capacity. Advanced municipal wastewater treatment facilities and control of nonpoint sources of pollution from urbanized areas tributary to Dillon Reservoir and the Fraser, the Eagle, and Roaring Fork Rivers have been necessary to maintain the existing high quality of these waters.

In the lower lying areas of the basin, different climatic conditions, more erodible or alkaline soils, and some of the underlying geologic formations (e.g. Mancos Shale) affect the quality of water. The lower reaches of the Colorado River mainstem carry an unusually heavy sediment load. The red color of the soil being washed downstream is the source of the name "Colorado".

Figure 4: Colorado and Gunnison River Basins in Colorado



a. Basin Description

The Colorado River Basin encompasses almost 20,000 square miles in western Colorado. Major tributaries include the Blue, Eagle, Roaring Fork, Gunnison, and Uncompahgre Rivers. The eastern boundary is the Continental Divide with mountain peaks often-over 14,000 feet elevation. The basin is bordered on the north by the North Platte and Green River Basins; and on the south by the Rio Grande, San Juan and Dolores River Basins.

The headwaters of the region are generally high mountain areas, with tundra and alpine or sub-alpine forests. Moving downstream, there is a transition to wooded uplands, semi-desert shrub lands, desert shrub lands, and, at the lowest elevations, salt deserts.

Land Use: A substantial portion of the basin is comprised of federally owned land. Livestock grazing, recreation and timber harvest are the predominant uses of federal lands. Active and inactive mines can be found in the basin. Coal mining occurs in the central portion of the Roaring Fork Valley, North Fork of the Gunnison Valley and in the lower Colorado Valley. Metals' mining has occurred in the higher elevations in the mineral belt. Lower elevation river bottoms and the area near the confluence of the Colorado and the Gunnison Rivers are also used for irrigated agriculture. The Uncompahgre Valley is extensively farmed using irrigation water diverted through the Gunnison Tunnel.

Ecoregions: The ecoregions in the Colorado River Basin are the Wyoming Basin, Colorado Plateaus, and Southern Rockies. These are described in Table 18: Ecoregions in the Colorado River Basin.

Table 18: Ecoregions in the Colorado River Basin

Ecoregion		***Land Surface Form [1]***	***Potential Natural Vegetation[2]***	***Land Use[3]***
18	Wyoming Basin	Plains with hills or low mountains	Sagebrush steppe, wheatgrass/needlegrass shrub-steppe, saltbush/ greasewood, juniper/pinyon woodland	Desert shrubland grazed, some irrigated agriculture
20	Colorado Plateaus	Tablelands with considerable to very high relief, plains with high mountains	Saltbush/greasewood, blackbush, juniper/ pinyon woodland, Great Basin sagebrush	Open woodland grazed, desert shrubland grazed, some irrigated agriculture
21	Southern Rockies	High mountains and tablelands with high relief	Western spruce/fir, Douglas-fir, pine/ Douglas-fir, southwestern spruce/fir, alpine meadows (bentgrass, sedge, fescue, bluegrass)	Forest and woodland grazed

Table 18: Ecoregions in the Colorado River Basin (Continued)

[1] Hammond, E.H., 1970. "Classes of land-surface form," in *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. "Potential natural vegetation," in *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. "Major land uses," *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from "Ecoregions of the South Central States," by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987.

b. Surface Water Quality Assessment

Surface water assessment activities have been driven in greatest part in support of the development of water quality standards. Additional assessments are performed in support of CDPS Permits and the 303(d) List of Impaired Waters.

Water quality standards for the waters comprising the Colorado basin are contained in three regulations: 1) Classifications and Numeric Standards for the Upper Colorado River Basin and North Platte River, Regulation No. 33; 2) Classifications and Numeric Standards for the Lower Colorado River Basin, Regulation No. 37; and 3) Classifications and Numeric Standards for the Gunnison and Lower Dolores River Basins, Regulation No. 35. Each regulation is reviewed on a three year, or triennial basis.

The Upper Colorado standards were subject of a 1999 rulemaking hearing. Water quality assessments in support of the standard revisions were developed in 1999 and were later utilized in development of the potential 2000 303(d) List of Impaired Waters. The Lower Colorado and Gunnison standards were subject of a July 2001 rulemaking hearing. Assessments for these basins were previously completed in 1997 during preparation of the state's current 303(d) List of Impaired Waters and again in 1999 in preparation for a potential 2000 303(d) List submittal.

c. Individual Use Support Summary:

Table 19: Individual Use Summary for the Entire Colorado River Basin (in river miles) presents a summary of the designated use support status of streams and rivers in the entire Colorado River Basin. Approximately 62 percent of the Colorado Basin's 24,700 stream miles have been assessed.

Table 19: Individual Use Summary for the Entire Colorado River Basin (in river miles)

Use	*Size Assessed*	*Size Fully Supporting*	*Size Not Supporting*	*Size Not Attainable*
Aquatic Life Cold 1	8,937	8,691	246	0
Aquatic Life Cold 2	1,087	1,086	1	0
Aquatic Life Warm 1	95	95	0	0

Table 19: Individual Use Summary for the Entire Colorado River Basin (in river miles)

Use	*Size Assessed*	*Size Fully Supporting*	*Size Not Supporting*	*Size Not Attainable*
Aquatic Life Warm 2	5,095	5,094	1	0
Primary Contact (Recreation, Class 1)	8,876	8,876	0	0
Secondary Contact (Recreation, Class 2)	3,669	3,635	35	0
Drinking Water Supply	11,297	11,216	82	0
Agriculture	15,218	15,210	8	0

* No aquatic life use is designated for these miles.

Many segments were assessed in 2000 and 2001 in anticipation of a 2000 303(d) List submittal and for the Lower Colorado and Gunnison triennial rulemaking hearings, respectively. Many of these waters were demonstrated to be fully supporting all designated uses. Parameters assessed for these waters included: pH, dissolved oxygen, cadmium, copper, iron, lead, manganese, selenium, zinc, fecal coliform, unionized ammonia, and nitrates plus nitrites. In addition, many of these waters were assessed for aluminum, silver, arsenic, boron, mercury, nickel, and total sulfates. These waters included portions of the following rivers: Gunnison River and tributaries, Colorado River and tributaries, Yampa River, White River, Blue River and Eagle River. The triennial review assessments are documented in the associated regulation rationale documents submitted in accordance with the rulemaking hearing proceedings.

Outstanding Waters: Areas of exceptionally high quality waters are designated as "Outstanding Waters". The Outstanding Waters designation has been assigned to headwater portions of each of the major drainages in the basin. These include portions of the Colorado, Fraser, Blue, Eagle, Williams Fork, White, Gunnison, Uncompahgre, and San Miguel Rivers. Much of the headwaters are located in pristine environments upstream of developed areas. The upper portions of the Colorado River are located within Rocky Mountain National Park, which is a protected area. Portions of the Gunnison River flow through Wilderness Areas, a National Park, and a National Conservation Area. Many of the other basin headwaters also originate in protected Wilderness Areas.

Water Quality Concerns: Water quality is affected by various land uses within the basin including mining operations, agriculture and municipal growth and development. Pollutant loading associated with metals mining and growth may affect water quality in high elevation streams. Different land uses in the lower basin elevations, different climatic conditions, more erodible or alkaline soils, and underlying geologic formations also affect surface water quality. Because of the semi-arid climate, agriculture in the lower basin is dependent upon an extensive system of canals and ditches. Irrigation of soils overlaying the Mancos shales has contributed to the loading of salts and selenium in the basin.

Mining - Much effort has gone into controlling the impacts from active mines and remediating the impacts of inactive mines. In the higher elevations, most mining activities currently are, or have been, related to metals production-mainly gold, silver, or molybdenum. Coal production is the major mining activity in the lower elevations. In both types of mining, the reactions of water, air and minerals can produce acidic water, which can then leach metals from the exposed rock. Many historic mining districts in the high mountain areas include draining adits, tailings piles and waste rock piles, which contribute to metals loading in the rivers.

The water quality of several stream segments in the basin indicates that there may be some degree of non-attainment to aquatic life due to elevated concentrations of metals. Zinc is generally the most common metal to exceed standards. Zinc, copper, and cadmium levels are high on sections of the Blue, Eagle, and San Miguel Rivers. Portions of these watersheds drain areas that were extensively mined in the late 1800's and early 1900's. Probable sources of the metals have been identified in previous 305(b) reports. Natural Resources Damage Suits (NRDS) have been settled at locations on the Eagle and San Miguel Rivers and clean-up actions are ongoing that should improve the water quality. Portions of the Blue River mainstem, French Gulch, the Snake River, San Miguel River and Peru Creek have been included on the state's 303(d) list due to non-attainment of metal standards.

Mining is one part of 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 that 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. Except for coal mining along the North Fork of the Gunnison, the other mining activities in the Gunnison Basin are virtually inactive now, due to depressed prices in the metals industry. The NRDS against the mining operation on the upper San Miguel River is also in effect against the same company for problems on Red Mountain Creek, a tributary of the Uncompahgre above Ouray. The lawsuit on Red Mountain Creek has been settled and remediation is underway.

Agriculture - Agriculture is another main part of the economic foundation of the Gunnison Basin. Portions of the Gunnison River and its tributaries, and the Uncompahgre River, are included on the 303(d) list due to non-attainment of selenium standards. Selenium is present in the Mancos Shale that underlies extensive areas within the basin. The Uncompahgre Valley is extensively irrigated through Mancos Shale soils, which are suspected of adding to selenium loads in the Uncompahgre River. A stakeholder group has formed and is working on this issue. TMDLs addressing selenium in the Gunnison River basin are scheduled for completion in 2004. A TMDL for the Uncompahgre River is scheduled for mid-2008. Four species of threatened and endangered fish exist in the Colorado River and efforts are underway to identify major selenium sources and implement practices that will reduce selenium levels.

Growth –Much of the region's economy depends on outdoor recreation and water-based activities, such as fishing, whitewater boating, flat water boating, camping, and hiking. Growth in resort communities has created the need for expanded infrastructure including development of additional wastewater treatment capacity. The Gunnison basin is experiencing significant growth and conversion of agricultural land to subdivisions.

Development of mountain communities has also led to concerns and control of nutrient loadings. Studies have shown that reservoirs such as Dillon may be extremely sensitive to additional phosphorus loading due to their naturally high quality waters and low phosphorus concentrations. Elevated phosphorus contributions have been demonstrated to cause accelerated eutrophication of those waterbodies. Special phosphorus standards and wasteload allocations have been incorporated into a control regulation 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 the phosphorus standard in the reservoir. The Dillon Reservoir Control Regulation was revisited during a rulemaking hearing in January 2001.

d. Impaired Waters

The impaired river segments in the Colorado and Gunnison River Basins are shown on Table 20: Impaired Waters in the Colorado and Gunnison Basin, with the current status and tentative schedule for completion of TMDLs. The San Miguel River (COGUSM03B) and Straight Creek (COUCBL18) Sediment TMDLs were submitted to and approved by EPA in the summer of 2000. In addition, the Un-named Tributary to Willow Creek Ammonia TMDL (COUCUC06C) was submitted to and approved by EPA in the summer of 2000.

Table 20: Impaired Waters in the Colorado and Gunnison Basins

Waterbody ID (WBID)	*Waterbody*	*Portion*	*Pollutant or Condition*	*Sources*	*TMDL Project Status*	*Projected Completion Date*
COGULG02	Gunnison R., Uncompahgre R. to Colorado R.	All	Se	Agriculture	Data collection ongoing	6/04
COGULG09	Fruit Growers Res.	All	F. Coli, NH3	Municipal Discharge, Agriculture	Delisting Pending	6/02
COGUNF05	Various tribs to N. Fork Gunnison R., USFS boundary to N. Fork	especially tribs in and d/s of Mancos shale	Se	Agriculture	Data collection ongoing	6/04
COGUSM03	San Miguel R., BridalVeil & Ingram Creek To Marshall	Below historic mining (Idarado)	Zn	Mining	Pending CERCLA action	6/06
COGUSM03	San Miguel R. Marshall Creek S. Fork San Miguel	Below historic mining (Idarado)	Sediment Cd, Mn, Zn,	Urban Runoff, Mining	Sediment TMDL Available; Cd, Zn pending CERCLA action	Sediment 06/00 Cd, Mn, Zn 6/06

Table 20: Impaired Waters in the Colorado and Gunnison Basins (Continued)

Waterbody ID (WBID)	***Waterbody***	***Portion***	***Pollutant or Condition***	***Sources***	***TMDL Project Status***	***Projected Completion Date***
COGUSM06	Marshall Creek, source to San Miguel R.	All	Zn	Mining	Pending	6/04
COGUUG08	Slate R., Coal Creek To East R.	All	Fe, Mn		Pending	6/08
COGUUN04	Uncompaghre R., US Hwy. 550 to Gunnison R.	All	F. Coli, Se	Agriculture	Data collection ongoing	6/04
COGUUN14	Sweitzer Lake	All	Se	Agriculture	Pending	6/04
COUCBL02	Blue R., French Gulch to Swan R.	All	Cd, Zn	Mining	Data collection ongoing	6/04
COUCBL06	Snake R., source to Dillon Res.	Below Peru Creek	Cd, Cu, Pb, Mn, Zn	Mining	Data collection ongoing	6/06
COUCBL07	Peru Creek, source to Snake R.	All	Cd, Cu, Mn	Mining	Data collection ongoing	6/06
COUCBL11	French Gulch, 1.5 mi. below Lincoln to Blue R.	All	PH, Cd, Zn	Mining	Data collection ongoing	6/04
COUCBL18	All tribs to Blue R. Dillon Res. to Green Mtn. Res.	Straight Creek, source to Blue R.	Sediment	Road Runoff	TMDL Available	6/00
COUCEA05	Eagle R., Belden to Gore Creek	All	Cd, Zn, Mn	Mining	* Cd in attainment of standard; Zn, Mn pending	6/06
COUCEA07	Cross Creek, source to Eagle R., exc. segment 1	Lower portion near mouth	Cd, Zn, Mn	Mining	*Cd in attainment of standard; Zn, Mn pending	6/06
COUCEA09	Eagle R., Gore Creek to Colorado R.	All	Mn	Mining	Pending	6/06

Table 20: Impaired Waters in the Colorado and Gunnison Basins (Continued)

Waterbody ID (WBID)	***Waterbody***	***Portion***	***Pollut-ant or Condi-tion***	***Sources***	***TMDL Project Status***	***Projected Comple-tion Date***
COUCRF09	Coal Creek, source to Crystal R.	All	Fe	Mining	Data collection ongoing	6/08
COUCUC06 C	Tributary. to Willow Creek, Willow Creek Res.	Un-named tributary to Willow Creek	NH3	Municipal Point Source	TMDL Available	6//00
COUCUC08	Williams Fork R., source to Colorado R.	All	Mn	Natural	* Delist – standards changed	11/99

* indicates information obtained after the 1998 303(d) List was produced

e. Trend Analysis

The Colorado River flows across the state boundary downstream of Fruita, Colorado. The USGS flow gage and water quality station on the Colorado River near the Colorado-Utah State line, USGS #09163500, was used to evaluate trends. Forty-eight parameters were evaluated, with eleven showing recent trends. Dissolved iron and selenium showed downward trends from the 1970's to 1997. Fecal coliform showed downward trends from 1977 to 1995. Conductivity and suspended sediment showed downward trends through 1997. An upward trend is noted in pH through 1997. Several nutrients demonstrated slight downward trends. Downward trends in pathogens may be attributable to improved point source controls. Statistically significant trends are included in Table 21: Water Quality Trends in the Colorado River Basin.

Table 21: Water Quality Trends in the Colorado River Basin

Parameter	***Period of Record***	***No. of Data Points***	***Trend***
Dissolved Iron	1974-1997	90	Downward
Dissolved Selenium	1979-1997	103	Downward
Dissolved Arsenic	1979-1990	48	Upward
Dissolved Cadmium	1979-1996	50	Slight downward
Dissolved Nickel	1979-1996	64	Slight downward
Total Sulfate	1969-1997	184	Downward
Total Kjeldahl Nitrogen	1979-1997	121	Slight downward
pH	1969-1997	180	Upward
Conductivity	1969-1997	203	Slight downward
Fecal coliform	1977-1995	95	Slight downward
Suspended Sediment	1976-1997	159	Slight downward

5. Green River Basin

The Green River Basin in Colorado is comprised of the Yampa and White River Basins, the principal Colorado tributaries to the Green River. The Green River, which originates in Wyoming, enters the northwest corner of the state from Utah where it is joined by the Yampa in Dinosaur National Monument. The Green then turns back into Utah, where it is joined by the White River. The Yampa and White River are among the least developed rivers in Colorado. They originate in the high alpine forests of the Flat Tops Wilderness Area.

This basin is large (10% of the state), but sparsely populated (38,860 people)—accounting for less than 1% of Colorado's population. Craig is the largest city in the basin with a population of approximately 9,200. The total population of the municipalities listed in Overview is 38,860. The natural quality of the water in the basin is good, with high mountain headwaters generally extremely good; portions of the headwaters have been designated as Outstanding Waters. However, there are water quality concerns in the basin. Lower elevation water bodies in the more arid regions have experienced impacts from naturally occurring salts and accelerated sedimentation.

Green River Basin Overview

Counties: Garfield, Moffat, Routt, Rio Blanco

Major Population Centers: Craig, Steamboat Springs, Meeker, Rangely, Hayden

Population[1] 38,860

Surface Area (square miles): 21,353
Total Stream Miles: 14,600
Number of Lakes (Perennial lakes/reservoirs > 10 acres): 318
Lake Acres (Perennial lakes/reservoirs > 10 acres): 28,644

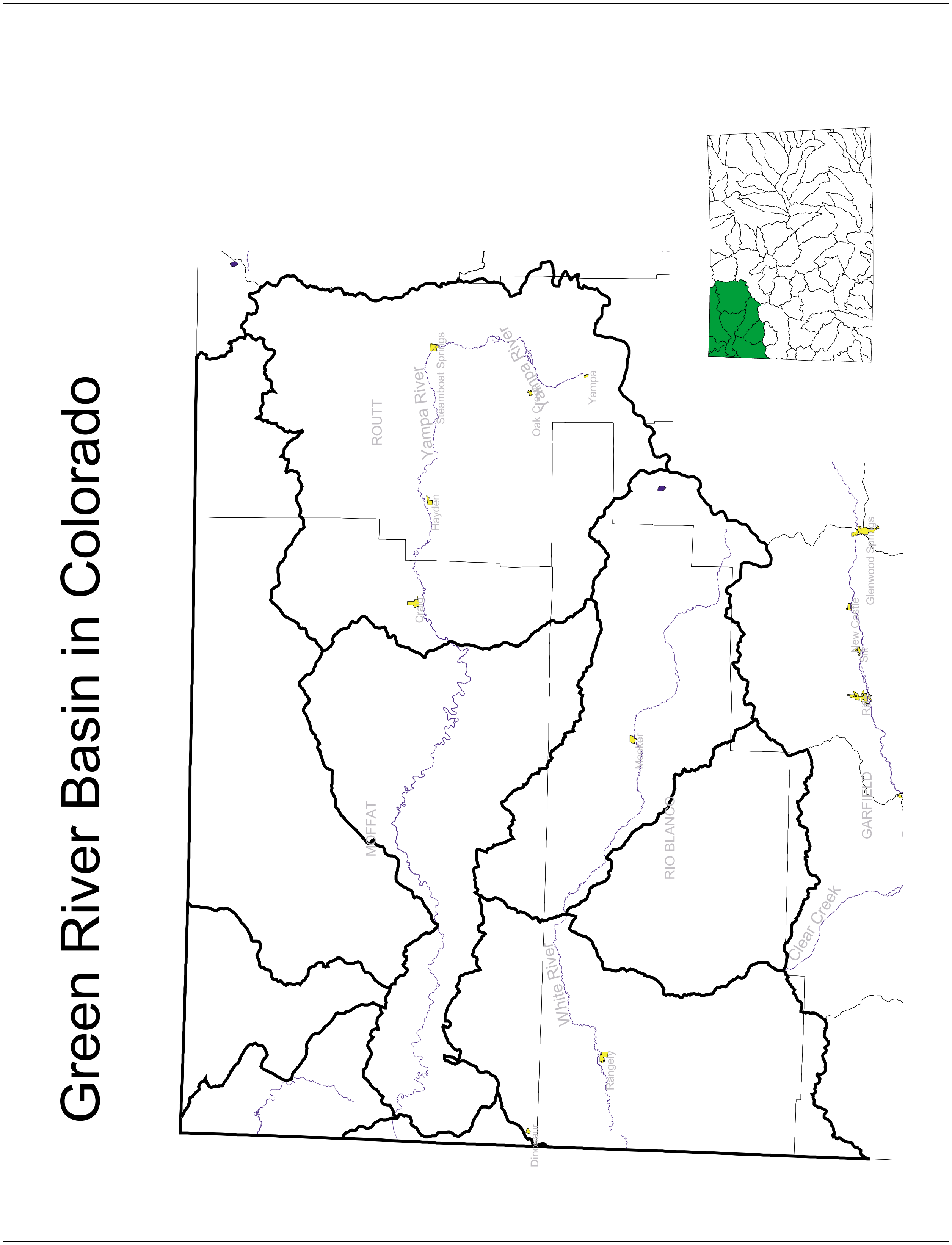
Major Land Use Types:
Forest and Range (square miles): 16,900
Agriculture (square miles): 2,475
Urban (square miles): 1,975
Estimated Public Land: 47%

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

Large portions of the basin are federally owned lands with livestock grazing and recreation as predominant land uses. Steamboat Springs is a destination ski resort and is likely to continue to experience population growth for years to come. Routt County alone has experienced a 24% population increase in the last ten years.

Significant coal and oil shale reserves are located within the watersheds of the Yampa and White Rivers. The potential for energy resource development in the basin may represent a significant water quality issue quality in the future. However, only limited coal mining and soda ash extraction operations are currently active.

Figure 5: Green River Basin in Colorado



a. Basin Description

The Green River Basin covers over 21, 000 square miles in northwestern Colorado. The eastern boundary is the Continental Divide, which separates the North Platte Basin from the headwaters of the Yampa River. The southern boundary is formed by the Flat Top Mountains and the White River and Roan Plateaus. The basin is bisected by the Grand Hogback, separating the White River National Forest to the east from the Piceance Basin to the west. Hydrologically, the basin is bordered to the north by the Wind River Mountain Range in Wyoming and to the west by the Uinta and Wasatch Mountains in Utah.

Precipitation in the basin ranges from an annual total of 23 inches at Steamboat Springs, in the upper portion of the Yampa River Basin, to about 10 inches at Rangely, in the lower White River Basin near the Colorado/Utah border.

Ecoregions: Ecoregions in the Green River Basin include the Wyoming Basin, Colorado Plateaus, and Southern Rockies; these are described in Table 22: Ecoregions in the Green River Basin below.

Table 22: Ecoregions in the Green River Basin

Ecoregion		***Land Surface Form [1]***	***Potential Natural Vegetation[2]***	***Land Use[3]***
18	Wyoming Basin	Plains with hills or low mountains	Sagebrush steppe, wheatgrass/needlegrass shrub-steppe, saltbush/ greasewood, juniper/pinyon woodland	Desert shrubland grazed, some irrigated agriculture
20	Colorado Plateaus	Tablelands with considerable to very high relief, plains with high mountains	Saltbush/greasewood, blackbush, juniper/ pinyon woodland, Great Basin sagebrush	Open woodland grazed, desert shrubland grazed, some irrigated agriculture
21	Southern Rockies	High mountains and tablelands with high relief	Western spruce/fir, Douglas-fir, pine/ Douglas-fir, southwestern spruce/fir, alpine meadows (bentgrass, sedge, fescue, bluegrass)	Forest and woodland grazed

[1] Hammond, E.H., 1970. "Classes of land-surface form," in *The national atlas of the United States of America*, U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. "Potential natural vegetation," in *The national atlas of the United States of America*, U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. "Major land uses," *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from "Ecoregions of the South Central States," by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987

Landuse: Approximately half of the basin's land is publicly owned, with the US Forest Service managing the higher elevation forested regions and the Bureau of Land Management managing the lower elevation range lands. Livestock grazing, recreation and silviculture are the predominant uses of this public land. Steamboat Springs, historically a destination ski resort, has expanded the local economic base from one based exclusively on skiing to one incorporating year-round recreational opportunities. Steamboat Springs has subsequently experienced a 34% population increase over the last ten years. Land use in the lower basins is primarily agricultural; livestock grazing in upland areas and hay and irrigated pasture in the river bottoms.

b. Surface Water Quality Assessment

Within the White and Yampa Basins, assessments have been completed for some 1,020 stream miles. The Green River Basin in Colorado totals 14,600 stream miles. Surface water quality monitoring and assessment within the basin has focused primarily on localized stream reaches where municipal wastewater discharges or mining has generated water quality concerns. Additionally, assessments are completed in conjunction with preparation for applicable water quality standards hearing. The standards for this basin are contained in separate regulations. Upper portions of the Yampa and White Rivers are addressed in the Classifications and Numeric Standards for Upper Colorado Basin and North Platte River, Regulation No. 33. The remainder of the Green River Basin is addressed in the Classifications and Numeric Standards for Lower Colorado River Basin, Regulation No. 37.

The Upper Colorado standards were reviewed and revised in 1999. Assessments of waterbodies in the Upper Yampa and White sub-basins were completed in preparation for that review. The Lower Colorado River Basin triennial review rulemaking hearing, which includes waterbodies in the Lower Yampa and White River sub-basins occurred in July 2001. In preparation for this hearing, the Division focused monitoring in this basin. Additional monitoring will be performed in the Upper Colorado Basin, including portions of the Yampa River, through 2002, as information is developed in anticipation of the 2003 triennial review.

Individual Use Support Summary: The designated use support for the Green River Basin is shown in Table 23: Individual Use Summary for the Green River Basin. Nearly all assessed waters in the basin fully support their designated uses.

Table 23: Individual Use Summary for the Green River Basin (in river miles)

Use	*Size Assessed*	*Size Fully Supporting*	*Size Not Supporting*	*Size Not Attainable*
Aquatic Life Cold 1	1,672	1,671	1	0
Aquatic Life Cold 2	888	888	0	0
Aquatic Life Warm 1	219	219	0	0
Aquatic Life Warm 2	4,396	4,396	0	0
Primary Contact (Recreation, Class 1)	2,821	2,821	0	0

Table 23: Individual Use Summary for the Green River Basin (in river miles) (Continued)

Use	***Size Assessed***	***Size Fully Supporting***	***Size Not Supporting***	***Size Not Attainable***
Secondary Contact (Recreation, Class 2)	4,132	4,132	0	0
Drinking Water Supply	2,489	2,489	0	0
Agriculture	7,174	7,174	0	0

*No aquatic life use is designated for these miles.

The quality of water in the Green River Basin ranges from excellent in the upper reaches of its major tributaries, to poor in some lower elevation tributaries to the White River. Headwater segments of both the White and the Yampa Rivers have been designated as Outstanding Waters. The upper basin has relatively pristine water quality typical of high elevation cold-water trout streams.

Water Quality Concerns: Many lower elevation tributaries in the Piceance Creek Basin exhibit poor water quality due primarily to the streams being fed by ground water in contact with oil shale. These streams show exceedingly high concentrations of dissolved solids, sulfates, and other minerals associated with oil shale. Other lower elevation streams in the White River Basin suffer from sediment problems due to land management practices on highly erosive soils.

While no segments within the basin have been included on the most current (1998) 303(d) list, a number of segments in the basin have been identified on the state's 1998 Monitoring and Evaluation List. These segments have been identified by the USFS as potentially subject to excessive sediment deposition. The Division is coordinating with both the USFS and the BLM to assess the degree of use impairment that potentially exists and identify contributing land use practices. These assessments will be initiated in 2000 and are likely to continue into 2008.

There were no water bodies or stream segments found to be in non-attainment of the assigned standards within the basin. The water quality assessments did, however, indicate a potential problem associated with DO levels in Stagecoach Reservoir, near Steamboat Springs, and in the Yampa River below the reservoir. These segments are also included on the Colorado 1998 Monitoring and Evaluation list. Additional monitoring is anticipated during 2001 to further evaluate the problem.

c. Trend Analysis

The Green River flows out of state downstream of its confluence with the Yampa River. The White River flows into the Green River in Utah. Lack of data on the Green and Yampa Rivers resulted in analyzing the White River close to the state boundary. The USGS flow gage and water quality station on the White River below Boise Creek, near Rangely, USGS #09306290, was used to evaluate trends. Forty-six parameters were evaluated with seven showing trends. Many of the parameters evaluated, including most of the metals, lacked sufficient data to demonstrate significant trends. Several nutrients showed downward trends indicating improved water quality from 1982-1996. Conductivity also showed downward trends from 1982-1996. Statistically significant trends are included in Table 24: Water Quality Trends in the White River Basin.

Table 24: Water Quality Trends in the White River Basin

Parameter	***Period of Record***	***No. of Data Points***	***Trend***
Total NH_3 + NH_4	1982-1993	40	Downward
Total Phosphorus	1982-1996	46	Slight downward
Dissolved Kjeldahl Nitrogen	1982-1996	65	Downward
Total Kjeldahl Nitrogen	1982-1996	45	Downward
Unionized NH_3-N	1982-1996	81	Slight downward
Unionized NH_3-NH_3	1982-1996	81	Slight downward
Conductivity	1982-1996	174	Downward

6. Platte River Basin

The Platte River Basin covers approximately 21,000 square miles in northeastern Colorado. The North Platte and Laramie River sub-basins flow north from north-central Colorado into southeastern Wyoming. The South Platte River sub-basin drains the northeastern quadrant of Colorado. The North and South Platte Rivers join in Nebraska to form the Platte River, which is a tributary of the Missouri River. The major tributaries to the South Platte River are Bear Creek, Cherry Creek, Clear Creek, Boulder Creek, St. Vrain Creek, Big Thompson River, and the Cache La Poudre River.

The portions of the North Platte and Laramie River sub-basins in Colorado are sparsely settled. Walden is the largest town, which lies in the North Platte and Laramie River sub-basins in Colorado. The South Platte River sub-basin, on the other hand, has the largest population of any river basin in Colorado with almost 3 million people, or almost 70% of the state's population.

The natural hydrologic conditions of the basin have been greatly altered by numerous water management projects throughout the basin. There are extensive trans-mountain diversions across the Continental Divide from the Colorado Basin into the South Platte Basin.

Platte River Basin Overview

Counties: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin, Jackson, Jefferson, Larimer, Morgan, Weld, portions of El Paso, Elbert, Logan, Lincoln, Park, Teller, Washington

Major Population Centers: Denver metro area, Fort Collins, Loveland area, Greeley/LaSalle/Windsor area, Sterling, Boulder/Longmont area, Brush/Ft. Morgan area

Population[1]: 2,918,500

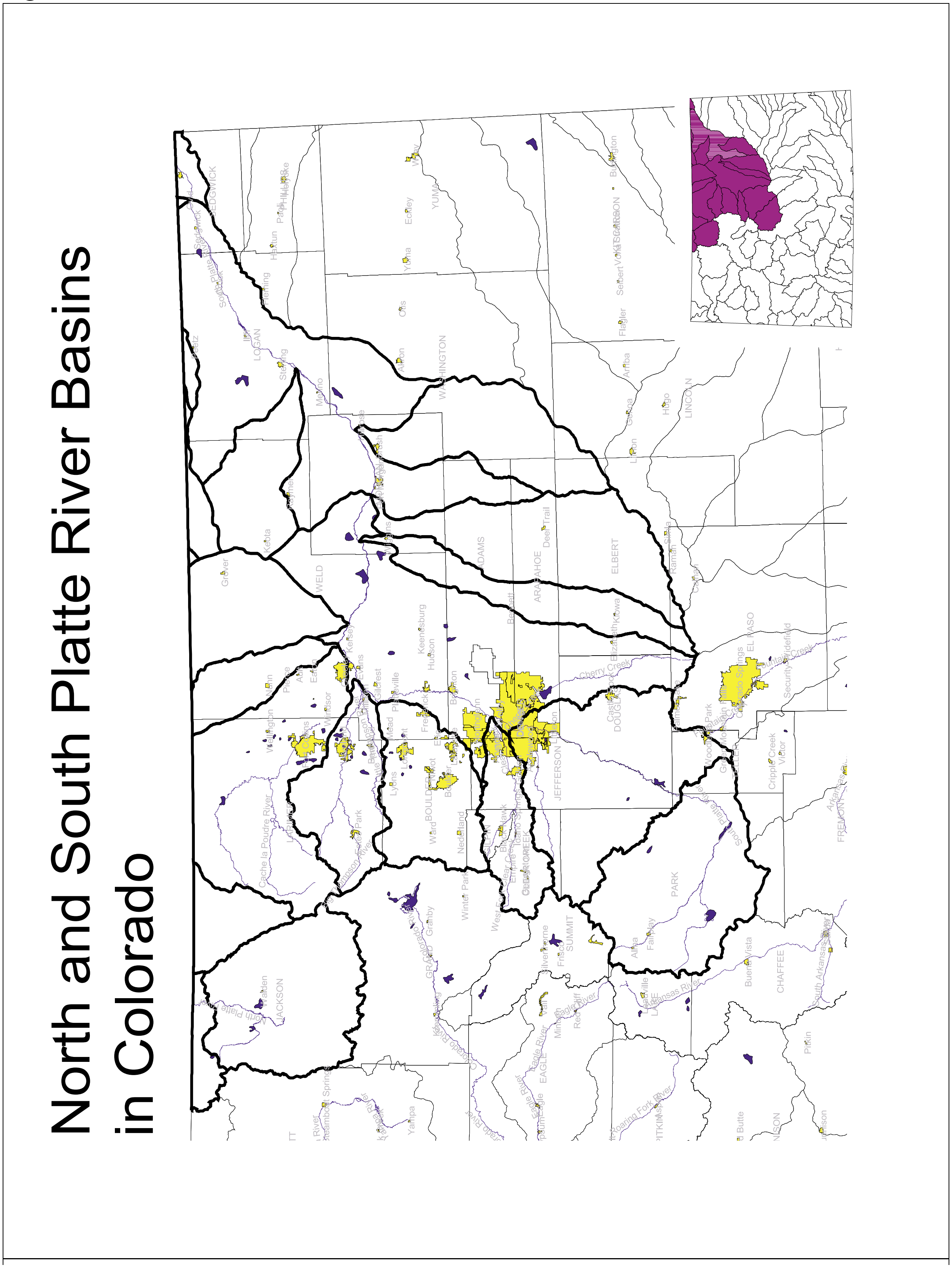
Surface Area (square miles): 20,943
Total Stream Miles: 22,907
Number of Lakes (Perennial lakes/reservoirs > 10 acres): 698
Lake Acres (Perennial lakes/reservoirs > 10 acres): 62,306

Major Land Use Types:
Forest and Range (sq. miles): 11,938
Agriculture (sq. miles): 7,540
Urban (sq. miles): 1,465

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

Water quality is generally good in the basin; however, there are water quality concerns. Urbanization, rapid growth, historical mining, and agriculture all impact water quality.

Figure 6: North and South Platte River Basins in Colorado



a. Basin Description

The Platte River basin encompasses approximately one-fifth of the state and includes a wide variety of conditions and settings. The basin stretches from the Continental Divide in central Colorado to the eastern high plains. Elevations in the watershed vary from over 14,000 feet at the Continental Divide in the west to 3,400 feet where the South Platte River crosses the Colorado/ Nebraska state line in the northeast corner of the state. The southeastern edge of the basin is the broad divide that separates the South Platte Basin from the Republican and Arkansas River Basins.

The Platte River Basin contains two main geomorphologic regions. These regions are the Rocky Mountain region in the west and the Plains region in the east, with a transitional area between. The streams in the mountains have channel slopes commonly greater than 5%, while the streams in the eastern plains have channel slopes of less than 5%. The majority of the precipitation that falls in the basin falls in the mountainous western part of the basin as snow in the winter.

Ecoregions: Ecoregions in the Platte River Basin are the Western High Plains, Southwestern Tablelands, Wyoming Basin, and Southern Rockies; these are described in Table 25: Ecoregions of the Platte River Basin.

Table 25: Ecoregions of the Platte River Basin

Ecoregion		***Land Surface Form*** [1]	***Potential Natural Vegetation*** [2]	***Land Use*** [3]
18	**Wyoming Basin**	Plains with hills or low mountains	Sagebrush steppe, wheat-grass/needlegrass shrub-steppe, saltbush/greasewood, juniper/pinyon woodland	Desert shrubland grazed, some irrigated agriculture
21	**Southern Rockies**	High mountains and table-lands with high relief	Western spruce/fir, Douglas-fir, pine/ Douglas-fir, south-western spruce/fir, alpine meadows (bentgrass, sedge, fescue, bluegrass)	Forest and woodland grazed
25	**Western High Plains**	Smooth to irregular plains	Grama/buffalo grass	Cropland, cropland with grazing land, irrigated agriculture
26	**Southwestern Table-lands**	Tablelands with moderate to considerable relief	Grama/buffalo grass, sand-sage/bluestem prairie, mes-quite/buffalo grass, bluestem grama prairie	Subhumid grassland and semiarid grazing land, some cropland with grazing land

Table 25: Ecoregions of the Platte River Basin (Continued)

[1] Hammond, E.H., 1970. "Classes of land-surface form," in *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. "Potential natural vegetation," in *The national atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. "Major land uses," *The national atlas of the United States of America*, U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from "Ecoregions of the South Central States," by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987

Landuse: Approximately one-third of the basin's land area is publicly owed. This is concentrated in the mountainous regions where land is managed by the U.S. Forest Service, Bureau of Land Management, and the National Park Service.

The Front Range region is heavily populated. The Denver metropolitan area, which is the largest, fastest growing, and most densely populated in the state, sits in the center of the South Platte sub-basin. There are more cities of over 10,000 people than in any other basin in the state. Some of the largest cities include Denver, Lakewood, Aurora, Fort Collins, Greeley, Loveland, Boulder, Longmont, and Sterling.

Out into the plains, Adams, Larimer, Weld, Morgan and Sedgwick Counties are the regions of intensive agriculture. Extensive systems of canals and storage reservoirs have been established to provide water for irrigated agriculture. Confined animal feeding operations such as dairies, hog farms, and other large livestock feeding operations are also present. There is little industry except for that connected to agriculture, and population density is much less than along the Front Range corridor.

The natural hydrologic conditions of the basin have been greatly altered by numerous water management projects. There are extensive trans-mountain diversions across the Continental Divide from the Colorado Basin into the South Platte Basin. After water reaches the plains from the mountainous regions, numerous diversions within the basin can completely remove water from the mainstem of the South Platte River and many of its tributaries. There are also more permitted point source discharges (over 500) in the South Platte Basin than in any other basin in the state.

The portions of the North Platte/Laramie River Basins in Colorado remain largely untouched by the heavy development common in the Front Range of Colorado. The major sources of economy in this area are agriculturally based, with some outdoor recreation related industries. Extensive tracts of public lands, including wilderness areas, national forests, and the Colorado State Forest line the sides of the basins.

The upper reaches of the South Platte River Basin are located in the Rocky Mountains. These mountains consist mainly of granitic and metamorphic rocks. The high elevations of the basin receive the highest annual precipitation levels (approximately 30 inches), most of which falls as snow in the winter. From these mountainous regions, the South Platte and its tributaries, such as Bear Creek, Clear Creek, Cache La Poudre River, Big Thompson River, St. Vrain Creek, and Boulder Creek, supply high quality water to cities, industries, and agriculture along the Front Range. Most of these streams in the mountainous regions also provide excellent habitat for aquatic life, and abundant recreational opportunities.

The middle region of the South Platte River lies in the geomorphologic transition region between the high mountains and eastern plains. This region is home to the most diverse flora and fauna of the entire basin. This region receives only half of the precipitation (approximately 15 inches) the upper part of the basin receives. The lower third of the Platte River lies on top of an extensive series of sedimentary rock, cutting through the Ogallala Sandstone as the river leaves the state. Precipitation levels ranges from 15 inches in the upper portion to 20 inches at the state line. This is one of Colorado's major agricultural regions.

Because of the population increase in the last few years along the front range, the entire South Platte Basin, particularly near population centers, is receiving a rapidly increasing demand for recreational uses.

b. Surface Water Quality Assessment

In Colorado, surface water quality is assessed primarily in conjunction with preparation for the triennial review of water quality standards, as well as for special projects and preparation of the 303d List. Water quality standards for the waters comprising the Platte River are contained in two regulations. The North Platte sub-basin is included in the Classifications and Numeric Standards for the Upper Colorado River Basin, Regulation No. 33; and the South Platte and Laramie sub-basins are included in the Classifications and Numeric Standards for the South Platte, Laramie, Republican and Smoky Hill River Basins, Regulation No. 38.

The water quality of North Platte sub-basin was assessed in 1999 for a standards review hearing for the Upper Colorado and North Platte.

A comprehensive review for the South Platte sub-basin took place in 2000 and 2001. Portions of the South Platte sub-basin had been assessed in recent years, but a comprehensive review of the whole basin had not been done for many years. Many changes were made to the segmentation and standards in the basin as a result the rule making hearing. Many waters in the Basin now have more appropriately protective standards in place. The assessment of this new information is available in this report.

Individual Use Support Summary: One of the objectives of the assessments was to evaluate the chemical, physical, and biological status of classified stream segments in the basin relative to adopted use effluent classifications and standards. Each use was evaluated to determine the degree of support of the use. The degree of use support categories were defined in Part II. Background.

The individual use support of streams in the Platte River Basin is shown in Table 26: Individual Use Summary for the Platte River Basin. Of the streams assessed, 100% are suitable for agriculture. Aquatic Life can be supported in the majority of the streams. A majority of the streams support the recreation classification assigned to them.

Table 26: Individual Use Summary for the Platte River Basin (in river miles)

Use	*Size Assessed*	*Size Fully Supporting*	*Size Not Sup-porting*	*Size Not Attainable*
Aquatic Life Cold 1	6,142	4,140.8	2,001	0
Aquatic Life Cold 2	436	400	36	0
Aquatic Life Warm 1	75	30	45	0
Aquatic Life Warm 2	2,879	2,562	317	0
Primary Contact (Recreation, Class 1)	7,819	7,718	101	0
Secondary Contact (Recreation, Class 2)	444	444	0	0
Drinking Water Supply	6,562	6,562	0	0
Agriculture	9,523	9,523	0	0

Outstanding Waters: Because of changes made during the recent rule making hearing of the South Platte basin (Reg. No. 38) all waters in the Sough Platte basin that are located in wilderness areas and National Parks are now classified outstanding waters. The areas that now have the protection of an outstanding waters classification are the Cache La Poudre, Comanche Peak, Indian Peaks, Lost Creek, Neota, Mount Evans, and Rawah Wilderness Areas, and Rocky Mountain National Park.

Water Quality Concerns: The North Platte River and Laramie River have very few permitted discharges. Other stressors in the area are grazing and irrigation of pasture land, recreational uses and silviculture. At present, some stream erosion and sedimentation are the only significant water quality problems that exist in the basin. The South Platte River portion of the Platte River Basin has the largest population of any river basin in Colorado, with more water quality problems and issues facing it than any other basin in the State.

The natural hydrologic conditions of the basin have been greatly altered by man. There are 12 trans-mountain water diversions from the western slope of the Continental Divide, importing approximately 400,000 acre-feet/year of water into the basin. There is an extensive reservoir system with developed water storage for over 2 million acre-feet/year of water. Annually more than 3 million acre-feet of water are diverted from South Platte River basin streams. Most of this diverted water is used for irrigation, which has significantly altered the ground water levels along the length of the whole middle and lower South Platte River. Where the South Platte was once a dry stream at some times of the year, ground water return flows now keep water in the river year-round. Irrigation and ground water return flows gradually bring water back into the South Platte as the river moves downstream. The South Platte River regularly gains over 5 cubic feet per second/mile (cfs/mile) in some stretches.

Despite the year-round return flow seepage, irrigation diversion structures at times divert the entire flow of the South Platte River. There are times and locations where there is little or no in-stream flow below the diversion structures. These diversion structures also prevent migration and other natural movements of the aquatic life as well as diverting flow.

The upper reaches of the South Platte sub-basin including Clear Creek, North Fork of the South Platte, Geneva Creek, Mosquito Creek, and James Creek intersect the Colorado mineral belt and are degraded by past mining activities and natural causes due to contact with minerals. Aquatic life in these stream segments is severely restricted. Development in some mountain areas has also negatively impacted the waters there, increasing the depletion of fractured rock aquifers while adding nutrients and other pollutants to waters that flow down out of the Front Range.

The middle region of the South Platte River flows through the heavily populated Front Range area, and is also where the first significant diversions of the South Platte River take place. The confluences of all of the major tributaries to the South Platte River occur in the Middle South Platte River Basin. 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. Over 90% of all the permitted discharges of pollutants to the South Platte River take place in the middle region of the South Platte Basin. At times, the majority of flow in some South Platte tributaries, and in the South Platte River itself is WWTF effluent. A number of the treatment facilities have completed upgrades, are currently upgrading, 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 the urbanization of their watersheds. Site-specific control regulations are in place to provide protection for these reservoirs.

The South Platte River, through and downstream of the Denver urban area, exceeds the standard for E. Coli set to protect recreational uses. This exceedance appears to be caused by sources other than the municipal dischargers in the area.

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. Several Eastern Plains cities, such as Fort Morgan, that used to depend solely on ground water as the drinking water source, are pursuing high quality surface water supplies from streams in the foothills. Also, some parties claim that nitrate levels in some irrigation waters are detrimental to certain growth stages of some crops (barley and beets). Some studies are underway in the South Platte Basin, which will provide additional information on the nature of, and possible solutions to, this problem.

The lower third of the South Platte River flows through the rich agricultural areas. The flow in the South Platte River through this area is almost completely controlled by agricultural water management. The very high flows during runoff are the only natural flows left in the river. Weld County in northern Colorado is one of the wealthiest agricultural counties in the entire nation. This area is largely dependent on irrigated agriculture and livestock feeding operations, both of which 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. With the dramatic improvements in point source pollution controls, non-point source pollution is probably now the largest problem in this part of the basin. Water management, excessive pesticide and fertilizer application, and upstream additions of non-degrading pollutants have restricted the habitat in this part of the South Platte River Basin. Even though data clearly shows the anthropogenic impacts on the South Platte River, water quality in the mainstem of the South Platte is not all bad. Fecal concentrations at the State line are within the primary contact (swimming) standard, as are other inorganic and metals pollutant parameters.

A recent study by USGS NAWQA of the South Platte River Basin shows water quality and habitat improves between the middle South Platte area and the Colorado/Nebraska border as water travels through the lower South Platte area.

c. Impaired Waters

The 1998 303(d) List waters in the Platte Basin are shown below in Table 27: Impaired Waters in the Platte River Basin, with the associated TMDL project status.

Table 27: Impaired Waters in the Platte River Basin

Waterbody ID	*Waterbody*	*Portion*	*Pollutant / Concern*	*Sources*	*TMDL Project Status*	*Completion Date*
COSPBO09	Boulder Creek., S. Boulder Creek. to Coal Creek	All	NH3, Aq Life	Muni Point Sources & unknown causes	Data collection ongoing	6/02; 6/04
COSPBO10	Boulder Creek., Coal Creek. to St. Vrain Creek.	All	NH3, Aq Life	Muni Point Sources & unknown causes	Data collection ongoing	6/02; 6/04
COSPBT05	Big Thompson R., I-25 to S. Platte R.	All	Mn, F. Coli	Unknown	* F. Coli - Delist due to standards attainment, Mn pending	6/00

Table 27: Impaired Waters in the Platte River Basin (Continued)						
Waterbody ID	***Waterbody***	***Portion***	***Pollutant / Concern***	***Sources***	***TMDL Project Status***	***Completi on Date***
COSPBT09	Little Thompson R., Culver Ditch to Big Thompson R.	All	Mn, F. Coli	Muni Point Sources	*F. Coli - Delist due to standards attainment, Mn pending	6/00
COSPCL02	Clear Creek, I-70 Bridge. at Silver Plum to Argo Tunnel	All	Cu, Zn	Mining	Data collection ongoing	6/02
COSPCL09	* Fall River and Tribs. to Fall River	Silver Creek	Cu	Mining	* Pending 2002 303(d) List	
COSPCL11	Clear Creek, Argo Tunnel to Farmers Highline Canal	All	Fe, Mn, Zn	Mining	Data collection ongoing	6/04
COSPCL13	N. Clear Creek & Tribs., source to Clear Creek	All	Cd, Mn, Zn, Cu, Aq Life	Mining	Pending CERCLA Clean up	6/06
COSPCL14	Clear Creek, Farmers Highline Canal to Youngfield St.	All	Cd, Mn	Mining	Pending	6/08
COSPCL15	Clear Creek, Youngfield St. to S. Platte R.	All	Mn	Mining Urban Runoff	Pending	6/08
COSPCP07	N. Fork. Cache La Poudre R., Halligan Reservoir. to Poudre R.	3.2 miles below Halligan Resv.	Sediment	Hydrologic Modification	Pending	6/02
COSPSV03	St. Vrain Creek, Hygiene Rd. to S. Platte R.	All	NH3, Aq Life	Muni Point Sources & unknown causes	Data collection ongoing	6/02; 6/04
COSPSV04	Little James & Left Hand Creek.'s	Little James Creek Watershed	pH, Cd, Fe, Mn, Zn	Mining	Pending	6/02

Table 27: Impaired Waters in the Platte River Basin (Continued)

Waterbody ID	*Waterbody*	*Portion*	*Pollutant / Concern*	*Sources*	*TMDL Project Status*	*Completi on Date*
COSPUS01	S. Platte R.'s, sources to N. Fk. S. Platte R.	S. Platte R., from 11-mile Dam to Cheesman Resv.	Sediment	Road Runoff	Pending	6/02
COSPUS02	Mosquito Creek, source to Mid. Fk. S. Platte R.	All	Zn, Cd, Pb	Mining	TMDL Available	6/00
COSPUS02	S. Mosquito Creek, above Mosquito Creek	Below historic mining (London Mine)	Cd, Fe, Zn, Mn	Mining	TMDL Available	6/00
COSPUS03	Tribs. to S. Platte R., Tarryall Creek to N.Fk. S. Platte R.	Trout Creek and Tribs., on NF Land	Sediment	Road Runoff	Pending	6/02
COSPUS04	N. Fk. S. Platte R. & Tribs., source to S. Platte R.	Hall Valley area to Geneva Creek	Al, Cd, Cu, Fe, Pb	Mining	Pending	6/08
COSPUS05	Geneva Creek, Scott Gomer Creek to N. Fk. S. Platte R.	All	Zn	Mining	Pending	6/08
OSPUS14	S. Platte R., Bowles Ave. to Burlington Ditch	All	1. Mn 2. NO_3 3. F. Coli	2. Muni Point Source 3. Urban Runoff	1. *Mn - Delist due to standards attainment 2. TMDL Available 3. Pending	1. 6/00 2. 6/00 3. 6/04
COSPUS15	S.Platte R., Burlington Ditch to Big Dry Creek	All	DO	Muni Point Source	TMDL Available	6/00
COSPUS15	S.Platte R., Burlington Ditch to Big Dry Creek	All	NO_3	Muni Point Source	* Delist due to standards attainment	6/00
COSPUS15	S.Platte R., Burlington Ditch to Big Dry Creek	u/s Metro	Cd	unknown	Data collection underway	6/02

Table 27: Impaired Waters in the Platte River Basin (Continued)						
Waterbody ID	***Waterbody***	***Portion***	***Pollutant / Concern***	***Sources***	***TMDL Project Status***	***Completion Date***
COSPUS15	S.Platte R., Burlington Ditch to Big Dry Creek	All	Cu	Urban Runoff, Point Sources	Pending	6/02
COSPUS16 L1	Mary Lake	All	Hg, Aldrin, Dieldrin	Indust. Point Sources	* Delist – remediation is complete	6/00
COSPUS16 L2	Ladora Lake	All	Hg, Aldrin, Dieldrin	Indust. Point Sources	* Delist – remediation is complete	6/00
COSPUS16 L3	Lower Derby Lake	All	Hg, Aldrin, Dieldrin	Indust. Point Sources	* Delist – remediation is complete	6/00
* Indicates information obtained after the 1998 303(d) list was produced.						

d. Trends

The South Platte River flows across the state boundary just downstream of Julesburg, Colorado. The USGS flow gage and water quality station on the South Platte River at Julesburg, USGS #06764000, was used to evaluate trends. The trend analysis methodology is described in Part III. Fifty-two parameters were evaluated with seven showing trends. The only metal with a statistically significant trend was manganese with a period of record of 1973 to 1995, that appears to be slightly downward. None of the physical or pathogen parameters showed trends. Several nutrients demonstrated trends. Statistically significant trends are included in Table 28: Water Quality Trends in the Platte River Basin.

Table 28: Water Quality Trends in the Platte River Basin			
Parameter	***Period of Record***	***No. of Data Points***	***Trend***
Dissolved Manganese	1973-1995	73	Slight downward
Total NH_3 + NH_4	1972-1994	67	Downward
Total NO_2 + NO_3	1973-1992	73	Upward
Dissolved Phosphorus	1977-1996	96	Downward
Total Kjeldahl Nitrogen	1972-1996	117	Downward
Unionized NH_3-N	1977-1996	95	Downward
Unionized NH_3-NH_3	1977-1996	95	Downward

In general, nutrients show downward trends from the 1970's to 1996. There was an upward trend in unionized ammonia and total nitrogen from the 1970's to the early 1980's; however, this pattern reversed itself in unionized ammonia concentrations from the early 1980's to the 1990's. Downward trends in nutrients may be attributable to improved point source controls as well as improved agricultural practices.

7. Republican River Basin

The Republican River Basin covers the northeastern High Plains of Colorado (Figure 7: Republican River Basin in Colorado). Yuma (population 3,300), Holyoke (population 2,300) and Burlington (population 3,700) are the largest cities in this sparsely populated basin, where the population represents less than 1% of the entire State's population.

Republican River Basin Overview

Counties: Phillips, Yuma; partially includes: Sedgwick, Washington, Lincoln, Logan, Elbert, Kit Carson, Cheyenne
Major Population Centers: Burlington, Holyoke, Yuma
Population[1]: 28,419

Surface Area (square miles): 8,785
Total Stream Miles: 5,618
Number of Lakes (Perennial lakes/reservoirs > 10 acres): 65
Lake Acres (Perennial lakes/reservoirs > 10 acres): 2,267

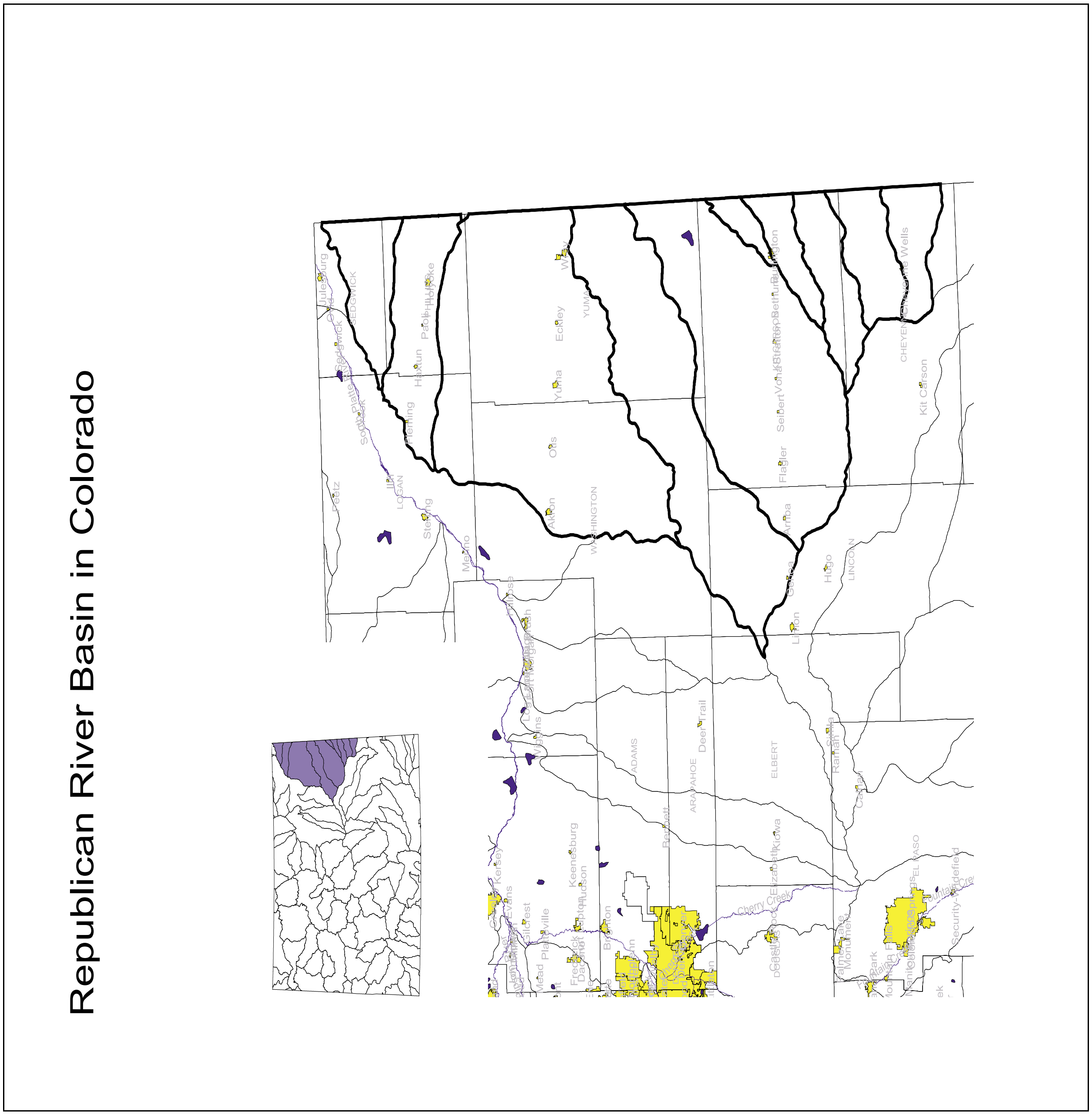
Major Land Use Types:
Forest and Range (square miles): 4,305
Agriculture (square miles): 4,393
Urban (square miles): 87
Estimated Public Land: <<1%

[1] 2000 Estimate based on Colorado Department of Local Affairs statistics

The Republican is the only large river basin in the state that does not have headwaters in the mountains. The area depends primarily on ground water from the Ogallala Aquifer for irrigating cropland and providing domestic water for the farm communities. Discharges from confined animal feeding operations and chemigation, the practice of adding fertilizers and pesticides to the irrigation well discharge, have recently received more attention and aroused the concern of local citizens. Without adequate backflow protection on the wells, pesticides and fertilizers can go back down the well and into the aquifer. Due to the number of hog farming operations being established in this area, the community continues to be polarized with respect to potential environmental and economic effects. There are currently more than 70 hog farm sites operated in the basin. A Citizen's Initiative, Amendment 14, which mandated strict regulation of on these operations, was passed in November 1998. The regulations significantly reduce the risk of water quality contamination by requiring, among other conditions, nutrient monitoring and management plans.

Unique natural hydrologic conditions in this basin allow a portion of the North Fork of the Republican River to maintain a high-quality cold-water trout fishery, the only trout habitat in eastern Colorado. Bonny Reservoir, a large lake for eastern Colorado, is also an important recreational resource in the basin. This Reservoir is located on the South Fork of the Republican River, less than 10 miles from Colorado's border with Kansas.

Figure 7: Republican River Basin in Colorado



a. Basin Description

The Republican River Basin is a dry basin on the eastern plains of Colorado adjoining the Nebraska and Kansas borders. The Basin includes the Arikaree River, the North and South Forks of the Republican River and several other intermittent streams. The majority of the basin is relatively flat and sits atop the Ogallala sandstone. Municipalities and agricultural facilities in the area depend primarily on ground water from the Ogallala Aquifer. In Colorado, the Smoky Hill River is also considered part of this Basin for standard-setting purposes. Figure 7: Republican River Basin in Colorado shows the major rivers, towns, and counties in the Basin.

The estimated average annual precipitation is 15 inches per year. The historic average annual flow out of Colorado from the Republican Basin is 47,060 acre feet, constituting less than 5% of the flow from Colorado east toward the Mississippi River and less than 0.5% of the total flow leaving Colorado.

Ecoregions

The ecoregions of the Republican River Basin are listed below in Table 29: Ecoregions of the Republican River Basin.

Table 29: Ecoregions of the Republican River Basin

Ecoregion		***Land Surface Form [1]***	***Potential Natural Vegetation[2]***	***Land Use[3]***
25	Western High Plains	Smooth to irregular plains	Grama/buffalo grass	Cropland, cropland with grazing land, irrigated agriculture
26	Southwestern Tablelands	Tablelands with moderate to considerable relief	Grama/buffalo grass, sandsage/bluestem prairie, mesquite/buffalo grass, bluestem grama prairie	Subhumid grassland and semiarid grazing land, some cropland with grazing land

[1] Hammond, E.H., 1970. "Classes of land-surface form," in *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 62-63.

[2] Kuchler, A.W., 1970. "Potential natural vegetation," in *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 89-91.

[3] Anderson, J.R., 1970. "Major land uses," *The National Atlas of the United States of America,* U.S. Geological Survey, Washington, D.C., Plates 158-159.

Source: Adapted from "Ecoregions of the South Central States," by James M. Omernik and Alisa L. Gallant, U.S. Environmental Protection Agency, EPA/600/D-87/315,1987

Land Use: There are virtually no large tracts of publicly owned land in the basin. Most of the area is used as range land with some irrigated and dryland agriculture. There are 5 permitted point-source discharges in the Republican Basin, excluding sources covered by general permits. These sources are domestic waste water treatment facilities for the cities of Wray, Flagler, Siebert, Burlington and Cheyenne Wells.

b. Surface Water Quality Assessment

The Republican River Basin was assessed in 1999-2000 in preparation for triennial review. The Division operates 6 water quality stations in the Republican Basin: the South Fork of the Republican upstream of Bonny Reservoir, Landsman Creek upstream of Bonny Reservoir, Arikaree River, Chief Creek upstream of Wray, the North Fork at State Line and the North Fork upstream of Wray. These stations, in addition to information from several Division of Wildlife stations in the Basin, were be used in the broader assessment for triennial review of this River Basin which occurred in November 2000. The next assessment will be in preparation for the triennial review scheduled for 2004.

Individual Use Support: Table 30: Individual Use Summary for the Republican River Basin (in river miles): is a summary of the number of segments in each use classifications and the current designated use support for the waterbody segments of the Republican River.

The Republican River Basin assessment evaluates the chemical, physical, and biological status of classified stream segments in the Basin relative to adopted use effluent classifications and standards. Each use is evaluated to determine the degree of support of the use.

Table 30: Individual Use Summary for the Republican River Basin (in river miles)

Use	Size Assessed	Size Fully Supporting	Size Not Supporting	Size Not Attainable
Aquatic Life Cold 1	37	0	37	0
Aquatic Life Cold 2	0	0	0	0
Aquatic Life Warm 1	84	84	0	0
Aquatic Life Warm 2	12	12	0	0
Primary Contact (Recreation, Class 1)	132	115	17	0
Secondary Contact (Recreation, Class 2)	0	0	0	0
Drinking Water Supply	65	65	0	67
Agriculture	132	132	0	0

Bonny Reservoir is an important recreational and wildlife resource in the Basin; it supports over 250 species of birds.

A portion of the North Fork of the Republican River is able to maintain the only trout habitat in eastern Colorado. Chief Creek is also capable of sustaining year round populations of many species of fish. The high quality perennial flow allows The Division of Wildlife to operate a fish hatchery on Chief Creek. The North Fork, however, is on the 1998 303(d) list for aquatic life impairment and it is being evaluated for potential sediment impacts. In contrast to the flows in the North Fork of the Republican and Chief Creek, the upper tributaries to the Republican River and the Smoky Hill River and its tributaries are ephemeral and/or intermittent streams.

c. Impaired Waters

Listed below in Table 31: Impaired Waters in the Republican River Basin are the stream segments that are on the 1998 303(d) List, as well as their current TMDL Project Status (current as of June 30, 2000).

Table 31: Impaired Waters in the Republican River Basin

Waterbody ID (WBID)	Waterbody	Portion	Pollutant or Condition	Causes	TMDL Project Status
COSPRE03	N. Fk. Republican R. source to CO/NE Line	All	Aq Life	Unknown	Pending

DOW surveys have shown reduced fish communities, especially native species, in Chief Creek, a tributary to the north fork of the Republican River. Also, additional sediment data is needed to evaluate the impacts to the North Fork originally noted on the 1996 303(d) List.

The TMDL project for the North Fork of the Republican River Basin is scheduled to be completed by June 30, 2006.

d. Trends

Trend analyses were not performed for the waters in the Republican River Basin similar to the other basins due to of the lack of flow data for this basin.

D. Fish Kills

The Monitoring Unit of the WQCD responded to four fish kills during the 2000-2001 biennium.

- On August 25, 2000, a fish kill occurred on Clear Creek as a result of a beer release from the Coors Brewing Facility causing an upset condition at the wasetwater treatment plant. WQCD and CDOW personnel conducted counts of dead fish in Clear Creek from Coors in Golden, to the confluence with the South Platte River. The kill was caused by low DO (anoxia) resulting from the high BOD load from the spill.

- On September 13, 2000, a fish kill was reported on Cherry Creek Reservoir. The Colorado Division of Wildlife (CDOW) investigated the fish kill and reported a loss of approximately 207 fish (170 of which were walleye). Another fish kill occurred on September 29, 2000. The CDOW reported a loss of approximately 225 fish (approximately 125 were walleye).

- On May 4, 2001, dead fish were observed in the O'Brian Canal, the Hudson Canal, and Horse Creek Reservoir. A glycol release from Denver International Airport into Third Creek was a suspected factor in the fish kill. Low dissolved oxygen resulting from stagnant water in the canals was also a suspected cause for the kill. A chemical analysis of the water in the canal was inconclusive for determining the cause of the fish kill.

- On September 3 and 4, 2001, a fish kill was reported on the Cache la Poudre River below Greeley. The fish kill resulted from a release to the river from a cattle-hauling truck wash facility. The fish kill resulted from ammonia toxicity and low dissolved oxygen.

- On October 8, 2001, a fish kill was reported in Kalcevic Reservoir in Adams County. It was determined the kill was caused by low dissolved oxygen which resulted from recent sediment and nutrient loading to the reservoir.

E. Lakes and Reservoirs Water Quality Assessment

Colorado has approximately 1,533 significant publicly owned lakes of greater than ten surface acres. The total surface acreage of these lakes has been estimated at 164,029. Significant publicly owned lakes are defined as those natural lakes, reservoirs, or ponds 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.

Section 314(a)(2) of the Clean Water Act requires states to report on the status of lake water quality as part of the §305(b) report. Colorado conducted lake assessments under the Lake Water Quality Assessment assistance grant from EPA between 1989 to 1994. Since 1995, Colorado has not received separate EPA funding for lake and reservoir monitoring.

1. Monitoring Current Biennium

During this biennium (2000 and 2001), the Division monitored eight lakes and reservoirs. The Division also sampled Beaver Creek Reservoir, San Luis Lake, Trinidad Lake, Platoro Reservoir, Twin Lakes, Fruitgrowers Reservoir, Sweitzer Lake, and Prewitt Reservoir. The lake and reservoir monitoring efforts provide data to evaluate the trophic status of Colorado lakes and reservoirs. The data also are used to assess attainment of water quality standards.

Basic trophic status information and fish tissue for mercury analysis were collected from Sanchez, McPhee, and Narraguinnep Reservoirs by the Division as part of a mercury TMDL study in 1999. An EPA contractor released a revised draft report of this mercury study for McPhee and Narraguinep in September 2001. A report for Sanchez Reservoir is in progress.

2. Trophic State Assessment

Trophic state is a classification of lakes based on the nutrient status and level of biological productivity (especially algae). Commonly used indicators of nutrient status and productivity include water transparency as measured by Secchi disc, the amount of algae as measured by chlorophyll-a and in-lake phosphorus concentration. The trophic state of a lake is broadly defined as follows:

- Oligotrophic: lakes with few available nutrients and a low level of biological productivity
- Mesotrophic: lakes with nutrient levels and biological productivity between oligotrophic and eutrophic
- Eutrophic: lakes with high nutrient levels and a high level of productivity
- Hypereutrophic: lakes in an advanced eutrophic state

Trophic status, per se, is not an indicator of water quality problems. It is an index of water quality only to the extent that trophic condition limits the desired use of a lake (i.e., water supply or for recreation). Generally, the effects of lake eutrophication 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 the DO concentration in bottom waters to levels that are lethal to fish. Eutrophication often leads to increased fish production, but at the expense of desired species that inhabit cold deep areas, such as trout.

As part of the lake assessments, the Division also considers trophic assessment based on data collected by agencies other than the Division. Routine monitoring of publicly owned reservoirs is being, or has been performed, by the USGS, Army Corps of Engineers, Denver Water Board, and various other entities including cities, regional council of governments, and river basin associations.

The Division uses the Trophic State Index (TSI) equations developed by Carlson (1977) to estimate trophic state. Data for the epilimnion (upper-most layer in a stratified lake) collected during the summer/fall growing season (June through October) was used to calculate the mean total phosphorus, mean chlorophyll-a, and mean Secchi disc transparency for each lake. These three values were used to calculate the TSI for each lake. The individual TSI for each lake was compared to the categories presented below (Table 32: Trophic Status Index (TSI) vs Trophic State) to determine an overall trophic status (Olem and Flock 1990).

Table 32: Trophic State Index (TSI) vs Trophic State

TSI	***Trophic State***
0-40	Oligotrophic
41-50	Mesotrophic
51-65	Eutrophic
> 65	Hypereutrophic

Interpretation of TSIs for estimating the trophic status of reservoirs sometimes poses problems because of discrepancies among TSIs. For example, reservoirs tend to have large watersheds and are turbid due to suspended inorganic materials. This tends to elevate the TSIs for Secchi depth and total phosphorus when compared to chlorophyll-a. To estimate the trophic status in this situation, the Division further evaluated the data by another method, including averaging the TSIs for an overall score or using chlorophyll-a as the primary indicator.

Table 33: Summary of Trophic Status of Colorado Lakes

Trophic State	***Number of Lakes***	***Total Size (acres)***
Eutrophic	19	31,462
Hypereutrophic	3	3,888
Mesotrophic	13	13,537
Oligotrophic	9	7,431

Table 34: Trophic Status of Colorado Lakes presents the estimated trophic status of individual lakes monitored by the WQCD and others entities in the period from 1998-2001. The table also includes lake and reservoir trophic status information not reported in the 2000 305(B) report. The recreational codes correspond to the following uses: B-boating, F-fishing, SK-water skiing, and S-swimming.

Table 34: Trophic Status of Colorado Lakes

Lakes	County	Surface Acres	Recreational Uses*	Chlorophyll a ug/L	TSI Chlorophyll	Total Phosphorus ug/L	TSI Phos.	Secchi Depth (m)	TSI Secchi	Estimated Trophic Status	Elevation	Year Assessed
Barr L.	Adams		B,F,	NA		88	92	NA		Hyper-eutrophic		1995-1998
Bear Creek R.	Jefferson	109	B,F,	14.6	57	42.4	58	2.3	48	Eutrophic	5600	2000
Beaver Creek R.	Rio Grande			2.7	40	36.7	56	3.1	43	Mesotrophic		
Blue Mesa R.	Gunnison			4.4	45	36	56	3.6	41	Mesotrophic/ Eutrophic		1997-2000
Boyd L.	Larimer			1.3	33	8.9	36	4.1	40	Oligotrophic		1999
Chatfield R.	Jefferson	1410	B,F,SK,S	3.8	44	16	44	2.75	45	Mesotrophic	5430	1998
Cherry Creek R.	Arapahoe	900	B,F,SK,S	25	62	81	68	0.96	61	Eutrophic	5550	2000
Crystal R.	Montrose			2.7	40	17	45			Mesotrophic		1997-2000
Equalizer L.	Larimer					61	63			Eutrophic		
Fruitgrowers R.	Delta	476		202	83	159	77	0.67	67	Hyper-eutrophic	5493	1997-2000
Grand L.	Grand	507	B,F,SK,S	3.7	43	11.4	39	3.46	42	Mesotrophic	8367	1999
Horseshoe L.	Larimer			15.1	57	34.1	55	0.8	63	Eutrophic		1999

Table 34: Trophic Status of Colorado Lakes (Continued)

Houts L.	Larimer					85	68			Hyper-eutrophic		1999
Loveland L.	Larimer			5.8	48	20.6	48	2.4	47	Mesotrophic		1999
McPhee R.	Monte-zuma			1.9	37	1.1	56	3.1	44	Mesotrophic		1999
Morrow Pt. R.	Montrose/ Gunnison			2.4	39	16	44	5.2	36	Oligotrophic/ Mesotrophic		1997-2000
Narraguin-nep R.	Monte-zuma			1.0	31	1.1	6	2.1	49	Oligotrophic		1999
Platoro	Conejos	947	B,F,	4.2	45	17.5	45	2.6	46	Mesotrophic	9970	2000
Prewitt R.	Washing-ton	2924	B,F,S	152	80	78	67	0.31	77	Hyper-eutrophic	4099	1999-2001
Sanchez	Costilla	890	B,F,SK,S	9.5	52					Eutrophic	7520	1999
San Luis L.	Alamosa	890	B,F,SK,S	3.7	44	96.7	70	0.4	73	Eutrophic	7529	2000
Stagecoach R.	Routt	780	B,F,SK,S	22	61	47.5	60	2.5	47	Eutrophic	7160	1999
Standley L.	Jefferson	1230	B,F,SK	2.8	41	12.1	40	2.85	45	Mesotrophic	5500	2000
Sweitzer R.	Delta	139	B,F,SK,S			42	58	1.2	57	Eutrophic	5126	1997-2000
Trinidad L.	Las Ani-mas	2018	B,F,SK,S	NA		12.5	41	2.2	48	Mesotrophic	6180	2000
Twin Lakes	Lake	2277	B,F,SK,S	1.5	35	25	50	5.1	36	Oligotrophic	9210	2000

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

3. Designated Use Support

The designated use support of Colorado's lakes and reservoirs is summarized in Table 35: Designated Use Support for Colorado Lakes and Reservoirs. As the table shows, most lake acres in the state are fully supporting of their designated uses. The acres listed under a designated use support category cannot be added together to produce a total number of acres because the same lake may be partially supporting, for instance, for several use classifications (Primary Contact Recreation, Aquatic Life Class 1 and Agriculture).

Table 35: Designated Use Support for Colorado Lakes and Reservoirs

Use	*Size Assessed*	*Fully Supporting*	*Not Supporting*	*Not Attainable*
Aquatic Life Cold 1	33,617	27,895	5,722	0
Aquatic Life Cold 2	887	745	142	0
Aquatic Life Warm 1	29,458	28,954	504	0
Aquatic Life Warm 2	567	306	261	0
Fish Consumption	6,354	0	6,354	0
Primary Contact (Recreation, Class 1)	60,447	57,919	2,528	0
Secondary Contact (Recreation, Class 2)	6,066	6,066	0	0
Drinking Water Supply	45,908	45,908	6	0
Agriculture	64,149	64,149	0	0

The information in the table above was developed by both direct monitoring of lakes and evaluation of other data.

4. Summaries for Lakes and Reservoirs

The following lakes and reservoirs are of particular interest to the WQCD. The lakes in Grand County are the subject of special studies funded by 319 grants and an EPA §104(b)(3)grant. The remaining lakes are those lakes that have been identified as not attaining standards. These lakes are on the 303(d) List, or will appear on the next 303(d) List.

a. Colorado River Basin

Grand Lake (Grand County) is located near the southwestern boundary of Rocky Mountain National Park, near the town of Grand Lake. As the largest natural lake in Colorado, Grand Lake has 507 surface acres and supports several recreational water activities including: boating, sailing, water- and jet-skiing, swimming, and fishing. The CDOW manages this lake as a cold-water fishery.

Grand Lake was monitored for the WQCD by a volunteer monitoring group at two locations. In 1999, the Division received funding through an EPA §104(b)(3) grant to monitor and assess the water quality of the Town of Grand Lake's storm drain. An automated sampler was installed in the storm drain to collect flow-weighted composite stormwater samples. This study was continued through 2000 and 2001.

In 2000, the WQCD obtained two 319 grants to study lakes in Grand County. These projects are titled Three Lakes Clean Lakes Watershed Assessment, and Shadow Mountain Lake Restoration. These studies on Grand Lake, Shadow Mountain Lake and Lake Gandby will continue into 2002.

Fruitgrowers Reservoir: Fruitgrowers Reservoir is a 476 surface acre impoundment which lies in the drainage of Alfalfa Run in Hart's Basin, about 3 miles north of Austin, and about three miles south of Cedaredge, Colorado. It is primarily an irrigation reservoir, which intercepts runoff directly from Alfalfa Run, and by diversion from Surface Creek and Dry Creek. The reservoir was once a popular recreational area for boating, swimming and fishing, but during the past 10 years, these uses are no longer in place. When testing showed coliform bacteria counts in excess of state standards for natural swimming areas, the Delta County Health Department closed the reservoir to all water contact activities. The Bureau of Reclamation (BOR) has now developed the reservoir as a wildlife area and it has become a popular area for bird watching. The Division is presently participating with the federal and local entities in a cooperative water quality study of Fruitgrowers Reservoir and its watershed to determine the potential cause of the significant water quality problems the reservoir is experiencing.

The reservoir was monitored at approximately 9 sites in July and September of 1997. Based on the TSIs for chlorophyll-a, total phosphorus and Secchi Depth, of 78, 76, and 68, respectively, the reservoir is hypereutrophic. The reservoir was not thermally stratified on either sampling date but DO concentrations decreased significantly with depth to concentrations less than 5 mg/L. Metals and other monitored parameters were below detection limits or were detected at low levels. Fecal coliform levels were elevated at one sampling site.

Fruitgrowers Reservoir was sampled in cooperation with a coalition of local and government stakeholders. The focus of the sampling effort was to determine if the Reservoir should be removed from the 303(d) List, to address water quality standards issues for the Gunnison and

Lower Dolores Triennial Review Rulemaking Hearing in July 2001, and to evaluate nutrient enrichment. As a result of the 2001 standards assessment, Fruitgrowers Reservoir may be delisted for unionized ammonia and fecal coliform. However, it will be listed for DO.

b. Platte River Basin

Cherry Creek Reservoir: Cherry Creek Reservoir is located in Arapahoe County, southeast of Denver. The Cherry Creek Basin covers approximately 245,500 acres or 385 square miles, with the Reservoir occupying approximately 850 surface acres. Cherry Creek Reservoir is owned and operated by the U.S. Army Corps of Engineers. The reservoir is surrounded by Cherry Creek State Park, which contains 3,915 acres of multi-use recreation land managed by the Colorado Division of Parks and Outdoor Recreation. (DRCOG, 1984)

This Reservoir originally was built for flood control. The construction of the reservoir was completed in 1950, but the reservoir did not fill completely for several years. By 1957, when the water levels rose, the recreational use of the reservoir began to develop. The Reservoir has a maximum depth of approximately 6 meters near the outlet, with an average overall depth of 3 meters. Currently, Cherry Creek Reservoir and the surrounding areas are used for recreational activities including sport fishing, boating, swimming, bicycling, bird watching, hiking, and wildlife habitat. Cherry Creek Reservoir is classified as Class 1 Warm Water Aquatic Life, Class 1 Recreation, Water Supply, and Agriculture.

In 1982, the Clean Lakes Study of Cherry Creek Reservoir indicated that eutrophication of the reservoir could negatively impact the beneficial uses of the reservoir. The Clean Lakes Study identified phosphorus as the major nutrient causing algal production in the Reservoir. In 1984, the WQCC adopted a mean total phosphorus standard of 35 µg/L for Cherry Creek Reservoir based on the growing season of July through September. The 35 µg/L total phosphorus standard was intended to maintain in-lake chlorophyll a concentrations of 15 ug/L. In addition, the WQCC adopted a waste load allocation for total phosphorus discharge of 14,270 pounds per year. For 1992-1999, the reservoir did not meet the total phosphorus standard of 0.035 mg/L. Furthermore, the target level for chlorophyll a of 15 ug/L frequently was exceeded and the DO standard was not attained.

For the 2000 Cherry Creek Reservoir Control Regulation triennial review, the Basin Authority proposed changes to the total phosphorus standard, as well as the control regulation and associated TMDL. The Basin Authority had proposed a total phosphorus standard of 60 ug/L. Other parties had proposed a chlorophyll-a standard of 15 ug/L in place of the total phosphorus standard. At the rulemaking hearing in September 2000, the WQCC adopted a chlorophyll-a standard of 15 ug/L. In May,2001, the WQCC adopted a revised control regulation for Cherry Creek Reservoir that implements a phased nutrient TMDL for the reservoir. The WQCD will work with the Cherry Creek Basin Authority during the next triennium to develop the phased TMDL.

There was considerable debate and controversy in the 2000 Cherry Creek Reservoir standards hearing and the 2001 Cherry Creek Reservoir Control Regulation hearing. Details of the issues can be found in the Water Quality Control Commission Hearing Record. Additional information can be found in the Denver Regional Council of Governments public record for the Metro Vision 2020 Clean Water Plan Revisions regarding the Cherry Creek Basin Water Quality Authority Management Plan.

Barr Lake. In the November 2000 South Platte Basin Triennial Review, Barr Lake was identified as not attaining the pH standard. Studies indicate the lake is hypereutrophic. As a result of the triennial review, the WQCD suggested that Barr Lake be the subject for a Clean Lakes Study. The lake probably will be listed on the next 303(d) List.

c. San Juan and Dolores River Basins

McPhee and Narraguinnep Reservoirs: The WQCD has been working with Region 8 EPA and the Colorado Air Pollution Control Division (APCD) over the past three years on a study of mercury contamination in fish from McPhee and Narraguinnep Reservoirs. EPA contracted with Tetra Tech, Inc to prepare a technical support document identifying available data and potential mercury sources. This report is intended to support TMDL development for the Reservoirs. Tetra Tech's Draft Report,*Technical Support for Developing a Total Maximum Daily Load for Mercuryin McPhee and Narraguinnep Reservoirs, Colorado* August 2001, indicated that significant reductions in mercury loading would be necessary for both Reservoirs to meet the TMDL targets of 0.5 ppm mercury or less in fish tissue. The WQCD has been working with the APCD and EPA to review and revise the draft Tetra Tech Report and address several technical concerns and identify additional data needs.

Attainment of target fish tissue concentrations will likely require combinations of reductions from various sources. Historic mining areas appear to be a significant loading source. Voluntary clean up activities, are underway which may result in some degree of loading reduction. Power plants in the Southwest are likely sources of atmospheric mercury deposition to the Reservoirs, but at this time, there are not sufficient data to allocate the atmospheric deposition component to individual sources. Additional monitoring will be facilitated with the installation of an air deposition monitoring station at Mesa Verde National Park.

5. Lakes Impacted by Toxics

Colorado has identified ten lakes that are impacted by toxics. These lakes are discussed below.

Derby, Ladora, and Mary, which are on the Rocky Mountain Arsenal (RMA) are impacted by bioaccumulation of organics in fish. Fish consumption is banned at these lakes. The Rocky Mountain Arsenal lakes were listed on the 1998 303(d) list for TMDLs. However, as a result of the 2000 South Platte Basin Triennial review rulemaking hearing, delisting of the lakes has occurred. The RMA lakes will not appear on the next 303(d) List.

Fish in Teller Reservoir, on the Fort Carson military reservation, are contaminated by mercury and fish consumption is banned.

Some species of fish collected in Narraguinnep Reservoir, McPhee Reservoir, Navajo, and Sanchez Reservoirs have mercury levels exceeding 0.5 ppm. These lakes are posted with health advisories that recommend limiting the number of meals of fish per month, especially for children and pregnant women.

Sweitzer Lake has an advisory on fish consumption due to selenium bioaccumulation in fish.

Terrace Reservoir is severely impacted by metals. Terrace Reservoir was impacted by upstream mining operations at Summitville in the 1980's and early 1990's. Mining at Summitville ceased in December of 1992. In 1994 the area became a Superfund site. Water quality in Terrace Reservoir has been improving since 1994 as remedial operations have taken place at Summitville. In 2000 and 2001, the CDOW conducted fish survivability studies in Terrace Reservoir. The results were positive; the fish survived.

Milton Lake is included in Segment 3 of the Middle South Platte River Basin (COSPMS03). Data collected on Milton Lake indicate the lake is not attaining the pH standard. These data also indicate the lake is hypereutrophic. The lake probably will be listed on the next 303(d) list.

6. Acid Effects on Lakes

EPA published a study of acid rain problems in Colorado in 1986. One hundred thirty-two of the state's estimated 1,476 lakes were sampled during the study. Seventy percent of the 1,476 lakes are believed to be very sensitive to acid precipitation and 521 (35%) are sensitive to acid precipitation. The very sensitive lakes have an acid neutralizing capability (ANC) of not more than 50 microequivalents per liter (µeq/L) and the sensitive have a range of 50 to 200 µeq/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.

In 1994, the APCD funded the USGS and the National Parks Service to study the acid deposition patterns in the Yampa River Valley and to the east (downwind) of the valley, including the Mt. Zirkel Wilderness Area and Rocky Mountain National Park. A USGS fact sheet (March 1997) about this study concluded that, at 1997 levels of emissions from all sources in the Yampa River Valley, the Mt. Zirkel Wilderness Area contains hydrologic systems that may be the most effected by acid deposition in the Rocky Mountains. The USGS showed an increase in snow-pack acidity in early snowmelt in a watershed in the Rocky Mountain National Park. This increase in acidity was also noted adjacent to the Mt. Zirkel Wilderness Area, where projections of acidity levels in temporary ponds are expected to be at levels harmful to aquatic species including tiger salamanders, other amphibians, and trout fry.

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