WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM—UPPER COLORADO RIVER BASIN

In 1991, the U.S. Geological Survey, U.S. Department of the Interior, began a National Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and groundwater resources and to identify the major natural and human factors that affect the quality of these resources. In meeting these goals, the program will produce a wealth of water-quality information that will be useful to policy makers and managers at the National, State, and local levels.

The NAWQA program emphasis is on regional-scale water-quality problems. The program will not diminish the need for subregional and site-specific studies and monitoring presently designed and conducted by Federal, State, and local agencies to meet their individual needs. The NAWQA program, however, will provide a regional framework for conducting many of these activities and an understanding about regional and national water quality that cannot be acquired from individual, site-specific programs and studies.

Studies of 60 hydrologic systems that include parts of most major river basins and aquifer systems (study-area investigations) are the building blocks of the national assessment. The 60 study areas range in size from 1,000 square miles to more than 60,000 square miles and represent 60 to 70 percent of the Nation's water use and population served by public-water supplies. Twenty study-area investigations were started in 1991, 20 additional started in 1994, and 20 more are planned to start in 1997. The Upper Colorado River Basin in Colorado and Utah was selected as one of 20 study areas that began assessment activities in 1994.

DESCRIPTION OF THE UPPER COLORADO RIVER BASIN

More than 99 percent of the Upper Colorado River Basin study area is in Colorado; the remaining is in Utah. It has a drainage area of about 17,800 square miles. The primary river within the basin, the Colorado River, originates in the mountains of central Colorado and flows about 230 miles southwest into Utah. The headwaters of the Colorado River and most of its tributaries originate in the mountains that form the eastern and southern boundaries of the study area. This boundary is the Continental Divide. The major tributaries to the Colorado River in the study area are the Blue, Eagle, Roaring Fork, Gunnison, and Uncompahgre Rivers.

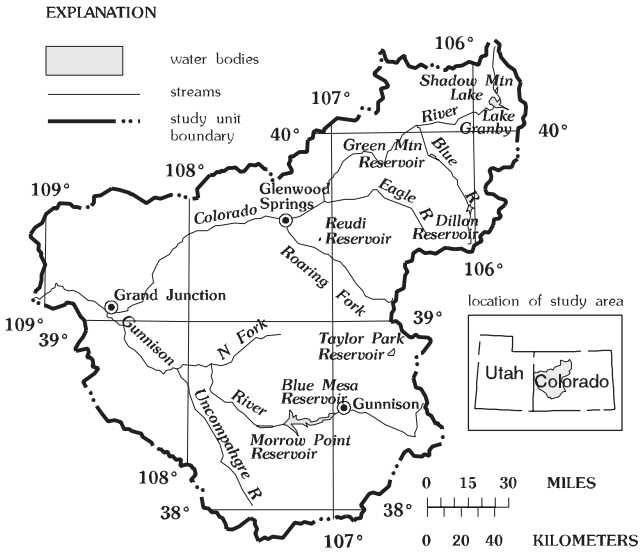
This two-State study area is predominantly rural and is inhabited by about 234,000 people, more than 99 percent residing in Colorado. The majority of the basin population is concentrated in the Grand Junction, Colorado area. Tourism is a major year-round industry and accounts for substantial increases in population primarily during winter and summer.

Physiography, Geology, and Hydrology

The study area is almost equally divided between the Southern Rocky Mountain province to the east and the Colorado Plateau province to the west. The area's rugged landscape displays north-northwest-trending mountain ranges in the east. The mountains are flanked by steeply dipping sedimentary rocks. To the west are high plateaus bordered by steep cliffs along the valleys. Distinctive mesas are conspicuous features in the area. The topography varies greatly, and altitudes range from more than 14,000 feet along the Continental Divide to about 4,300 feet near the Colorado-Utah State line . The predominant vegetation is pine, fir, and spruce forests in the mountains and greasewood and sagebrush in the lower altitudes.

The Upper Colorado River Basin is underlain by rocks ranging in age from Precambrian (1,800 million years) to Quaternary. The long history of sedimentation, erosion, and tectonic activity associated with the formation of these rocks has resulted in a complex geologic setting. Precambrian formations of gneisses, schists, and granites form the core of the high mountains and are very resistant to erosion. Sedimentary rocks predominate through the rest of the study area and consist primarily of sandstone, siltstone, and shale and local occurrences of evaporites. Several widespread geologic formations were deposited in marine environments and resulted in bedded and disseminated sodium chloride (halite) and calcium sulfate (gypsum), as well as clay that has high concentrations of exchangeable sodium and magnesium. These formations contribute substantially to the natural sources of salinity in the study area. Sedimentary formations also contain deposits of oil, oil shale, coal, and natural gas. The alluvium consists of unconsolidated deposits that typically transmit the most ground water in the study area. Structural features, including anticlines, domes, and faults, expose large sequences of strata in the study area.

Streamflow has marked seasonal and annual variability. Most annual streamflow in the Upper Colorado River Basin results from snowmelt during spring and early summer. Most annual floods on these streams occur during the snowmelt period. Although the magnitude of these floods can be quite large, exceptionally large snowmelt floods that could cause severe flooding are very uncommon. Low flows on perennial streams are sustained primarily by flows from ground water. Gradual melting of perpetual snowfields and reservoir releases also augment low flows on some streams. Thunderstorms in



the summer are a primary source of streamflow in plateau areas. Annual precipitation varies from less than 12 inches in the plateau regions to the west to more than 40 inches over the mountains to the east. Annual runoff in the study area ranges from 0.5 inch throughout much of the basin to more than 20 inches in the high mountains.

Little ground-water information is available for the Upper Colorado River Basin because most of the area is unsuitable for extensive ground-water development and surface-water supplies usually are available. The most productive wells in the area are completed in unconsolidated deposits including alluvium, gravel, landslide deposits, terrace deposits, and glacial deposits. Yields of wells completed in these deposits normally are greater than 10 gallons per minute and range from 1 to 750 gallons per minute. Wells completed in bedrock are in the Eagle Valley Evaporite, Maroon Formation, Burro Canyon Formation, Dakota Sandstone, Mancos Shale, Mesaverde Group, Green River Formation, Precambrian rock, and basalt units. These wells generally are present at higher altitudes above river and stream valleys and typically yield an average of about 18 gallons per minute and range from 1 to 60 gallons per minute. Regional ground-water-flow directions are similar to surface-water-flow directions. Recharge from precipitation occurs in mountainous terrain generally in the eastern part of the study area, flows westward and discharges to springs and surface water in lower topographic terrain generally in valleys and in the western part of the study area.

Water and Land Use

Management of water resources in the Upper Colorado River Basin is strongly influenced by the 1922 Colorado River Compact and the 1948 Upper Colorado River Basin Compact. The Colorado River Compact formally divided the basin and apportioned the beneficial consumptive use. The Upper Colorado River Basin Compact apportioned the water of the Upper Colorado River Basin among the five States having drainage areas that contribute to the flow of the Colorado River upstream from Lees Ferry, Arizona. Management of water quality in the study area has been greatly influenced by three Public Laws. Public Law 92-500, enacted in 1972, required the establishment of criteria for dissolved-solids concentration in the Colorado River. In 1974, Public Law 93-320 authorized the construction of 4 salinity-control projects and the development of plans for 12 others. The 1984 amendment to the act (PL98-589) provided authority to the Bureau of Reclamation and the U.S. Department of Agriculture to install salinity controls needed to meet criteria for dissolved-solids concentrations.

The transmountain diversions from the western to the eastern slope of the Continental Divide averaged about 510,000 acre-feet per year from 1973 to 1982, which is less than 12 percent of the average annual streamflow at the mouth of the Upper Colorado River Basin. These transmountain diversions generally supply irrigation and municipal water to farms and cities in the South Platte, Arkansas, and Rio Grande drainages.

Off-stream water use in the Upper Colorado River Basin during 1990 totaled about 3,535 million gallons per day. About 99 percent of the water used was surface water. About 96 percent of the total water use was for irrigation.

Storage of surface water in lakes and reservoirs in the study area exceeds 2.3 million acre-feet. Most of this storage is associated with three large water-resources development projects: (1) Currecanti Unit of the Colorado River Storage Project; (2) Colorado-Big Thompson Project; and (3) municipal water supply for the Denver metropolitan area.

Land designated for use as rangeland or woodland comprises about 85 percent of the Upper Colorado River Basin. Livestock production is the principal use of the large areas of rangeland available for foraging. Many of the mountain slopes and plateau areas are forested. Commercial tree species include lodgepole pine, Engleman spruce, and Douglas fir. Other prinicipal land-use designations include cropland, recreation land, and urban land.

Irrigated agriculture is a principal land use in the study area and uses about 4,000 million gallons per day. Crops that are irrigated include livestock feed, fruit, and vegetables. Most of the irrigated lands are in river valleys or on plateaus and are supplied by extensive systems of canals and ditches. Large parts of the study area have been set aside specifically for recreational activities. All or part of four National Park Service recreational areas and four wilderness areas are located in the study area. More than 10 ski areas operate in the area, and snowmaking during low-flow conditions can affect stream quantity and quality. Mining brought the first settlers to the region and is still the major industry in many areas. Molybdenum, vanadium, copper, nickel, uranium, lead, zinc, oil shale, coal, and oil and gas resources all have been mined in the study area. Urban land is the smallest land-use category in the study area. However, several metropolitan areas (Denver, Colorado Springs) outside the basin have a marked effect on water and land use in the basin as a result of transbasin diversions.

MAJOR WATER-QUALITY ISSUES

The major water-quality issues in the Upper Colorado River Basin relate to land and water use and differ in the headwaters and downstream areas. The primary nonpoint-source activities are irrigated and nonirrigated agriculture, grazing, streamflow regulation from dams and diversions, and recreation. Primary point-source activities are mining-related industry, agricultural-related industry, and municipal wastewater-treatment facilities. Both point- and nonpoint-source activities can affect the stream biota and habitat.

The following water-quality issues have been identified, in conjunction with the Upper Colorado River Basin liaison committee, as high priority regional-scale issues of concern to the State and local water-resource managers. The liaison committee consists of representatives from Federal, State, and local agencies, universities, and the private sector who have water-resources responsibilities.

- Effects of sediment, nutrients, and organic compounds from increasing urban development, including transportation routes and construction, on the biology and water quality of receiving streams and affected ground waters.
- Effects of hydrologic modification (transbasin, channel modification, dams) on water quality and biology of receiving streams.
- Effects of metals, sediment, and salinity from mineral and energy extraction on the biological and chemical quality of receiving waters, particularly in the headwaters of the Colorado River and its tributaries.
- Effects of nutrients, trace elements, pesticides, and sediment from nonpoint- and point-agricultural sources on the water quality and biology of receiving streams and affected ground waters.
- Effects of salinity from natural, agricultural, and municipal sources on the water quality of receiving streams.

Additional water-quality issues that were identified by the liaison committee as lower priority issues are listed below.

- Identify high quality water-quality conditions
- Determine quality of water in wetlands and effects of land-use practices on wetlands.
- Effects on downstream users
- Effects from municipal wastewater-treatment plants
- Effects of recreational uses

COMMUNICATION AND COORDINATION

Communication and coordination between the U.S. Geological Survey and water-management and other water-resource organizations are critical components of the NAWQA program. Study-area liaison committees have proven to be highly effective in increasing communication and collaboration. Specific activities of the Upper Colorado River Basin liaison committee include:

- Exchanging information on and prioritizing water-quality issues of regional and local interest.
- Identifying sources of water-quality data and other ancillary information including but not limited to land use, demographics, soils, land-management practices, and pesticide-use statistics.
- Assisting in the design and scope of project elements.
- Reviewing project-planning activities, findings, and interpretations, including reports.

Information on technical reports and hydrologic data related to the NAWQA program can be obtained from:

District Chief
U.S. Geological Survey
Denver Federal Center
Box 25046, Mail Stop 415
Denver, Colorado 80225

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N.E. Driver, 1994