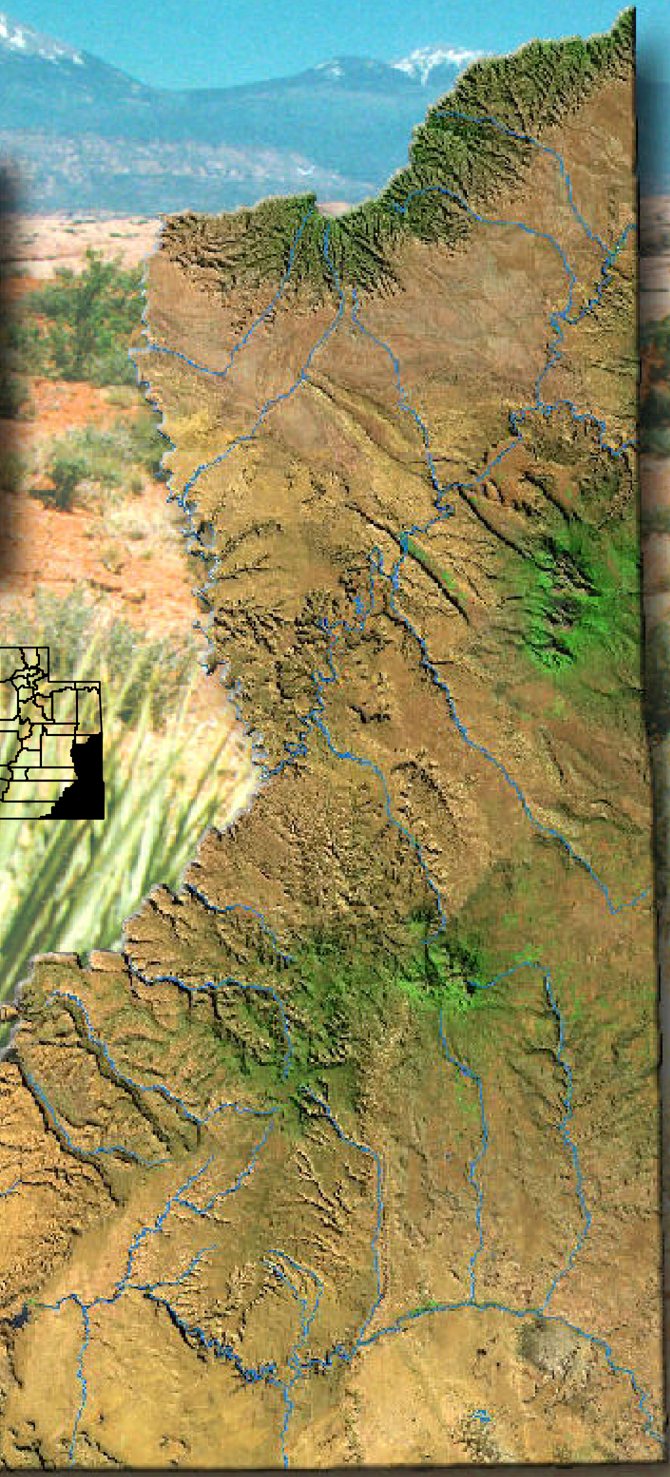
# Utah State Water Plan

# SOUTHEAST COLORADO RIVER BASIN

**Division of Water Resources**

**October 2000**



STATE OF UTAH
NATURAL RESOURCES
Division of Water Resources

# Utah State Water Plan - Southeast Colorado River Basin

Section

Utah State Water Plan

# Southeast Colorado River Basin

Utah Board of Water Resources
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October 2000

Utah Division of Water Resources
Utah Department of Natural Resources

Section 1

# Southeast Colorado River Basin

**Utah State Water Plan**

## Foreword

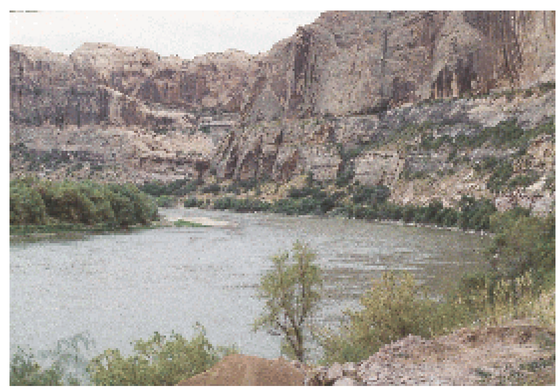
The *Utah State Water Plan* (1990)[16] was prepared to provide a foundation for establishment of state water policy. Within the framework of water policy planning, the state meets its obligation to plan and implement programs to best serve the needs of the people.

In addition to the Utah State Water Plan, more detailed plans have been published for the Bear River, Cedar/Beaver, Jordan River, Kanab Creek/Virgin River, Sevier River, Uintah Basin, Utah Lake and Weber River hydrologic basins. The West Colorado River Basin and West Desert plans will be published by late 2000. The Southeast Colorado River Basin Plan discusses the water-related resources and the problems, needs, issues and alternatives for conservation and development measures. Final selection of alternatives will rest with the local decision makers.

This plan is based on information now available, but it can be re-evaluated and revised to reflect changing circumstances. Successful planning needs the active participation of all concerned individuals and entities and their responses to the issues at hand. In addition, coordination at all levels of government improves the quality of planning. Common acceptance of resource conservation and development goals enhances the likelihood of reaching these objectives. However, individuals or small groups are often able to bring about progress where centralization can stifle innovation. This basin plan is intended to help bring about greater coordination between those involved to assure the needs and demands of the local people are met.

The Southeast Colorado River Basin is not a single river basin but is a collection of smaller basins draining primarily to the Dolores, Green, San Juan and Colorado rivers. All of these drainages ultimately end up in Lake Powell.

Most of the easily developable water in the basin is now in use. There is, however, additional water that can be developed. One of the challenges facing the residents of this basin is to find the most economical way to develop the available water.



Colorado River

**ACKNOWLEDGMENT**

The Board of Water Resources gratefully acknowledges the dedicated efforts of the State Water Plan Steering Committee and Coordinating Committee in preparing the *Southeast Colorado River Basin Plan*. This work was spearheaded by the planning staff in the Division of Water Resources with valuable assistance from individual coordinating committee members and their associates representing state agencies with water-related missions. Their high standards of

professionalism and dedication to improving Utah's natural resources were essential.

We appreciate the input and assistance of representatives of state and federal cooperating entities, the statewide advisory group and the local basin planning advisory group who expressed opinions and provided expertise from a broad spectrum of Utah's population. Representatives of many local entities and groups provided much needed assistance at the "grass-roots" level.

We extend thanks to those who attended meetings and provided written and oral comments. In endorsing this plan, we reserve the right to consider local water projects on their own merits. This plan is an important guide for water development and conservation in the Southeast Colorado River Basin. ❑

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Section 2

# Southeast Colorado River Basin

**Utah State Water Plan**

## Executive Summary

### 2.1 FOREWORD

Within the broad responsibility to enhance the quality of life and general welfare of its citizens, the state of Utah has the specific obligation to plan for and encourage the best use of its resources. The *State Water Plan* (1990)[16] provides the statewide foundation and direction. More detailed plans have been prepared for the *Bear River, Kanab Creek/Virgin River, Weber River, Jordan River, Sevier River, Uintah, Utah Lake and West Colorado River basins.* The *Southeast Colorado River Basin and West Desert(includes Columbia River) Basin* will be the final plans in this series. This plan was prepared under the direction of the Board of Water Resources.

The purpose of this plan is to identify potential conservation and development measures and projects and to describe alternatives to alleviate the problems, needs and demands of the local people. The final selection of alternatives for meeting future needs will be made by the local people.

### 2.3 INTRODUCTION

Water planning has always been a part of Utah's history. Current water planning needs add more impetus. This section presents the general planning guidelines used to insure continuity. Preparation of this plan has involved many local, state and federal entities who are involved in and have expertise regarding water resources. The planning process allows for review and approval at various stages of completion.

The Southeast Colorado River Basin is located in the southeast corner of the state and covers 6,976,250 acres (10,900 square miles) in Grand and San Juan counties. The basin area is 12.8 percent of the state. Part of the Navajo Indian Reservation and the Ute Mountain Ute tribal lands are located in southern San Juan County. The southern end of the Uintah and Ouray Indian Reservation is in northern Grand County. The largest communities are Blanding, Moab and Monticello. Aneth is the largest Navajo Nation community.

> Like the State Water Plan (1990), the Southeast Colorado River Basin Plan contains 19 sections. In addition, there is Appendix A, Acronyms, Abbreviations and Definitions; and Appendix B,

The basin is located in the Colorado Plateau Province with elevations varying from 3,700 feet at Lake Powell to 12,720 feet on Mount Peale in the La Sal Mountains. The primary river systems are the Colorado, Dolores, Green and San Juan rivers. Most of the available water supply comes from smaller streams such as Mill Creek, Pack Creek, Indian Creek, North and

South creeks and Recapture Creek. The area is characterized by high mountains and deeply incised canyons providing colorful, spectacular rock formations. People come from all over to enjoy this popular recreational area.

In this arid and semi-arid area, summer temperatures usually reach the high 90s and winter temperatures are 10°F to 20°F depending on the location. The annual precipitation ranges from 6 to 30 inches depending primarily on elevation. Frost-free days vary from 231 days at the Hite Marina to 119 days at La Sal.

There are five vegetative types consisting of conifer-aspen stands and shrubs in the higher elevations to shadscale-blackbrush cover in the lower areas. Intermediate elevation vegetation includes pinyon-juniper and sagebrush. Soils vary from loams to sandy to clay with areas containing sands and gravels. There are also large areas of barren sandstone rock formations and intrusions of partially eroded lacolith domes.

Most of the higher elevation lands are used for wildlife habitat or livestock grazing and some timber production. The lower areas are used for rangeland, cropland and recreation. There are 8,930 acres of irrigated cropland and 130,400 acres of dry cropland. The grazing areas cover about 2.36 million acres or about 34 percent of the basin.

Abajo Mountains

The private lands and state lands each cover about seven percent of the area or a total of over one million acres. The federal and Indian lands cover over 85 percent (5.9 million acres) with the Bureau of Land Management administering the largest area at 51 percent or over 3.5 million acres. The Navajo Indian Reservation, Ute Mountain Ute and Northern Ute tribal lands cover about 18 percent of the basin (1.27 million acres).

Although the Southeast Colorado River Basin has been called a "vast contiguity of waste" whose main function was "to hold the world together", it has a long and rich history. Elk Mountain (Moab area) was the first settlement in 1855. This was soon abandoned. Cattle were brought into the area and the livestock industry thrived until the long drought toward the end of the 1800s. As the settlements increased in the 1880s, water was diverted for irrigation and domestic use. The diversion of water from local streams and from groundwater aquifers satisfied the demands until the late 1950s but there was soon a need for reservoir storage. By the 1980s, three large reservoirs had been constructed along with development of a culinary well field near Moab.

## 2.4 DEMOGRAPHICS AND ECONOMIC FUTURE

The economy of the Southeast Colorado River Basin has expanded from an agricultural base to one where recreational, commercial and industrial enterprises are important. Moab, Monticello and Blanding are the largest cities and they are also the trade and service centers.

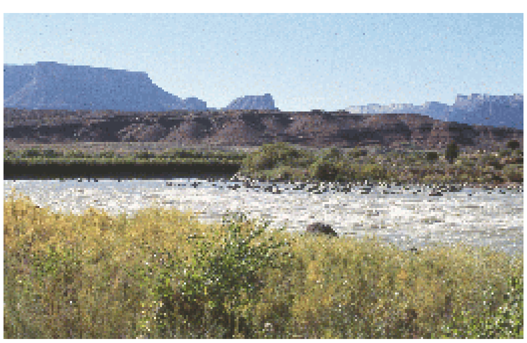
The Indian populations were established in the area in the 1500s and 1600s. White settlers and cattlemen came into the area and began establishing themselves from the mid- to late 1800s. The population was 916 in 1890 and had grown to 2,172 by the turn of the century. By 1950, it had increased to 7,218, mostly in San Juan County. With the uranium boom and the popularity of recreation and tourism, the population had increased to 23,247 by 1998, 1.1 percent of the state and still only 2.1 people per square mile. There are about 6,865 Navajo Indians living on and about 1,200 living off the reservation. The Ute Indian population at White Mesa is about 220 with about 70 more living in Allen Canyon and in other areas. The total basin population is projected to be 39,477 by 2020 and 90,070 by 2050. The Navajo Nation and Ute White Mesa population are projected to be 8,255 and 384, respectively, by 2020 and 12,405 and 582, respectively, by 2050.

Agriculture only accounts for about 3.2 percent of the total employment. Four sectors provide most of the employment. These are: 1) Trade, 2,460; 2) government, 2,359; 3) non-farm proprietor, 2,410; and 4) service, 2,337. Total employment was 11,839 in 1998 and is projected to increase to 21,930 by 2020. The current rate of unemployment within the Navajo Nation is over 50 percent with about one-half of the families living below the poverty level.

## 2.5 WATER SUPPLY AND USE

Water has been and still is a scarce resource. Much of the water from the perennial streams originating within the basin has been developed. There is still some undeveloped surface water and a supply of groundwater in several aquifers. Most of the surface water originates in the La Sal and Abajo mountains along with some of the recharge to groundwater aquifers. One of the first things those coming into the area did was to develop the water supply for irrigation of crops and for domestic use.

The total surface water yield is about 148,420 acre-feet annually. The highest yielding streams supply the areas around Moab, Monticello and Blanding. In addition, there is some water diverted from the Colorado River in the Castle Valley area and from the San Juan River in the Aneth/Montezuma Creek area and around Bluff.



San Juan River

Groundwater is withdrawn from two types of aquifers, consolidated rock and unconsolidated or alluvial deposits. There are consolidated rocks throughout most of the basin with varying amounts and quality of groundwater. The primary alluvial aquifers are located in Spanish Valley and Castle Valley where well production has been measured as high as 2,500 gpm and some springs at over 300 gpm. Total culinary water supplies from groundwater are about 14,990 acre-feet annually, 2,770 acre-feet from springs and 12,220 acre-feet from wells.

Total diversions for cropland irrigation are 34,950 acre-feet annually with about 18,430 acre-feet depleted. Of this amount, 6,640 acre-feet are pumped from the Colorado River and about 2,000 acre-feet are diverted from the Dolores River.

There are 5,569 acre-feet diverted annually for culinary use in community systems including 1,490 acre-feet diverted for private domestic systems. Secondary water use is 3,007 acre-feet annually and self-supplied industrial use is 2,030 acre-feet annually.

The net water surface evaporation from reservoirs and lakes is about 2,050 acre-feet. In addition, there is use by wetlands and riparian vegetation. Non-consumptive use includes instream flows for fish and wildlife purposes and recreation activities, both stream and flat-water.

## 2.6 MANAGEMENT

When the early settlers moved into the area, there was not a need for intensive management of the water resources. As the number of water users increased, management became important in order to make the best use of the available supplies. The first diversion structures were earth while later diversions included a water wheel and a log crib dam. Since then, concrete diversions and pipelines have become common place. Reservoirs have been constructed to store water during high flows for use at a later time. This has made more efficient use of the runoff from the high mountain areas.

There are 15 different types of water provider agencies. These include water and sewer agencies, municipal public works departments, water conservancy districts, water users associations and irrigation companies. These providers deliver water for one or more uses to different types of clientele. In addition, the Navajo Nation has its own management systems for culinary water delivery.

There are 20 public community water systems, 4 in Grand County and 16 in San Juan County including 9 within the Navajo Indian Reservation and one in White Mesa. There are an additional 8 community systems on the Navajo Indian Reservation of which only one is monitored or regulated by the state of Utah.

There are seven irrigation companies delivering water to lands for crop production. Water users obtain supplies from 30 lakes and storage reservoirs, 19 built primarily to supply irrigation water.

As the demand for water increases, management entities will have to become more efficient in order to satisfy these needs. This will require implementing practices to make sure the watersheds are managed to protect the water yielding areas. Conjunctive management of surface water and groundwater will be needed in some cases to optimize the use of both sources. Delivery systems will have to be maintained and expanded. There are 12 potential reservoir sites presented for possible future development.

## 2.7 REGULATION/INSTITUTIONAL CONSIDERATIONS

The responsibility for water regulation rests primarily with three state agencies. The State Engineer, as Director of the Division of Water Rights, is responsible for the allocation and division of water as well as for dam safety. The three largest dams, Ken's Lake, Loyd's Lake and Recapture Creek Reservoir, are classified as high hazard because of the potential for loss of life and property damage. Water quality regulations are administered by the Water Quality Board and Drinking Water Board. The Division of Water Quality and Division of Drinking Water, respectively, are staff for these two boards. Water conservancy districts, special service districts, cities and towns also have responsibilities for regulating and managing certain aspects of the water resources.

Federal reserved water rights will play an important part in water development and use in the Navajo Indian Reservation and the several national parks and monuments. Reserved rights for the Navajo Nation have not been defined. This could impact future use of the Colorado River. The Ute Mountain Utes at White Mesa have a certificated water right. Reserved water rights for the national parks and monuments are being pursued.

## 2.8 WATER FUNDING PROGRAMS

Development of water resources has always required funding although many of the early projects were funded "in-kind." Much of the funding comes from the local water users, either as match for state or federal monies or to pay back loans.

There are eight state agencies and boards with 15 programs available to provide funding for water-related projects. These programs are available to assist with irrigation, drinking water, recreation, waste water treatment, fish habitat and other related facilities. Grants of over $9.5 million and loans of nearly $28.8 million have been provided for water-related projects. Additional funds were also provided but data were not available.

There are eight federal agencies with 17 programs with funding available for water-related projects. These programs can be used for conservation and rehabilitation of farmland including reducing erosion and flooding. They also provide funding for irrigation and culinary water supplies, water quality improvement, damage mitigation and other related needs. Federal agencies have provided grants of nearly $216.5 million (including cost-sharing of over $7.4 million) and loans of nearly $4.7 million.

Nearly $151 million of the grant funds were for three water reclamation projects by the Bureau of Reclamation from 1927-69.

## 2.9 WATER PLANNING AND DEVELOPMENT

As the area grows, the demand for water will increase requiring planning for the conservation and development of the limited resources. Long-range planning is important because of the many state, federal and local agencies and entities involved. One goal should be to coordinate the water-related activities of these entities when assistance is requested by the local people.

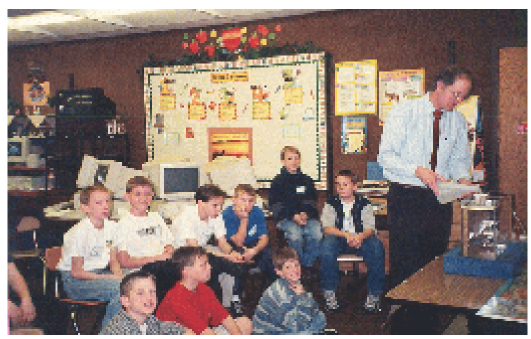
The culinary municipal and industrial use is expected to increase from 5,570 acre-feet in 1996 to 11,140 acre-feet in 2020 and 27,970 acre-feet by 2050. This demand can be reduced by implementing conservation practices. Only 30 acre-feet of culinary water provided by public community systems was used for industrial purposes but there was 2,030 acre-feet of reported self-supplied use. The self-supplied industrial water use is expected to increase to 4,560 acre-feet by 2020 and to 6,720 acre-feet by 2050. Secondary water use was 1,140 acre-feet in 1996. This will increase to 2,350 acre-feet by 2020 and 5,610 acre-feet by 2050.

The annual diversions for cropland irrigation are about 34,950 acre-feet, 13,800 acre-feet in Grand County and 21,150 acre-feet in San Juan County. This use is expected to remain about the same or decrease slightly due to encroachment of urban areas.

The reoccurring droughts bring the realization that more dependable water supplies are needed, especially those for municipal and industrial uses. Local water planners are pursuing other alternative sources for future water development. These include construction of a dam on North Creek to store 1,200 acre-feet of stream flows or diversion of the water to Loyd's Lake. Dry Wash No. 2 Reservoir could be enlarged to raise the storage capacity from 185 to 370 acre-feet. The San Juan Water Conservancy District is investigating buying water from the Dolores River Project in Colorado and piping it to Monticello and Blanding. There is also potential storage in Coal Bed Canyon. The Navajo Area Indian Health Service has 11 active projects, three funded, to extend and improve the culinary water supply on the reservation.

Water conservation programs can make the present supplies go farther. This makes it imperative to carry out a conservation education program, particularly for those at the elementary school level. Cloud seeding programs can increase the available water supply.

The only issue is resolution of the Indian reserved water rights. These rights need to be established under Utah water law so future planning can be carried out within the proper context.



Water Education

## 2.10 AGRICULTURAL WATER DEVELOPMENT

Much of the surface water supply has been developed but there is still the possibility of groundwater development for agricultural uses. The limited extent of irrigated agriculture is primarily due to the lack of economically developable water supplies. The major irrigated areas are located in Spanish Valley near Moab, around Monticello, in the Blanding area, and along the San Juan River near Bluff. Most of the early water projects were to develop water for irrigation of crops. Recent projects include the construction of Ken's Lake, Loyd's Lake and Recapture Creek Reservoir.

There are currently 8,929 acres of irrigated cropland. The most common crops grown are alfalfa and pasture which account for over 7,500 acres of the total. Cropland producing cash crops such as orchards and vineyards are mostly located in Spanish Valley. There are 34,950 acre-feet of water diverted for irrigation and 18,430 acre-feet are depleted. In addition, there are 130,400 acres of dry cropland, 128,200 acres in San Juan County and 2,200 acres in Grand County. Winter wheat is the principal crop while safflower is also important.

There is a shortage of water for much of the irrigated cropland, especially during the late part of the growing season. As agricultural costs increase, it is not economically feasible to develop additional agricultural water unless it can be done as part of a municipal and industrial project. The best opportunities to increase water supplies are on-farm practices to make more efficient use of the present resources. There is also the potential for development of additional municipal and industrial water along with some agricultural water from the Dolores River Project and pumping water from the Colorado and San Juan rivers. The irrigation water is generally of good quality except that diverted from the San Juan River is high in sediments.

Erosion is a problem in some areas. In the upper Montezuma Creek dry cropland areas, annual gross erosion rates are about 6 tons/acre. Some upper watershed areas are eroding at 39 tons per acre annually. Presently, there is severe erosion on 82,500 acres of rangeland yielding 236,460 tons of sediment and 17,600 acres of cropland yielding 216,480 tons annually. The total salt load is 15,230 tons annually. Establishment of a healthy watershed is the best way to reduce erosion and the resulting downstream sedimentation and salt loading.

## 2.11 DRINKING WATER

There are 52 public water systems. These include 20 public community systems, 24 public non-community systems and 8 Navajo Nation community systems. The public community systems deliver 3,867 acre-feet; the public non-community systems, 212 acre-feet; and private domestic systems use about 1,490 acre-feet. The average basin-wide use by the public community systems was 206 gallons per capita per day and 228 gpcd when all drinking water uses are included, lower than the state average of 267 gpcd. About 79 percent of the culinary water supply comes from groundwater. The three communities using surface water with water treatment plants to bring the water up to state standards are Blanding, Halchita and Monticello. All of the systems and facilities are operated according to the state and federal safe drinking water acts. The demand by 2020 will be about 11,140 acre-feet and 27,980 acre-feet by 2050. No allowance for conservation is included. All of the public community systems have adequate water to satisfy the 2020 demand. Moab is limited by 1,158 acre-feet in system capacity to meet the 2020 demand and by 4,973 acre-feet to meet the 2050 water supply demand.

The future use by the Navajo Nation is based on a 2.48 percent population growth rate and 160 gallons per capita day. The culinary water use will increase from the present 484 acre-feet (132 gpcd) to 1,053 acre-feet by 2020 and 2,198 acre-feet by 2050.

The City of Blanding needs to increase the capacity of its water treatment plant in order to meet future demands. The community of Halchita has a need to upgrade their water treatment plant and Mexican Hat needs a better water supply. There is the potential for these two communities to build a treatment plant to serve the needs of both. A study is now underway in Spanish Valley to determine if the groundwater aquifer can be developed to meet the projected demand. The Town of Castle Valley is doing a groundwater supply and septic tank density study to determine the population the local aquifer will support.

## 2.12 WATER QUALITY

The water quality in most of the tributary streams is good, usually with total dissolved-solids less than 300 μmhos/cm. These streams are the major surface water supply for most of the uses within the basin. The Colorado River, Green River and San Juan River all average less than 1,000 μmhos/cm while the Dolores River averages just over 1,100 μmhos/cm. The groundwater quality varies depending on the aquifer, its depth and the location in regards to the recharge area. Most of the bedrock aquifers yield water that is fresh (0 to 1,000 mg/L) to moderately saline (3,000 mg/L). The Navajo sandstone generally yields high quality water except in the Aneth area where it approaches briny conditions (more than 35,000 mg/L). Wells in Spanish Valley generally produce water with total dissolved-solids concentrations less than 500 mg/L (848 μmhos/cm) and over two-thirds of these wells with less than 250 mg/L (424 μmhos/cm). The alluvial aquifers in Castle Creek yield water with about 177 mg/L (300 μS/cm). Wells sampled in the Cutler formation in Castle Valley had total dissolved-solids ranging from 497 mg/L (842 μmhos/cm) to 2,572 mg/L (4,360 μmhos/cm).

The Clean Water Act requires the Division of Water Quality to monitor pollution of the surface water and groundwater resources. They administer the Pollutant Discharge Elimination System at the federal and state levels. There are eight wastewater treatment lagoons under this program and one mechanical secondary treatment plant. The surface water reservoirs, lakes and streams are given beneficial use classifications. These determine which water is available for various uses and also indicates the trophic status.

The Division of Water Quality has initiated a monitoring program which will define sources of pollution exceeding the state standards. Actions will be determined to bring polluted water bodies within the standards or they may be reclassified. Areas with pollution problems include Spanish Valley and Comb Wash. There is also a problem where there are tailings piles left from ore processing activities. Water moving through these piles can leach contaminants into surface water and groundwater supplies.

There are two issues. One discusses the problem of contamination from septic tanks and drain fields. The other discusses the regional contamination of water supplies from mining tailings ponds.

## 2.13 DISASTER AND EMERGENCY RESPONSE

Floods and droughts are the most frequent disaster-related occurrences in the basin. Local governments have the responsibility to initiate the first response to any disaster or emergency. If the event is beyond their capability, the state can be called in for assistance. Federal assistance is also available in cases of a major occurrence.

Most communities in the basin are located in close proximity to the perennial streams. This makes them susceptible to flooding, especially from high intensity cloudbursts. Some flood plain studies have been conducted but Moab is the only community eligible under the National Flood Plain Insurance Program. San Juan County has also passed ordinances making the unincorporated areas eligible.

Drought conditions have occurred at varying frequencies in the past. Droughts are more insidious, beginning slower and usually lasting over longer periods of time than other disasters.

Local governments should prepare Emergency Operations Plans in order to respond efficiently to any disasters. Disaster response should be coordinated at the local and state levels. The only issue describes the need for flood plain management. Plans should be prepared for communities within mapped flood plains so they can manage developments in these areas.

## 2.14 FISHERIES AND WATER-RELATED WILDLIFE

The basin is home to generally healthy populations of native fish and wildlife species ranging from the high mountain to the desert environments. Settlement of the area has brought about some decline in population although some are making a comeback.

There is a diversity of sport fish from trout in the higher elevations to warm water species in the lower areas. The riparian areas provide the food, water, cover and space habitat needed for wildlife more dependent on water to maintain the species. The Colorado, Green and San Juan rivers contain four endangered species of fish. These are the Colorado pikeminnow, humpback chub, bonytail chub and razorback sucker. The Upper Colorado River Recovery Implementation Program is a 15-year effort aimed at the recovery of these species of fish.

Protection of fish and wildlife habitat is important for their survival. This can be accomplished by cooperative mitigating actions where water development is planned and by management of watersheds to provide adequate habitat. The lakes and streams have been given a beneficial use classification according to their value as a fishery. There are four issues. These discuss the loss of wetlands and riparian habitat, irrigation water diversion dams, winter fish kills, and the impacts of tourism.

Mule deer habitat is important

## 2.15 WATER-RELATED RECREATION

The scenic and nationally known recreational aspects of the area are a major attraction. Many commercial enterprises have been developed to take advantage of these resources. The three state parks provide scenic vistas of the Colorado and San Juan rivers from outlooks nearly 2,000 feet above. Edge of the Cedars State Park Museum has an unequaled collection of Anasazi pottery and the remains of an Ancestral Pueblo Village. There are two national parks, three national monuments, one national recreation area, one wilderness area and one national forest. In addition, there are large areas of public domain providing spectacular scenery, hiking, 4-wheeling and other recreational activities from alpine environs to outstanding desert panoramas. The Colorado, Green, Dolores and San Juan river corridors provide hiking, touring and rafting experiences. There were over 5,000 river rafting trips in 1997. There are over 40 facilities for camping.

Water safety is becoming a problem as is conflicting uses of bike and hiking trails. The protection of ancient Indian cultural areas and artifacts is an increasing concern with more use of these remote areas. Public education programs seem to be the best solutions along with law enforcement in problem areas.

## 2.16 FEDERAL WATER PLANNING AND DEVELOPMENT

The federal government has been involved in many programs in the Southeast Colorado River Basin. While past activities were oriented around projects, they are now more involved in conservation and protection of the resources. One of the main concerns is for the federal government to be part of the coordinated efforts regarding the resources along with local and state involvement. Coordination is imperative considering the large areas of federal land in the basin.

Major activities include management of the public lands by the Departments of the Interior and Agriculture and several assistance programs by several other agencies in these departments. There have not been any recent major federal development projects in the area..

## 2.17 WATER CONSERVATION

Water conservation can substantially reduce the long-term demand for water when it is properly implemented. Significant reduction in water use can be achieved when people understand the reasons to conserve. This has always been a water-short area so most people are aware of the associated problems.

Agriculture is the largest water user in the area so conservation of irrigation water can have the biggest impact. Some delivery systems lose about 10-20 percent of the water. Improved conveyance systems with on-farm sprinklers or other efficient irrigation methods can increase the overall efficiency. The present overall irrigation efficiency is about 50 percent which is high when compared to the state average.

About 79 percent of the municipal and industrial water comes from groundwater. All of the surface water use is in San Juan County in the communities of Blanding, Halchita and Monticello. The average drinking water use from public community systems for Grand County is 263 gallons per capita per day (gpcd) and for San Juan County is 162 gpcd, 185 gpcd excluding the Navajo Nation. The basin average is 206 gpcd, 61 gpcd less than the state-wide average of 267 gpcd.

As the basin population increases, seven communities will be limited by the volume of water they can deliver with their existing systems by 2020. By the year 2050, some communities will be short of water supplies. Conservation will enable communities to extend the time period when system expansion will be required or when additional supplies will be needed. Water rates can provide a strong incentive to use municipal water more efficiently. Conservation can be achieved through use of low water-using fixtures in the home and planting low water-using landscaping. Water use by large water-using areas such as golf courses and parks can be reduced by better scheduled irrigations.

Two issues are discussed. One of these concerns community water management and conservation plans and the other discusses water pricing as a means of achieving conservation.

## 2.18 INDUSTRIAL WATER

Industry is not a major water user but this can change dramatically with fluctuations in mining or other industrial activities. Various mining activities have been the largest users of water although the oil industry has also had major impacts, particularly on groundwater. At present, use of culinary water for industrial purposes is insignificant. Industries that supply their own water now use about 2,030 acre-feet. This self-supplied industrial water use will increase to 4,560 acre-feet by 2020 and 6,720 acre-feet by 2050.

There is concern about contamination of the groundwater by tailings piles left after processing of mined ore is discontinued. The uranium tailings pile near Moab is now being considered for capping or removal. Removal proponents claim their will still be leaching of toxic materials even if the pile is capped.

## 2.19 GROUNDWATER

Groundwater development will become increasingly important as the demand for municipal water increases. The development of groundwater is more complex than that of surface water because it is hidden from view. Groundwater has been developed from two types of aquifers, consolidated rock aquifers and unconsolidated or alluvial aquifers.

The permeability of the water bearing rocks is determined by the geologic structure. The most prolific aquifers are found in the Salt Anticlines and in the Hatch Syncline structures. The quality of the groundwater is often better in areas closer to the recharge areas and at shallower depths. The “N” or Navajo sandstone aquifer is the most prolific water yielding aquifer in the basin. The Navajo sandstone is also part of the Glen Canyon Group providing water in the Spanish Valley area. There are two major areas where groundwater is produced from alluvial aquifers. These are Castle Valley and Spanish Valley.

The basin is underlain by the Paradox formation which consists largely of evaporite deposits. The top of this brine layer ranges in elevation from below sea level to about 6,540 feet. Salt water intrusion is apparently occurring in the Aneth area.

Groundwater for public water supplies is drawn from wells (12,220 acre-feet) and springs (2,770 acre-feet). This does not include pumpage from domestic wells. In addition, there are unmonitored springs that discharge groundwater. Groundwater supplies for culinary use are primarily pumped from the alluvial aquifers in Castle Valley and Spanish Valley.

Generally the water quality in Spanish Valley is good with total dissolved-solids of 300 mg/L or less. Some springs flow up to 300 gallons per minute with some wells producing up to 2,500 gallons per minute. Water quality in the alluvial aquifer in Castle Valley ranges from 211 mg/L to 1,156 mg/L.

Two issues are discussed. One is the need for development of long-range plans for groundwater management and the other is the need for regional groundwater exploration and an inventory of developable supplies. ❑

# Contents

Section 3

# Southeast Colorado River Basin

**Utah State Water Plan**

## Introduction

### 3.1 BACKGROUND

The responsibility for comprehensive water planning was given to the Division of Water Resources by legislative mandate. In accordance with that directive, the Utah State Water Plan[16] was published in 1990 under the direction of the Utah Board and Division of Water Resources and the State Water Plan Coordinating Committee. The Southeast Colorado River Basin Plan is one of eleven prepared as supplements to the State Water Plan. The preparation of this basin plan included valuable input from individuals and from local, state and federal agencies involved with water issues, regulation and development.

The formulation of a comprehensive state water plan is a perpetual and dynamic process. This process requires periodic re-evaluation of the changing issues associated with the development and use of the water resources. As areas grow, there are new demands on the limited water resources. To effectively address the issue of meeting the growing demand for water, basin plans are scheduled for revision every 5 - 15 years.

Spanish Valley

Basin water plans establish and provide a means by which the basic framework of the state's water policy can be implemented at the local water user level. Plan specifics are presented in the remaining sixteen sections of this report covering water supply, use, quality, demand, conservation and development.

> For millions of years, the wind and rain have incessantly formed the winding canyons and sheer cliffs, dissecting the plateaus surrounding the lofty volcanic mountains. Civilizations from aeons of time have inhabited this area to extract a way of life from the fertile soils and the pure water.

### 3.2 PLANNING GUIDELINES

The mission of the Division of Water Resources is to direct the orderly and timely planning, conservation, development, protection and preservation of Utah's water resources to the end they will be used to meet the beneficial needs of the citizens of the state. Within this context, the State Water Plan[16] and individual basin plans offer comprehensive assessments of both current and projected water conditions.

This overall planning effort provides the basis and background to assess the current and projected status of the state's water resources.

### 3.2.1 Principles

The Southeast Colorado River Basin Plan is based on a number of principles including:

- All waters, whether surface or subsurface, are held in trust by the state as public property and their use is subject to rights administered by the State Engineer. In addition, the waters of the Navajo Nation are subject to the jurisdiction of the Navajo Nation Water code of 1984.
- Water is essential to life. It is our responsibility to leave adequate water of acceptable quality for future generations.
- The diverse present and future interests of Utah's residents should be protected through a balance of economic, social, aesthetic and ecological values.
- Water uses that are difficult to identify beneficiaries for, such as recreation and aesthetics, should be included in program evaluations.
- Public input is vital to water resources planning.
- All residents of the state are encouraged to exercise water conservation and implement wise use practices.
- Water right owners are entitled to transfer their rights under free market conditions.
- Water resources projects should be technically, economically and environmentally sound.
- Water planning and management activities of local, state and federal agencies should be coordinated.
- Local governments, with state assistance as appropriate, are responsible for providing an acceptable level of protection to the general public against emergency events such as flooding and extended drought.
- Designated water uses and overall water quality should be improved or maintained unless there is evidence the loss in use and quality is outweighed by other benefits.
- The citizens of Utah need a broad-based understanding of water's physical characteristics, potential uses and values to carry out effective planning and management.

### 3.2.2 Purpose

The purpose of this basin plan is to assist local, state and federal entities in developing appropriate water management and conservation programs, and in coordinating water planning activities. The information presented in this report includes the following goals: identification and discussion of issues impacting the development and use of water resources within the study area; and encouraging all state, federal and local water agencies to actively participate in the overall planning process.

### 3.2.3 Organization

State water planning is the responsibility of the Division of Water Resources under the auspices of the Board of Water Resources. Other state agencies with major water-related missions have been included in the development of the Southeast Colorado River Basin Plan. Special interest groups and local individuals have also contributed to this plan.

The State Water Plan Coordinating Committee has representatives from twelve state agencies involved to various degrees in the regulation, development and planning of water resources in the state. This committee provides input to the basin planning process from a state-wide perspective.

The State Water Plan Steering Committee consists of the chair and vice-chair of the Board of Water Resources, executive director of the Department of Natural Resources, and the director and assistant director of the Division of Water Resources. The steering committee provides policy guidance, recommendations on prominent water-related issues and final approval to individual basin plans prior to their acceptance by the Board of Water Resources.

Federal and other state agencies, with either direct or indirect involvement in water resources, have participated in the overall preparation of this basin plan. These agencies have particular expertise and perspective on water use and development within this basin.

A Local Basin Planning Advisory Group has provided input to the overall basin planning process by giving advice and making comments on preliminary drafts of this plan. This group was made up of individuals representing various organizations, special interest groups and water users concerned with water development and use issues.

### 3.2.4 Process

The overall process to prepare a comprehensive water plan for the Southeast Colorado River Basin included completion of the following; the in-house, committee, advisory and public review drafts. The in-house draft provides development of data and review of basic issues and facts relating to local water supply, use and related information about the basin. The committee draft is prepared for review and comments by state agencies involved with local water development and regulation. The advisory draft allows a thorough review of the document by local water users, representatives of various special interest groups, and state and federal agencies concerned with local water issues. The general populace is invited to comment or learn about the contents of the public review draft at meetings held at strategic locations within the basin. Revisions within each draft were necessary to make this document complete and as accurate as possible.

## 3.3 BASIN DESCRIPTION

The Southeast Colorado River Basin is located in the southeast corner of the state and covers 6,976,250 acres (10,900 square miles), about 12.8 percent of the state. It includes all of San Juan County except Lake Powell and all of Grand County except the area draining north to the Uinta Basin. In addition, the portion of the City of Green River in Grand County is not included. The basin is bordered on the west by the Colorado River and Green River, on the north by the Book Cliffs and on the south and east by the Arizona and Colorado state lines. Although the southern part of the western boundary has been generalized as the Colorado River, the boundary as used in this report is the eastern shoreline of Lake Powell. The Uinta Basin hydrologic area is on the north and the West Colorado River Basin is on the west. The basin boundaries and features are shown on Figure 3-1. Also see Figure 5-1 for hydrologic subarea delineations.

### 3.3.1 Physiography and Geology[32,62,86]

The basin is located in the Colorado Plateau Province which centers near the four corners area. Elevations vary from about 3,700 feet at Lake Powell's high water level to 11,361 feet on Abajo Peak in the Abajo Mountains and 12,720 feet on Mount Peale in the La Sal Mountains. There are 18 peaks over 10,000 feet in elevation. Monitor Butte is a high point in western Monument Valley at 6,115 feet, over 2,000 feet above the valley floor and Navajo Mountain is 10,387 feet in elevation. The La Sal, Abajo and Navajo mountains are formed by partially eroded lacolith dome intrusions of Tertiary age.

Contrasting geological landscapes

The primary river systems are the Colorado, Dolores, Green and San Juan rivers. Even though the study area ends at the state lines, the

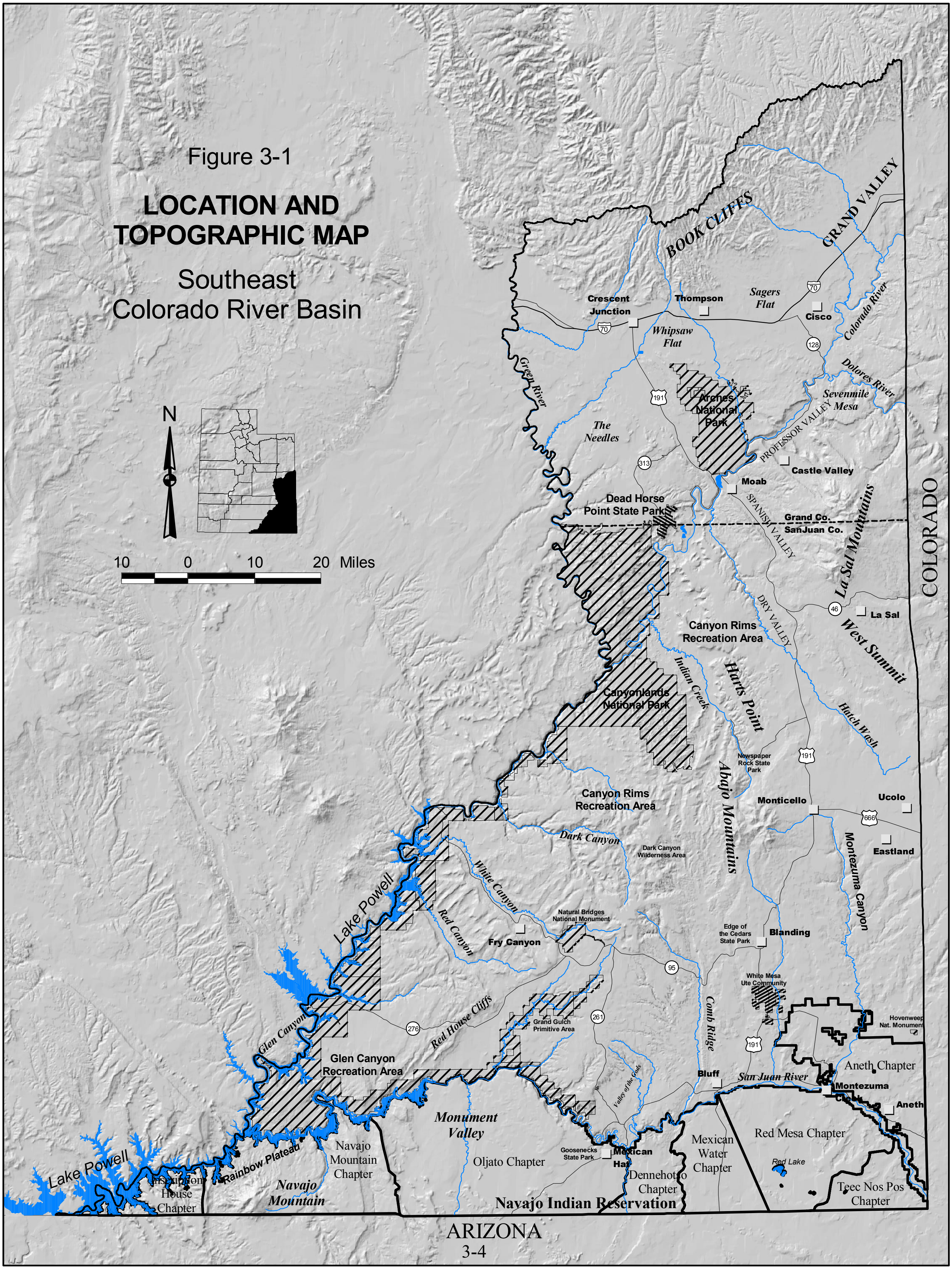



Figure 3-1

**LOCATION AND TOPOGRAPHIC MAP**

Southeast Colorado River Basin

upper hydrological boundaries for these rivers extend well into Arizona, Colorado, New Mexico and Wyoming. There are other locally important streams throughout the basin, all of them ultimately draining into these four rivers. These streams include Castle Creek, Mill Creek, Pack Creek, Indian Creek, North Creek, South Creek, Recapture Creek, Cottonwood Wash, McElmo Creek and Montezuma Creek (See Figure 5-1).

The area is extremely colorful and features spectacular rock formations, particularly in a number of state and federal parks. As a result of its natural geologic features and its close proximity to Glen Canyon and Lake Powell, the basin is a popular recreational area for both national and international tourists. Lake Powell is one of the most popular recreational sites in the western United States while the Colorado and San Juan rivers attracts many who venture on river rafting trips.

The area is characterized by high mountains and deeply incised canyons. The dissected mesas form several levels, with the highest being 7,000 feet at Monticello. Faulting has interrupted the continuity of the strata in some places. Collapsed salt domes near the La Sal Mountains have formed valleys, such as Lisbon and Spanish valleys, which are bounded by faults.

A characteristic feature of the basin's topography is its horizontal rock structure with steep escarpments which have resulted from gradual erosion over millions of years. Beds up to 1,000 feet thick have eroded away in places leaving isolated blocks standing as mesas.

The processes of canyon erosion and escarpment retreat have resulted in not only spectacular scenery, but unique groundwater conditions. The generalized geology is shown in Figure 3-2. Stratigraphic relations and classifications of bedrock aquifers are shown in Figure 3-3.

### 3.3.2 Climate[41,73]

The local climate is arid and semi-arid at the lower elevations with a cooler, wetter climate in the La Sal Mountains and Abajo Mountains. Summer temperatures usually reach the high 90s in July to September. The normal maximum temperature ranges from 84° F in Monticello to 99° F in Moab. Winters are dry and cold but usually not severe. The normal minimum temperature ranges from 11° F at La Sal to 18° F at Mexican Hat and Moab. The record high temperature is 114° F at Moab and the record low is -36° F at Cisco.

As a rule, winter snowfall amounts to only a few inches in the lower valleys with an occasional storm producing over one foot. Most of the precipitation is generated from seasonal storm patterns moving in from the Pacific Ocean during the winter and spring months. Summer storms are often localized thunderstorms produced by moist air masses moving in from the Gulf of Mexico.

Storms in red rock country

The average annual precipitation is between 6 and 30 inches depending primarily on elevation. Annual precipitation varies between 8 and 12 inches in most of the area except it is over 25 inches in the Abajo Mountains and it is over 30 inches in the La Sal Mountains. The precipitation in the southwest part of San Juan County, western Grand County and south of the San Juan River is from 6 to 8 inches except on Navajo Mountain where it is over 12 inches. The record daily precipitation is 4.31 inches in Aneth. The record monthly precipitation is 8.28 inches at Cedar Point and the record monthly snowfall is 62 inches at Monticello.

The frost-free days are measured from the last spring day to the first fall day when the

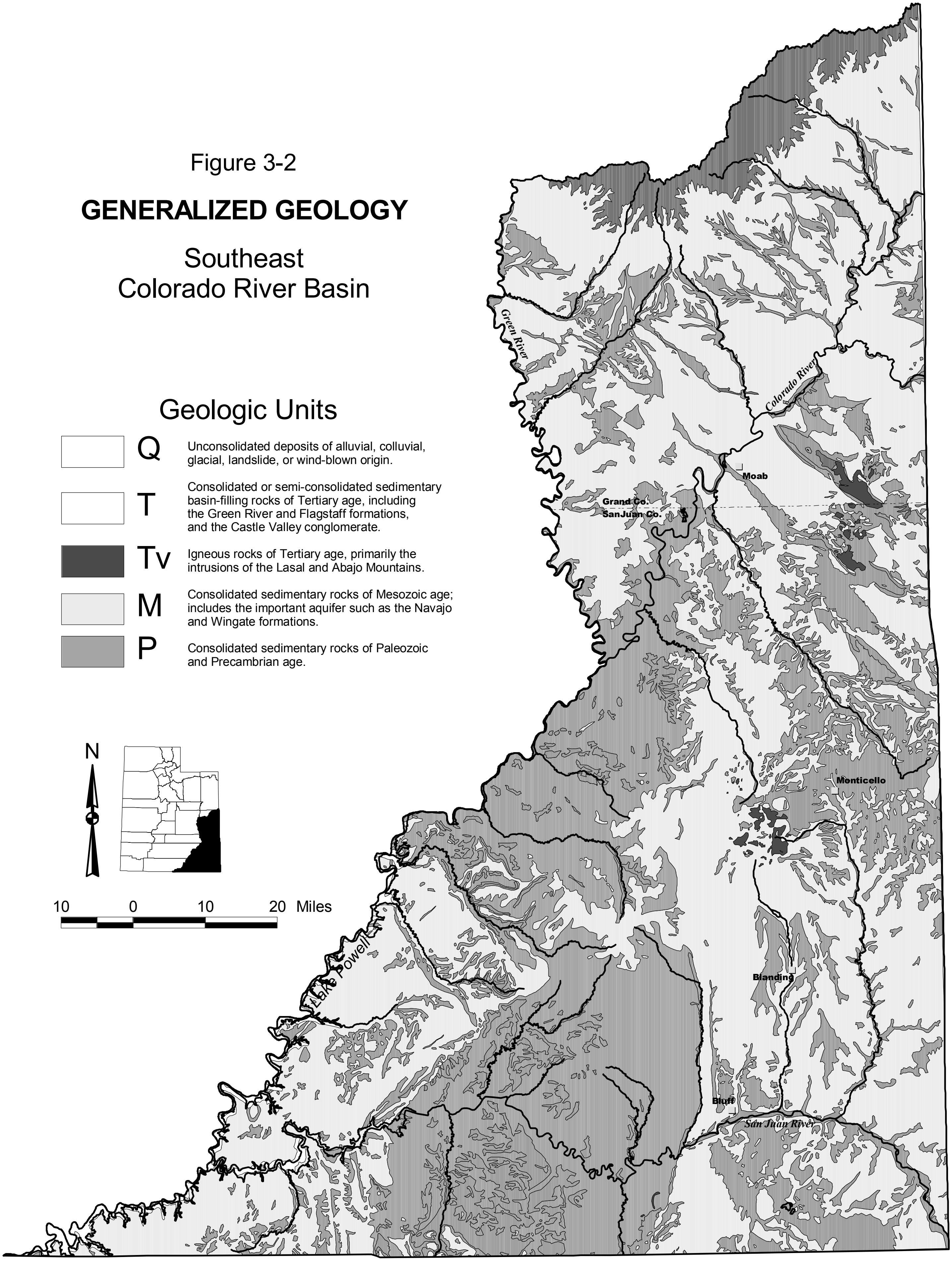


Figure 3-2
GENERALIZED GEOLOGY
Southeast
Colorado River Basin
Geologic Units
Q
Unconsolidated deposits of alluvial, colluvial, glacial, landslide, or wind-blown origin.
T
Consolidated or semi-consolidated sedimentary basin-filling rocks of Tertiary age, including the Green River and Flagstaff formations, and the Castle Valley conglomerate.
Tv
Igneous rocks of Tertiary age, primarily the intrusions of the Lasal and Abajo Mountains.
M
Consolidated sedimentary rocks of Mesozoic age; includes the important aquifer such as the Navajo and Wingate formations.
P
Consolidated sedimentary rocks of Paleozoic and Precambrian age.
N
10
0
10
20
Miles
Green River
Colorado River
Moab
Grand Co.
SanJuan Co.
Monticello
Blanding
Bluff
San Juan River
Lake Powell

## Figure 3-3
# GEOLOGIC STRATIGRAPHY

| Era | System | Series | Four Corners Designation | | | San Juan County Designation | |
|---|---|---|---|---|---|---|---|
| | | | Four Corners Platform Geologic Formations | Hydrogeologic Units | | Hydrogeologic Units | Geologic Formations |
| Mesozoic | Cretaceous | Upper | Mancos Shale | Mancos Confining Unit | | | |
| | | | Dakota Sandstone | Dakota Aquifer | Dakota - Glen Canyon Aquifer System | C Aquifer | Dakota Sandstone |
| | | Lower | Burro Canyon Formation | | | | Burro Canyon Formation |
| | Jurassic | Upper | Morrison Formation – Brushy Basin Member | Morrison Confining Unit | | M Aquifer | Westwater Canyon Mbr. |
| | | | | Morrison Aquifer | | | Recapture Member |
| | | | | | | | Salt Wash Member |
| | | | | | | | Bluff Sandstone |
| | | Middle | Wanakah Formation – Junction Creek SS | Curtis–Stump Confining Unit | | | |
| | | | Entrada Sandstone | Entrada Aquifer | | N Aquifer | Entrada Sandstone |
| | | | Carmel Formation | Carmel–Twin Creek Confining Unit | | | |
| | | Lower | | | | | Navajo Sandstone |
| | | | Glen Canyon Group – Navajo Sandstone | Glen Canyon Aquifer | | | Kayenta Formation |
| | | | Glen Canyon Group – Kayenta Formation | | | | Wingate Sandstone |
| | | | Glen Canyon Group – Wingate Sandstone | | | | |
| | Triassic | Upper | Chinle Formation | Chinle–Moenkopi Confining Unit (Upper Part) | | | |
| | | Middle | Moenkopi Formation | | | | |
| | | Lower | | | | | |
| Paleozoic | Permian | Upper | | Chinle–Moenkopi Confining Unit (Lower Part) | | | |
| | | Lower | Cutler Formation – De Chelly Sandstone | Coconino–De Chelly Aquifer | | C Aquifer | De Chelly Sandstone |
| | | | Cutler Formation – Organ Rock Shale | | | | |
| | | | Cutler Formation – Cedar Mesa Sandstone | | | P Aquifer | Cedar Mesa Sandstone |
| | Pennsylvanian | Upper | Rico Formation | Not a Principal Aquifer | | | |
| | | Middle | Hermosa Formation | | | | |
| | | Lower | Molas Formation | | | | |
| | Mississippian | Upper | Leadville Limestone | | | | |
| | | Lower | | | | | |
| | Devonian | Upper | Ouray Limestone | | | | |
| | | | Elbert Formation | | | | |

Base modified from USGS, 1995 and Utah DNR, Tech. Pub. No. 86, 1986

Source: San Juan County, Utah Water Master Plan - Wright Water Engineers, Inc.[96]
Note: Hydrologic units are U.S. Geological Survey terminology as desiginated by Avery. [21]

lowest temperature is 32° F. These vary from 231 at the Hite Marina to 119 days at La Sal.

Temperature, precipitation and frost data are presented in Table 3-1. The locations of climatological reporting stations are shown on Figure 3-4. The average annual precipitation is shown on Figure 3-5 for the 1961-90 base period.

There is one electronic snotel station and one manual snow course located on both the La Sal Mountains and the Abajo Mountains.[73] Normally, the April 1st reading is used to forecast the season water supply. At the two snotel stations, the average March 1st reading is over 0.5 feet higher than the April 1st reading. The snotel and snow course data are shown in Table 3-2 and the locations are shown on Figure 3-4.

### 3.3.3 Soils, Vegetation and Land Use[69,70,71,72]

Resource data on the soils and vegetation varies in detail, particularly across land ownership and administration boundaries. Land use data varies depending on the purpose for collecting the data and on the methodology used.

**Soils and Vegetation** - Soil surveys are made to describe the soil profile and the related vegetation. This often describes the land use which is generally dictated by the soil types and the vegetation produced. The Natural Resources Conservation Service has the national responsibility for all soil surveys regardless of land ownership or administration. Under certain conditions, soil surveys are carried out by others such as the Forest Service or Bureau of Land Management. Interagency coordination has made the soil surveys exceptionally useful. The status of the soil surveys is shown on Figure 3-6.

Soil surveys are conducted at different levels of detail. For all but the most intensive surveys, data is collected at three levels; 2nd, 3rd and 4th order mapping described as follows.

The 2nd order surveys are made for intensive land uses. This type survey is conducted on all cropland areas.

The 3rd order surveys are made for land uses not requiring precise knowledge of small areas or detailed soils information. This type survey is conducted on all national forests and the majority of private and public rangelands.

The 4th order surveys are used to provide data for broad land uses, potential planning and general land management.

There are five vegetative types in the basin which occur from the higher elevations above 12,000 feet to Lake Powell at an elevation of 3,700 feet. Vegetation varies from conifer-stands in the high mountains to shadscale and blackbrush in the lower areas. There are also large areas of barren sandstone rock formations and intrusions of partially eroded lacolith domes.

Upland to high mountain vegetation

The **High Mountain Climatic Zone and Conifer-Aspen Forest Type** are at elevations of 8,300 to 13,000 feet with annual precipitation of 25 to 35 inches. Soils are shallow to deep and are found on benches and mountainsides. Erodible soils are susceptible to mass movement. Native vegetation includes Engelman spruce, Douglas fir, subalpine fir, quaking aspen, Gambel oak, mountainmahogany, shrubs, sedges and grasses. This area produces most of the stream flow and all of the commercial timber. Use for

Table 3-1
SELECTED CLIMATOLOGICAL DATA

| Weather Station | Average Mean Temp | Record Low Temp | Record High Temp | Normal Annual Precip | Record Monthly Precip | Normal Annual Snowfall | Record Month Snowfall | Frost Free Days |
|---|---|---|---|---|---|---|---|---|
| | | (Degrees F) | | | (inches) | | | |
| Aneth | 55.4 | -18 | 110 | 8.49 | 5.47 | 3.3 | 10.0 | 183 |
| Blanding | 50.0 | -23 | 110 | 13.05 | 7.01 | 44.5 | 55.0 | 149 |
| Bluff | 53.4 | -22 | 108 | 8.17 | 6.35 | 10.1 | 21.0 | 167 |
| Canyonlands-Neck | 52.5 | -13 | 104 | 9.09 | 5.02 | 24.5 | 27.0 | 168 |
| Canyonlands-Needles | 52.8 | -16 | 107 | 8.53 | 4.43 | 16.0 | 23.3 | 152 |
| Castle Valley | 53.9 | -14 | 107 | 11.50 | 3.39 | 19.9 | 21.9 | 187 |
| Cedar Point | 46.7 | -20 | 100 | 14.69 | 8.28 | 71.9 | 48.0 | 135 |
| Cisco | 51.7 | -36 | 108 | 7.11 | 2.84 | 10.9 | 24.0 | 154 |
| Dewey | 53.3 | -25 | 113 | 8.62 | 4.40 | 13.2 | 26.0 | 153 |
| Harley Dome | 51.1 | -27 | 106 | 9.20 | 3.35 | 22.4 | 17.0 | 156 |
| Hite Marina | 60.9 | 3 | 112 | 5.34 | 5.46 | 4.6 | 15.5 | 231 |
| Hovenweep N.M. | 51.3 | -24 | 105 | 11.52 | 6.85 | 22.4 | 24.2 | 145 |
| La Sal 2 S.E. | 46.2 | -25 | 101 | 15.03 | 5.09 | 50.0 | 32.0 | 119 |
| Mexican Hat | 56.0 | -17 | 110 | 6.60 | 6.20 | 2.8 | 13.0 | 185 |
| Moab | 56.8 | -24 | 114 | 9.00 | 6.63 | 6.1 | 32.0 | 181 |
| Monticello | 45.7 | -22 | 101 | 15.47 | 7.64 | 61.8 | 62.0 | 121 |
| Monument Valley-Mission | 56.1 | -11 | 106 | 7.40 | 5.61 | 13.4 | 29.0 | 200 |
| Natural Bridges N.M. | 50.4 | -14 | 103 | 12.84 | 8.02 | 47.9 | 40.2 | 147 |
| Navajo Mtn | 49.6 | -25 | 100 | 9.18 | 5.29 | 26.3 | 50.1 | 142 |
| Thompson | 52.8 | -23 | 108 | 9.19 | 3.99 | 12.3 | 22.5 | 175 |

Source: Utah Climate, Utah Climate Center, Utah State University, Logan Utah, 1992.

Figure 3-4

## CLIMATOLOGICAL DATA STATIONS

Southeast Colorado River Basin

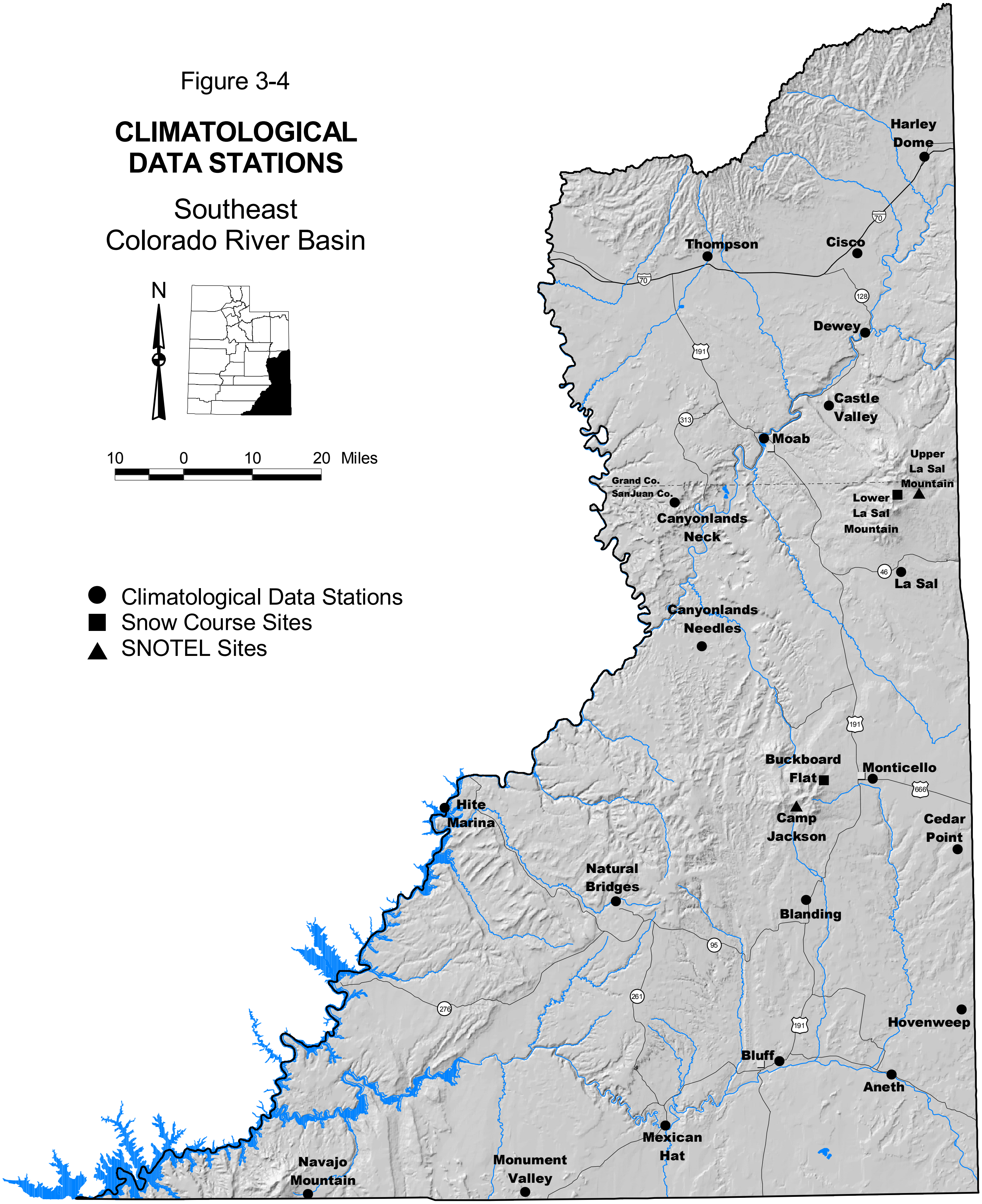
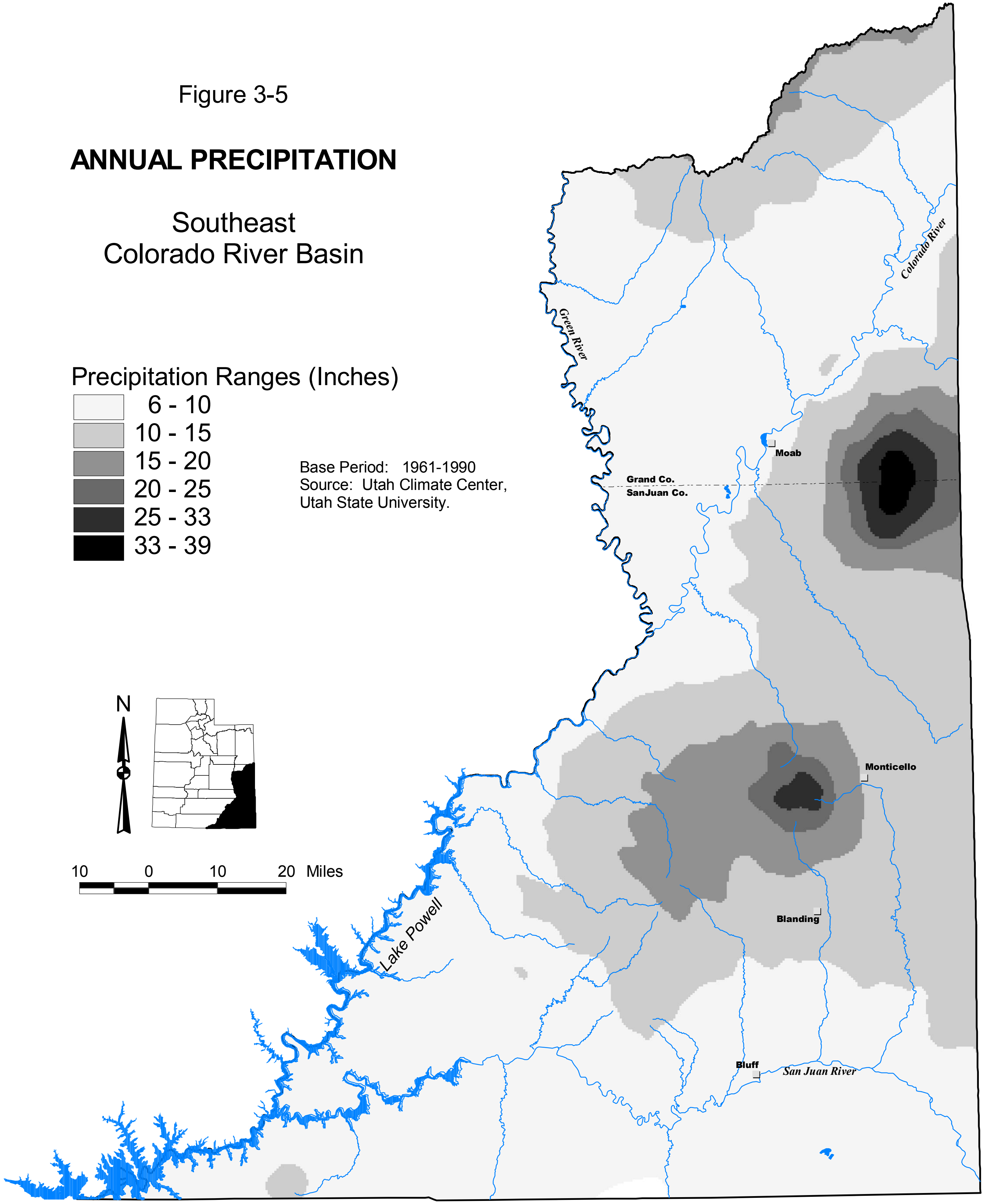


Figure 3-5

## ANNUAL PRECIPITATION

Southeast
Colorado River Basin



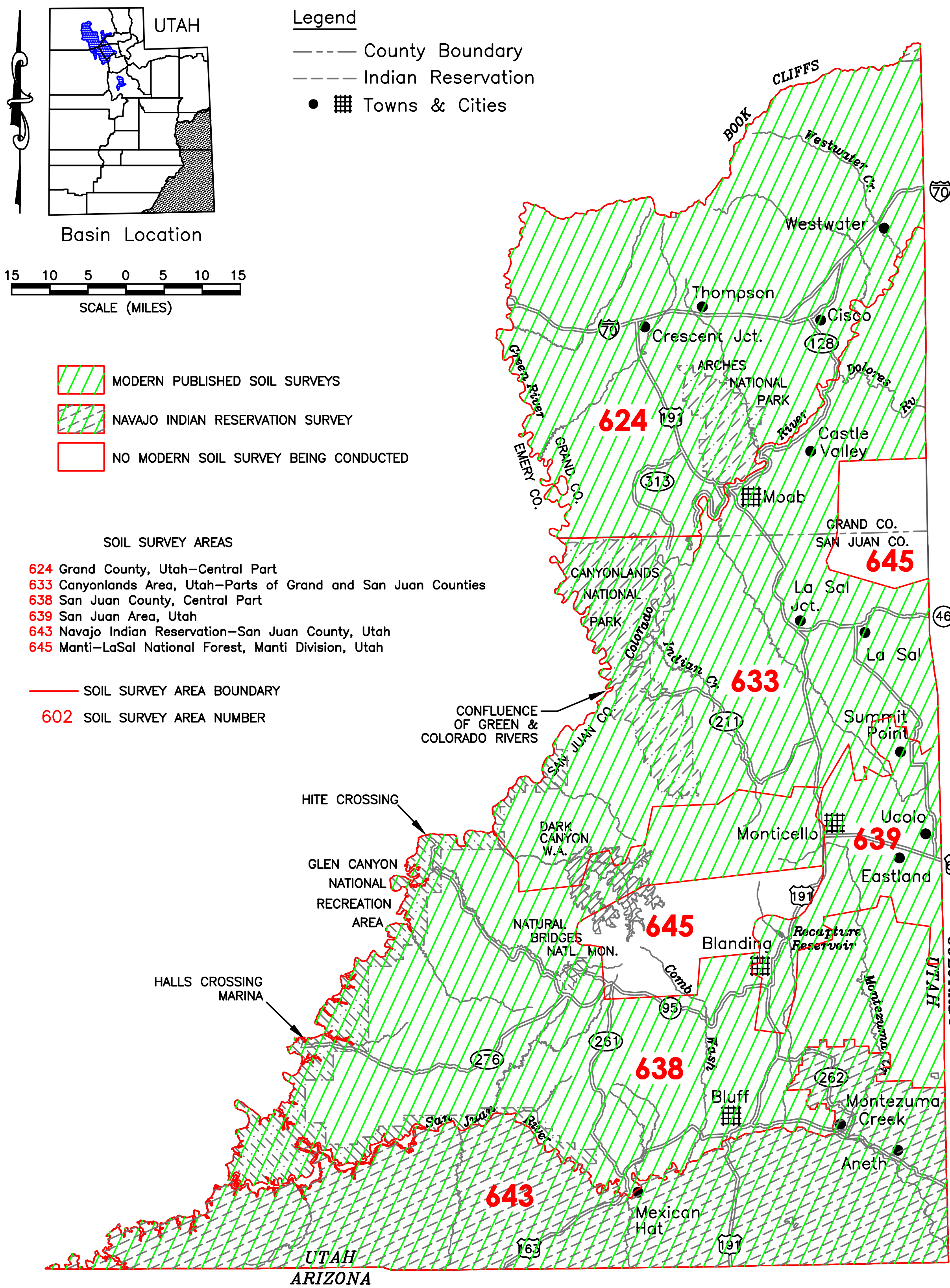



Figure 3–6
SOIL SURVEY AREAS
Southeast Colorado River Basin

Source: Natural Resources Conservation Service
Revised June 1996 1000210

| Table 3-2<br>SNOTEL AND SNOW COURSE DATA<br>1961-90 Average | | | |
|---|---|---|---|
| | SNOTEL | | |
| Station | Elevation (feet) | April 1st SWE[a] (inches) | Annual Precipitation (inches) |
| Camp Jackson | 8,600 | 9.8 (10.4)[b] | 28.6 |
| La Sal Mountain | 9,400 | 11.9 (12.6)[b] | 30.5 |
| | SNOW COURSE | | |
| Buckboard Flat | 9,000 | 12.6 | 31.6 |
| La Sal Mt Lower | 8,800 | 9.7 | No gage |

[a] Snow water equivalent in inches.
[b] Average March 1st readings.
Source: Utah Cooperative Snow Survey Data, NRCS.[73]

rangeland may be limited because of steep slopes. Wildlife includes deer, elk, black bear, coyote, mountain lion, bobcat, small mammals, raptors, sage grouse and some aquatic species.

The **Mountain Climatic Zone and Mountain Brush Type** are at elevations of 7,800 to 8,900 feet and the annual precipitation is 16 to 25 inches. Soils are shallow to deep, well drained and are found on benches and mountainsides. The vegetation is primarily trees, shrubs and grasses including Utah juniper, pinyon pine, some Douglas fir, Gambel oak, big sagebrush, Oregon-grape, mountainmahogany, snowberry, needleandthread and bluegrass. Wildlife include elk, deer, black bear, coyote, mountain lion, bobcat, small mammals and raptors. There is some aquatic habitat. This zone is used extensively for rangeland although in some areas, use is limited because of steep slopes.

The **Upland Climatic Zone and Pinyon-Juniper Forest Type** are at elevations of 6,000 to 7,800 feet and receive 12 to 16 inches of precipitation per year. The soils are dry most of the growing season but are moist in some parts during the spring and late summer in most years. This zone includes many mesas and higher structural benches. There is livestock grazing, dryland agriculture and small areas of irrigated lands in this zone. The vegetation is Utah juniper-pinyon stands, big sagebrush, mountainmahogany, Basin big sagebrush, birchleaf, Salina wildrye, Western wheatgrass and Indian ricegrass. Wildlife include deer, bobcat, foxes, small mammals and raptors.

The **Semidesert Climatic Zone and Sagebrush Type** are at elevations of 3,700 to 6,100 feet and receive 5 to 8 inches of precipitation annually. The soils are semidesert loam, sandy loam, and stony and gravelly loam. They are dry most of the growing season except during spring and early summer. The vegetation is mainly shadscale, blackbrush and big sagebrush with areas of Utah juniper and pinyon at elevations above 5,000 feet. Sagebrush is found in this zone and also at nearly every elevation and range of precipitation on deep, well-drained soils in every other climatic zone and vegetation types. Wildlife includes deer, coyote, badger, foxes, small mammals and raptors. This zone contains dry cropland and irrigated cropland.

The **Desert Climatic Zone and Grass and Desert Shrub Type** are at an elevation of 3,500 to 6,100 feet and receive 5 to 8 inches of precipitation annually. Vegetation is mostly shadscale and blackbrush with some big sagebrush although there is fourwing saltbush on the deeper sandy soils. Indian ricegrass and needleandthread are most dominant of the grasses. Soils vary from loam to sand to clay. Wildlife includes mountain lion, antelope, deer, coyote, bobcat, foxes, white-tailed prairie dog, cottontail and black-tailed jack rabbits, song birds and raptors. Big horn sheep are found in the Red Canyon-Colorado River area. This zone contains irrigated cropland.

**Land Use** - Soil is generally used to provide the highest production or for the best use according to its capability. The Natural Resources Conservation Service has established capability groupings to show the soil suitability, limitations and expected response to various types of treatment.

Capability classes, the broadest group, are classified on a numerical scale from one to eight indicating progressively greater limitations and narrower choices for agricultural cultivation. Other uses, such as grazing for livestock or wildlife, may not be as restrictive. The lower class numbers are choice lands suitable for growing irrigated and dryland crops. The higher class numbers are more suitable for permanent pasture and progressively to grasslands, forested areas and rocklands.

Lands used for farming can also be defined according to their agricultural production ability and potential. Two categories describe the better croplands: prime farmlands and farmland of statewide importance. There are over 61,000 acres of prime farmlands.

There are about 8,930 acres of irrigated cropland with an additional 4,400 acres of idle/fallow land and 130,400 acres of dry cropland. Urban, residential and other intensive land uses are usually located in these same areas. Less intensively developed areas surround the farmlands. Over 37 percent of the basin or about 2.36 million acres are used for grazing by livestock and wildlife. Timber production, mining and other purposes are also important uses. In addition, much of the area is covered by bare rock. The less intensively developed areas are also used for a wide variety of recreational pursuits including rock hounding, sightseeing, hiking, hunting and ATV activities.

Wet and open-water areas are an important environmental land use. These areas include marshlands, lakes, reservoirs, rivers, sewage lagoons, riparian lands and industrial evaporation ponds. Wet and open-water areas consume significant amounts of water by either surface evaporation or evapotranspiration of natural occurring vegetation. Wet and open-water areas are generally located within municipalities, along existing river systems or in areas with relatively high water tables. There are over 100,600 acres of wet and open-water areas within the cropland areas.

### 3.3.4 Land Status

The total area of the Southeast Colorado River Basin is 6,976,250 acres (10,900 square miles). Of this total, 66.9 percent is administered by various federal agencies and 18.2 percent is included in Indian reservations/lands. The state of Utah administers 7.4 percent leaving 7.3 percent of the area as private land. There are 10,520 acres of water. The distribution of these areas is shown in Table 3-3.

The federal land managing agencies include the Bureau of Indian Affairs, Bureau of Land Management, Forest Service, National Park Service and Department of Defense. Indian reservation lands are controlled by three tribes;

Table 3-3
SUMMARY OF LAND OWNERSHIP AND ADMINISTRATION

| Land Status | County | | Basin Total | |
|---|---|---|---|---|
| | Grand (acres) | San Juan (acres) | Area (acres) | Area (percent) |
| **Federal** | | | | |
| Forest Service | 57,600 | 403,340 | 460,940 | 6.6 |
| Bureau of Land Management | 1,488,340 | 2,053,460 | 3,541,800 | 50.8 |
| National Park Service | 75,720 | 519,380 | 595,100 | 8.5 |
| Wilderness Area | 0 | 68,030 | 68,030 | 1.0 |
| Department of Defense | 1,630 | 0 | 1,630 | neg. |
| Indian Reservations/lands | 870 | 1,269,790 | 1,270,660 | 18.2 |
| **Federal Total** | **1,624,160** | **4,314,000** | **5,938,160** | **85.1** |
| State | 256,040 | 262,630 | 518,670 | 7.4 |
| Private | 95,670 | 413,230 | 508,900 | 7.3 |
| Water Areas [a] | 150 | 10,370 | 10,520 | 0.2 |
| **Basin Total** | **1,976,020** | **5,000,230** | **6,976,250** | **100.0** |

[a] Water areas are under various ownerships.

the Navajo Nation, the Ute Mountain Ute Tribe and the Northern Ute Tribe. State agencies include the School and Institutional Trust Lands Administration; Division of Forestry, Fire and State Lands; and the Division of Parks and Recreation. Significant issues include water development, water quality, timber production, range management, recreation development, and mineral and petroleum exploration and extraction.

All of the area was originally public land. When Utah gained statehood, four sections in every township were designated as state lands. The state could not claim title to these lands until after they had been surveyed, some within the last 3-4 decades.

Other land withdrawals have taken place also. Land was withdrawn for a national forest preserve in the La Sal area in 1906 followed by one in the Monticello area in 1907. The La Sal and Monticello preserves were combined in 1988 as part of the Manti-La Sal National Forest. The Utah park system includes Dead Horse Point (1959), Edge of the Cedars State Park and Museum (1978), Goosenecks of the San Juan (1962) and Newspaper Rock (1961). The national park system includes Arches National Park (1971), Canyonlands National Park and Recreation Area (1964), Hovenweep National Monument (1923), Natural Bridges National Monument (1908) and Rainbow Bridge National Monument (1910).[42] See Section 15, for more information on these areas.

## 3.4 WATER RELATED HISTORY[45,46,50,87,88,89,95]

The Southeast Colorado River Basin has a long and rich history relating to the development and use of its water resources. It seems not everyone knew this, as the Deseret Evening News once called the area a "vast contiguity of waste" whose main function was "to hold the world together." Many have imagined this area as unproductive and uninhabited. It has never been either one.

At the end of the last great Ice Age, the ancient Paleo-Indians roamed most of North America from about 11,500 to 8,000 years ago. They hunted large animals such as mammoths and large bison and gathered wild plants. With warmer weather emerging, the Archaic peoples moved toward the southwestern deserts. Here they hunted smaller animals such as deer and bighorn sheep and became more dependent on wild plant food for survival in this more arid area. With the adoption of a maize or corn horticulture by about 1000 B.C., the Archaic people started using cultivated plants. This was about the time the Anasazi culture became evident, first the Basketmakers and later the Pueblo groups. They began diverting small streams of water to irrigate their crops which consisted primarily of corn, squash and later, beans. They still followed the hunter-gatherer tradition, returning to tend and harvest their crops.

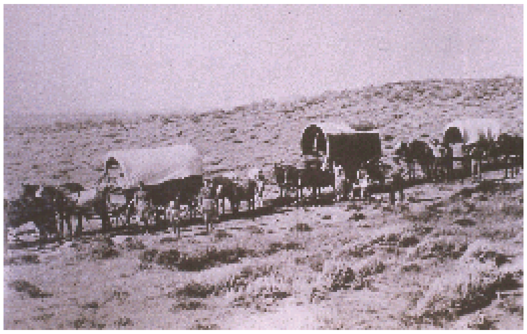
Anasazi ruins

Recent insights into Anasazi Indian life have resulted in some unexpected data on agricultural practices and particularly on some irrigation methods.[40] A series of stone-lined ditches and agricultural terraces have been found in southeastern Utah. These land-conserving terraces were used to raise crops with water diverted from channels. At Beaver Creek on the Rainbow Plateau, an entire ditch and field complex has been discovered. Here, water was diverted at the upper edge of an alluvial fan and conveyed in stone-lined ditches to a terrace system where successful gardening was carried out. It was estimated this system supported a community of over 20 households.

There is also evidence in other areas of masonry retaining walls built on bare Kayenta formation ledges along a stream. Some earth is still retained behind the walls and was still moist from seepage from the Kayenta-Navajo contact. It appears the soil had been placed when the terrace was built. Soil-conserving and crop producing terraces such as these are common on the slopes of Navajo Mountain.

There is still speculation about the disappearance of the Anasazi culture from the area. Evidence points to two possibilities, a prolonged and severe drought or they were forced to leave to avoid more aggressive cultures. In any event, after the agriculturalist Indians disappeared, the nomadic Utes and Navajos used the area as their hunting grounds. There is also evidence the Southern Paiutes moved into the area from the west. One thing is sure, the local Indian inhabitants changed several times over the years as one tribe would challenge another and lay claim to the region. However, the basic method of water use remained relatively unchanged.

The area was to become part of the Old Spanish Trail, established during the late 1700s and early 1800s. One segment entered Utah following the Colorado River to near Cisco where it turned and went west, crossing the Green River near the town of the same name. Another alternate entered Utah south of the La Sal Mountains in the Lisbon Valley area. From here it went northwesterly around the northwestern flanks of the La Sal Mountains,


Settling the land

down Spanish Valley and crossed the Colorado River near Moab and then north to the Green River crossing. Although the only water needed was for survival, the Old Spanish Trail was a part of the area history.

From the mid- to late 1800s, the Mormon influence on development of the area's land and water resources was established. To meet their immediate need for food and to develop a stable economy, Mormon immigrants focused on developing irrigated agriculture where readily accessible water existed, first at the Elk Mountain Mission in 1855, along the San Juan River in the 1880s and eventually throughout the area.

The earliest attempt to settle the land was the Elk Mountain Mission in 1855.[45,87] The Indians were already irrigating about 10 acres, having planted seeds provided by the advance party the year before. The settlers diverted water for vineyards, orchards and vegetable crops using earth and brush dams. The settlement was abandoned that fall after attacks by the Ute Indians. Later in the 1880s after the settlers were reestablished, they built a more substantial log diversion on Mill Creek above Spanish Valley. Water was also diverted from springs for culinary use and for irrigation. Eventually, water was diverted from both Mill Creek and Pack Creek to irrigate lands in Spanish Valley.

Homesteaders came to San Juan County in 1878 and located on Deer Creek, about one mile southwest of present Old La Sal where they tended their milk cows and made butter and cheese. About two months later, other settlers brought in about 2,000 head of cattle and located at Coyote, about one mile west of the present La Sal Post Office. This was the first large cattle herd in San Juan County. It was 1895 before the first canal was constructed to bring water from La Sal Creek to Coyote Flats. A large area was soon fenced and planted to alfalfa and grain along with some fruit trees and a grove of poplars.

When the “Hole in the Rock” expedition arrived in Bluff in the spring of 1880, they were weary from their journey so the main body decided to settle there instead of at Montezuma Creek as originally planned. The settlers in Bluff constructed a diversion using riprap to divert water from the San Juan River. Because of the high sediment load in the river, it took back-breaking hand-shovel work to keep the silt and sand out of the ditches so the water could make it to the fields. This system was not very stable and problems soon developed. Keeping the Bluff system in operation was a constant, almost daily demand on the settlement. Years later it was said of Bluff that the acreage was small, the river treacherous, and the water supply uncertain.

Shortly after the settlement of Bluff, part of the expedition moved on to Montezuma Creek. They soon had a waterwheel, 16 feet in diameter and 12 feet across, delivering about 40 gallons per minute for irrigation of nearby lands.[46] Soon there were three additional waterwheels in operation. They were better off than Bluff because they had rock shelves to anchor the waterwheels, while the downstream diversion had to rely on riprap dams and hand-shovel work. There was also a small irrigation system in Aneth that had been established the year before.

This new prosperity was to be short-lived. Floods in the San Juan River in 1884 wiped out the entire community along with the waterwheels at Montezuma Creek except for one home built on a high rock outcrop. The people in Bluff fared better as the flood plain was wider in this area. Still, the floods from the

San Juan River and Cottonwood Wash covered many of the homes, corrals and cropland with 8 to 10 inches of mud, destroyed part of the riprap dams and silted in parts of the canal.

Settlers from Bluff moved into Verdure (South Montezuma) in 1887 while they were locating and getting ready to settle Monticello (North Montezuma). They worked diverting water from North Creek although the Carlisle Cattle Company already claimed the stream. After their differences were settled, they formed what is now the Blue Mountain Irrigation Company, the oldest in San Juan County that is still in existence.

Because of the effort needed to establish Monticello, White Mesa remained a luscious grazing area until the establishment of San Juan County's youngest town, Blanding in 1897. They soon started surveying and construction began on a ditch to divert water from Johnson Creek onto the mesa. The surveying was done with a carpenter's level and a board about 18 feet long. As they surveyed and built the ditch, they came to about 100 yards of solid rock. They worked from both ends and soon had a tunnel. Because an illusion distorted what was uphill and downhill, the LC Ranch cowboys would pass and laugh about the crazy men trying to make water run uphill. After several interruptions, the project was finally completed in the spring of 1903.

As the population of Blanding started to grow, it appeared the demand for water was going to exceed the supply of Johnson and Recapture creeks. The White Mesa Irrigation Company decided in 1921 to build a tunnel to divert water from Indian Creek on the northern flank of the Abajo Mountains to Johnson Creek on the southern flank. This mile-long tunnel was to be the longest ongoing project (over 30 years) in the area. After tremendous personal sacrifice and a lot of faith, a few individuals kept the project going until in June 1952, water was delivered to the fields in the Blanding area.[103]

During these same early years, the area was discovered by large ranchers from southwestern Colorado and northern Texas. The L.C. Company established itself in about 1880 at the confluence of Recapture and Johnson creeks. They ran about 17,000 cattle. The Carlisle Company established a headquarters at Paiute Spring in 1883. They were soon shipping over 10,000 head to market. Soon the area was being grazed by thousands of cattle owned by several large companies. They were all attracted by the excellent rangeland and by the low taxes. There was also the advantage of abundant winter range along with nearby summer range on the La Sal, Blue and Elk mountains. But by the late 1890s, most of the large operators had sold their land and cattle. Problems with Indians, rustlers and low cattle prices all contributed to the demise of the cattle industry. However, the main reason was the deterioration of the range due to severe overgrazing along with the worst drought in history.[102]

Indian Creek tunnel

Evidence of the changing weather patterns can be gleaned from several sources. When the settlers first moved into San Juan County, it was toward the end of an unusually wet period. This was evidenced by the fact the Hole-in-the-Rock settlers of 1879 were only able to work on the road when drier weather permitted. The San Juan River was always running high. Beginning with the spring of 1886, storms were very light and drought soon covered the area. After over a decade, the storms came again and by 1897, the drought was over, just after the large cattle herds had gone.

The economy soon started to improve as water was developed for irrigation. The rangeland started a slow recovery but will never, nor should it, sustain the large herds of the past. The discovery of oil, uranium and several other minerals also contributed and helped accelerate population growth and increased demands for the basic necessities of life.

Valley City is an example of a once thriving farming community which is now a ghost town. In 1905, work began on a reservoir to store water for the irrigation of 2,500 acres of land in an area about five miles south of Crescent Junction. There were soon 60 acres of orchards under irrigation. A few years later, the dam was washed out by a flash flood. The dam was rebuilt but the community never recovered. Shortly after 1930, the school was closed as people left and Valley City became a ghost town.

Until the late 1950s, local water demand for most domestic uses was adequately met by surface water and groundwater sources. Culinary water systems had been constructed in Monticello and Blanding by the turn of the century and in Moab shortly after. Bluff drilled wells to tap the groundwater in the San Juan River flood plain. However, the steady increase in population required the construction of various projects to develop supplemental water supplies. The largest of these ventures resulted in the construction of the Mill Creek, Monticello and Recapture Creek reservoir projects and a culinary well field near Moab. Early attempts at developing the area's water supplies were financed by a combination of direct contributions from local businesses or from tax revenues. ❑

# Contents

Section 4

# Southeast Colorado River Basin

**Utah State Water Plan**

## Demographics and Economic Future

**4.1 INTRODUCTION**

The Southeast Colorado River Basin encompasses one of the most isolated areas in the state. Archaeological investigations have found remains of ancient Anasazi communities established by the Basketmakers and Cliff Dwellers throughout the area. The remains of irrigation systems have been found indicating established agricultural oriented communities.

The Southern Ute Indians were established in the area by the early 1500s and the Navajo Indians by the 1600s. The Ute Indians were hunters while the Navajo Indians were agriculture and livestock oriented. The Ute Reservation and the Navajo Reservation were both established in 1868, after the "Long Walk" of the Navajo Indians. The government established the Utes in Allen Canyon and Montezuma Canyon with the idea they could make a living from farming. The Navajos stayed south of the San Juan River. In the 1930s, the federal government took most of the livestock from the Navajos and killed them in order to reverse the over-use of the rangeland. This was catastrophic to their livelihood.

In the 1870s, a number of small scale cattle operations began to filter into the area. These were followed by large herds from Colorado and Texas. The livestock economy was soon infiltrated by early settlers in the 1880s who established irrigated agriculture along with small commercial enterprises. The discovery of gold in the La Sal Mountains in the 1890s was followed by the oil boom of the 1920s and uranium in the 1950s. This brought more diversity to the regional economy with the passing of these boom and bust cycles.

Expanding recreation and tourism activities are bringing increasing numbers of commercial enterprises into the area. This swing away from traditional agriculture attracts an inward migration of people while keeping others from leaving.

By the 1950s, the Ute Indians were moving into the White Mesa area where they improved their farming and livestock raising operations. They built homes, brought in electricity and provided culinary water to the community. The White Mesa Council was established in 1978 to be the local governing body.

The Navajo Indians started working off the reservation during the 1940s and 1950 in order to make a living. When oil royalties became available in the 1960s and 1970s, it provided new opportunities for improvements in education, health care and economic development. The Utah Navajo Development Council was established as a private, non-profit organization to administer these funds.

However, the Ute Mountain Ute Indians living in the White Mesa area and the Navajo Indians living on the reservation still have a lower standard of living than people in the surrounding areas. Some are leaving to find employment while others are staying in the area to work and improve their economic climate.

The overall local basin economy has now become more stable with a diverse mixture of agriculture, government, services and trade sectors. Tourism and recreational activities are making major impacts on the economy while the manufacturing industry is important.

The population of the basin was 916 in 1890 and had more than doubled to 2,172 by the turn of the century. By 1950, it had increased to 7,218 with nearly all of the increase coming in San Juan County. The 1950s uranium boom nearly tripled the Grand County population while the San Juan population only doubled. By 1990, the total population was 19,241. In 1998, the population was 23,247 (1.1 percent of the state) which equates to only 2.1 people per square mile. As only private land is used for residential use, the density in the off-reservation populated area is 20.3 people per square mile. The density on reservation lands is 3.6 people per square mile.

## 4.2 DEMOGRAPHICS

The population growth rate from 1980 to 1998 was only 0.40 percent per year. This is only about one-fifth of the statewide annual growth rate of 1.90 percent for the same period. Grand County is expected to increase 5.0 percent from 1998 to 2000, mostly due to tourism and recreation. San Juan County will increase by less than one percent for the same period. The 1998 population of Grand County was 9,815 and is projected to be 21,955 by 2020. The increase is less dramatic in San Juan County with an increase from 13,432 in 1998 to 17,522 by 2020. Annual growth rates for this period are 3.8 percent for Grand County and 1.12 percent for San Juan County. The increase in San Juan County includes the increase of the Navajo Nation. The average rate of state-wide population increase is estimated at 2.1 percent from the year 2000 through 2020. The Navajo Nation, Department of Water Resources uses a growth rate of 2.48 percent. The current and projected population is given in Table 4-1 and shown on Figure 4-1. Data is not adequate to make city projections to 2050. The county projections to 2050 are shown in Table 4-2 and on Figure 4-1a.

Homes in Aneth

The Navajo Indians comprised over one-half of the San Juan County population in 1990 with most of them living on the Navajo Indian Reservation. The Navajo Nation population in the seven populated chapters all or partly in Utah is currently estimated at 6,865. A chapter is a political subdivision of the Navajo Nation. In addition, there are over 1,200 Navajo Indians living outside the reservation.

The Navajo Nation uses different demographics in terms of projected population and economic growth.[84] Using their growth rate of 2.48 percent, the Navajo Nation Indian population on the reservation is projected to be 11,768 by 2020 and 24,540 by 2050.

There are also 290 members of the Ute Mountain Ute Tribe living on tribal lands around White Mesa Village and in the Allen Canyon area west of Blanding. The Ute Indian population is projected to be 384 by 2020, an

Table 4-1
POPULATION PROJECTIONS [a]

| County/Community | 1998 | 2000 | 2020 |
|---|---|---|---|
| **Grand** | | | |
| Castle Valley | 388 | 371 | 778 |
| Moab | 5,268 | 5,919 | 13,018 |
| Balance of County | 4,159 | 4,488 | 8,159 |
| **Grand County Total** | **9,815** | **10,778** | **21,955** |
| **San Juan** | | | |
| Blanding | 3,243 | 3,293 | 4,202 |
| Bluff[b] | 293 | 296 | 500 |
| Mexican Hat | 79 | 80 | 102 |
| Monticello | 1,941 | 1,971 | 2,515 |
| Montezuma Creek | 608 | 618 | 788 |
| White Mesa Village | 220 | 223 | 285 |
| Aneth (NN) | 757 | 768 | 980 |
| Balance of Navajo Nation | 5,510 | 5,593 | 7,138 |
| Balance of County | 781 | 793 | 1,012 |
| **San Juan County Total** | **13,432** | **13,635** | **17,522** |
| **Navajo Nation Total** | **6,865** | **6,979** | **8,906** |
| Basin Total | **23,247** | **24,413** | **39,477** |

Note:
[a] All population totals are estimated for only the portion of each county within the basin boundaries.
[b] Bluff population numbers provided by Southeast AOG.
[C] Projections by the Navajo Nation, for comparison.
Sources:
1. State of Utah; Governor's Office of Planning & Budget, State of Utah, Utah Data Guide, Spring/Summer 1998.
2. The Navajo Nation, Division of Community Development, American Indian Resident Population Census by Chapter: 1980, 1990, & 1997.

Table 4-2
COUNTY POPULATION PROJECTIONS

| County | 1998 | 2020 | 2050 |
|---|---|---|---|
| Grand | 9,763 | 21,955 | 65,168 |
| San Juan | 13,432 | 17,522 | 24,902 |
| **Total** | **23,247** | **39,477** | **90,070** |

Figure 4-1
POPULATION PROJECTIONS

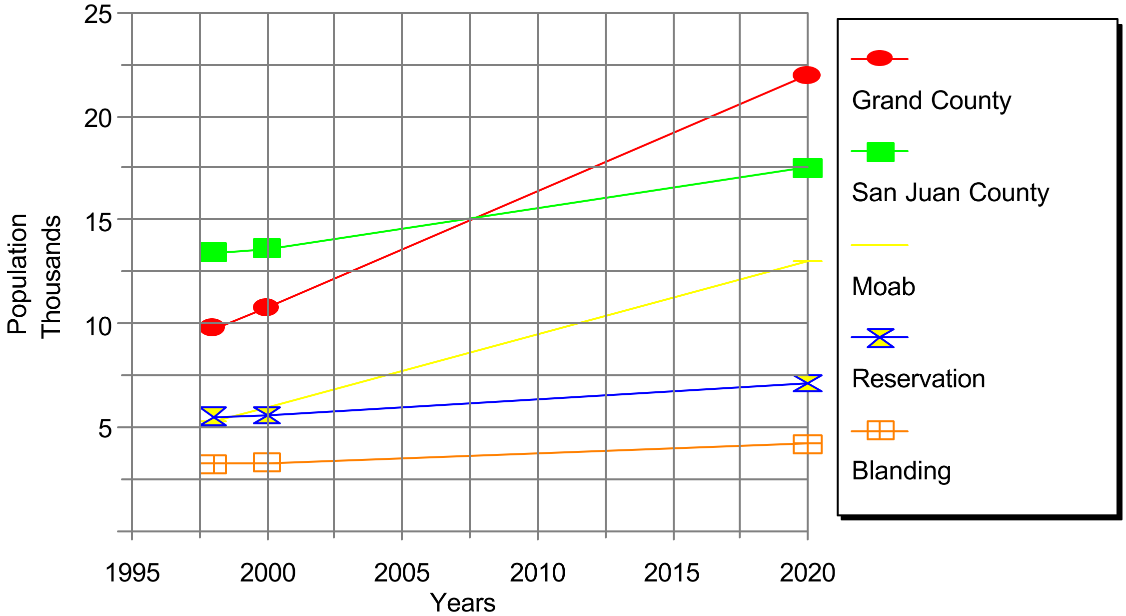
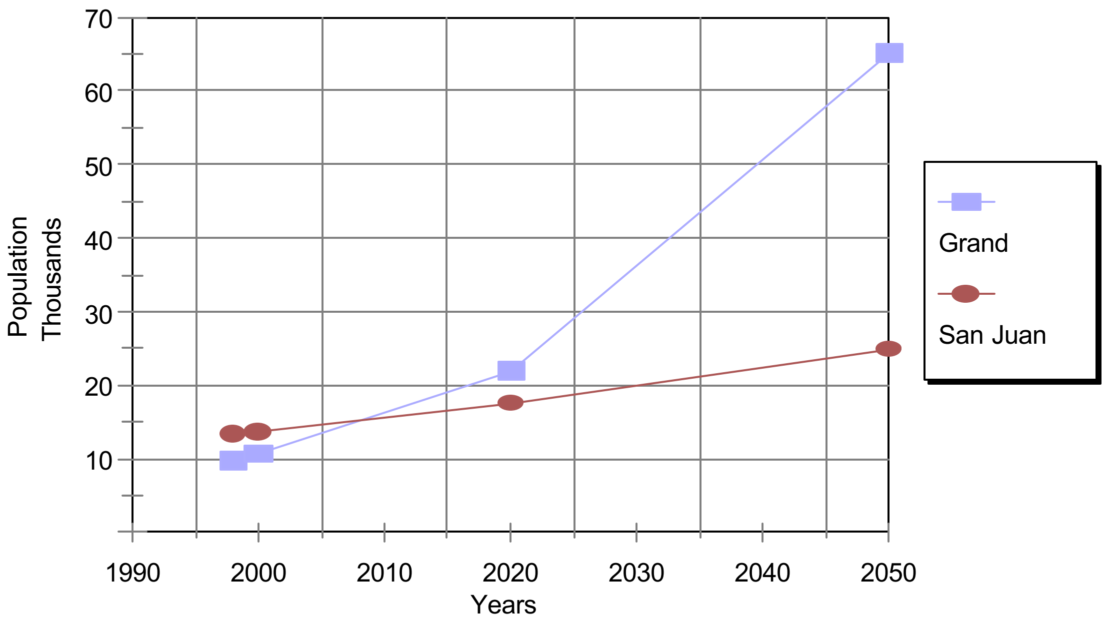



**Figure 4-1a**
County Population Projections to 2050



annual growth rate of 1.2 percent. The current and projected Indian population as determined in the San Juan County Water Master Plan (1998)[96] is shown in Table 4-3.

## 4.3 EMPLOYMENT

Even though this is considered a rural area, 1998 employment in the agriculture sector was only 3.2 percent of the basin total. Non-agriculture wages and salary employment accounted for 9,019 jobs out of the 11,839 total.

The largest employment in 1998 was about equal in four sectors. These were 2,460 jobs in the trade sector; government (local, state and federal), 2,359; non-farm proprietor, 2,410; and service, 2,337 jobs. The remaining sectors each provide from 137 to 591 jobs. These are shown in Table 4-4. Employment projections by county are shown on Figure 4-2 and projections by major industry are shown on Figure 4-3.

## 4.4 ECONOMIC FUTURE

Economic projections for most of the state are made utilizing the State of Utah Process Economic and Demographics (UPED) projection model. This model takes into account a number of variables assessing the demographic and industrial mix of an area's overall economy. The model incorporates historical employment growth patterns along with assumptions regarding labor force survival rates. Any transient and part time population occupying the hotel rooms and condominiums at regional recreation and tourist areas are not accounted for in the UPED model. Population estimates for the unincorporated community of Bluff in San Juan County are not computed in the UPED Model. Personnel at the Southeast AOG, working with local officials of the San

Construction is increasing

Table 4-3
INDIAN POPULATION PROJECTIONS

| Geographic Area | 1997 | 2020 | 2050 |
|---|---|---|---|
| White Mesa Reservation | 290 | 384 | 582 |
| Navajo Reservation | 6,037 | 8,255 | 12,405 |
| Dennehotso Chapter | 32 | 41 | 56 |
| Navajo Mountain Chapter | 427 | 557 | 787 |
| Oljato Chapter | 1,769 | 2,333 | 3,346 |
| Mexican Water Chapter | 329 | 541 | 1,037 |
| Red Mesa Chapter | 1,150 | 1,706 | 2,854 |
| Teec Nos Pos Chapter | 105 | 133 | 182 |
| Aneth Chapter | 2,225 | 2,914 | 4,143 |
| **Indian Total** | **6,327** | **8,609** | **12,987** |

Source: San Juan County Water Master Plan prepared by Wright Water Engineers, Inc. [96]

Table 4-4
EMPLOYMENT PROJECTIONS

| County/Industry | 1998 | 2000 | 2010 | 2020 |
|---|---|---|---|---|
| **Grand** | | | | |
| Agriculture [a] | 103 | 102 | 97 | 89 |
| Mining | 118 | 125 | 162 | 181 |
| Construction | 210 | 274 | 556 | 741 |
| Manufacturing | 59 | 65 | 94 | 124 |
| TCPU [b] | 129 | 146 | 232 | 306 |
| Trade | 1,754 | 1,949 | 2,942 | 3,818 |
| FIRE [c] | 97 | 109 | 168 | 220 |
| Services [d] | 1,333 | 1,500 | 2,383 | 3,238 |
| Government | 832 | 921 | 1,447 | 1,929 |
| Non-Farm Proprietors | 1,551 | 1,758 | 2,841 | 3,735 |
| **County Total** | **6,186** | **6,949** | **10,922** | **14,381** |
| **Non-Ag W&S Employment** | **4,533** | **5,087** | **7,984** | **10,557** |
| **San Juan** | | | | |
| Agriculture [a] | 281 | 279 | 264 | 243 |
| Mining | 225 | 227 | 231 | 235 |
| Construction | 188 | 202 | 253 | 279 |
| Manufacturing | 532 | 539 | 579 | 641 |
| TCPU [b] | 291 | 310 | 393 | 460 |
| Trade | 706 | 729 | 846 | 922 |
| FIRE [c] | 40 | 41 | 47 | 51 |
| Services [d] | 1,004 | 1,057 | 1,329 | 1,534 |
| Government | 1,527 | 1,558 | 1,839 | 2,024 |
| Non-Farm Proprietors [e] | 859 | 896 | 1,069 | 1,160 |
| **County Total** | **5,653** | **5,838** | **6,850** | **7,549** |
| **Non-Ag W&S Employment** | **4,486** | **4,635** | **5,489** | **6,118** |
| **Basin Totals** | | | | |
| Agriculture [a] | 384 | 381 | 361 | 332 |
| Mining | 343 | 352 | 393 | 416 |
| Construction | 398 | 476 | 809 | 1,020 |
| Manufacturing | 591 | 604 | 673 | 765 |
| TCPU [b] | 420 | 456 | 625 | 766 |
| Trade | 2,460 | 2,678 | 3,788 | 4,740 |
| FIRE [c] | 137 | 150 | 215 | 271 |
| Services [d] | 2,337 | 2,557 | 3,712 | 4,772 |
| Government | 2,359 | 2,479 | 3,286 | 3,953 |
| Non-Farm Proprietors [e] | 2,410 | 2,654 | 3,910 | 4,895 |
| **Basin Total** | **11,839** | **12,787** | **17,772** | **21,930** |
| **Non-Ag W&S Employment** | **9,019** | **9,722** | **13,473** | **16,675** |

Notes:
[a] Both agriculture and non-agriculture wages and salary employment include agricultural services.
[b] Transportation, communications, and public utilities.
[c] Finance, insurance, and real estate.
[d] Includes private household employment; excludes agricultural services employment.
[e] Utah Department of Employment Security's definition.

Sources:
1. State of Utah; Governors Office of Planning & Budget, State of Utah Economic & Demographic Projections, 1994.
2. The Navajo Nation, Division of Community Development, American Indian Resident Profile, Spring 1995.

Figure 4-2
Employment by County

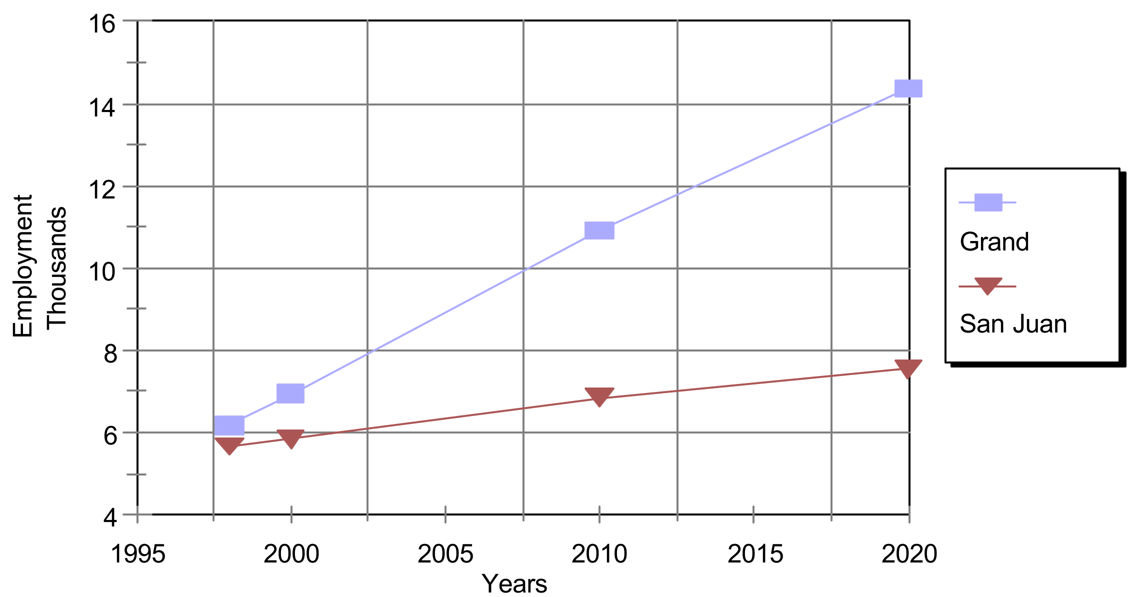
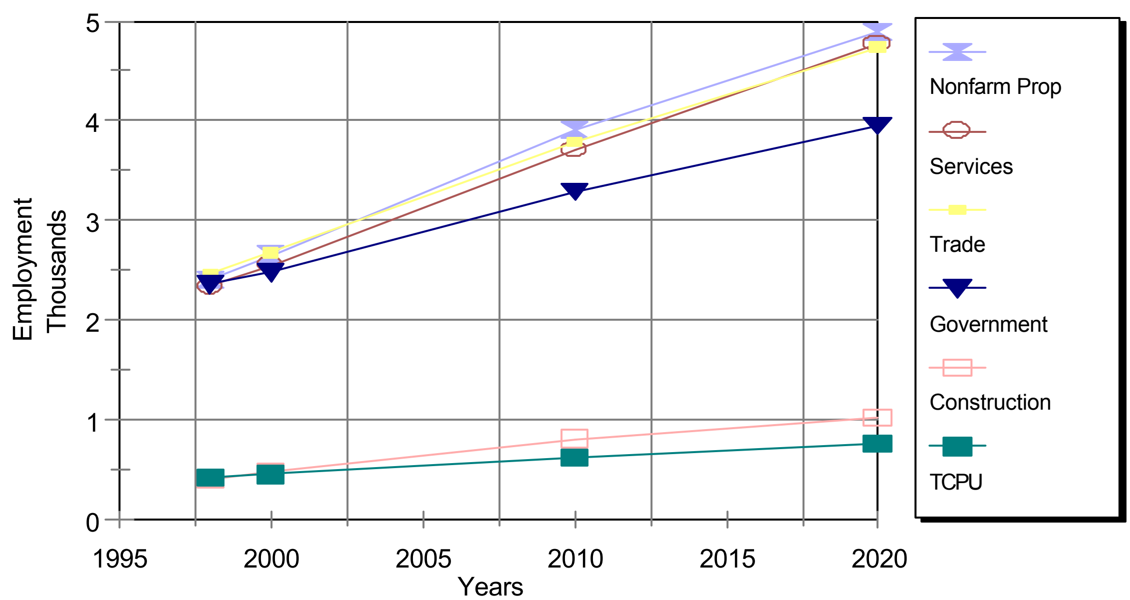



**Figure 4-3**
Basin Employment by Major Industry



Moab Main Street

Juan County Service Area #1 (Bluff), provide population estimates for this area.

In terms of employment, the number of jobs increased by an average of 0.8 percent over a one-year period from the third quarter of 1995 to the third quarter of 1996 for the basin non-Indian population. Overall, annual employment is projected to grow by about 2.8 percent per year to 2020.

The current rate of unemployment within the Navajo Nation is over 50 percent. This rate is not expected to change over the foreseeable future. About one-half of the Navajo families live below the federal poverty level.

Employment opportunities for the local Indian population are projected to grow at nearly the same rate as the population at 1.1 percent per year. The Navajo Nation Water Management Branch is using a growth rate of 2.48 percent for water demand projections.[84] Currently, more than 40 percent of the Navajo families haul water for their domestic water needs.

Most rapid employment growth includes state and local government, wholesale and retail trade, non-farm proprietors and various services. Continued economic growth is expected to be maintained by further increases in all sectors of the economy with mining showing only minor gains and agriculture declining slightly. ❏

# Contents

Section 5

# Southeast Colorado River Basin

**Utah State Water Plan**

## Water Supply and Use

**5.1 INTRODUCTION**

This section of the Southeast Colorado River Basin Plan discusses the present surface water and groundwater supply available and its present use. Although the Colorado and San Juan rivers could be major water sources, their use is small when compared to local streams and groundwater. The Colorado River is used mostly for recreational activities although there is some water diverted for irrigation. Irrigation water and some municipal and industrial water are diverted from the San Juan River along with recreational uses. In addition, there is some Dolores River water used for irrigation near La Sal.

Projected water uses and demands are discussed in Section 9. Agricultural water uses are discussed further in Section 10 and culinary water is discussed in more detail in Section 11. Groundwater is discussed in more detail in Section 19.

**5.2 BACKGROUND**

The Southeast Colorado River Basin is bordered on the west by the Colorado River and Green River, on the north by the Book Cliffs and on the south and east by Arizona and Colorado state lines. The drainages that flow north to the Uinta Basin are not included. Although the southern part of the western boundary has been generalized as the Colorado River, the boundary as used in this report is the eastern shore line of Lake Powell. The Uinta Basin hydrologic area is on the north and the West Colorado River Basin is on the west.

Much of the water from the perennial streams originating within the basin have been developed. There is still some undeveloped surface water and a supply of undeveloped groundwater in several aquifers throughout the area. These supplies will be developed as the demand increases and when it becomes economically feasible.

Water is the lifeblood that supports man's endeavors, especially in an otherwise harsh, unfriendly land. Water helps crops grow, quenches mans thirst and enriches the surrounding environment.

Most of the surface water supply diverted for use originates either on the La Sal Mountains or the Abajo Mountains. These mountains also recharge the groundwater that shows up in the valleys in the form of springs or seeps and are the primary supply for the alluvial and consolidated rock aquifers.

Many normally dry drainages experience short-duration flows produced by high-intensity cloudburst storms or unusually high snow-melt runoff. These are not a dependable supply of water although there is some recharge to the alluvial or consolidated rock aquifers.

The primary use of water is for irrigation although use for municipal purposes is increasing, especially in Grand County. Water use for industry is increasing but it is still less than one-fourth of the total use.

The Southeast Colorado River Basin was divided into 17 subareas for purposes of the land-use inventory and preparation of the water budgets. These hydrologic subareas are shown on Figure 5-1. The water budgets are an accounting procedure for determining all the water inflows, supplies, uses and outflows within a given hydrologic subarea. These subareas were delineated to take advantage of hydrologic and geologic conditions that would minimize unknown variables. The base period used for the water budgets and calculating the yield was 1961-90.[12] The land-use surveys were made in 1990.[19] Most of the groundwater data was based on varying periods of records or spot measurements. The municipal and industrial water use is based on data collected during 1996.[14]

## 5.3 WATER SUPPLY

The total water supply comes from precipitation, mostly in the higher elevations. Up to 90 percent of the precipitation in the upper watersheds is consumed by native vegetation and evaporation. This need must be met before there is surface water runoff or infiltration to the groundwater aquifers that feed springs and provide groundwater inflow. Because of this relationship, a small change in precipitation can cause a large change in water yield.

Water has been and still is a scarce resource in this area. One of the first things the early settlers did was to dig ditches and divert water onto the land so they could grow crops. When the first Mormon settlers established the Elk Mountain Mission in 1855 at present Moab, they first diverted water to vineyards and orchards. These were abandoned when the settlers left Elk Mountain. The first diversion after resettlement was constructed on Mill Creek in 1879. Two ditches were dug, one on the north side and one on the south, to carry water to the land for irrigation.[45]

The day after the settlers arrived in Bluff in April 1880, they held a meeting to appoint two committees, one to divide the land and one to survey and dig a ditch.[89] The ditch committee started work the next morning. “They drove their picks and shovels through stratas of clay and quicksand with an assurance of reward which the San Juan and its valleys have never yet bestowed.” The most oft-heard cry that summer was, “The ditch is broken!” Upstream in Montezuma Creek, settlers had arrived a year earlier from Colorado. Along with a vanguard from the Bluff settlers, they diverted water onto the land to irrigate crops. Although the diversion works were built on rock, the river still took its toll when floods came.

### 5.3.1 Surface Water Supply

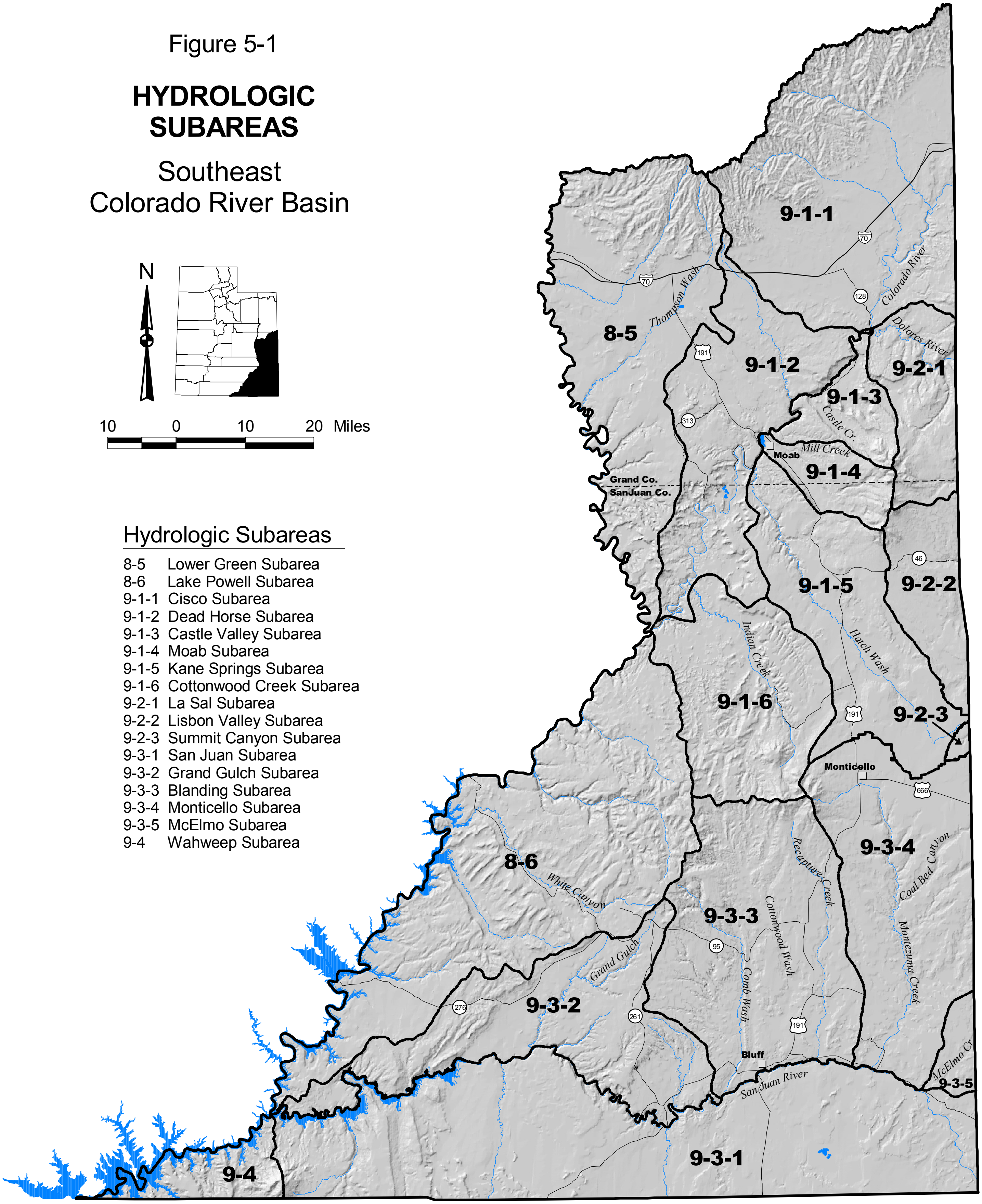
Most of the surface runoff comes from snow-melt during the months of April, May and June. Individual streams peak at different times depending on the watershed aspect, elevation and configuration. Runoff patterns are also influenced by watershed gradient, types of soils, and types and condition of vegetation. Also, storage reservoirs modify surface water flows. Watersheds with good vegetative cover and sandy or clayey loam soils will retain water better and allow it to infiltrate down through the soil profile. This puts the moisture into the groundwater system so it reappears downslope later in the season than it would if it remained as surface water flows. The base flows of streams under these conditions are sustained longer into the season. The tributary water yield from each subarea is shown in Table 5-1.

Monticello Lake

Figure 5-1

# HYDROLOGIC SUBAREAS

## Southeast Colorado River Basin




### Hydrologic Subareas

- 8-5 Lower Green Subarea
- 8-6 Lake Powell Subarea
- 9-1-1 Cisco Subarea
- 9-1-2 Dead Horse Subarea
- 9-1-3 Castle Valley Subarea
- 9-1-4 Moab Subarea
- 9-1-5 Kane Springs Subarea
- 9-1-6 Cottonwood Creek Subarea
- 9-2-1 La Sal Subarea
- 9-2-2 Lisbon Valley Subarea
- 9-2-3 Summit Canyon Subarea
- 9-3-1 San Juan Subarea
- 9-3-2 Grand Gulch Subarea
- 9-3-3 Blanding Subarea
- 9-3-4 Monticello Subarea
- 9-3-5 McElmo Subarea
- 9-4 Wahweep Subarea

| Table 5-1<br>SUBAREA TRIBUTARY YIELD | | | |
|---|---|---|---|
| Subarea | Annual Yield (acre-feet) | Subarea | Annual Yield (acre-feet) |
| Cisco | 12,460 | Lisbon Valley | 13,810 |
| Dead Horse | 10,420 | San Juan | 3,480 |
| Castle Valley | 9,800 | Grand Gulch | 7,060 |
| Moab | 22,030 | Blanding | 18,710 |
| Kane Spring | 12,170 | Monticello | 14,670 |
| Cottonwood Creek | 13,380 | McElmo | 980 |
| La Sal | 9,450 | **Total** | **148,420** |

Base Period: 1961-90
Yields were not calculated for the Lower Green, Lake Powell, Wahweep and Summit Canyon areas as there are no developed uses made of the small flows.

The amount of runoff or river flow is measured at stream gaging stations that have been or are currently operated and maintained by the U.S. Geological Survey. Some gages are operated on a cooperative basis with local entities or state agencies. Most of these stations are listed in Table 5-2 along with the period of record and average annual flows. The locations of these gaging stations are shown on Figure 5-2.

Most of the water supply comes from the portion of the La Sal and Abajo mountains above the 6,000 to 8,000-foot levels depending on aspect and location. These watersheds produce higher volumes of water and the flows last longer into the summer.

Runoff produced below about 7,000 feet in elevation is erratic in some areas as most of it comes from summer thunderstorms producing cloud-burst flood flows. These flows have high peaks but are of short duration and low volume, often with loads of sediment and debris. Only a small part of this type of flow can be controlled and utilized.

Mill Creek

Yield from the La Sal Mountains supplies the Moab, Castle Valley and La Sal areas and yield from the Abajo Mountains supplies the Monticello and Blanding areas. The schematic representations of average annual flows for three streams are shown in Figures 5-3, 5-4 and 5-5. The width of the arrows and bands indicates the average annual flow volume. The flow volumes are derived or estimated from stream gage data or other records and by correlation.

**Table 5-2**
**Gaging Station Record - Southeast Colorado River Basin** [66]
**(acre-feet)**

| Number | Stream Gage Name | Years | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 09169000 | Two Mile near La Sal | 1945-1951 | 27 | 27 | 28 | 29 | 30 | 67 | 624 | 626 | 86 | 26 | 21 | 21 | 1,612 |
| 09177500 | Taylor Creek near Gateway, Co. | 1945-1967 | 26 | 29 | 29 | 24 | 31 | 103 | 1,038 | 715 | 211 | 40 | 36 | 16 | 2,298 |
| 09178000 | Deep Creek near Paradox, Co. | 1945-1953 | 36 | 74 | 85 | 80 | 70 | 94 | 212 | 258 | 255 | 100 | 19 | 21 | 1,304 |
| 09178500 | Geyser Creek near Paradox, Co. | 1945-1951 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 69 | 118 | 0 | 0 | 0 | 206 |
| 09180000 | Dolores River near Cisco | 1951-1998 | 13,984 | 12,011 | 11,310 | 10,801 | 12,603 | 25,971 | 125,404 | 195,894 | 122,950 | 40,544 | 18,969 | 13,384 | 603,825 |
| 09180500 | Colorado River near Cisco | 1914-1998 | 243,959 | 227,104 | 203,105 | 189,780 | 182,719 | 238,378 | 497,076 | 12,154,615 | 1,399,441 | 573,259 | 268,738 | 219,902 | 16,398,07<br>6 |
| 09180920 | Onion Creek above Onion Creek Bridge near Moab | 1980-1981 | 75 | 83 | 86 | 94 | 87 | 87 | 79 | 89 | 69 | 63 | 80 | 55 | 947 |
| 09180970 | Onion Creek below Onion Creek Bridge near Moab | 1980-1981 | 58 | 71 | 71 | 83 | 140 | 376 | 136 | 105 | 68 | 53 | 76 | 51 | 1,288 |
| 09181000 | Onion Creek near Moab | 1951-1955 | 44 | 64 | 62 | 56 | 66 | 174 | 60 | 60 | 31 | 33 | 140 | 38 | 828 |
| 09181500 | Professor Creek near Moab | 1951-1953 | 152 | 220 | 164 | 201 | 212 | 157 | 162 | 13 | 16 | 19 | 186 | 25 | 1,527 |
| 09182000 | Castle Creek above Diversions, near Moab | 1951-1975 | 34 | 29 | 24 | 20 | 17 | 21 | 38 | 181 | 245 | 129 | 62 | 40 | 840 |
| 09182200 | Castle Creek below Castleton near Moab | 1993-1998 | 162 | 144 | 148 | 149 | 138 | 157 | 146 | 400 | 479 | 320 | 187 | 167 | 2,597 |
| 09182400 | Castle Creek below Castle Valley near Moab | 1993-1998 | 445 | 487 | 470 | 469 | 410 | 464 | 407 | 475 | 496 | 365 | 316 | 348 | 5,152 |
| 09182500 | Castle Creek near Moab | 1951-1958 | 279 | 464 | 464 | 486 | 468 | 510 | 324 | 148 | 72 | 29 | 382 | 176 | 3,802 |
| 09182900 | Courthouse Wash at Arches Hwy Cross near Moab | 1959-1965 | 38 | 2 | 6 | 80 | 87 | 19 | 42 | 15 | 5 | 229 | 238 | 326 | 1,087 |
| 09183000 | Courthouse Wash near Moab | 1950-55,<br>67-98 | 185 | 65 | 45 | 50 | 43 | 92 | 99 | 77 | 133 | 122 | 228 | 131 | 1,270 |
| 09183500 | Mill Creek at Sheley Tunnel, near Moab | 1955-59,<br>88-98 | 533 | 448 | 419 | 385 | 329 | 402 | 674 | 1,816 | 1,739 | 942 | 626 | 529 | 8,842 |
| 09184000 | Mill Creek near Moab | 1950-71,<br>73-93 | 623 | 566 | 539 | 494 | 475 | 523 | 795 | 1,802 | 1,696 | 930 | 819 | 663 | 9,925 |
| 09184500 | Pack Creek at M4 Ranch, near Moab | 1955-1959 | 55 | 51 | 47 | 44 | 46 | 54 | 82 | 476 | 665 | 187 | 79 | 54 | 1,840 |
| 09185000 | Pack Creek near Moab | 1955-1959 | 201 | 206 | 231 | 240 | 244 | 258 | 224 | 427 | 513 | 129 | 126 | 114 | 2,913 |
| 09185500 | Hatch Wash near La Sal | 1951-1971 | 64 | 6 | 6 | 5 | 38 | 468 | 84 | 8 | 3 | 74 | 338 | 63 | 1,157 |
| 09185800 | Indian Creek Tunnel near Monticello | 1958-59,<br>61-80 | 48 | 34 | 20 | 16 | 16 | 26 | 79 | 287 | 347 | 136 | 56 | 38 | 1,103 |
| 09186000 | Indian Creek near Monticello | 1950-1957 | 38 | 27 | 22 | 19 | 20 | 30 | 214 | 816 | 690 | 118 | 66 | 30 | 2,090 |
| 09186500 | Indian Creek above Cottonwood Creek, near Monticello | 1950-71,<br>89-91 | 87 | 80 | 62 | 51 | 44 | 75 | 382 | 1,060 | 730 | 145 | 129 | 74 | 2,919 |
| 09187000 | Cottonwood Creek near Monticello | 1950-1957 | 100 | 121 | 123 | 162 | 172 | 178 | 357 | 337 | 276 | 142 | 227 | 49 | 2,244 |
| 09187500 | Indian Creek above Harts Draw, near Monticello | 1950-1957 | 229 | 90 | 153 | 200 | 238 | 136 | 465 | 805 | 992 | 394 | 545 | 96 | 4,343 |
| 09187550 | Indian Creek above Bogus Pocket, near Monticello | 1984-1987 | 496 | 489 | 321 | 460 | 474 | 717 | 1,828 | 3,008 | 1,254 | 478 | 748 | 213 | 10,486 |
| 09372200 | McElmo Creek near Bluff | 1981-1982 | 2,878 | 2,430 | 2,907 | 2,744 | 5,695 | 4,978 | 4,364 | 5,089 | 6,831 | 5,397 | 8,137 | 6,725 | 58,175 |
| 09376900 | Spring Creek above Diversion, near Monticello | 1966-1972 | 12 | 7 | 3 | 2 | 1 | 24 | 90 | 307 | 240 | 27 | 20 | 5 | 738 |
| 09378100 | North Creek above Ranger Stat near Monticello | 1980-1985 | 11 | 10 | 7 | 6 | 5 | 14 | 181 | 502 | 598 | 57 | 0 | 0 | 1,391 |
| 09378170 | South Creek above Reservoir near Monticello | 1986-1998 | 14 | 39 | 12 | 11 | 18 | 146 | 399 | 497 | 199 | 43 | 18 | 17 | 1,413 |
| 09378200 | Montezuma Creek at Golf Course at Monticello | 1980-1992 | 22 | 36 | 16 | 16 | 22 | 126 | 709 | 977 | 533 | 74 | 17 | 13 | 2,561 |
| 09378600 | Montezuma Creek near Bluff | 1986-1993 | 254 | 643 | 210 | 963 | 1,889 | 4,738 | 2,272 | 1,047 | 486 | 185 | 289 | 212 | 13,188 |
| 09378630 | Recapture Creek near Blanding | 1966-1998 | 11 | 8 | 3 | 2 | 7 | 106 | 297 | 411 | 139 | 10 | 4 | 1 | 999 |
| 09378650 | Recapture Creek below Johnson Creek near Blanding | 1976-1993 | 25 | 60 | 3 | 5 | 77 | 644 | 2,090 | 2,331 | 911 | 90 | 14 | 10 | 6,260 |
| 09378700 | Cottonwood Wash near Blanding | 1965-1987 | 434 | 151 | 202 | 163 | 468 | 900 | 1,551 | 1,085 | 227 | 277 | 816 | 228 | 6,502 |
| 09379000 | Comb Wash near Bluff | 1959-1968 | 57 | 45 | 188 | 0 | 3 | 30 | 25 | 5 | 86 | 325 | 945 | 330 | 2,039 |
| 09379500 | San Juan River near Bluff | 1915-1998 | 100,273 | 72,714 | 66.512 | 67,070 | 82,115 | 117,683 | 213,730 | 355,171 | 364,174 | 166,932 | 113,425 | 99,163 | 1,818,962 |

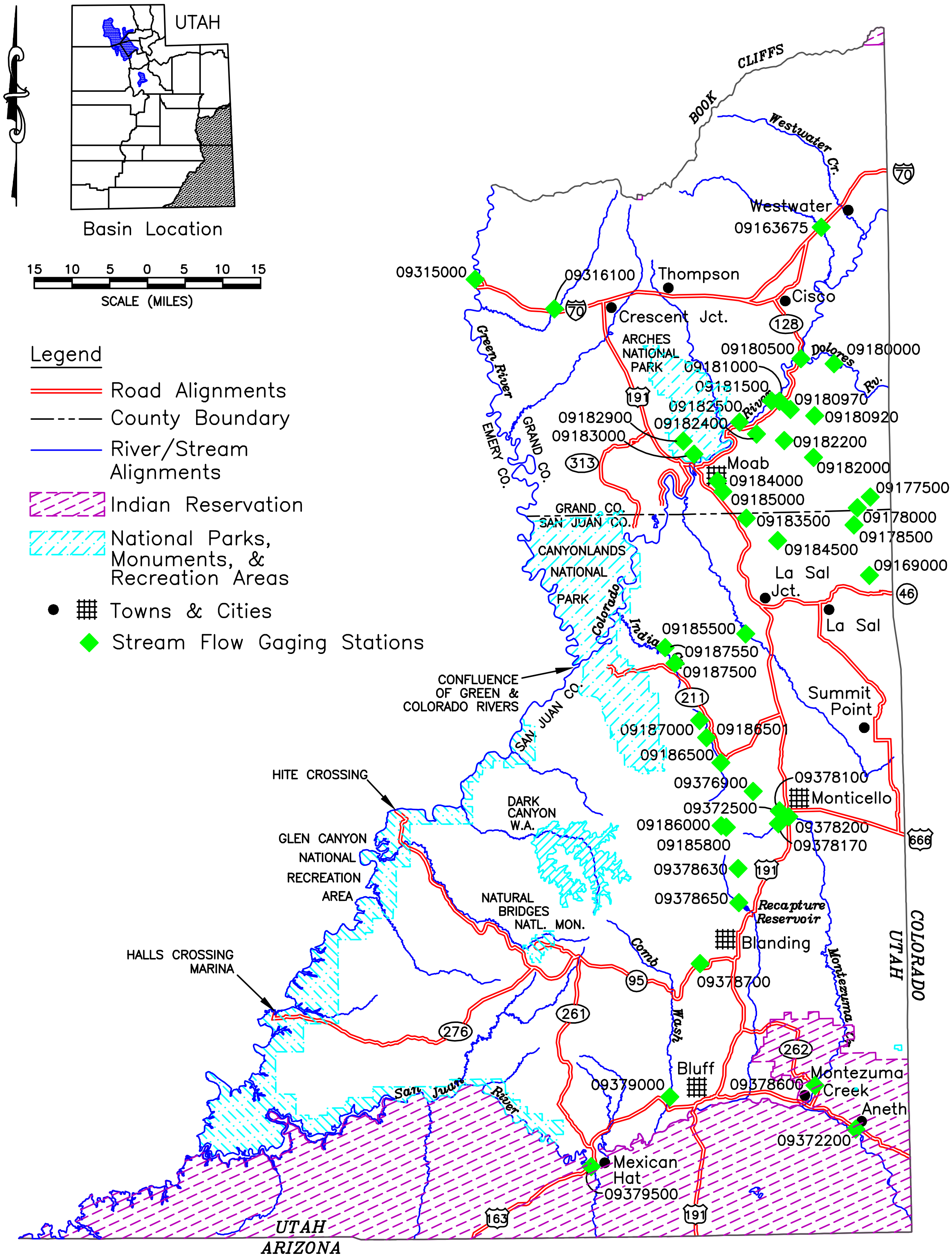
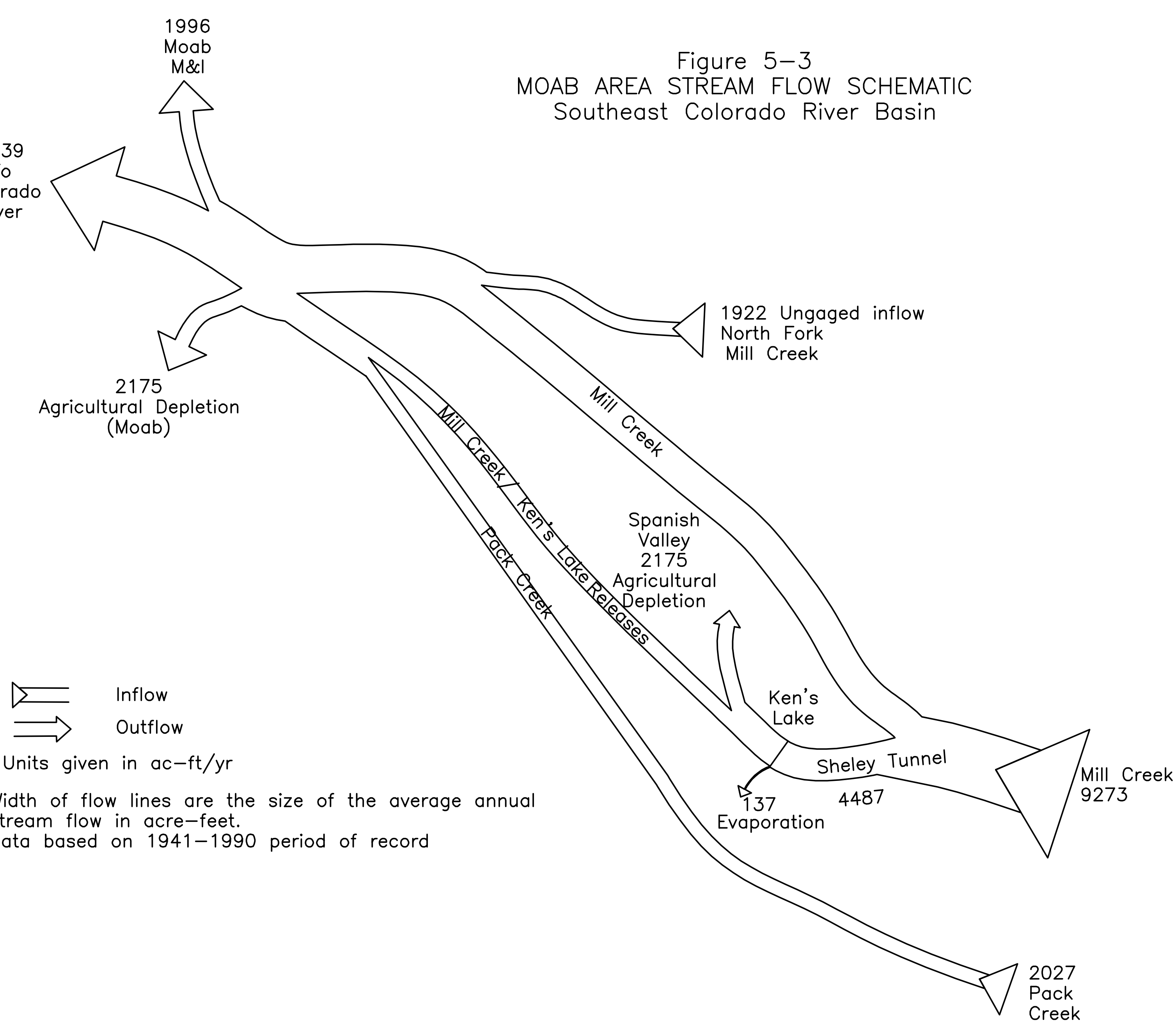



Figure 5-2
STREAM FLOW GAGING STATIONS
Southeast Colorado River Basin

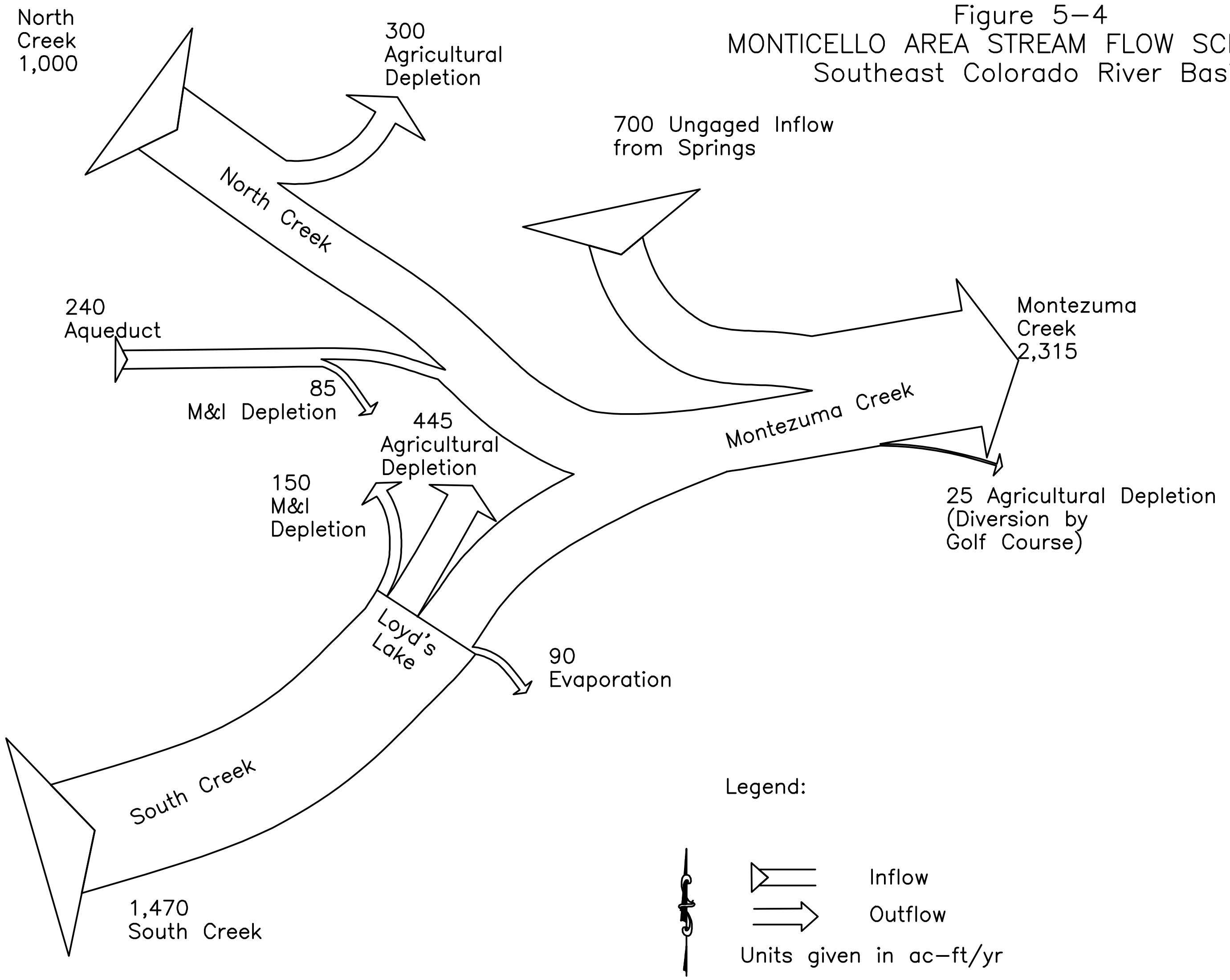
Figure 5-3
MOAB AREA STREAM FLOW SCHEMATIC
Southeast Colorado River Basin




Units given in ac-ft/yr

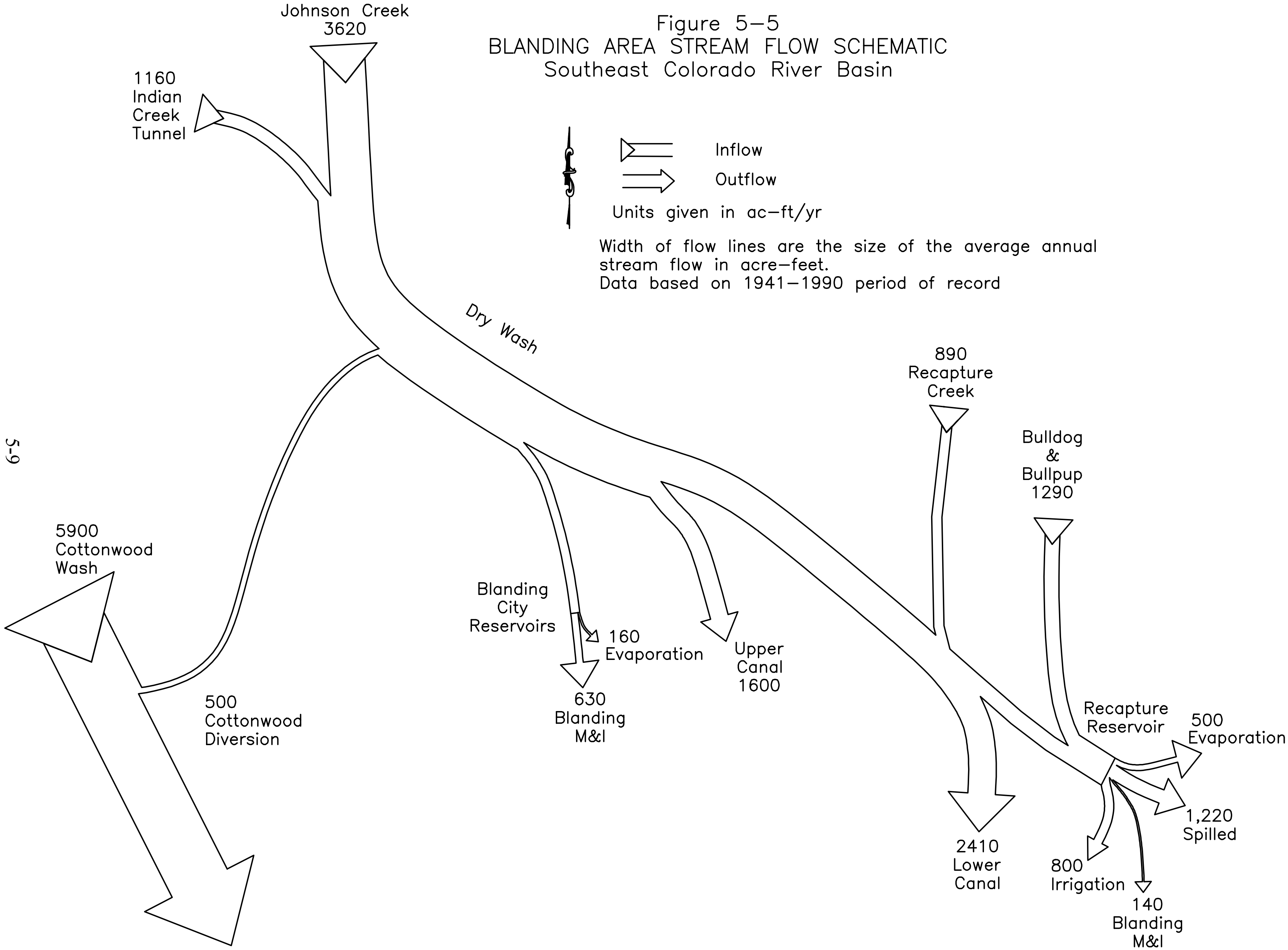
Width of flow lines are the size of the average annual stream flow in acre-feet.
Data based on 1941-1990 period of record

Figure 5–4
MONTICELLO AREA STREAM FLOW SCHEMATIC
Southeast Colorado River Basin




Width of flow lines are the size of the average annual stream flow in acre–feet.
Data based on 1941–1990 period of record

Figure 5–5
BLANDING AREA STREAM FLOW SCHEMATIC
Southeast Colorado River Basin



The average annual flows for four locations are shown graphically. These are: Mill Creek near Moab, Figure 5-6; South Creek above Reservoir near Monticello (Loyd's Lake), Figure 5-7; Recapture Creek near Blanding, Figure 5-8; and Montezuma Creek near Bluff, Figure 5-9. The general shape of the hydrographs for different probabilities are shown for Mill Creek near Moab on Figure 5-10 and for Recapture Creek near Blanding on Figure 5-11.

### 5.3.2 Groundwater Supply

Groundwater has been withdrawn over the past century from two types of aquifers, consolided rock and unconsolidated or alluvial deposits. The water-yielding consolidated rock units cover most of the basin at varying depths. The alluvial aquifers are limited in extent and use with the exception of Spanish Valley in Grand and San Juan counties and Castle Valley in Grand County.

The Spanish Valley aquifer is a major source of culinary water for residents in the Moab area. The most productive wells are generally just above Moab where the aquifer discharges to the Colorado River. Measured well production has been as high as 2,500 gpm within the Moab well fields with some individual local springs producing over 300 gpm.

All of the culinary water in the Moab, Spanish Valley and Castle Valley areas is derived from local groundwater sources, about 80 percent from wells and 20 percent from springs. The valley aquifers consist of unconsolidated, coarse alluvial-fan deposits and stream alluvium with minor deposits of clay. However, underlying consolidated rock aquifers contribute to the overall aquifer production.

A substantial amount of well pumpage can be attributed to underflow from existing consolidated rock formations fed from Castle and Placer creeks. The Division of Water Rights, in cooperation with the Town of Castle Valley, has just completed a groundwater study in the area to determine the potential capacity of the groundwater acquifers and identify any water quality problems in these water sources.[29]

Many of the springs in the basin have low yields but are generally of good water quality. Data on springs producing over 20 gallons per minute (32.3 acre-feet/year) are shown in Table 5-3. One spring on the Navajo Indian Reservation flowing 10 gallons per minute is shown as typical of that area.

Most of the public and domestic culinary water supplies come from groundwater, primarily from wells. The present supply of groundwater available is limited by water rights, hydrologic constraints and/or system constraints. These groundwater supplies are shown in Table 5-4.

Groundwater seep for livestock water

## 5.4 WATER USE

Water use is closely related to the basin’s current economic base. The primary use of water is for agriculture while other uses include residential, municipal, commercial and industrial purposes.

### 5.4.1 Municipal and Industrial Water Use

Municipal and Industrial (M&I) water use includes all diversions for residential developments, commercial businesses, industrial plants and operations, public buildings, and institutional uses and related outdoor facilities. M&I water is classified as treated (culinary or potable) or untreated (secondary or nonpotable).

Municipal Water Use - Culinary water is generally provided by public works departments of local municipalities and by larger water

Figure 5-6

**ANNUAL FLOWS**

Mill Creek near Moab

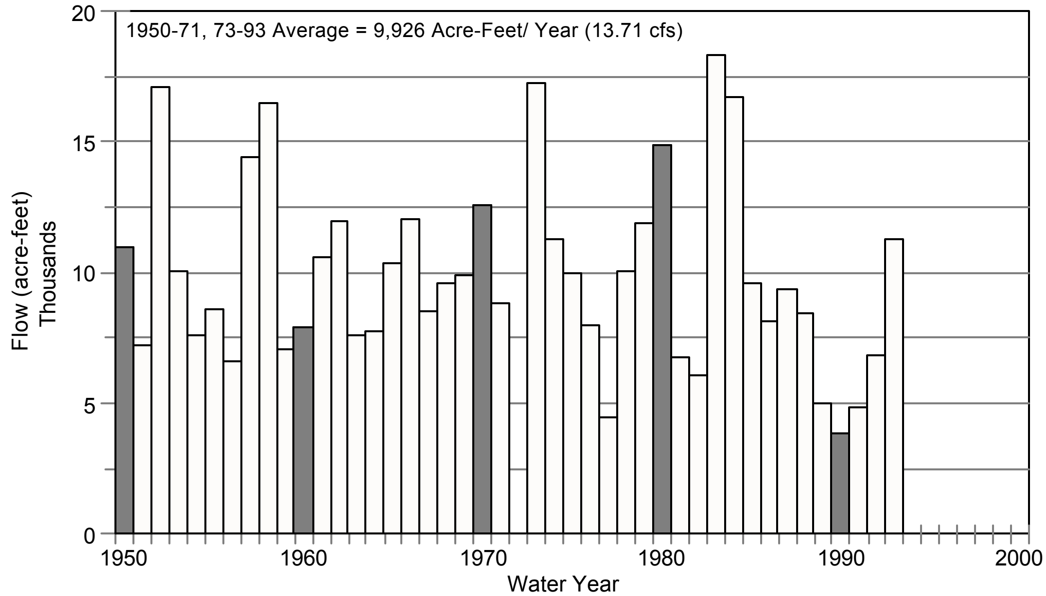



Figure 5-7

**ANNUAL FLOWS**

South Creek above Reservoir near Monticello (Loyd's Lake)

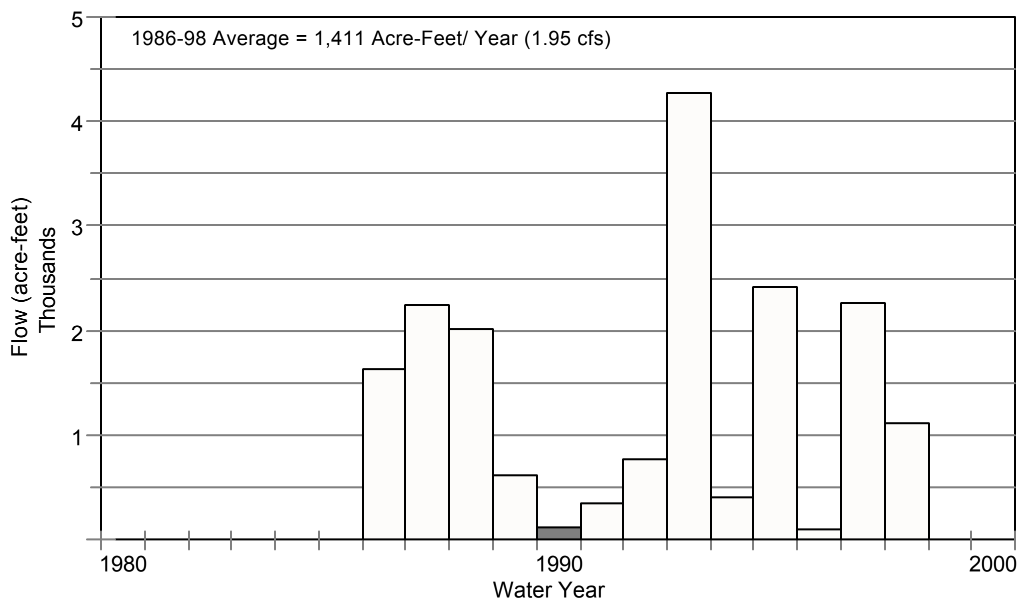


Figure 5-8

**ANNUAL FLOWS**

Recapture Creek near Blanding

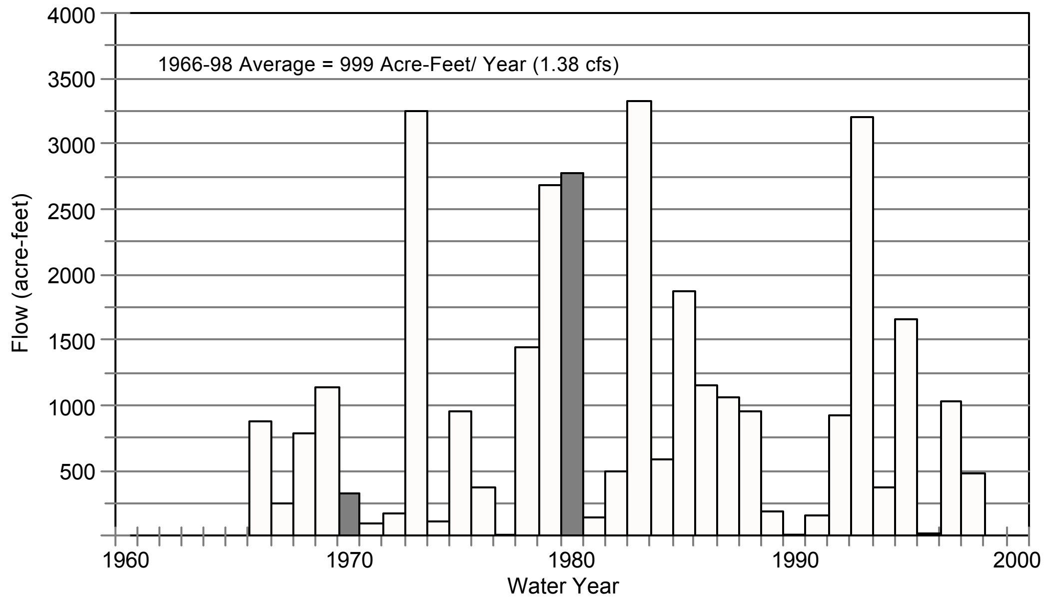



Figure 5-9

**ANNUAL FLOWS**

Montezuma Creek near Bluff

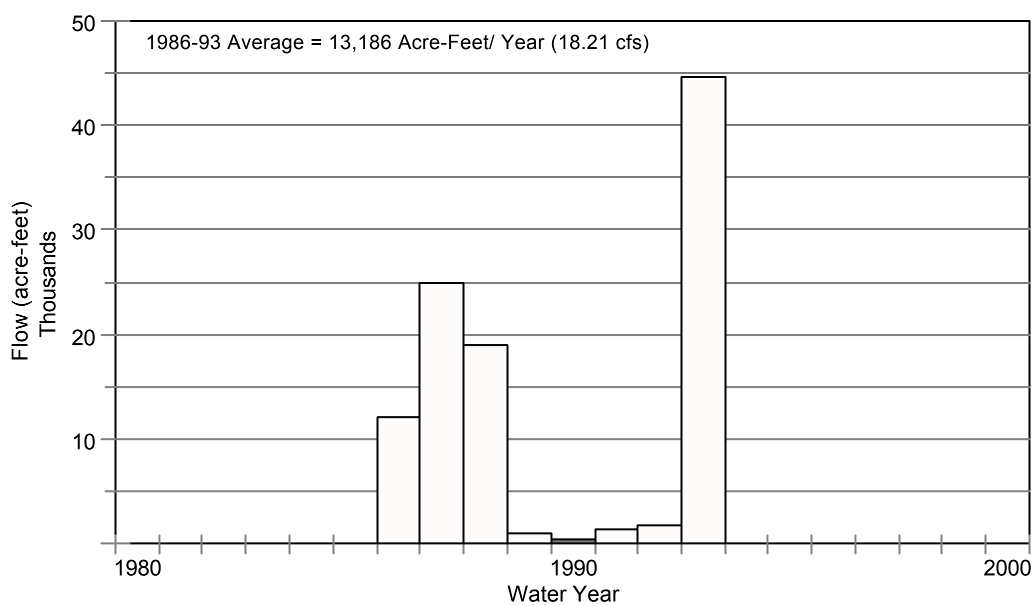


Figure 5-10

**MONTHLY STREAMFLOW PROBABILITES**

Mill Creek near Moab

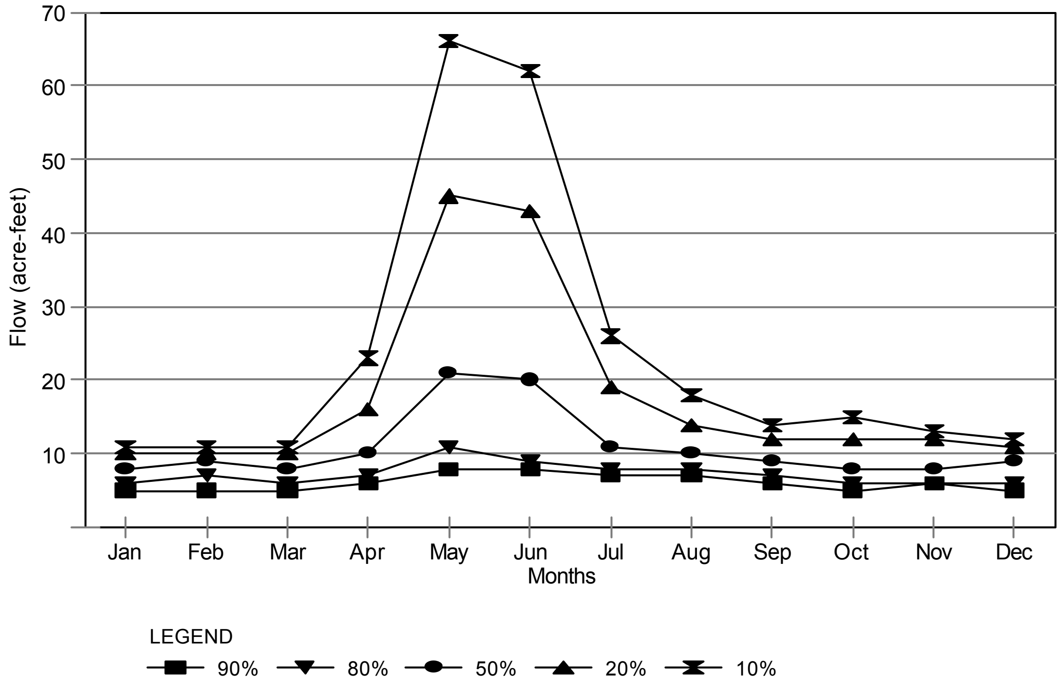



Figure 5-11

**MONTHLY STREAMFLOW PROBABILITES**

Recapture Creek near Blanding

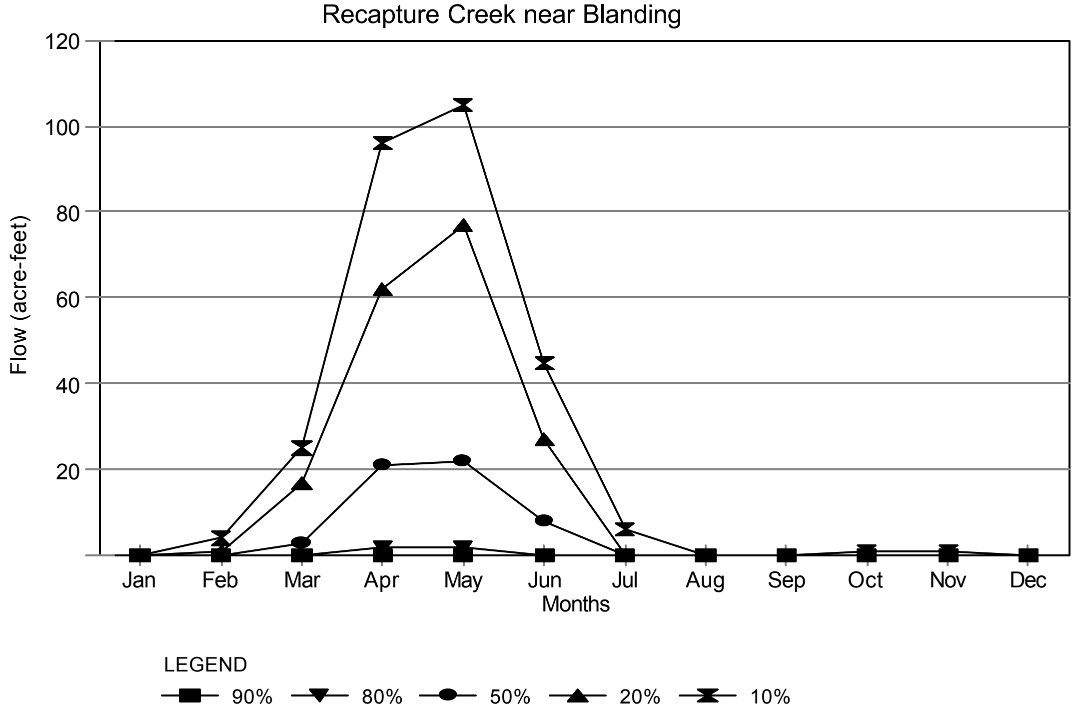


Table 5-3
SELECTED SPRINGS[21,23]

| Spring | Location (T,R,Sec) | Discharge (gal/min) | Quality (µS/cm) | Date |
|---|---|---|---|---|
| Kane | 21,24,36 | 43.5 | 5,290 | 9-8-85 |
| Burn | 22,25,12 | 42.0 | 680 | 9-7-85 |
| Unnamed seep | 22,25,18 | 20.0 | 1,100 | 9-8-85 |
| Skakel | 25,21,35 | 240<br>450 | 290<br>- | 8-15-85<br>9-23-91 |
| Watercress | 25,21,35 | 198 | | 9-23-91 |
| Jackson Res | 26,22,07 | 24 | 954[a] | 3-68 |
| Deep Cut | 26,22,14 | 90.0 | 305 | 11-19-68 |
| Birch | 26,22,15 | 90.0 | 295 | 10-19-67 |
| Somerville | 26,22,15 | 15.0 | 350 | 11-6-86 |
| Moab #1 | 26,22,15 | 50.0 | 460 | 8-16-85 |
| Moab #2 | 26,22,22 | 330 | 280 | 8-16-85 |
| Moab #3 | 26,22,22 | 390 | 285 | 8-15-85 |
| Warner Lake | 26,24,28 | 200 | 170[a] | 7-67 |
| Pack Creek | 27,23,24 | 200 | 1,220[a] | 4-68 |
| Barber | 27,24,30 | 30 | 1,240[a] | 4-68 |
| Coyote | 28,24,14 | 112 | 220 | -64 |
| 9Y21 (NN) | 43,20,23 | 10 | | |

Note: Only springs with flows greater than 20 gallons per minute are shown except the typical 9Y21 used by the Navajo Nation (NN). Water quality specific conductance is measured in µS/cm. See Appendix A for definitions.

[a] Values are in micromhos per centimeter.

Table 5-4
POTABLE GROUNDWATER SYSTEM SOURCE SUPPLIES[14,15,84]

| Type of Use | Springs (ac-ft) | Wells (ac-ft) | Total (ac-ft) |
|---|---|---|---|
| **GRAND COUNTY** | | | |
| Public Community Systems | 1,870 | 8,140 | 10,010 |
| Public Non-Community Systems | 0 | 40 | 40 |
| Private Domestic Use | 0 | 890 | 890 |
| **Grand County Total** | **1,870** | **9,070** | **10,940** |
| **SAN JUAN COUNTY** | | | |
| Public Community Systems | 870 | 410 | 1,280 |
| Public Non-Community Systems | neg. | 20 | 20 |
| Private Domestic Use | 0 | 600 | 600 |
| Navajo Tribal Utility Auth | 0 | 1,800 | 1,800 |
| Other Navajo Indian Comm Systems | 30 | 320 | 350 |
| **San Juan County Total** | **900** | **3,150** | **4,050** |
| **BASIN TOTAL** | **2,770** | **12,220** | **14,990** |

Note: The public community systems data are the available supply. Section 11 shows the current use. The above data does not include self-supplied industrial water, irrigation water or livestock water from wells or springs.
Source: M&I Water Supply Studies by the Division of Water Resources and Navajo Tribal Utility Authority data. One self-supplied industrial well supplies about 1,000 acre-feet. In addition, over 2,000 acre-feet are discharged from springs used for purposes other than culinary water.

conservation districts that retail water to customers or wholesale water to other provider agencies, municipalities or commercial businesses. In addition, 1,490 acre-feet are provided by private domestic systems. Recent statewide studies by the Division of Water Resources on residential water use show about 35 percent is used inside the home and 65 percent is used for outside purposes.

The major providers of culinary water include three municipalities, five water districts, one school district and a number of publicly and privately owned small community systems. In addition there are 16 community systems providing culinary water on the Navajo Indian Reservation and one community system operated by the Ute Mountain Utes at White Mesa.

One notable diversion is 1,160 acre-feet of water (1941-90 average) from upper Indian Creek into Johnson Creek to supplement municipal and irrigation water supplies in Blanding. This water is diverted through a tunnel completed in 1952. A measurement made on June 19, 1979 showed a flow of 45 cfs. Diversion of the maximum flow only occurs for a short time during peak runoff periods during May, June and July. A summary of annual diversions for both culinary and secondary water is given in Table 5-5.

Halchita culinary water tanks

Data for Table 5-5
CULINARY AND SECONDARY WATER DIVERSIONS - 1996

| System | Residential | Commercial | Institutional | Industrial | Total |
|---|---|---|---|---|---|
| | | (acre-feet) | | | |
| **GRAND COUNTY** | **CULINARY WATER DIVERSIONS** | | | | |
| Public Community Systems | 1,551 | 445 | 167 | 0 | **2,163** |
| Non-Community Systems | 895[a] | 18 | 14 | 0 | **927** |
| **Grand County Total** | **2,446** | **463** | **181** | **0** | **3,090** |
| **SAN JUAN COUNTY** | | | | | |
| Public Community Systems | 1,071 | 167 | 131 | 4 | **1,373** |
| Non-Community Systems | 657[b] | 92 | 25 | 0 | **774** |
| **San Juan County Subtotal** | **1,728** | **259** | **156** | **4** | **2,147** |
| NTUA[c] Public Systems | 95 | 15 | 39 | 26 | **175** |
| Other Navajo Indian Systems | 144 | 0 | 12 | 0 | **156** |
| **Navajo Indian Reservation Subtotal** | **239** | **15** | **51** | **26** | **331** |
| **San Juan County Total** | **1,967** | **274** | **207** | **30** | **2,478** |
| **BASIN TOTAL** | **4,413** | **737** | **388** | **30** | **5,568** |
| | | **SECONDARY WATER DIVERSIONS - 1996** | | | |
| **GRAND COUNTY** | | | | | |
| Public Community Systems | 124 | 0 | 580 | 0 | **704** |
| Non-Community Systems | 0 | 0 | 0 | 940[d] | **940** |
| **Grand County Total** | **124** | **0** | **580** | **940** | **1,644** |
| **SAN JUAN COUNTY** | | | | | |
| Public Community Systems | 262 | 0 | 0 | 0 | **262** |
| Non-Community Systems | 3 | 0 | 8 | 1,090[d] | **1,101** |
| **San Juan County Total** | **265** | **0** | **8** | **1,090** | **1,363** |
| **BASIN TOTAL** | **389** | **0** | **588** | **2,030** | **3,007** |

Source: Municipal and Industrial Water Supply Studies by the Division of Water Resources and from Navajo Tribal Utility Authority data.
a Includes 890 acre-feet of private domestic use
b Includes 600 acre-feet of private domestic use
c NTUA: Navajo Tribal Utility Authority.
d Self-supplied industrial water.

Industrial Water Use - The processing of precious metals, oil, natural gas, uranium, salt and other minerals often requires substantial quantities of water. The annual demand for industrial water varies considerably depending on the type and production capacity of each individual processing plant. It also depends on the current market for the product being processed. Due to the fluctuation in the demand for some minerals (uranium being the most prominent), it is not unusual for major processing plants to cut back on production or shut down completely. Data for water use by industries are not always available due to the proprietary nature of the industry. The self-supplied industrial water use reported for 1996 was 2,030 acre-feet or less than one-fourth of the total M&I diversions.

### 5.4.2 Agricultural Water Use

Water development has been occurring since the area was settled with irrigated agriculture as an important element of the local economy. A number of large irrigation projects have been built recently to supply the increased agricultural water demand. These projects include Mill Creek (Ken's Lake) Reservoir, Monticello (Loyd's Lake) Reservoir and Recapture Creek Reservoir along with related diversions, pipelines, canals and other management structures. These were completed primarily for supplemental irrigation water although municipal and industrial needs are an important part of the projects. The average annual quantity of water diverted for cropland irrigation is 34,950 acre-feet of which 18,430 acre-feet are depleted.

In the Cisco Subbasin, 75-80 percent of the cropland is irrigated with an estimated 5,060 acre-feet of water pumped from the Colorado River. There is 1,580 acre-feet of water pumped from the Colorado River for irrigation in the Castle Valley area. About 2,000 acre-feet of water is diverted from the Dolores River into the Kane Spring Subbasin for irrigation and stockwater and over 1,000 acre-feet is diverted from the San Juan River. Other areas are irrigated primarily with water diverted from local streams.

The irrigated acreage along with diversions and depletions of water used for agriculture are summarized in Table 5-6. See Section 10 for more information.

Sprinkler on Spanish Valley

### 5.4.3 Wetlands and Open Water Areas

Wetlands and open water areas include those with vegetation using large amounts of water through evapotranspiration by plants and/or evaporation from water surfaces. The net evaporation from reservoirs in the water-budget areas is 2,050 acre-feet.

Table 5-6
IRRIGATION WATER USE BY COUNTY

| County | Area (acres) | Average Annual Diversions (acre-feet) | Water Use Depletions (acre-feet) |
|---|---|---|---|
| Grand | 2,780 | 13,800 | 6,910 |
| San Juan | 6,150 | 21,150 | 11,520 |
| **Total** | **8,930** | **34,950** | **18,430** |

Most of the wetland areas are found along the rivers and streams. They also occur near springs, reservoirs, bogs, wet meadows, lakes and ponds. Wetlands and riparian vegetation are varied and support a wide diversity of wildlife species. Only the wetlands and open water areas in and near the irrigated areas were mapped with data included in this report. Wetlands and open water areas at higher elevations were not mapped as part of this study.

### 5.4.4 Instream Flow Requirements

The basin's river systems are diverse. They range from one of the largest river drainages in the United States (Colorado River) to small high mountain streams. The larger river systems; the Colorado, Green, Dolores and San Juan rivers, provide year-round instream flows for recreation and fish habitat. Many of the smaller streams are intermittent except in the upper reaches, and have no storage, making them less suitable as fisheries. The only required instream flow is a minimum of three cubic feet per second in Mill Creek below the Sheley Tunnel diversion to the valley proper. There is no minimum flow requirement in this stream below the Moab Irrigation Company diversion. See Section 14 for more information on fisheries and riparian habitat.

### 5.4.5 Recreation

Outdoor water-related recreation includes river running, kayaking, swimming, boating and fishing. Not so obvious, but perhaps of equal enjoyment, are activities such as hiking along existing streams and rivers, camping near reservoirs and streams, or simply taking a sightseeing trip through the high mountains, a forest or a canyon with water amenities along the way.

Recreation is an acknowledged and viable use of the basin's water resources. The initial planning and justification of most water development projects includes provisions for recreation. Federal and state agencies spend considerable amounts of money to assure that outdoor recreational opportunities are maintained and managed at reservoirs, rivers and streams. Other recreational water-use includes conservation pools in reservoirs for the maintenance of fish habitat, swimming and boating. Water is also provided for culinary uses at local, state and federal campgrounds and other recreational facilities.

Hite Marina

The water provided for recreation is not consumed. Water-based recreation is included as a benefit in most projects; however, quantification of this type benefit is difficult. Local, state and federal agencies fund facilities to assure the public access to meaningful and satisfying recreation. ❑

# Contents

Section 6

# Southeast Colorado River Basin

**Utah State Water Plan**

## Management

**6.1 INTRODUCTION**

This section of the Southeast Colorado River Basin Plan presents information and data on management of the water resources. This includes the responsibilities and organizational make-up of management agencies and their involvement in the storage, treatment, distribution and development of the water resources. Data are presented on the major water suppliers, public community systems, major irrigation companies, and lakes and reservoirs.

**6.2 SETTING**

When the early settlers moved into the area, they began to farm in order to support themselves. This required development of the untamed water resources for irrigation of crops and to provide water for household purposes. The earliest attempt was the Elk Mountain Mission in 1855 where diversions were earth or "earth and brush" dams. Later, more substantial structures were built such as the log diversions on Mill Creek above Spanish Valley in the 1880s. In 1879, homesteaders from Colorado joined forces with the advance vanguard of the "Hole in the Rock" expedition to construct a dam to divert water from the San Juan River for irrigation near Aneth. When the main body of the "Hole in the Rockers" arrived, they built riprap dams at Bluff to divert water. Some of the party went on to the original destination of Montezuma Creek and constructed a 16-foot waterwheel to divert water for irrigation. The floods of 1884 wiped out the improvements at Montezuma Creek and Aneth and heavily damaged those at Bluff.[46]

Work began in 1887 to develop North Creek in the Monticello area. After prior claims were acquired, this became the Blue Mountain Irrigation Company. Work was started in 1898 to divert water from Johnson Creek into the Blanding area but was not completed until 1902. The most time consuming project was a tunnel to divert water from Indian Creek to Johnson Creek which lasted over 30 years from its inception in 1920.[103]

> The precious wild and free-flowing water has been tamed and distributed through the visionary and cooperative actions of the early settlers. This rugged stewardship is still a way of life.

Although the Anasazi cultures left evidence of irrigation, recent practices to divert water began shortly after 1900 when Indian agents provided money and know-how to install diversions and ditches. Even now, there is only limited farming by the Navajo and Ute Indians.

Since these early beginnings, other improvements have been made in order to develop the water resources necessary to sustain the established communities and meet the growing water demands. In addition, water developments were made to support industrial needs although these uses have fluctuated as market conditions changed.

As a result of the growing need to find new and reliable sources of water, conservancy districts, local water providers and municipalities are actively involved in the development of both surface water and groundwater sources. One of the most recent investigations involves importation of Dolores River water to a number of communities in San Juan County. This proposal is described in Section 9.

### 6.3 MANAGEMENT ENTITIES AND SYSTEMS

Water-related service facilities are managed by a variety of agencies and organizations. There are about 15 different types of provider agencies including water and sewer agencies; municipal public works departments; water conservancy districts; water user associations; and small ditch, canal, distribution and irrigation companies. Also, water provider organizations cannot always be categorized based on their clientele or type of service provided. Often, a water supplier provides different types of water service to several different kinds of clientele.

#### 6.3.1 Municipal and Industrial Water Management

Municipal and industrial (M&I) water is used for residential, commercial, institutional and industrial purposes. It can be either culinary (potable) or secondary (nonpotable) quality water. M&I water providers are local entities and generally include public works departments of cities and towns and the Navajo Nation. However, water conservancy districts and water-user associations also provide water for various M&I uses. The public community water systems are listed in Table 6-1. There are four public community systems in Grand County and 16 in San Juan County, nine within the Navajo Indian Reservation and one in White Mesa. There are an additional nine systems within the Navajo Indian Reservation which the Navajo Nation class as public community systems. Unincorporated municipalities that own and operate water systems include Bluff, Eastland, Mexican Hat and Thompson. All public community water systems are regulated by the Division of Drinking Water except those listed as "Other Navajo Indian Community Water Systems". The "Other Navajo Indian Community Water Systems" are regulated by the Navajo Nation Public Water System Supervision Program. Culinary water use is described in Section 11.

#### 6.3.2 Wholesalers/Multi-Use Distributors

Water wholesalers are among the larger providers within the basin. They generally operate and maintain water conveyance, treatment and storage facilities associated with the larger development projects. Wholesalers may also provide water for smaller canal and ditch companies, municipalities, and a number of large industrial and commercial businesses.

<u>Grand County Water Conservancy District</u> - The Grand County Water Conservancy District (GCWCD) was founded in 1971 with a seven member board of directors to develop both surface water and groundwater supplies for irrigated agriculture and municipal uses in San Juan and Grand counties. The district's main facilities include: Ken's Lake earth fill dam and reservoir and a pressurized irrigation pipeline included in the Mill Creek Project; a 1.0- million gallon steel culinary water reservoir; and a number of wells in Spanish Valley. The district provided culinary and secondary water to residential areas serviced by the Spanish Valley Water and Sewer Improvement District (SVW & SID). It also provided irrigation water to farmers in Spanish Valley and a small amount to the Moab Irrigation Company.

The (SVW&SID) and the Grand County Special Service Water District had a contract to provide, purchase and deliver water to users. GCWCD has an exchange contract for Ken's Lake water with White Ranches for use of a well. The GCWCD was capable of delivering

Table 6-1
PUBLIC COMMUNITY WATER SYSTEMS FACILITIES

| System | Owner/Agency | Number Served | Connections | Water Source | Storage[a] (no./gal) |
|---|---|---|---|---|---|
| **GRAND COUNTY** | | | | | |
| Day Star Adventist Academy | Day Star Adventists | 37 | 12 | 3 flowing wells | 1/270,000 |
| Grand Water & Sewer Service Agency | Grand Water & Sewer Service Agency | 2,238 | 895 | 4 wells | 1/1,000,000 |
| Moab City | Moab City | 5,000 | 1,595 | 4 springs, 4 wells | 3/3,000,000 |
| Thompson Special Service Dist | Thompson Spec Serv Dist | 70 | 39 | 1 spring | 2/130,000 |
| **SAN JUAN COUNTY** | | | | | |
| Blanding City Public Works Dept | Blanding City | 3,299 | 1,100 | Johnson & Indian Creeks | 2/1,100,000 |
| Eastland Special Service Dist | Eastland Special Service District | 60 | 20 | 3 wells | 20/100,000[b] |
| Hall's Crossing Marina | National Park Service | 330 | 105 | 2 wells | 1/300,000 |
| Monticello Municipal Water Sys | Monticello City | 2,100 | 710 | 1 spring,5 wells,South Cr | 2/1,250,000 |
| Monument Valley High School | San Juan School Dist | 60 | 8 | 2 wells (in Arizona) | 1/30,000est |
| Navajo Mountain High School | San Juan School Dist | 50 | 7 | c | c |
| San Juan County Serv Area #1 | Serv Area Board (Bluff) | 300 | 146 | 3 wells | 2/400,000 |
| San Juan Co Spec Serv Dist #1 | District Board (Mexican Hat) | 110 | 12 | 2 wells | 1/106,000 |
| White Mesa Community | Ute Mountain Ute Tribe | 325 | 100 | 2 wells | 1/100,000 |
| **Navajo Tribal Utility Authority Water Systems** [d] | | | | | |
| Aneth Community | NTUA/Shiprock | 370 | 143 | 2 wells | 3/156,000 |
| Holly Village | NTUA/Shiprock | 60 | 28 | 1 well | 1/72,000 |
| Mexican Hat/Halchita Community | NTUA/Western | 320 | 107 | San Juan River, WTP | 2/200,000 |
| Montezuma Creek Community | NTUA/Shiprock | 240 | 78 | 3 wells & infiltration gallery | 1/70,000 |

Table 6-1 Continued - -
PUBLIC COMMUNITY WATER SYSTEMS FACILITIES

| System | Owner/Agency | Number Served | Connections | Water Source | Storage[a] (no./gal) |
|---|---|---|---|---|---|
| Oljato Community | NTUA/Western | 300 | 51 | 2 wells | 1/236,000 |
| Red Mesa Community | NTUA/Shiprock | 240 | 64 | 1 well | 1/55,000 |
| Todohaidekani Community | NTUA/Shiprock | 120 | 47 | 1 well | 2/180,000 |
| **Other Navajo Indian Community Water Systems** | | | | | |
| Aneth BIA Boarding School | BIA/Shiprock | 300 | 22 | 3 wells | 1/270,000 |
| Goulding Trading Post & Lodge | LaFont/Western | 300 | 63 | 2 wells | 2/40,000 |
| Monument Valley Mission/Hosp [e] | Monument Valley Hospital/Western | 190 | 55 | [e] | 3/62,000 |
| Monument Valley Tribal Park | Navajo Tribe/Western | 250 | 5 | 1 well | 1/3,000 |
| Navajo Mtn Boarding School | BIA/Western | 50 | 17 | BIA well and [c] | 3/25,000 |
| Navajo Mountain Chapter House | Navajo Mtn Chapter/Western | 75 | 15 [f] | Infiltration gallery | 1/10,000 |
| Navajo Mountain Health Clinic | Navajo Mtn Chapter/Western | 50 | 10 [f] | [c] | 1/NA |
| Rainbow Village/Navajo Mountain | O&M/Western | 255 | 51 | 3 springs collected in an infiltration gallery | 1/200,000 |
| Shonto Chapter House | Shonto Chapter/Western | 150 | 30 [f] | 1 well (shallow) | NA |

Source: Division of Water Resources Municipal & Industrial Water Supply Studies - 1996.
Navajo Nation Department of Water Resources, Water Management Branch.
Note: All public community water systems are regulated by the Utah Division of Drinking Water except those listed as Other Navajo Indian Community Water Systems. There is one exception, Goulding Trading Post is regulated by the Division of Drinking Water. All public community water systems on the Navajo Indian Reservation are regulated by the Public System Supervisory Program, Navajo Nation Environmental Protection Agency.

[a] Storage - number of tanks and total capacity.
[b] There are 20 homes with 5,000 gallon cisterns.
[c] Served by Rainbow Village.
[d] NTUA - Navajo Tribe utility owners and operators.
[e] System is connected to the Goulding Trading Post & Lodge wells.
[f] Estimated at 5 people per connection.

water to the City of Moab through the SVW&SID distribution system. This was only done in emergency situations.

In January 1999, the Grand County Water Conservancy District, Spanish Valley Water & Sewer Improvement District and Grand County Special Service Water District were all combined to create the Grand Water & Sewer Service Agency making the above agreements redundant. All of the operations formally carried out by the three old entities will now come under the auspices of the combined agency.

San Juan Water Conservancy District - The San Juan Water Conservancy District was founded in 1964 to develop surface water supplies for both agricultural and municipal uses in San Juan County. It has a nine member board of directors. The district owns and operates Loyd's Lake west of Monticello and a pipeline servicing a number of small local irrigated farms. Recapture Creek Reservoir north of Blanding was constructed by the district along with a pressurized pipeline delivering water to a number of small farms and industrial businesses in the Blanding/White Mesa area.

Recapture Reservoir

The district provides culinary and secondary water to the municipalities of Monticello and Blanding. It also provides agricultural irrigation water to 2,888 acres of cropland in-and-around the Blanding area including a number of small farms also serviced by the Blue Mountain and Blanding Irrigation companies. The district has assisted in a number of studies and provided funding for projects including culinary water systems for Bluff and Mexican Hat.

### 6.3.3 Navajo Nation Municipal and Industrial Water Management

About 23 percent of the Navajo Nation is located in San Juan County. The tribal headquarters are in Window Rock, Arizona with regional locations in Shiprock and Kayenta. There are eight chapters all or partly in Utah. These are shown in Figure 3-1.

There are public community water systems located in all but one of the chapters. In some locations, cisterns are installed and water is hauled in at regular intervals. In isolated situations, individual families haul in their own water supplies.

The Navajo Nation Division of Natural Resources, Department of Water Resources provides the technical and management functions related to the reservation water facilities. This department includes the Safety of Dams, Water Management, Operations and Maintenance, Technical and Construction, and Water Code branches.

All of the culinary water systems are operated by the Navajo Tribal Utility Authority (NTUA). The Navajo Nation Public Water Systems Supervision Program (PWSSP) has oversight on all water systems in the reservation.

The Indian Health Service oversees compliance with the federal Safe Drinking Water Act and provides funding for water system projects, either through the Sanitation Deficiency System or through housing funds. Priority is given to central water supply projects. In areas where centralized projects are not feasible, funding is available for cistern systems supplied by hauled water. Cistern systems are discouraged and are only installed as a last resort.

### 6.3.4 Agricultural Water Management

Agricultural water provider agencies generally include conservation and conservancy districts, irrigation, ditch, canal and in some cases, reservoir and pipeline companies. Irrigation companies are shown in Table 6-2.

Agricultural water users are generally small entities governed by boards of directors with a part-time general manager and small or no clerical and facility maintenance staffs. These organizations are generally financed through assessments on water shares owned by private individual water users.

Irrigation companies deliver most of the agricultural water to the farmers although there is a significant amount supplied by individuals. Most of the irrigation companies have constructed irrigation-water storage reservoirs to provide better management of the existing supplies. Table 6-3 presents data on these reservoirs. Locations of the reservoirs are shown on Figure 6-1.

### 6.3.5 Watershed Management

The majority of the watershed areas are managed by federal and state agencies. Most of the private lands are located where there are arable soils and enough moisture, either precipitation or irrigation water, to raise a crop. The public lands in the watershed areas are nearly always managed through a joint cooperative effort between private individuals, the Forest Service, and the Bureau of Land Management (BLM). These areas are generally well managed and many have a better growth of vegetation than existed five to six decades ago. There are, however, localized areas of concern where there is excessive erosion.

The BLM has recently investigated the Comb Wash area west of Blanding.[55] These investigations have indicated there are some areas of moderate to high erosion of existing stream banks and channels along with some general sheet erosion. Some of the area is beginning to restore itself but most of it needs more intense management.

To better manage the overall resource, the BLM is completing a watershed management plan for the entire 185,600-acre watershed. Project work and /or more intensive management will begin after the plan is approved and funding is secured.[55]

## 6.4 PROBLEMS AND NEEDS

The Southeast Colorado River Basin is experiencing moderate population growth in most of its cities and towns. The area has an influx of people from both in-state and out-of-state who prefer the relative isolation of the area, favorable winter climate and close proximity to Lake Powell. Popular recreational

Table 6-2
IRRIGATION WATER COMPANIES

| County/Company | Area Served[a] (acres) | Water Source |
|---|---|---|
| Grand County | | |
| Castle Valley Irr Co. | 400-500 | Castle Creek |
| Moab Irr Co. | 1,100 | Mill Creek |
| San Juan County | | |
| Blanding Irr Co. | 4,100 | Johnson, Recapture & Indian Creeks |
| Blue Mountain Irr Co. | 1,200 | North and South Creeks |
| Carlisle Water Co. | 500 | North Creek |
| La Sal Irr Co. | 400 | La Sal,Beaver,Two Mile,& Indian Cr. |
| Pioneer Ditch Water Users | 500 | South Creek |

[a] Area served includes other lands in addition to those currently irrigated.

Table 6-3
EXISTING LAKES AND RESERVOIRS

| | County/Name | Owner | Supply Source | Dam Height (feet) | Capacity (acre-feet) | Area (acres) | Use |
|---|---|---|---|---|---|---|---|
| | **GRAND** | | | | | | |
| 1 | Cresent Lake | Bureau of Land Management | Crescent Wash | 30 | 182 | 15 | I |
| 2 | Hidden Lake | State of Utah-Trust Admin. | Tributary to Beaver Creek | 18 | 40 | NA | FC |
| 3 | Oowah | Forest Service | South Fork of Mill Creek | 27 | 27 | 4 | R |
| 4 | Pace Lake | J.B. Ranch | John Brown Creek | 15 | 364 | 58 | I |
| | **SAN JUAN** | | | | | | |
| 5 | Bailey | Rick Bailey | Spring Creek (off channel) | 26 | 100 | 40 | I |
| 6 | Bankhead (lower) | Jim Blankenagel | West Coyote Wash | 13 | 127 | 5 | I |
| 7 | Bankhead (upper) | Jim Blankenagel | West Coyote Wash | 15 | 100 | 42 | I |
| 8 | Blanding City No. 3 | Blanding City | Johnson Creek | 47 | 133 | 10 | I |
| 9 | Blanding City No. 4 | Blanding City | Westwater Creek | 52 | 520 | 40 | I |
| 10 | Camp Jackson | Blanding City | Johnson Creek | 25 | 49 | 5 | M&I |
| 11 | Dark Canyon | Forest Service | Dark Canyon Creek | 33 | 67 | 6 | R |
| 12 | Don's Lake | State of Utah–Trust Admin. | Tributary to Beaver Cr. | 12 | 15 | NA | R |
| 13 | Dry Wash No. 2 | Blanding Irr. Co. | Johnson Creek | 43 | 185 | 15 | I |
| 14 | Dugout Ranch | Nature Conservancy | Indian Creek | 49 | 520 | 40 | I |
| 15 | Foy | Div. of Wildlife Resources | Spring | 18 | 25 | 3 | R |
| 16 | Gordon | Carlisle Water Co. | North Creek | 34 | 179 | 17 | I |
| 17 | Iron Springs | Norman & Richard Nielson | Iron Springs Canyon | 18 | 1,200 | 204 | I |
| 18 | Keller | Grayson Redd | Vega Creek | 18 | 206 | 34 | I |
| 19 | Ken's Lake[a] | Grand Co. WCD | Mill Creek | 98 | 2,820 | 86 | I,R |
| 20 | Loyd's Lake | San Juan WCD | South Creek | 74 | 3,500 | 95 | I,R |
| 21 | Monticello City No. 1 | Monticello City | North Cr. (off stream) | 26 | 125 | 20 | M&I |
| 22 | Monticello City No. 2 | Monticello City | North Cr. (off stream) | 17 | 25 | 2 | M&I |
| 23 | Monticello City No. 3 | Monticello City | North & South Cr. Springs | 15 | 30 | 3 | M&I |
| 24 | Monticello Lake | Div. of Wildlife Resources | Spring Creek (off stream) | 25 | 27 | 3 | R |
| 25 | Provancha | Redd Ranches | East Coyote Wash | 27 | 50 | 6 | I |
| 26 | Rattlesnake Ranch No. 1 | Jim Blankenagel | West Coyote Wash | 23 | 100 | 25 | I |
| 27 | Rattlesnake Ranch No. 2 | Jim Blankengel | West Coyote Wash | 43 | 377 | 31 | I |
| 28 | Recapture Creek | San Juan WCD | Recapture Creek | 140 | 9,319 | 265 | I,R |
| 29 | Snyder No. 2 | Charles Snyder | Coal Bed Creek | 18 | 75 | 15 | I |
| 30 | Starvation Canyon | Blanding City | Johnson Creek | 60 | 600 | 33 | I,M&I,R |

[a] Most of the water is used in Grand County.
Note: FC - Flood Control I - Irrigation, M&I - Municipal and industrial, R - Recreation.

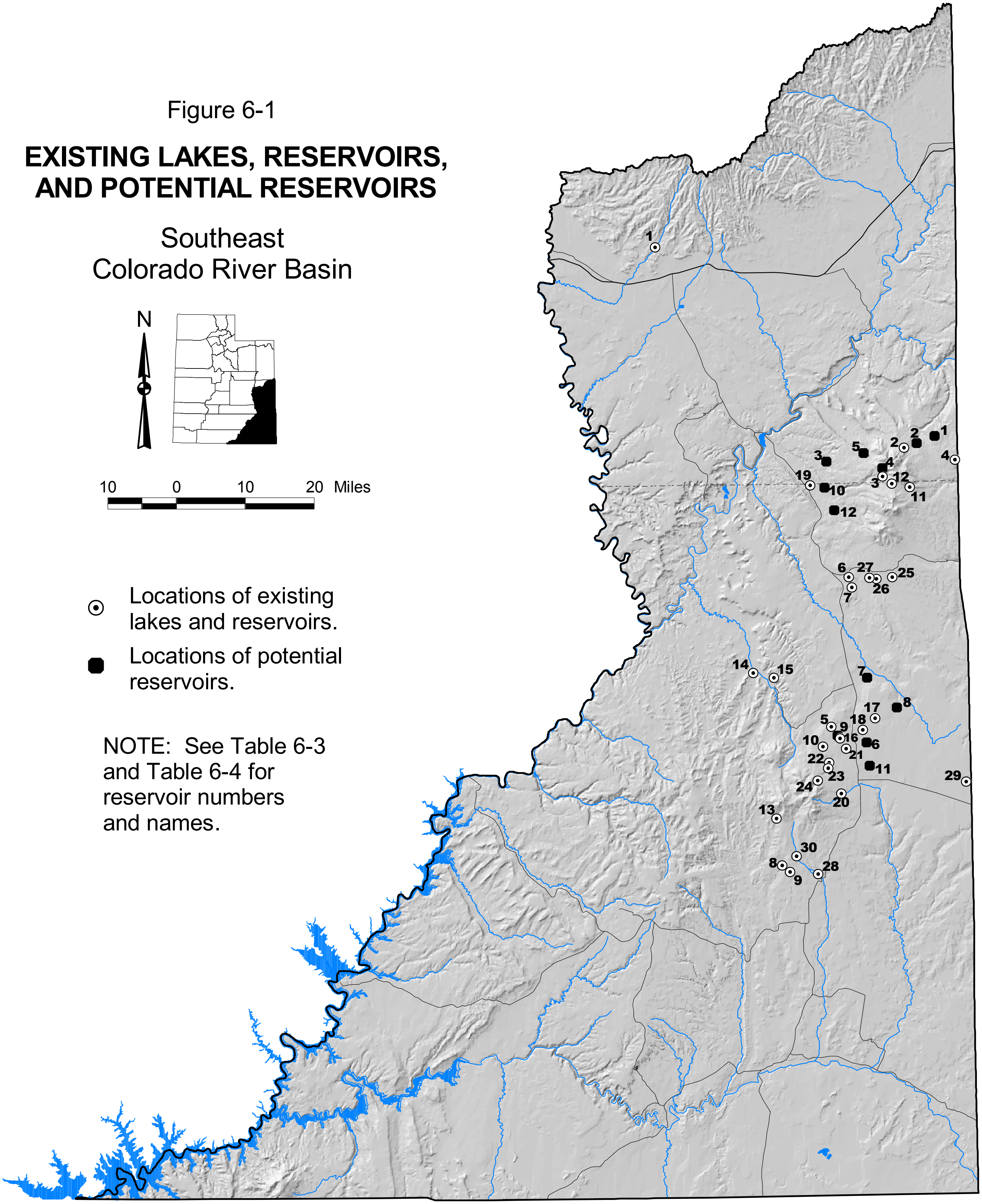



Figure 6-1

**EXISTING LAKES, RESERVOIRS, AND POTENTIAL RESERVOIRS**

Southeast
Colorado River Basin

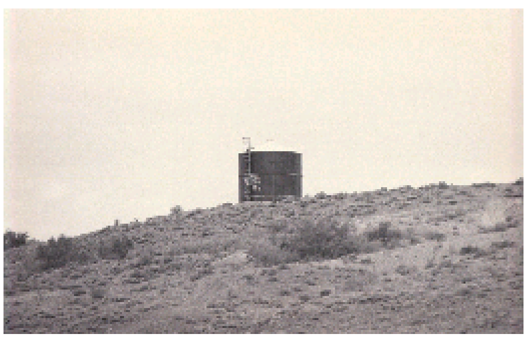
⊙ Locations of existing lakes and reservoirs.

⬣ Locations of potential reservoirs.

NOTE: See Table 6-3 and Table 6-4 for reservoir numbers and names.

activities include river rafting, hiking, biking, 4-wheeling, movie making and other outdoor activities.

The Spanish Valley/Moab area is projected to experience population growth that will increase the water demands beyond the present developed supply. This will require conjunctive management of the alluvial and Glen Canyon bedrock aquifers so that additional culinary quality water will be available to meet future demands. The Thompson Water Improvement District has adequate culinary water to meet projected needs until 2020. Beyond that point in time, additional supplies will be required. There is a need for cooperative management and improvement of the culinary water systems for the communities of Mexican Hat and Halchita so they could be combined into one system. Cooperative funding through the Utah Division of Drinking Water and the Bureau of Indian Affairs/Navajo Nation would provide facilities to serve both communities.


Mexican Hat water tank

The backlog of water supply and delivery facilities on the Navajo Indian Reservation will require large amounts of funding.[85] Many communities are using systems that need upgrading and expansion to serve more people. At the present rate of funding, projects now being considered are years away from being constructed.

**6.5 ALTERNATIVES**

Some potential management alternatives are briefly discussed below. More detail on these and other alternatives is presented in Section 9.

There is the potential to obtain additional water from the Dolores Project in Colorado. This would require a reservoir in Coal Bed Canyon so water could be delivered to the Eastland, Monticello and Blanding areas for various uses. Culinary water could also be purchased from Montezuma County Water Conservancy District.

There is also the potential for making additional use of water from the Colorado and San Juan rivers. Additional Colorado River water could be diverted for irrigation along the river in the Castle Valley and Moab areas. Water from the San Juan River can be treated and used in Mexican Hat and in conjunction with filling the additional needs in Halchita. San Juan River water can also be diverted for lawn and garden and agricultural use in the Aneth, Cajon Mesa, Montezuma Creek, Bluff and Mexican Hat areas.

There are extensive consolidated rock aquifers throughout the basin. Although these aquifers are at varying depths and contain poor to good quality water, there is potential for development. Aquifers within the Navajo Indian Reservation could be further developed to provide culinary water for the chapters and communities. The amount of groundwater that could be developed is not known at this time.

There are several potential reservoir sites that have been investigated over many years. The two potential reservoirs on Mill Creek are alternatives to enlarging Ken's Lake. The data available are shown in Table 6-4. There may be small reservoirs in place at some sites. Location of these reservoirs is shown on Figure 6-1. ❑

Table 6-4
POTENTIAL RESERVOIRS

| No. | Name | Source of Supply | Location S T R | Height (feet) | Capacity (ac-ft) | Notes |
|---|---|---|---|---|---|---|
| | | **GRAND COUNTY** | | | | |
| 1 | Fish | Beaver Creek/Dolores River | 35 25S 25E | 39 | 98 | a |
| 2 | Fisher Valley | Beaver Creek/Dolores River | 5 26S 25E | 20 | 63 | a |
| 3 | Mill Creek below Forks | Mill Creek | 8 26S 23E | 206 | 10,022 | a,b,c |
| 4 | Oowah Lake (enlargement) | South Fork of Mill Creek | 34 26S 24E | 43 | 51 | a,b |
| 5 | Wilson Mesa | Pinhook Creek/Placer Creek/Castle Cr | 22 26S 24E | 14 | 100 | a |
| | | **SAN JUAN COUNTY** | | | | |
| 6 | Blue Mountain | Spring Creek/Vega Creek/North Montezuma Creek/San Juan River | 35 32S 24E | 14 | 1,200 | a |
| 7 | East Canyon (lower) | E Can Cr/Hatch Can Cr/Kane Sp Can Cr | 8 31S 24E | 38 | 2,474 | a |
| 8 | East Canyon (upper) | E Can Cr/Hatch Can Cr/Kane Sp Can Cr | 31 31S 25E | 40 | 1,447 | a |
| 9 | Gordon Dam (enlargement) | Spring Creek/Vega Creek/North Montezuma Creek/San Juan River | 33 32S 24E | 38 | 2,500 | a |
| 10 | Mill Cr. (Upper Sheley) | Mill Creek | 4 27S 23E | 106 | 1,203 | a,b,c |
| 11 | North Creek | North Creek | 27 335 24E | 70 | 2,350 | a |
| 12 | Pack Creek | Brumley Creek/Pack Creek/Mill Creek | 14 27S 23E | 111 | 761 | a,b |

Notes:
a - Topography, cross sections, area-capacity table, other data available.
b - Preliminary investigation made.
c - These sites are alternatives to Ken's Lake enlargement if the water supply is adequate or if additional recreation facilities become desirable.
Source:
Twenty-Second and Twenty Fourth Biennial Report of the State Engineer to the Governor of Utah. For the Bienniums 1938-40 and 1942-44.

# Contents

Section 7

# Southeast Colorado River Basin

**Utah State Water Plan**

## Regulation/Institutional Considerations

### 7.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan discusses the state and federal laws and regulations dealing with water development, storage, distribution and quality. The following discussions also include the responsibilities delegated to state and federal agencies to administer these water laws and regulations. One of the primary purposes of Utah's water-related regulatory agencies is to provide orderly water rights administration, adequate good quality water supplies within an acceptable environment to meet the needs of the people.

### 7.2 SETTING

There is extensive regulation of the water resources throughout the Southeast Colorado River Basin that are carried out at the local, state and federal levels. At the local level, water resources are generally managed by municipal public works departments; water conservancy, special service and conservation districts; irrigation companies; and private water companies. In addition, the Southeastern Public Health District has oversight on water quality as it impacts the public. These local agencies are involved with the day to day operation of the many storage, treatment and distribution systems that make it possible to deliver surface water and groundwater to the various municipal and industrial, domestic and agricultural end users. Although local water agencies are responsible for the ultimate implementation and adherence to all state and federal water laws and regulations, they are generally not responsible for their creation or passage. Water laws and regulations are created by state and federal governing bodies who delegate the enforcement or administration to a number of public water and environmental agencies.

> Regulation has fostered the spirit of cooperation in water use and restored the value of clean, pure water surrounded by a pleasing environment.

### 7.3 WATER RIGHTS REGULATIONS

The administration of water rights law is the responsibility of individual state governments. In Utah, the State Engineer through the Division of Water Rights has the responsibility for: 1) Processing water rights applications; 2) distribution of water; 3) adjudication of surface water and groundwater rights; 4) dam safety programs; 5) regulation of alterations to streams and rivers; 6) licensing well drilling contractors and administering well drilling regulations; 7) studies to assess the extent of existing surface water and groundwater supplies; and 8) the maintenance of all filed water rights records. In addition, the State Engineer works with federal agencies and Indian tribes on reserved water rights, wetlands and other federal activities where mandates impact state water law.

The State Engineer is responsible for determining whether there is unappropriated water and if additional applications will be processed. This is determined through data analysis and public input. Action on an application will be withheld or rejected if it is determined it will interfere with another right, a more beneficial use, or be detrimental to the public welfare or the natural environment. This also applies to changes in the point of diversion, place of use and/or nature of use of an existing water right.

Verification of actual surface water and groundwater diversions are made to assure compliance with the adjudicated rights. Accordingly, gaging stations have been constructed at critical points on the existing river systems, often in cooperation with local entities and other state and federal agencies, to assist in the management of the water resources. Flow measurements are taken at these points on a predetermined schedule by a river commissioner. Groundwater diversions are metered or may be monitored by evaluating pumping data from selected wells. This is all done under the supervision of the State Engineer. If a single irrigation company or user has the rights to the entire stream, the owner takes the responsibility for the water distribution.

Diversion near Blanding

There are two river commissioners appointed in the Southeast Colorado River Basin. One commissioner is appointed for the Blue Mountain Distribution System and one for the Mill Creek-Pack Creek Distribution System. Their general responsibilities are to measure the stream flows and account for the diversions to the distribution systems. These data are published in an annual report submitted to the State Engineer's office. The balance of the water users provide their own water distribution controls.

Perfected, decreed or diligence water rights are considered real property. A pending application and stock in mutual water companies are considered personal property. As such, they can be bought and sold on the open market, and can be a primary source of collateral to finance water-related operations. An amendment to Section 73-1-10 and 11 of the Utah Code, annotated states "A water right . . . shall be transferred by deed in substantially the same manner as is real estate."

## 7.4 WATER QUALITY CONTROL

Water quality and pollution control regulations deal with the contamination of water in the outdoor environment. These regulations are created through state and federal legislation. The most comprehensive and enforced pieces of water quality legislation include the Utah Water Quality Act and the federal Water Pollution Control Act (Clean Water Act).

### 7.4.1 Utah Water Quality Act

When the Legislature passed the Utah Water Quality Act (UWQA) in 1991, the Water Quality Board and Division of Water Quality were assigned the responsibility to develop state water pollution standards, regulations and policies to prevent, control and abate new or existing surface water and groundwater pollution and to administer the federal standards and regulations under the federal Water Pollution Control Act of 1977 (Clean Water Act). These responsibilities also include: 1) Development and implementation of water quality management plans; 2) state certification and enforcement of various effluent discharge permit requirements; 3) administration of various water quality monitoring programs; 4) administration of state revolving wastewater construction loan programs; and 5) review of construction plans for wastewater disposal systems. In addition, the Utah Water Quality Board adopted and enforces the “Ground Water Protection Regulations.” The authority for federal Clean Water Act certification is carried out through the Water Quality Board by the Division of Water Quality. Whether the Environmental Protection Agency (EPA) administers a Clean Water Act program directly or delegates it to a state (primacy), EPA retains the oversight role to ensure compliance.

### 7.4.2 Federal Water Pollution Control (Clean Water) Act

The EPA is the regulatory agency charged with the responsibility of enforcing the Water Pollution Control Act (WPCA) and two of its major amendments: the Clean Water Act (CWA) which was passed by Congress in 1977 and the Water Quality Act (WQA) passed in 1987. However, the enforcement effort is done in close cooperation with the Utah Department of Environmental Quality which has primacy and administers the issuance of discharge permits for both point and non-point source pollution.

The WPCA generally includes regulations and programs designed to maintain a minimum standard of water quality in the outdoor environment. Minimum acceptable levels of water quality are monitored and regulated by a number of requirements including establishment of maximum contamination levels (MCL's) for raw drinking water sources. Under the Clean Water Act amendments, Section 401 certification is delegated through the Water Quality Board to the Division of Water Quality. This certification includes issuing Section 402 National Pollutant Discharge Elimination System (NPDES) permits to all entities responsible for point discharges to existing surface waters and Section 404 Corps of Engineers dredge and fill permits.

Utah is required to prepare a “303(d) list” showing all the stream reaches and water bodies that do not meet established water quality standards. The state prioritizes this list for planned actions designed to bring the waters into compliance. As part of this process, a total maximum daily load (TMDL) is established as part of the plan to improve water quality problems. To achieve the TMDL goal, a best management practice can be implemented to reduce sediment loading, reduce components of the total dissolved solids or some other action to achieve the desired water quality.

Sheley Diversion

## 7.5 DRINKING WATER REGULATIONS

Drinking water standards and regulations are established and enforced under the Safe Drinking Water Act by the EPA and by the Utah Drinking Water Board through the Division of Drinking Water (DDW). These provide for the monitoring and maintenance of public drinking water quality and provide funding for the construction of water treatment facilities. In general, the EPA delegates the responsibility of monitoring existing drinking water quality and the administration of various drinking water funding programs (primacy) to state agencies. The DDW is the agency responsible for all drinking water issues, projects and programs.

As prescribed by the Utah Safe Drinking Water Act, the division is responsible for maintaining and enforcing drinking water standards through: 1) Development and implementation of a comprehensive water monitoring program; 2) training or certification of treatment plant and distribution system operators; 3) reporting of water quality data to the EPA; and 4) general administration of a rating program to assess the overall effectiveness of existing treatment plants and distribution systems.

There are 20 community and 24 non-community water systems in the basin. These are monitored by the DDW to assure that all public drinking water adheres to state and federal regulations. Three water systems are supplied by surface water treatment plants, four communities rely all or partly on springs and the balance use wells. In addition, there are nine "Other Navajo Indian Community Water Systems" regulated by the Navajo Nation Public Water System Supervision Program.

Moab water tank

The Drinking Water Board has received funding to establish a Drinking Water State Revolving Fund (SRF) through the 1996 reauthorized Safe Drinking Water Act. Additional amounts allocated for project construction funding are; $6.0 million in 1999, $6.5 million in 2000, and between $6.0 million and $6.5 million each year through 2003. The state is expected to provide an additional 20 percent of each appropriation, or a total of about $6.3 million, as matching cost-share funds. There will also be grant funds available for regional water system planning.

Drinking water systems are shown in Table 11-1 and Table 11-2. Systems serving over 800 people are required to have a certified operator.

## 7.6 RESERVED WATER RIGHTS

There are two areas in the Southeast Colorado River Basin where federal reserved water rights will play a part in development of the water resources. These are for the Navajo Indian Reservation and the several national parks and monuments. Reserved water rights for the reservations are not fully defined and integrated with water rights established under state water law. These water rights were created outside the traditional western states method of acquisition through the permit system where beneficial use is the limit and measure of the right. Although these rights have been created outside the system of Utah water laws, they still need to be established under these laws. Many of these rights, which may be claimed, have not been identified, quantified or placed to beneficial use.

### 7.6.1 Indian Reserved Water Rights

The extent of the reserved water rights for the Navajo Nation has not been defined. Where rights may be claimed for the irrigation of cropland, considerable water could be required. There are also other types of uses that may be included in reserved water rights claims. This could affect future development of the water resources in this area as well as in other portions of the upper Colorado River drainage. There are already developments to provide culinary water in most of the chapters in the reservation. These include wells, springs and galleries (narrow passageway or tunnel). In addition, there will be a need for more culinary water development in each of the Navajo Nation chapters in Utah.

To quantify Indian reserved water right claims, the U.S. Supreme Court has ruled that the practicably irrigable acreage (PIA) should be the determination. Such claims are generally resolved in a general water adjudication in which the United States and the Tribe are a party. Currently, there is no active water adjudication covering the reservation lands.

The Ute Mountain Utes live on tribal lands on White Mesa south of Blanding and farm and graze lands in the Allen Canyon area west of Blanding. They have one deep well that produces culinary water for the residents living on White Mesa. This well has a certificated water right.

### 7.6.2 National Parks and Monuments

Currently, the State Engineer and the National Park Service are pursuing settlement agreements to quantify the federal reserved water rights for national parks and monuments. An agreement has been reached for Hovenweep National Monument and efforts are underway to resolve the claims for the Arches National Park, Canyonlands National Park, Glen Canyon National Recreation Area and Natural Bridges National Monument.

## 7.7 ENVIRONMENTAL CONSIDERATIONS

The amount and quality of water dictates the characteristics of the natural environment and its ability to sustain most forms of life. Water for human consumption is regulated and treated to protect against the spread of water-borne disease. However, water to sustain fish and wildlife species must also be regulated to assure the maintenance of quality habitat in streams, lakes, reservoirs and wetlands.

Current federal regulations to protect fish and wildlife species can have direct and significant impacts on the development of future water supplies and the ongoing operation of existing water projects. Impacts on threatened and endangered species must be taken into consideration during the early planning phases of any water resources related project. The Endangered Species Act (ESA) requires that agencies, organizations and private individuals consult with the U.S. Fish & Wildlife Service (FWS) to assess any and all impacts a potential project may have on threatened and endangered species. The consultation requirement allows the FWS the opportunity to become involved in the early phases of a project to assist the developer or contractor in determining design or construction options that could minimize the impacts on threatened and endangered species. They can also recommend a project be terminated.

For projects that require the approval of a federal Clean Water Act 404 permit, developers or contractors are required to submit pertinent design and operation data to the U.S. Army Corps of Engineers. This information is reviewed and evaluated by a number of federal and state agencies for overall feasibility and potential impacts on fish and wildlife habitat. The FWS is the reviewing agency for fish and wildlife habitat issues. State agencies involved in this review include the Division of Water Rights, the Division of Wildlife Resources and the Division of Water Quality.

## 7.8 DAM SAFETY

Dams impounding water in storage reservoirs represent a vital and significant investment in the overall development of this area’s resources. However, they also represent a potential loss of life and property in the event of catastrophic disasters. To identify dams with potential for the loss of life and property damage, the State Engineer inspects dams throughout the state and classifies them with high, moderate or low hazard ratings. The main factor in the designation of a high hazard rating is the potential for property damage and loss of life, not the condition of the dam.

There are 51 reservoirs with capacities of 10 acre-feet or more in the two county area. These reservoirs were constructed to provide storage for both culinary and irrigation water, flood control and limited recreation. The largest is Recapture Creek Reservoir with a capacity of 9,319 acre-feet. The five dams classified as high hazard are listed in Table 7-1. In addition, there are 14 dams classified as moderate hazard and 33 dams are classified as low hazard. ❑

Table 7-1
HIGH HAZARD RESERVOIR DAMS

| County/Name | Owner | Stream | Height (feet) | Capacity (acre-feet) | Surface Area (acres) |
|---|---|---|---|---|---|
| **Grand County** | | | | | |
| Tusher Canyon Detention | Moab City | Tusher Canyon | 19 | 12 | 2 |
| **San Juan County** | | | | | |
| Ken's Lake | Grand Co. WCD | Mill Creek | 91 | 2,820 | 86 |
| Loyd's Lake | San Juan WCD | South Creek | 66 | 3,500 | 95 |
| Recapture Creek | San Juan WCD | Recapture Creek | 120 | 9,319 | 265 |
| Starvation Canyon | Blanding City | Johnson Creek | 54 | 600 | 33 |

Source: Utah State Engineer's Office

# Contents

Section 8

# Southeast Colorado River Basin

**Utah State Water Plan**

## Water Funding Programs

### 8.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan presents information and data relating to the most commonly used funding programs to finance the planning, construction, and in some cases, the operation of typical water resources projects. These programs are administered by a broad range of local, state and federal agencies both directly and indirectly involved in the ongoing development of water resources. Some of the planning and development programs and specific agency activities and responsibilities are discussed in various sections of this plan. These include preparation of this document by the Division of Water Resources and other cooperating state and federal agencies with water-related missions.

Most of the planning programs are carried out by on-going agency funding although some cases require a local match. Funding for development programs usually requires cost-sharing arrangements. Agencies may provide loans or grants with a variable contribution at the local level. In many cases, funding arrangements are a mix of federal, state and local sources of grants and loans.

### 8.2 BACKGROUND

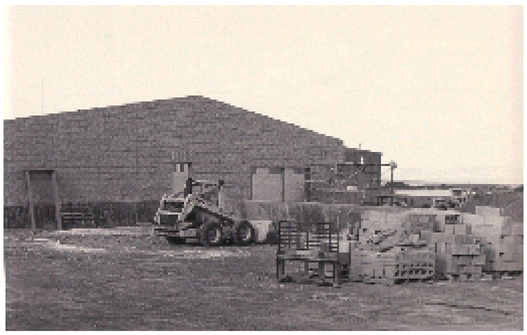
As soon as settlements were established, the people started to construct water delivery systems. This took local cooperative efforts with little funding and lots of hard work; now it takes more funding. Water projects are developed through a common effort by all those involved.

Many of the earliest projects were to divert water for irrigation of cropland in order to sustain their existence. Almost simultaneously, water for culinary purposes was delivered to the settlements. Generally, the earliest diversions were constructed of readily available materials that could be easily placed. Later, many of these structures had to be replaced because they were destroyed by floods or made unusable by sediment deposits.

> Water development has emerged from man's struggles with nature to increasingly sophisticated means for funding and construction.

It soon became apparent there was a need for runoff storage so it would be available for use later in the year when streamflows were low or nonexistent. This led to the construction of storage reservoirs on many of the streams along with conveyance systems to deliver the water to the place of use.

The complexity and size of recent water projects and related service facilities has required large sums of money to meet the growing demand for water. However, the ability to construct needed system enlargements or improvements is usually beyond the means of the smaller water providers without assistance. Large providers, such as water conservancy districts and cities, usually have more funding at their disposal. In addition, state and federal agencies provide a number of funding programs that offer grants or low interest loans to assist local water users to improve existing or build new water facilities. These programs include loan and grant funds. Though these agency programs are generally targeted for different purposes, there are cases where more than one program can assist with a particular project.



Monticello water treatment plant

**8.3 STATE FUNDING AND ASSISTANCE PROGRAMS**

It would be difficult to determine the total funds spent historically for planning and construction of water projects in the Southeast Colorado River Basin. In the early years, nearly all of the funding came from local pocketbooks. As time passed, more state and federal programs became available to provide funds through either loans or grants. Loans had to be repaid by the local water users so they have still paid for most of the development.

Table 8-1 lists eight state agencies administering 15 programs providing various levels of funding to plan and construct water resources projects. Table 8-2 shows the state funding expenditures for recent years. Since the turn of the century, some state funds have been available to construct water development projects. However, these were relatively minor amounts until 1947 when the state legislature created the Utah Water and Power Board. Since then, state funding programs have been established under various boards, commissions and committees. Some of the programs receive funding passed through federal agencies.

**8.4 FEDERAL WATER FUNDING PROGRAMS**

There are eight federal agencies with 18 water resources funding programs. Most of these have funds available for construction of facilities. There are also some federal agencies with funding for planning. Funds available from the Environmental Protection Agency are generally distributed through state agencies or Indian Tribes. Funds from one federal agency cannot be used to match funds from another federal agency.

Table 8-3 summarizes the types of funding programs administered by the federal agencies. Table 8-4 presents federal funding expenditures for water-related-projects.

**8.5 NAVAJO NATION WATER FUNDING PROGRAMS**

The Navajo Nation has funding programs of its own and can also receive funding from several federal agencies. The Navajo Indian Health Service, Office of Environmental Health and Engineering is responsible for water projects to improve existing drinking water systems and to install new facilities.

The Navajo Nation can also obtain funding from the Bureau of Indian Affairs and the federal Environmental Protection Agency. Culinary water project funding is available under PL 86-121 although the annual appropriations have been low.[85]

**8.6 LOCAL WATER FUNDING**

Most of the funding for water resources projects comes from the pockets of the taxpayers. This is true whether the loan comes from a local, state or federal agency. When loans are obtained to finance project construction, these are paid by assessment of the water users or by the individual. When a large amount of funding is required upfront, water users often go to local funding sources for loans. ❑

Table 8-1
STATE WATER-RELATED FUNDING PROGRAMS

| Funding Agency/Program | Contact | Purpose | Type |
|---|---|---|---|
| Board of Parks and Recreation | Div of Parks and Recreation | | |
| Land and Water Conservation Fund | | Recreation facilities | Cost-share |
| Riverway Enhancement Program | | Recreation facilities | Cost-share |
| Board of Water Resources | Div of Water Resources | | |
| Revolving Construction Fund | | Small irr/cul projects | Loans |
| Cities Water Loan Fund | | Municipal cul systems | Loans |
| Conservation & Development Fund | | Large water projects | Loans |
| Dam Safety | | Dam safety requirements | Grants/loans |
| Community Development Policy Board | Div of Community Development | | |
| Block Grants | | Rural living envir imp | Grants |
| Permanent Community Impact Board | Div of Community Development | | |
| Permanent Community Impact Fund | | Rural living envir imp | Grants/loans |
| Disaster Relief Board Fund | | Disaster mitigation | Grants |
| Drinking Water Board | Div of Drinking Water | | |
| State Revolving Fund Program | | Drinking water systems | Loans |
| Soil Conservation Commission | Dept of Agriculture | | |
| Agriculture Resource Development Loan | | Improve private ag land | Loans |
| Nonpoint Source Program | | Watershed improvement | Grants |
| Utah Wildlife Board | Div of Wildlife Resources | | |
| Wallup-Breaux Bill | | Fish habitat-boating | Grants |
| Water Quality Board | Div of Water Quality | | |
| Revolving Construction Loan Program | | Wastewater treatment facilities | Loans |
| Federal Construction Grants | | Wastewater treatment facilities | Grants |

Table 8-2
STATE WATER-RELATED FUNDING EXPENDITURES

| Funding Agency | Grants ($1,000) | Loans ($1,000) | Period |
|---|---|---|---|
| Board of Parks & Recreation | | | |
| Land and Water Conservation | 392.3 | | 66-98 |
| Riverway Enhancement program | 171.0 | | |
| Motorized Trail Grants | 57.4 | | |
| Nonmotorized Trail Grants | 129.6 | | |
| Board of Water Resources | | | |
| Cities Water Loan Fund | | 1,567.0 | 47-99 |
| Conservation and Development Fund | | 15,012.0 | 47-99 |
| Revolving Construction Fund | | 1,860.5 | 47-99 |
| Dam Safety Studies | | -0- | |
| Wildlife Board | | | |
| Wallup/Breaux Bill | | | |
| Community Development | | | |
| Community Development Block Grants[a] | 949.6[a] | | 92-96 |
| Permanent Community Impact Board | | | |
| Permanent Community Impact Fund | 6,330.6 | 7,322.4 | 92-96 |
| Safe Drinking Water Board | | | |
| Financial Assistance Program | 1,263.4[b] | | 90-96 |
| Soil Conservation Commission | | | |
| Agriculture Resource Development Loans | | 378.4 | 95-98 |
| Water Quality Board | | | |
| State Loan Program | | 2,656.0 | Thru 97 |
| Federal Construction Grants | 400.0 | | Thru 97 |
| **Total** | **9,510.6** | **28,796.3** | |

[a] Includes $83,900 for regional planning.
[b] Includes $99,400 for regional planning.

Table 8-3
FEDERAL FUNDING PROGRAMS

| Agency | Program | Purpose | Type |
| --- | --- | --- | --- |
| Department of Agriculture | | | |
| Farm Service Agency | Conservation Reserve | Reduce erosion & maintain wetlands | Grants |
| | Flood Risk Program | Remove lands from flooding potential | Grants |
| Rural Development | Rural Development | Water supply/wastewater disposal | Grants & loans |
| | Resource Conservation & Development | Multi-purpose water & land conservation | Grants & loans |
| Natural Resources Conservation Service | Watershed Protection & Flood Prevention | Flood control & water development | Grants & cost-share |
| | Resource Conservation & Development | Multi-purpose water & related projects | Grants & cost-share |
| | Emergency Watershed Program | Reduce sedimentation & flooding | Grants & cost-share |
| | Environmental Quality Incentive Program | Improve water & land quality | Grants & cost-share |
| | Wetlands Reserve Program | Protect, restore and enhance wetlands | Grants & cost-share |
| Department of the Army | | | |
| Corps of Engineers | Civil Works | Flood control, water supply, recreation | Cost share |
| | Continuing Authorities | Flood control & protection, ecosystem rehab | Cost share |
| | Emergency Activities | Flood control & protection, drought relief | Cost-share |
| Environmental Protection Agency | EPA 314 Clean Lakes Program | Water quality | Grants |
| Department of the Interior | | | |
| Bureau of Indian affairs | PL86-121 | Irrigation systems | Grants |
| | | Culinary water systems | Grants |
| Bureau of Reclamation | Investigation program | Water storage delivery | Loan |
| | Public Works & Economic Development | Water development | Grants & loans |
| Federal Emergency Management Agency | Presidential Declared Disaster | Damage mitigation | Grants |
| | Flood Plain Management | Structural acquisition in flood plains | Grants |

Table 8-4
FEDERAL WATER-RELATED FUNDING EXPENDITURES

| Funding Agency Program | Grants ($1,000) | Loans ($1,000) | Period |
|---|---|---|---|
| Farm Service Agency | | | |
| Agricultural Conservation Program | 39,553 | | 1990-96 |
| Conservation Reserve Program | | | |
| Emergency Conservation Program | | | |
| Bureau of Indian Affairs | | | |
| Bureau of Reclamation[a] | 150,801 | | 1927-69 |
| Corps of Engineers | | | |
| Civil Works | | | |
| Continuing Authority Program | 240 | | 1978-93 |
| Emergency Activities | 50 | | 1974-96 |
| Flood Plain Management Services | 30 | | 1993-94 |
| Rural Development | | | |
| Community Development | 12,009 | 4,693 | 1992-96 |
| Federal Emergency Management Agency | | | |
| Presidential Declared Disaster | 13,363 | | 1983-84 |
| Flood Plain Management | | | |
| Natural Resources Conservation Service | | | |
| Watershed Protection-Flood Prevention | 300 | | 1965-95 |
| Emergency Watershed Program | 64 | | 1993-95 |
| Environmental Quality Improvement Program | 81 | | 1997 |
| **Total** | **216,491** | **4,693** | |

[a] Construction costs for three basin water reclamation projects from 1927 to 1969.

Note: Grant funds include cost-share funding provided by some agencies as shown in Table 8-3.

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Section 9

# Southeast Colorado River Basin

**Utah State Water Plan**

## Water Planning and Development

### 9.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan presents data and information on the planning and development of existing water supplies along with a brief discussion of past and current water development projects. Water demand is projected for the years 2020 and 2050 for domestic, municipal, commercial, industrial, agricultural, recreational and environmental use.

The existing water supplies are vital to the existence of the local communities while also providing environmental and aesthetic values. Local, state and federal agencies as well as other interested parties need to coordinate their activities regarding water resources.

One goal of the Division of Water Resources is to coordinate with federal and other state agencies to provide effective water-related activities and programs at the request of the local people. The decision-making process is the responsibility of the local stakeholders. This plan provides data to help solve existing water problems and for future implementation of the most viable alternatives.

### 9.2 BACKGROUND

Water has always been an essential part of the cultural and economic growth dating back to the early Anasazi Basketmakers' and Pueblos' diversion of small streams to irrigate their crops. Indian agriculture has waned over the years.

Beginning in the mid-1800s and into the twentieth century, Anglo-Saxon settlers developed relatively large acreages of agricultural crops sustained by diversions from the streams and springs tributary to both the Colorado and San Juan rivers. The growth of cattle oriented agriculture and the discovery of oil and various minerals changed the demand for water. As more people migrated to the area, there were increasing demands for additional water to supply the expanding residential developments and the growth of commercial and industrial businesses associated with tourism, mining of uranium and various precious metals, oil, and other minerals. Although farming and ranching still use most of the water, diversions for agriculture have leveled off because further development is not currently feasible.

> Explosive growth in tourism and recreation has increased the demand for culinary water; at the height of the season it is greater than the needs of the permanent population in some areas. Water development opportunities are being explored for other areas and uses.

#### 9.2.1 Past Water Planning and Development

The Southeast Colorado River Basin has been one of the most sparsely populated areas of the state, mostly because of the limited water supply. Beginning with the aborted Elk

Mountain Mission in 1855, water development has required a long, almost overwhelming but necessary commitment of the settlers' resources. Early use was made of readily available materials to deliver water to their homes and farms as was evidenced by the earth and brush dams used to divert Mill Creek and Pack Creek. By the turn of the century, a larger, more efficient log diversion structure was built by Orlando Warner in upper Spanish Valley. This dam diverted water for a saw mill, flour mill and for irrigation of crops. It was later raised and became part of Moab Light and Power Company.

When the "Hole in the Rock" expedition settled Bluff in 1880, they built riprap diversions and canals to get water from the San Juan River to their crops. The same year, some of them moved on to their original destination at Montezuma Creek where they constructed a waterwheel to divert water from the San Juan River to irrigate their crops. In 1884, floods raised havoc with the irrigation systems in both Montezuma Creek and Bluff.[46]

In 1887, settlers moved to the north and diverted North Creek into the Monticello area and formed what is now the Blue Mountain Irrigation Company. Later, some of the Bluff settlers moved on to the White Mesa and started construction of a ditch to bring water from Johnson Creek to "The Park" above the present community of Blanding.[50] Later a tunnel was constructed to divert water from Indian Creek to Johnson Creek. This 30-year project was finally completed in 1952.[103]

Until the late 1950s, water demands for domestic uses were met by surface water flows and groundwater sources. However, the steady increase in demand has required suppliers to construct various projects to develop supplemental water. The largest of these organizations were the Grand County and San Juan Water Conservancy Districts. Both districts have been major water providers for about 35 years and have sponsored, or been directly involved with, a number of water development projects including the Mill Creek (Ken's Lake-1981), Recapture Creek-1984, and Monticello (Loyd's Lake-1985) projects.

A reservoir was proposed on upper Mill Creek as early as 1909. After several investigations over the years, the Grand County Water Conservancy District constructed a tunnel, diversion dam and a reservoir (Ken's Lake) with a storage capacity of 2,820 acre-feet to serve Spanish Valley.

Loyd's Lake

Investigations by the San Juan Water Conservancy District resulted in a storage reservoir on Recapture Creek to store water from several drainages. The 9,320 acre-foot Recapture Creek Reservoir was built in 1984 to serve 2,000 acres of land in the Blanding area.

A growing demand for culinary water and an extended drought prompted the San Juan Water Conservancy District to study options for additional water supplies. As a result, the district and the City of Monticello constructed Loyd's Lake to provide 500 acre-feet of culinary water and 1,400 acre-feet of irrigation water to the city and the surrounding area.

In anticipation of a growing population, the Town of Bluff decided to upgrade their culinary water system. They drilled three new wells, constructed a 200,000-gallon water storage tank and upgraded the distribution system.

Assistance for these projects as well as for many others was obtained from the Division of Water Resources. A summary of Division of Water Resources assisted water projects is given in Table 9-1. The locations of these projects are shown by project sponsor on Figure 9-1.

**Table 9-1**
**BOARD OF WATER RESOURCES DEVELOPMENT PROJECTS**

| County/Sponsor | Fund | Type | Year |
|---|---|---|---|
| **Grand** | | | |
| Grand County WCD | C&D | Dam-Reservoir | 1979 |
| Moab City | CWL | Culinary system-pipeline | 1993 |
| Moab Irrigation Company | RCF | Low head pipeline | 1964 |
| Moab Irrigation Company | RCF | Dual water system | 1995 |
| Spanish Valley WID | CWL | Culinary system-pipeline | 1980 |
| Thompson WID | RCF | Culinary system-tank | 1974 |
| Thompson WID | RCF | Culinary system-pipeline | 1985 |
| **Total - Grand County** | **7** | | |
| **San Juan** | | | |
| Blanding City | CWL | Culinary system pipeline | 1982 |
| Blanding Irrigation Co | RCF | Tunnel | 1948 |
| Blanding Irrigation Co | RCF | Dam-storage reservoir | 1962 |
| Blanding Irrigation Co | RCF | Canal | 1965 |
| Blanding Irrigation Co | RCF | Pressure pipeline | 1968 |
| Blanding Irrigation Co | RCF | Pressure pipeline | 1987 |
| Blanding Irrigation Co | RCF | Sprinkler system | 1994 |
| Blue Mountain Irr Co | RCF | Sprinkler system | 1987 |
| Carlisle Water Co | RCF | Reservoir dam repair | 1986 |
| Carlisle Water Co | RCF | Reservoir dam enlargement | 1995 |
| Monticello City | CWL | Culinary treatment plant | 1976 |
| Monticello City | CWL | Culinary system pipeline | 1979 |
| Monticello City | C&D | Culinary treatment plant | 1997 |
| San Juan SA #1 | RCF | Culinary system | 1975 |
| San Juan WCD | C&D | Dam-storage reservoir | 1981 |
| San Juan WCD | C&D | Dam-storage reservoir | 1984 |
| San Juan WCD | RCF | Reservoir dam repair | 1997 |
| **Total - San Juan County** | **17** | | |

C&D - Construction and Development Fund
CWL - Cities Water Loan Fund
RCF - Revolving Construction Fund

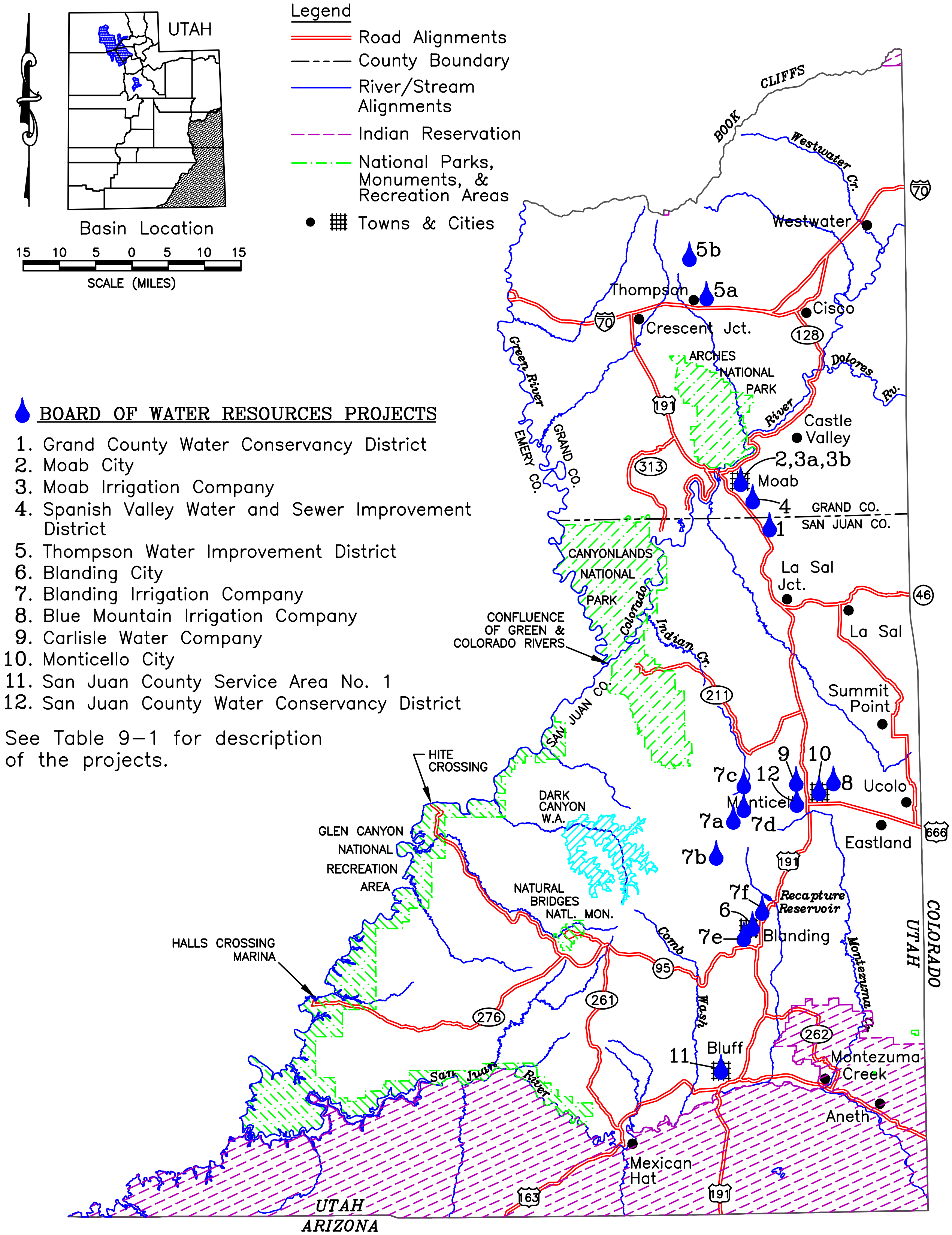



Figure 9-1
BOARD OF WATER RESOURCES PROJECTS
Southeast Colorado River Basin

### 9.2.2 Current Water Planning and Development

Most of the surface water supplies have been developed. New water for agriculture is not economically feasible unless it can be included in a multiple-use project. For this reason, most of the current planning is to develop municipal and industrial water supplies for the growing community needs within the next 10-20 years and beyond, primarily in Moab, Monticello, Blanding, Bluff and Mexican Hat. There is also planning for culinary water projects on the Navajo Indian Reservation.

To address the need for municipal and industrial water, the Grand County Planning Commission, Moab City and the Grand Water and Sewer Service Agency are preparing plans for long-range development. They are in the process of determining both water supply and infrastructure needs in the Moab and Spanish Valley areas. The San Juan Water Conservancy District completed a master water plan in 1998 prepared by a consulting engineering firm.[96] This plan emphasizes the future demands and discusses alternative ways to meet these needs. More detail on these and other alternatives for meeting future demands are discussed in Section 9.4.

## 9.3 WATER USE AND PROJECTED DEMAND

The increasing demands for municipal and industrial (M&I) water will require development of new water and the transfer of water from other uses. Population growth estimates given in Section 4, Demographics and Economic Future, are used to project the municipal water demands. The industrial water demands are based on anticipated industrial growth, not population increases. Agricultural water uses will stay about the same but a small amount of the existing supplies may be reallocated to meet M&I demands, particularly in the Spanish Valley/Moab area.

There are a number of local mining operations that could make demands on local surface and groundwater supplies. The level of demand will be dependent on the ever changing economics of the industry itself.

### 9.3.1 Present and Projected Municipal and Industrial Water [14,15]

The total municipal and industrial (M&I) culinary water use was 5,570 acre-feet in 1996, 3,090 acre-feet in Grand County and 2,480 acre-feet in San Juan County. Of this amount only 30 acre-feet was used for industrial purposes, all in San Juan County.

Total M&I culinary water use is estimated to be 11,140 acre-feet by the year 2020 and 27,980 acre-feet by 2050. This is based on the projected population growth for the same period. Also, no reduction in use is included for any conservation programs. See Table 9-2 for current and projected culinary water use.

Monticello municipal water storage reservoir

In addition, 2,030 acre-feet of self-supplied industrial water was diverted in 1996 with 1,770 acre-feet depleted. Of this amount, 940 acre-feet was diverted in Grand County and 1,090 acre-feet was diverted in San Juan County. Total self-supplied industrial diversions are estimated at 4,560 acre-feet by 2020 and 6,720 acre-feet by 2050. These projections could vary considerably depending on the market for industrial products. See Table 18-1 for more information.

| Table 9-2<br>CURRENT AND PROJECTED CULINARY M&I WATER DEMAND | | | |
|---|---|---|---|
| County | | | |
| Year/Use Category | Grand | San Juan<br>(acre-feet) | Total |
| **1996** | | | |
| Residential | 2,450 | 1,970 | 4,420 |
| Commercial | 460 | 270 | 730 |
| Institutional | 180 | 210 | 390 |
| Industrial | 0 | 30 | 30 |
| **Total** | **3,090** | **2,480** | **5,570** |
| **Per Capita Use** | **319** | **168** | **228** |
| **2020** | | | |
| Residential | 6,210 | 2,610 | 8,820 |
| Commercial | 1,180 | 360 | 1,540 |
| Institutional | 460 | 280 | 740 |
| Industrial | 0 | 40 | 40 |
| **Total** | **7,850** | **3,290** | **11,140** |
| **2050** | | | |
| Residential | 18,450 | 3,710 | 22,160 |
| Commercial | 3,480 | 520 | 4,010 |
| Institutional | 1,360 | 390 | 1,750 |
| Industrial | 0 | 60 | 60 |
| **Total** | **23,290** | **4,680** | **27,980** |

### 9.3.2 Current and Projected Secondary Water[14,15]

Secondary water systems provide irrigation water for residential and municipal areas. This water is also used for other miscellaneous outside uses. Current secondary water use within areas served by public community systems is 1,140 acre-feet, 700 acre-feet in Grand County and 440 acre-feet in San Juan County.

Secondary systems allow the use of lower quality water for irrigation of gardens, parks, golf courses and other large grass areas. This will save water meeting culinary standards for drinking and other related-water uses. The current and projected secondary water uses and demands are shown in Table 9-3.

### 9.3.3 Agricultural Water Demand[12]

Irrigated agriculture has been established in areas where adequate water supplies have been developed and where fertile soil conditions exist. These areas are primarily located within the Spanish Valley near Moab, in the areas around Monticello and Blanding, and along the flood plain lands near the San Juan River. Over 90 percent of the irrigated agriculture provides feed and forage for the livestock industry and consists of a variety of row and forage crops in addition to pasture lands. Orchards and vineyards are also important crops covering about 250 acres.

The growth of irrigated agriculture has leveled off in most areas but has declined in the Spanish Valley area, primarily due to the encroachment of residential development. The annual rate of

Table 9-3
CURRENT AND PROJECTED SECONDARY M&I WATER DEMAND

| Year/Use Category | Grand (County) | San Juan (County) (acre-feet) | Total |
|---|---|---|---|
| **1996** | | | |
| Residential | 120 | 260 | 380 |
| Commercial | 0 | 0 | 0 |
| Institutional | 580 | 180 | 760 |
| Industrial[a] | 0 | 0 | 0 |
| **Total** | **700** | **440** | **1,140** |
| **Per Capita Use** | **72** | **30** | **59** |
| **2020** | | | |
| Residential | 310 | 360 | 670 |
| Commercial | 0 | 0 | 0 |
| Institutional | 1,430 | 250 | 1,680 |
| Industrial | 0 | 0 | 0 |
| **Total** | **1,740** | **610** | **2,350** |
| **2050** | | | |
| Residential | 910 | 510 | 1,420 |
| Commercial | 0 | 0 | 0 |
| Institutional | 3,830 | 360 | 4,190 |
| Industrial | 0 | 0 | 0 |
| **Total** | **4,740** | **870** | **5,610** |

[a] Does not include self-supplied industrial water.

land lost to home construction is estimated at 10 to 15 acres per year. The net effect of this trend toward urbanization will slightly reduce the demand for water by irrigated agriculture. The overall impact on water demand is expected to be minimal.

The current annual diversions for irrigated agriculture are estimated at 34,950 acre-feet: 13,800 acre-feet for Grand County and 21,150 acre-feet for San Juan County. Also see Table 10-2. This use is expected to remain about the same although conversion of irrigated cropland to residential areas in Spanish Valley would reduce agricultural water diversions by as much as 1,900 acre-feet by 2020 and 4,300 acre-feet by 2050. The reduction in diversion for Grand County is based on conversion of 15 acres per year from agriculture to urbanization and a diversion rate of five acre-feet per acre. Present and projected agricultural water use is shown in Table 9-4.

Sprinkler near Blanding

| Table 9-4<br>CURRENT AND PROJECTED AGRICULTURAL WATER USE (acre-feet) | | | | | | |
|---|---|---|---|---|---|---|
| County | 1996 | | 2020 | | 2050 | |
| | Diversions | Depletions | Diversions | Depletions | Diversions | Depletions |
| Grand | 13,800 | 6,910 | 11,890 | 5,950 | 9,500 | 4,750 |
| San Juan | 21,150 | 11,520 | 21,150 | 11,520 | 21,150 | 11,520 |
| Total | 34,950 | 18,430 | 33,040 | 17,470 | 30,650 | 16,270 |

### 9.3.4 Recreational Water Demand

The area in and around the Southeast Colorado River Basin has a number of exceptional recreational opportunities. However, few of these recreational sites use a significant amount of water. Local reservoirs support a limited amount of boating. Camping activities use small amounts of water. As a result, water consumption that can be associated with outdoor recreation is negligible.

### 9.3.5 Environmental Water Uses

Environmental water use is generally associated with the maintenance of minimum instream flows, wet and open areas including waterfowl refuges, and flows required to maintain water quality in a given stream or river system. The most dominant environmental water use is the maintenance of wetlands and open water areas. There is only one instream flow requirement and that is for a 3-cfs minimum flow below the Sheley Tunnel diversion on Mill Creek.

### 9.3.6 Water Use Summary

All current water use and the projected demands are based on available data. The current irrigation water use is based on diversion records where they are available. In some cases where records were not available, diversions were estimated based on consumptive use of crops inventoried during the land use surveys. Municipal and industrial uses were inventoried and data shown is for 1996. The current and projected demands are shown in Table 9-5 and on Figure 9-2a, 9-2b and 9-2c for 1996, 2020 and 2050.

The industrial water use represents only a small portion of the total basin diversions. Future industrial use may not increase proportionately with the projected population as new industries are established or eliminated or scaled down as demand for products decreases.

## 9.4 ALTERNATIVES TO MEET WATER NEEDS

The severe drought years of the mid-to-late 1970s renewed the realization of the significant impact extended water shortages have on the personal lives and economic well being of the region. The water shortages in Grand and San Juan counties during these years were severe and caused the loss of livestock and crops and resulted in the implementation of extreme water conservation measures.

Although surface water is still available, most of it is found in areas where development is not economically feasible at this time. Creeks flowing from the Abajo and La Sal mountains provide most of the developed water supplies although there is still some undeveloped surface water. The groundwater aquifers covering most of the basin are also a major water source with supplies coming from springs, seeps and withdrawals from wells. Some groundwater has been developed but there is still a considerable amount available.

To provide a source of supplemental water for future drought conditions, the Board of Water Resources provided funding and technical assistance to local water provider agencies to construct several water storage and distribution facilities. These included the Mill Creek, Loyd's Lake and Recapture Creek Reservoir projects. However, population growth in recent years continues to encroach upon available reserves. To address this problem, local water planners have started investigations of other means to provide additional water.

### 9.4.1 North Creek Development

Preliminary investigations by the Division of Water Resources indicate that up to 1,200 acre-feet of supplemental M&I water could be developed through the construction of a dam and reservoir within the lower North Creek drainage. The cost for a proposed dam and reservoir is estimated at $5.0 million. A second option for developing North Creek water includes construction of a diversion facility with a gravity flow pipeline to the existing Loyd's Lake on South Creek. Loyd's Lake currently has an estimated 1,800 acre-feet excess storage capacity and would be able to store the 1,200 acre-feet from North Creek during an average water year. The cost for the 3- mile pipeline option is estimated at $400,000 not including the cost of rights-of-way.

The development of North Creek water would increase the culinary water supply to provide for the estimated 30 percent increase in population and could provide secondary and some agricultural water.

### 9.4.2 Dry Wash No. 2 Dam Enlargement

The Dry Wash No. 2 Dam is located on the south slope of the Abajo Mountains in Harris Hollow on the Johnson Creek drainage. The existing reservoir has a capacity of 185 acre-feet and supplies water for irrigation in the Blanding area. The present dam is 43 feet high and 650 feet long. The outlet works consists of

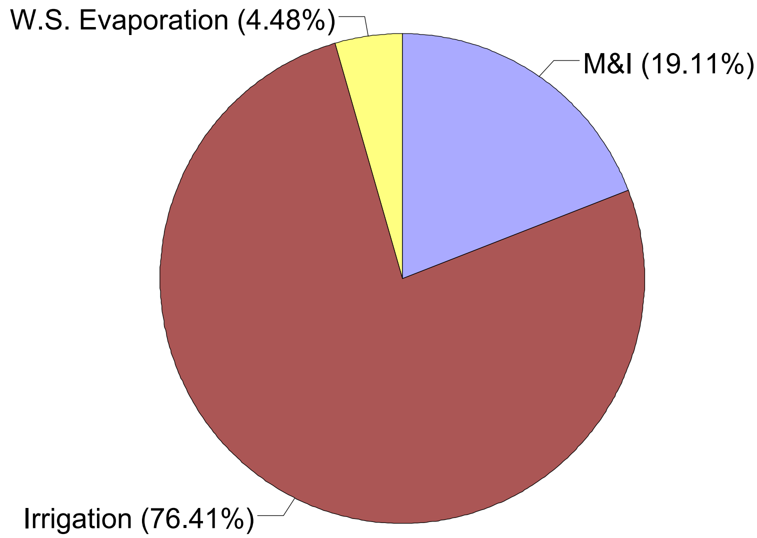
Table 9-5
SUMMARY OF CURRENT AND PROJECTED WATER DEMANDS (acre-feet)

| Use | 1996 | | 2020 | | 2050 | |
|---|---|---|---|---|---|---|
| | Diversions | Depletions | Diversions | Depletions | Diversions | Depletions |
| Culinary | 5,570[a] | 3,230 | 11,140 | 6,460 | 27,980 | 16,230 |
| Secondary | 1,140 | 990 | 2,350 | 2,040 | 5,610 | 4,880 |
| Industrial[b] | 2,030 | 1,770 | 4,560 | 3,970 | 6,720 | 5,850 |
| **Total M&I** | **8,740** | **5,990** | **18,050** | **12,470** | **40,310** | **26,960** |
| Irrigation[c] | 34,950 | 18,430 | 33,040 | 17,470 | 30,650 | 16,270 |
| W.S. Evap.[d] | 2,050 | 2,050 | 2,050 | 2,050 | 2,050 | 2,050 |
| **Basin Total** | **45,740** | **26,470** | **53,140** | **31,990** | **73,010** | **45,280** |

[a] Includes 30 acre-feet of industrial water use.
[b] Self-supplied industrial use. Some industrial use data not available.
[c] Some 1996 data estimated.
[d] Net evaporation, does not include precipitation. Includes cropland areas only.

**Figure 9-2a**

## Water Diversions - 1996




## Water Depletions - 1996

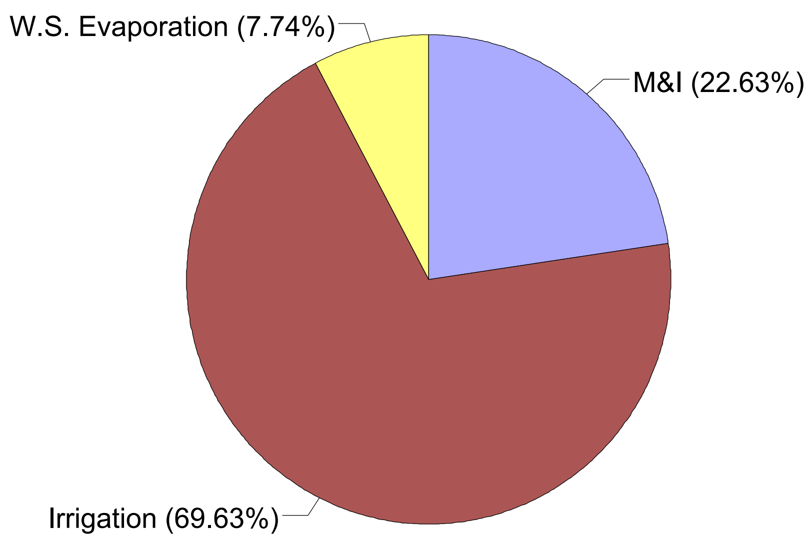
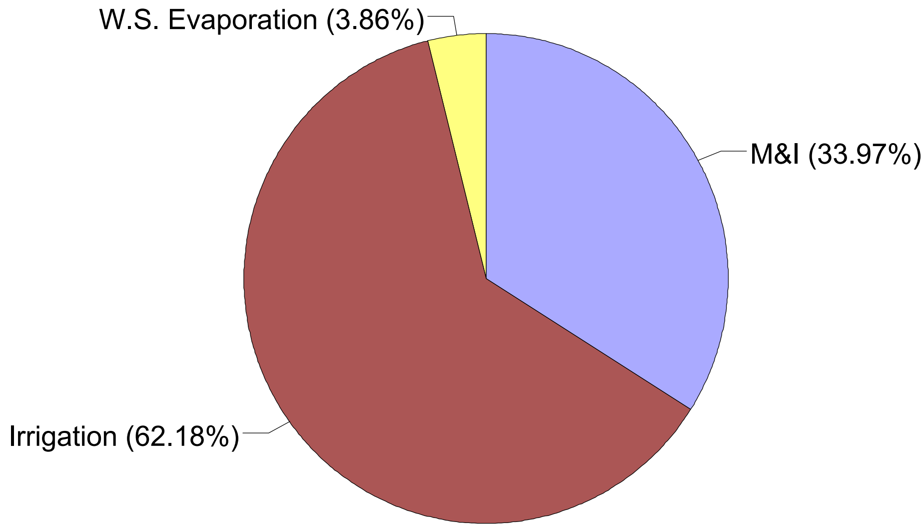


**Figure 9-2b**

## Water Diversions - 2020




## Water Depletions - 2020

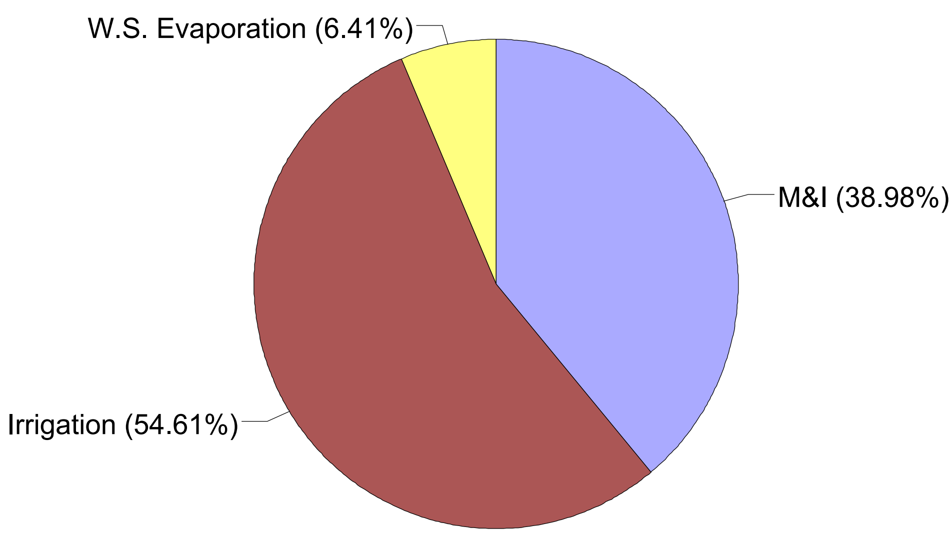
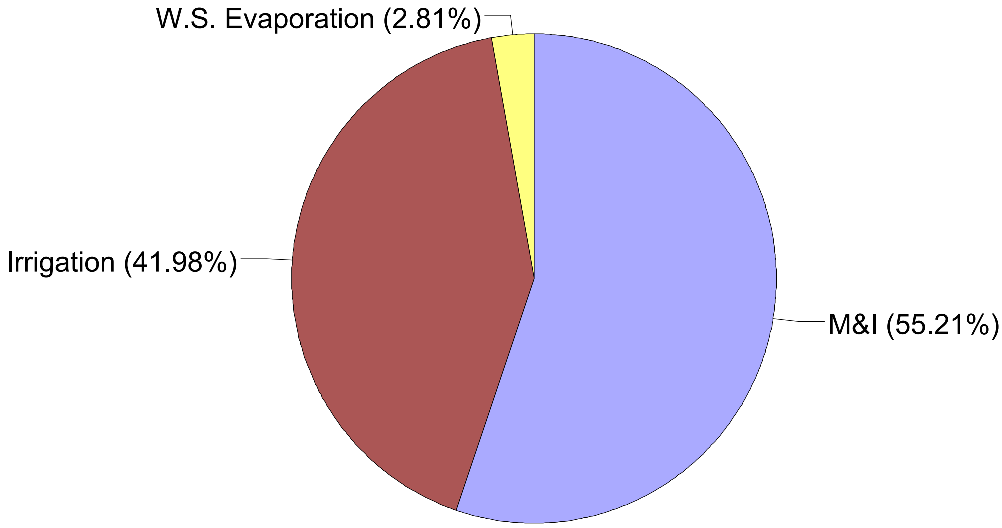
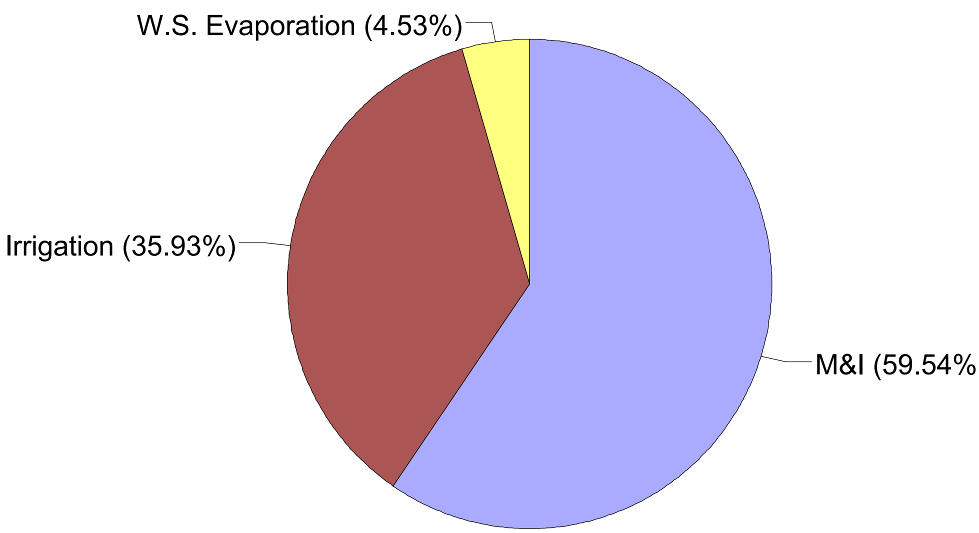


**Figure 9-2c**

## Water Diversions - 2050




## Water Depletions - 2050



Dry Wash Reservoir

an 18-inch diameter reinforced concrete pipe and drop inlet overflow (trickle tube) principal spillway. A concrete weir and riprap armored emergency spillway is located left of the embankment.

There has been consideration of raising the dam 12 feet which would double the storage capacity to about 370 acre-feet. The dam can be enlarged by relining the existing outlet pipe and extending the downstream end. This would allow raising the embankment from the downstream toe. Some diking between natural earthen knobs may be necessary. The overflow spillway would likely require serious modification or replacement with a principal/emergency spillway between existing earthen knobs on either side of the dam.

**9.4.3 Municipal Water Conservation**

A study conducted to determine leakage from municipal water systems in Utah indicates that anywhere from 1 to 15 percent of the water is lost in distribution system leaks. This water loss could be reduced by performing a system water audit and replacing defective pipe sections of the existing distribution system. Further conservation could be achieved by implementing progressive water pricing structures and meters or schedules for both culinary and secondary water service. At present, Monticello is the only city that does not bill for water based on the metered amount delivered. Although meters are in place, only commercial hookups are billed by volume of use. See Section 17 for more information on pricing.

**9.4.4 Culinary Water Treatment Plants**

Monticello City has recently replaced its water treatment plant (WTP) with a new, larger facility. In addition to the existing supply, the new WTP will draw water from Loyd's Lake as part of a long-term water-service agreement with the San Juan Water Conservancy District. This project was completed in 1999.

The City of Blanding is considering expansion and updating their present water treatment plant and other facilities. They have applied for funding to carry this out in the near future to meet the needs of an expanding population.

A new culinary WTP is being planned for Mexican Hat. The Mexican Hat WTP will divert water from the San Juan River to service residential and commercial water users in this small isolated community. A plan is being explored to allow the Navajo Nation community of Halchita in the Oljato Chapter to purchase water from Mexican Hat. The Halchita treatment plant currently pumps water from the San Juan River at Mexican Hat, treats it, and pumps it to two storage tanks near the town. This system is inefficient, expensive, and frequently shut down while waiting for service from the Navajo Tribal Utility Agency in Kayenta, Arizona. Another possibility is for the town of Halchita to construct a WTP supplied by wells and sell water to the town of Mexican Hat.

**9.4.5 Agricultural Water Conversion**

There is always the possibility of converting water now used for agricultural purposes to culinary uses. This can be done in two ways. One, if the land is sold for development of residential subdivisions or commercial enterprises, the agricultural water could be used or exchanged to provide culinary supplies. Two, by buying the land along with the water right and converting it for culinary uses. If the land is retired, provisions would need to be made to maintain some kind of cover to prevent flood or wind caused erosion.

### 9.4.6 Dolores River Project[96]

The Bureau of Reclamation completed the Dolores Project in 1986. The project consists of the McPhee dam and reservoir and related facilities in western Colorado on the Dolores River. Principal use is for irrigation and municipal and industrial water. All of the irrigation water has been allocated. There is currently 5,120 acre-feet of municipal and industrial water that is available for additional users. A meeting between the Dolores Water Conservancy District (DWCD) and the San Juan Water Conservancy District (SJWCD) was held in early 1998. The SJWCD was invited to cost-share in investigations of several agricultural water storage sites. Also, the existing project facilities could be used by SJWCD if and when system capacity were available.

As a result, SJWCD requested Wright Water Engineers, Inc. to investigate constructing a reservoir in Coal Bed Canyon and delivering water to Monticello and Blanding. Two storage capacities were investigated at the Coal Bed Canyon site in Utah; one for 4,000 acre-feet and one for 8,000 acre-feet. There would be 2,000 acre-feet of Dolores Project water and watershed yield above the reservoir depending on the precipitation for any given year, probably less than 2,000 feet on an average year. Another option investigated was delivery of water from Dolores Project facilities near Dove Creek to Monticello and Blanding.[90] No further action has been taken.

### 9.4.7 Groundwater Development [21,36]

The groundwater aquifers are found at varying depths over large areas of the basin. They include rocks from Cretaceous to Permian age although not all formations are present in all areas. The U.S. Geological Survey grouped these formations into regional aquifer systems in the San Juan County area with each group containing one or more formations. There has also been some grouping of these formations in the Grand County area. In general, the shallower aquifers nearer to the recharge areas contain better quality water. The estimated depth to usable water and aquifers accessible to communities are shown in Table 9-6. These formations and aquifer systems are described in more detail in Section 19. Also, refer to Figure 3-3, Geologic Stratigraphy.

### 9.4.8 Navajo Indian Reservation Irrigation Projects

There is a need for projects throughout the reservation to help the Navajo Indians improve their quality of life. Irrigation projects will help them provide a more adequate food supply. Water for household use has always been a problem, especially for those who have to haul water for domestic uses.

Irrigation Projects[84] - Two irrigation projects have been investigated by the Natural Resources Conservation Service in Arizona to serve the Navajo Indians. The Montezuma Creek Project was investigated in 1985 and the Aneth Irrigation Project was investigated in 1986.

The Montezuma Creek Project was originally developed in 1936 to irrigate 300 acres of alfalfa, corn and beans in the Montezuma Creek area. In 1985, there were 380 acres being farmed with eight cfs diverted from the San Juan River. The water right was from the upstream Navajo Dam and Reservoir. The water was delivered through an earth channel about 10,000 feet long. It was proposed to convert the project to a pump/sprinkler project at a total cost of $100,000 or $263.16 per acre. About 80 people would benefit. Lack of funding and interest by management have held up the project.

The Aneth Irrigation Project was originally developed in 1905 to irrigate 150 acres of alfalfa, corn and garden vegetables. In 1986, there were 50 acres under cultivation. There was one cfs being delivered through about 9,000 feet of earth ditch. It was estimated it would cost $500,000 or $3,333 per acre to rehabilitate the project. About 80 people would benefit. The

Table 9-6
POTENTIAL COMMUNITY DEVELOPMENT OF GROUNDWATER [21,23,24]

| Community/Chapter | Aquifer | | Depth (feet) |
|---|---|---|---|
| | System[a] | Formation | |
| **GRAND COUNTY** | | | |
| Castle Valley | | Alluvium | 30 |
| | P & C | Cutler formation | 150 |
| Grand Water & Swr Ser Ag | | Alluvium | |
| | N | Navajo sandstone | 200 |
| **SAN JUAN COUNTY** | | | |
| Aneth | N | Wells in N Aquifer | 1,100 |
| Blanding | D | Wells in D Aquifer | 200 |
| | M | Wells in M Aquifer | 900 |
| | N | Wells in N Aquifer | 2,000 |
| Bluff | N | N Aquifer | 600 |
| Dennehotso | P & C | Individual wells in P & C Aquifer | NA |
| Eastland | D | Individual wells-Dakota sandstone | 300 |
| | N | Well in Navajo sandstone | 1,600 |
| La Sal | N | Well in N Aquifer | 800 |
| | M | Well in M Aquifer | 600 |
| | D | Well in D Aquifer | 300 |
| Mexican Water | N | Wells in N Aquifer | 500 |
| Monticello | D | Wells in D Aquifer | NA |
| Navajo Mountain | P & C | Well in DeChelly sandstone | 2,800 |
| Oljato | P & C | Wells in DeChelly sandstone | NA |
| Red Mesa | N | Wells in N Aquifer | 1,000 |
| Teec Nos Pos | M | Wells in M Aquifer | 300 |
| | N | Wells in N Aquifer | 1,100 |
| Ute Mountain Ute | N | Wells in N Aquifer | 1,600 |
| | D or M | Wells in D or M Aquifer | 200,700 |

[a] Hydrogeologic Units
D - Dakota sandstone and Burro Canyon formation
M - Morrison formation
N - Carmel formation, Navajo sandstone, Kayenta formation, Wingate sandstone
P & C - Cutler formation

original diversion on McElmo Creek has been abandoned. Temporary diversions are now being used. Lack of funding and conflicts have held up the project.

Drinking Water Projects[85] - The Navajo Area Indian Health Service has 11 active projects, three of them funded for planning only. These projects vary in total cost from $373,000 to $1,780,500 and will extend and improve the culinary water supply within five chapters. The planning funds are provided to investigate projects in three chapters.

There are also 55 additional drinking water projects proposed. Of these, 27 projects are to extend existing water systems to serve more families and 15 projects are to provide cisterns for areas without any available water. The total water cost for these projects is nearly $22 million and the total project cost including administration is over $26 million. These projects have been given overall scores to prioritize funding. At the current rate of funding under PL 86-121, it will be years before they are funded.

### 9.4.9 Cloud Seeding

"Seeding" winter storm clouds over the mountains is a well established and understood practice. Clouds form as moist air is lifted and cooled during its passage across mountain ranges. Left to nature, many clouds are highly inefficient precipitators, retaining more than 90 percent of their moisture. By cloud seeding, the precipitation efficiency can be greatly improved. Generally, silver iodide is shot from ground generators to produce artificial ice nuclei that form ice crystals. Spreading the nuclei via aircraft is also common. These crystals attract moisture from the surrounding air forming droplets that grow large enough so they fall to the ground as snow in winter. Some projects using ground-based silver iodide generators to seed winter storms over mountain areas in the western United States have operated continuously since 1950.

Precipitation data from numerous cloud seeding projects have been examined in detail for evidence of downwind effects. Results from these analyses show a slight increase in precipitation in areas up to 90 miles downwind from the project area. No decrease in precipitation has been detected farther downwind from any long-term cloud seeding project.

The first cloud seeding project in Utah began in the early 1950s in the central portion of the state. Cloud seeding started again in 1973 and has continued to the present.

In 1973, the Utah Legislature passed the Utah Cloud Seeding Act. This law provided for licensing cloud seeding operators and permitting cloud seeding projects by the Utah Division of Water Resources. The act states that for water right purposes, all water derived from cloud seeding will be treated as though it falls naturally. The act also allowed for the division to sponsor and/or cost share in cloud seeding projects. Since 1976, the state through the Division and Board of Water Resources has cost shared with local entities for cloud seeding projects.

Cloud seeding projects were operated in San Juan and Grand counties in 1990 and in San Juan County in 1991, 1992 and 1993. The effectiveness of a cloud seeding project cannot be determined without several years of operation because of the wide variability in the weather from year to year.

A long-term project has been operating in central and southern Utah. Statistical analyses of the Central and Southern Utah Project with over 20 years of operation and data indicate a December through March precipitation increase of about 15 percent and an April 1 snow water content increase of about 10 percent. Runoff analysis in Utah indicates a 10 percent increase in April 1 snow-water content will result in a 10 to 20 percent increase in the April-July runoff depending on individual watersheds.

Cloud seeding is most effective when it is continued over several years, providing increased soil moisture, increased groundwater for springs and keeping up base flows. Seeding only in dry years may not be as effective because of a lack of seedable storm systems.

### 9.4.10 Water Education

The same amount of water exists today as when earth was first formed. However, demand for water keeps increasing. It has been estimated water usage has tripled since 1950. This makes it imperative to protect the ecological integrity of the natural systems while satisfying the human needs. Populations must balance their need to use water with their responsibility for its quality and availability. These and other issues will continue to confront us into the 21st century. Finding the answers depends on a populace sensitive to and knowledgeable about water and related resources. Education provides one of the best approaches to ensuring responsible behavior toward water.


Water Education Poster contest - 1999

Project WET (Water Education for Teachers), through its education services and programs, will help prepare students for citizenship through this century. The goal of Project WET is to facilitate and promote awareness, appreciation, knowledge and stewardship of water resources. Project WET is an internationally sponsored program that disseminates classroom-ready materials to help students develop the skills necessary to make informed decisions regarding water resources management.

The annual Young Artists' Water Education Poster contest is an event which continues to be the highlight of every October, Water Education Month. Children in kindergarten through 6th grade participate in this district/statewide contest each year. Themes chosen relate to water as a resource. The poster contest provides schools the opportunity to teach students about water awareness and wise water use.

Project WET is sponsored in Utah by the Division of Water Resources. A state coordinator supervises the training of public and private school teachers in a workshop setting where innovative water related, hands-on, and fun activities prepare them for classroom successes. Water fairs are conducted in individual schools where classes are taught by teachers trained in Project WET workshops and by trained local water professionals. Water experts are also available for individual classroom presentations on a variety of water related topics. Water-related resources materials (such as booklets, brochures and videos) are also available to spread the water message.

Water education also includes promoting the numerous programs available for water conservation. These include installing low water-using fixtures such as low-flow toilets and shower heads, using secondary irrigation water systems, and implementing conservation inducing price-rate structures. These programs are explained in more detail in Section 17.

**9.5 WATER PLANNING ISSUES**

Concerns have been raised about meeting future water demands. There is always the desire to develop more irrigation water, especially in the Monticello and Blanding areas. However, this is not feasible on its own merits at present. Also, meeting the culinary water demand is becoming an increasing problem, especially in the Spanish Valley/Moab area and in the communities of Blanding, Castle Valley and Mexican Hat. Although some progress has been made, there is much to be done.

The Southeast Colorado River Basin includes the Navajo Indian Reservation and Ute Mountain Ute tribal lands within its borders. Both entities fall under the administrative jurisdiction of the Bureau of Indian Affairs (BIA). The Indian population within these reservations experience water shortages and water quality issues similar to or greater than the non-Indian areas.

An effort should be made by both state and federal water agencies through tribal authorities and the BIA to coordinate the planning and development of the overall water supplies within the boundaries of impacted entities. Historically, water planning efforts have been done on an independent basis with little or no cooperation between Indian and non-Indian water agencies. As the water supplies in the San Juan River Basin become stressed, the issue of developing a coordinated water plan needs to be addressed. Navajo and Ute Indian water needs are an integral part of the San Juan County Water Master Plan. This is a step in the coordination process. ❑

# Contents

Section 10

# Southeast Colorado River Basin

**Utah State Water Plan**

## Agricultural Water

### 10.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan discusses information and data regarding the current and historical development of agriculture. It also discusses the agricultural problems, needs and future potential.

Agriculture is a major industry contributing to the economic well being of the area. As such, it is important that it remain viable and strong. Efforts should continue to make the best use of the land and water resources.

### 10.2 BACKGROUND

Irrigated agriculture has not been developed on a large-scale in the Southeast Colorado River Basin. However, San Juan County was listed as the fifth largest grain producer in the 1996 Utah Agricultural Statistics.[44] The 1992 agricultural census shows the basin had the second largest area of nonirrigated cropland harvested. With the exceptions of range cattle, sheep and dry land crops, current levels of on-farm production for basic agricultural commodities consistently rank in the lowest 20th percentile when compared with other regions of the state. The 1994 statistics for combined agricultural production indicate that less than 3.0 percent of the state's total agribusiness income can be attributed to this basin's farm and ranch production.

The limited extent of irrigated agriculture is primarily due to the lack of economically developable water supplies. As is the case with a majority of the state's arable lands, especially within the southeastern region, annual rainfall is insufficient in many areas to support most crops. Dry-land crops are produced where the annual precipitation is over about 12 inches. In these areas, dry-land beans, wheat, oats and safflower can be raised on alternate years with fallowing to allow moisture build-up. Alfalfa is also grown as a dry-land crop.

> Those who tamed the rugged frontier are still fighting to maintain the cropland and the rangeland they helped develop and preserve through conservation.

The major irrigated areas are located in Spanish Valley, around Monticello and in the Blanding area. There are smaller irrigated areas scattered around the basin, mostly where there are surface water supplies.

The livestock industry has had a large impact on the local and state production. It has also fluctuated more than any other agricultural commodity produced in basin.

In the mid 1870s, settlers to the area began to raise modest numbers of cattle, mostly along the lower elevations of the La Sal and Abajo mountains. Toward the end of the decade, a number of large cattle companies trailed in thousands of head of cattle from Texas, New Mexico, Colorado and other areas of Utah.[102] By 1885, a census indicated that well over 100,000 head of cattle were roaming the basin's range lands. However, the cattle industry at this magnitude was to soon disappear. The growth of the cattle herds had come during a time when the weather patterns produced tall, dense stands of grass in the high-mountain summer ranges as well as the broad winter ranges. The precipitation patterns changed around 1886 and all of the southwest region was hit with the worst drought in memory. The drought lasted until 1897 with only occasional relief. Large cattle herds were sold. Today there are smaller more manageable operations. Only a few of the larger cattle operations have survived over the years and remain today; perhaps the most notable of which are the Redd Ranches and the Dugout Ranch Partnership that was recently sold to The Nature Conservancy. It should be noted that sheep were favored by many settlers. Both the cattle and sheep operations rose and fell based on changing market conditions.

Dugout Ranch

The same pattern of boom to bust was also true for the farming industry. By 1910, a steady flow of homesteaders began migrating into the basin. A 1912 newspaper article noted that over the most recent ten-year period, and thanks to a sustained 130 percent growth rate, San Juan County alone had jumped from being the least populated county to ranking above six other counties in Utah. By 1920, homesteaders lay claim to over 200,000 acres of dry cropland in the region. Irrigated farms, however, were few and far between and accounted for only a small percentage of the total farming industry. Most irrigated agriculture was developed within close proximity to existing streams and rivers as there were no large storage facilities at the time.

The prosperity of dry-land farming was short-lived. By the early 1900s, the costs of seed, farm equipment, and other agribusiness expenses escalated drastically and a drop in the price of wheat and beans further aggravated the problem. The resulting economic downswing created significant hardships on the farming community. At its lowest point, entire homestead communities were abandoned leaving little evidence of what once existed. A 1990 census indicated that fewer than fifty people in San Juan County claimed agriculture as their only source of personal income; a trend that is found throughout the basin.

Although ranching was the largest agricultural activity during the early years in Grand County, the climate soon led to raising of crops. Even though some crops could be raised with only precipitation, irrigation made production more dependable and increased the yields.

Fruit was one of the first things to attract national recognition even though it had been introduced shortly after settlement.[45] The Stewart peaches grown here were named after one of the local producers. Grapes were also one of the first fruit crops grown.

With the railroad as close as Cisco, it was possible to ship fruit to distant markets. The vitality of the area is demonstrated by the size of the fruit. Pears weighing a pound each and grapes up to 3.5 inches in circumference were sold on the Moab market. During the fruit-growing heyday, 14-ounce peaches and 25-ounce apples were common.

To avoid the waste of large fruit crops, a 5,000-container per day cannery was built in 1911. However, it went out of business during the 1930s depression.

Fruit orchards and vineyards were always mentioned when irrigation schemes were proposed. In 1897, one such project proposed diverting water from the Colorado River near Grand Junction, Colorado and conveying it in a canal to the Cisco Desert and Westwater regions to irrigate 500,000 acres. Although this project never materialized, there was limited irrigation at Elgin and in the Westwater area.[45]

Even though the area had many advantages, there were also disadvantages. Too often frosts would kill an entire crop, making fruit growing unprofitable over the years. Floods also took their toll. This, along with the limited acreage, prohibited the area from becoming a major agricultural economic power.

Vineyard in Spanish Valley

In the late 1970s, a proposal was made to construct a large reservoir in Spanish Valley with water diverted from Mill Creek. The project did not materialize because of repeated delays and complications. At this time, less than 10 percent of the land was cultivated farmland and there were only 59 farms. Fruit and corn production were small, but still viable enterprises. The decline in farming was also a victim of increased mechanization and transportation, forcing out the small, marginal farmers.

Early dreams came true when Ken's Lake was completed in 1981. Water was diverted from Mill Creek through the Sheley tunnel. It was now possible to have a dependable water supply to irrigate the farms in Spanish Valley.

In San Juan County, several reservoirs have been constructed to store and regulate water for irrigation. The two largest and most recent are Loyd's Lake and Recapture Creek reservoirs. Loyd's Lake supplies water to the Monticello area and Recapture Creek Reservoir serves the Blanding area. Refer to Table 6-3 for data on the lakes and reservoirs in the basin.

## 10.3 AGRICULTURAL LANDS

The average size of farms has increased over the years reflecting the increased investment needed for a viable operation. A farm is defined as the land used as an entity in the production of agricultural commodities. A farm can include cropland, rangeland and timberland. The size of farms has increased in Grand County from 211 acres in 1930 to 717 acres in 1992 (the latest census published in the Utah Agricultural Statistics) and in San Juan County from 250 acres in 1930 to 1,577 acres in 1992. There were 294 farms in the basin according to the 1992 Census of Agriculture, 88 in Grand County and 206 in San Juan County. The total areas of cropland reported in the census for Grand County were dry cropland, 5,293; and irrigated land, 3,096 acres. There were 133,713 acres of dry cropland and 5,491 acres of irrigated land in San Juan County. The census data is different than the land-use data used in this report as the census data depends on a voluntary mail-in response and are estimates by the respondents. Also, the land-use data in this report does not include idle or fallow lands.

### 10.3.1 Soils

Recent soil surveys indicate that between 300,000 and 500,000 acres could be used for irrigated agriculture if water were available. However, the combination of accessible water available for use on large acreages of fertile soil for agriculture is in short supply. The areas of existing irrigated cropland are found on the fertile soil deposits along or in close proximity to existing streams or on alluvial fans. Soils on the benches and mesas produce good dry-land crops. See Section 3 for additional information.

### 10.3.2 Irrigated Croplands

Irrigated cropland is an important part of the agricultural industry. It is the source of many cash crops and provides the base for most of the cattle operations. There are currently 8,929 acres of agricultural land under irrigation with the most common crops being alfalfa and pasture grass for livestock. The 4,400 acres of idle and fallow lands are not included. There are 2,784 acres of irrigated cropland in Grand County and 6,145 acres in San Juan County. Diversions and depletions of irrigation water for 1996 were 13,800 acre-feet and 6,910 acre-feet in Grand County and 21,150 acre-feet and 11,520 acre-feet in San Juan County.

A summary of irrigated cropland is listed in Table 10-1 and the major irrigated cropland areas are shown on Figure 10-1. The current rate of diversion for irrigated agriculture is 34,950 acre-feet. The irrigation efficiency in this area is high, well above the state average. The irrigated acreage and diversions to cropland are shown for each subarea in Table 10-2.

Sprinkler east of Monticello

**Table 10-1**
**SUMMARY OF IRRIGATED AGRICULTURAL ACREAGE BY COUNTY**

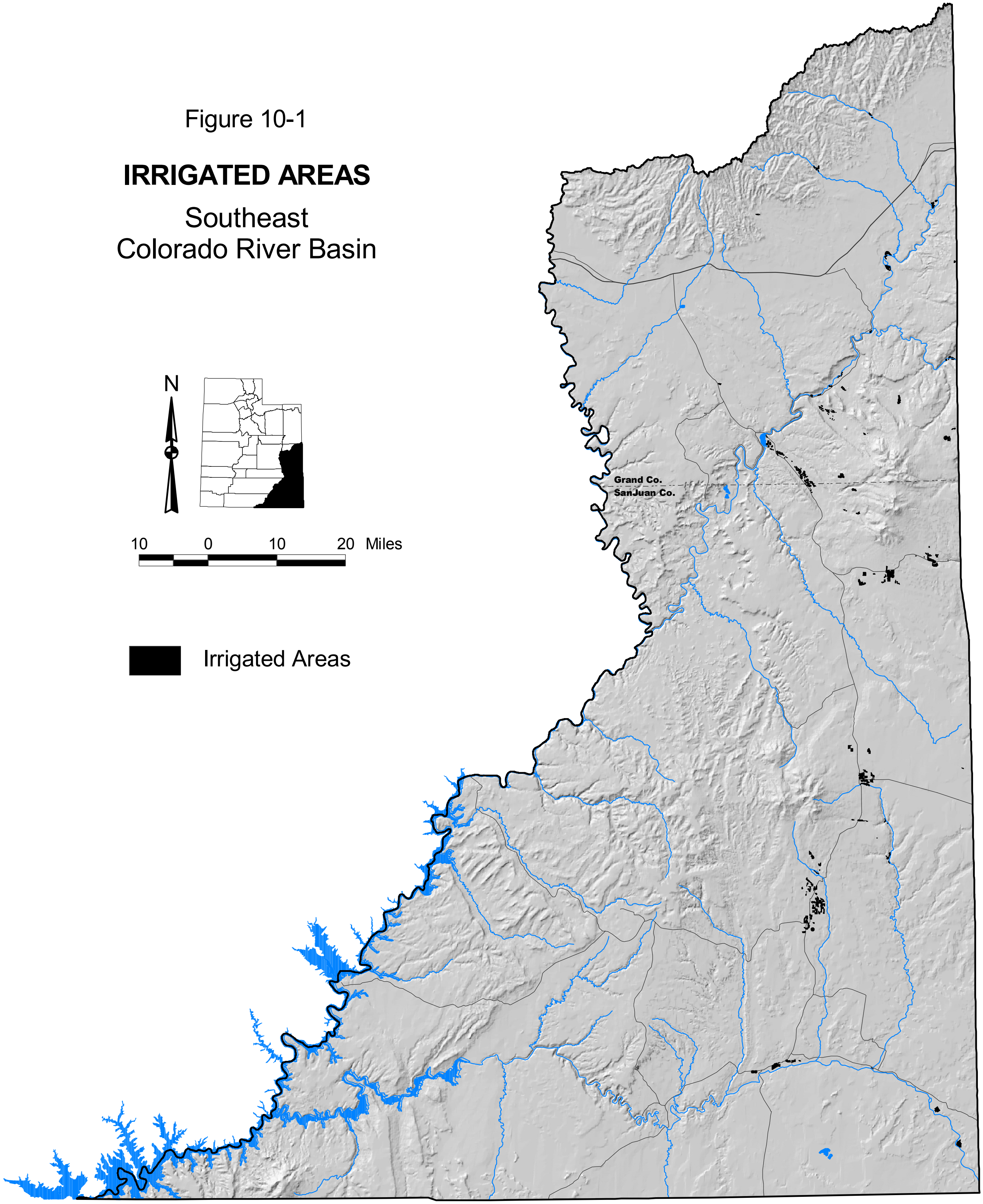
| Crop | County<br>Grand (acres) | <br>San Juan (acres) | Crop Total (acres) |
|---|---|---|---|
| Orchard | 136 | 55 | 191 |
| Vineyards | 31 | 27 | 58 |
| Grain | 33 | 378 | 411 |
| Corn | 50 | 0 | 50 |
| Vegetables | 3 | 10 | 13 |
| Alfalfa | 1,657 | 3,078 | 4,735 |
| Grass Hay | 43 | 454 | 497 |
| Pasture | 831 | 1,976 | 2,807 |
| Pasture Subject to Spring Flooding | 0 | 158 | 158 |
| **Subtotal-Surface Irrigated Crop Land** | **2,784** | **6,136** | **8,920** |
| Subirrigated Pasture | 0 | 9 | 9 |
| **Total-Irrigated Crop Lands** | **2,784** | **6,145** | **8,929** |

Note: Cropland consisting of 1,115 acres of fallow (Grand County, 203 acres, San Juan County 912 acres) and 3,284 acres of idle (Grand County, 872 acres, San Juan County, 2,412 acres are not included. These acreages are part of farm units and may be irrigated on alternate years or during wet cycles.
Source: Water-Related Land Use Inventory Report of the Southeast Colorado River Basin, Division of Water Resources.

Figure 10-1

## IRRIGATED AREAS

Southeast
Colorado River Basin



| Table 10-2<br>IRRIGATION WATER USE AND DEPLETION[12] | | | | |
|---|---|---|---|---|
| Name | Subarea Number[a] | Area (acres) | Diversions (acre-feet) | Depletions (acre-feet) |
| Cisco | 9-1-1 | 320 | 1,730 | 870 |
| Dead Horse | 9-1-2 | 30 | 170 | 90 |
| Castle Valley | 9-1-3 | 490 | 2,160 | 1,120 |
| Moab | 9-1-4 | 1,420 | 8,620 | 4,340 |
| Kane Spring | 9-1-5 | 370 | 1,280 | 560 |
| Cottonwood Creek | 9-1-6 | 450 | 1,920 | 1,250 |
| La Sal | 9-2-1 | 460 | 1,300 | 570 |
| Lisbon Valley | 9-2-2 | 740 | 2,520 | 1,140 |
| San Juan | 8-3-1 | 510 | 1,290 | 630 |
| Blanding | 9-3-3 | 2,560 | 9,370 | 5,300 |
| Monticello | 9-3-4 | 1,530 | 4,280 | 2,400 |
| McElmo | 9-3-5 | 50 | 310 | 160 |
| **Total** | | **8,930** | **34,950** | **18,430** |

[a] See Figure 5-1 for subarea locations.
Note: Irrigated area does not include idle or fallow land. Subareas 8-5, Lower Green; 8-6, Lake Powell; 9-2-3, Summit Canyon; 9-3-2, Grand Gulch; and 9-4, Wahweep do not have irrigated areas.

Most of the irrigated cropland is located within the small valleys in-and-around perennial streams and rivers.

### 10.3.3 Dry Cropland

There are about 130,400 acres of dry cropland in the basin with about 2,200 acres in Grand County and 128,200 acres in San Juan County. These are mostly in the San Juan River basin on high mesas or bench land. In 1999, the following acreages were harvested in San Juan County: winter wheat, 21,118 acres; spring wheat, 1,100 acres; oats, 900 acres; safflower, 12,046 acres; pinto beans, 6,200 acres; and alfalfa, 2,300 acres for a total of 43,664 acres.

In addition, over 80,000 acres of dry cropland are under the federal conservation reserve program. Under this program, there are incentives for farmers to take cropland out of production for 10 years. Farmers plant a

Dry farm near Monticello

mixture of grasses, forbes and shrubs to prevent erosion and enhance wildlife habitat. This draws big game away from neighboring farms resulting in less depredation. The Farm Service Agency and Division of Wildlife Resources pay for 75 to 100 percent of the cost.

### 10.3.4 Range and Forest Land

About 2.36 million acres of the basin's total land area of 6.98 million acres is considered rangeland; most of which is grazed by cattle or sheep. Most of the rangeland is managed by the Bureau of Land Management. The Manti-La Sal National Forest is managed by the Forest Service and includes major drainages that provide M&I and agricultural water to users throughout the area. In addition, there are scattered tracts of state lands and blocks of private lands used for grazing throughout the basin.

## 10.4 AGRICULTURAL PROBLEMS

Most of the agricultural water problems are related to irrigation water use although there is a need for more stockwatering facilities in the rangeland areas. Other problems include erosion and sediment production. Weed control is a problem in many agricultural areas. Another limiting factor for a viable agricultural economy is lack of a cash crop. This would provide the needed cash flow.

### 10.4.1 Irrigation Water Problems

Irrigation water development is becoming prohibitive because of the lack of available water and the large cost involved. About the only way agricultural water could be developed is in connection with other projects or to piggy-back on municipal and industrial water projects. In some areas, the trend toward conversion of farmland to residential and commercial development will also reduce the likelihood of agricultural water projects.

The quality of water diverted for irrigation is generally good with the exception of McElmo Creek, a tributary to the San Juan River, and Onion Creek, a tributary to the Colorado River above Moab. Water from springs and wells is of good quality unless it comes from very deep, semi-confined aquifers where recharge is slow. Water from Castle Creek, Mill Creek, South Creek and Recapture Creek are less than 165 mg/L (275 μmhos/cm). Onion Creek is about 660 mg/L (1,120 μmhos/cm) and McElmo Creek is about 1,920 mg/L (3,250 μmho/cm).

### 10.4.2 Erosion and Sedimentation Problems

The Southeast Colorado River Basin contains many areas of considerable erosion. The scenic land forms carved in the rocks throughout the area are evidence of geologic erosion. Soil erosion has occurred in many areas where the land is flatter, where vegetative cover is poor and where it is subject to cloudburst floods. In many areas, geologic or background erosion is moderate to heavy. Erosion is defined as movement of soil from a specified location. Sediment yield is the amount of the eroded material deposited at some point downstream from the eroded area.

The Montezuma Creek drainage has been of particular concern because of the extensive dry-crop farming practices. This area was the subject of an intensive study by the Natural Resources Conservation Service (NRCS), Bureau of Land Management and others. A report of the findings was published in June 1992.[68] The estimated geologic erosion rate for this area was 3 tons/acre net sediment yield and about 6 tons/acre/year gross erosion. The recommended NRCS maximum tolerable gross erosion is 5 tons/acre. Gross erosion is a measure of the potential for soil to be moved from its place of origin, not the amount of soil that reaches a stream or lake.

Severely accelerated concentrated-flow erosion is occurring on a portion of the Montezuma Creek watershed. These areas contain rangeland and cropland. Some cropland located on steep slopes (up to seven percent) are eroding at a rate of 39 tons per acre annually. The erosion is causing on-site and off-site sedimentation damages to riparian areas, rangeland, and cropland; off-site water quality impairment; damage to archaeological sites; reduced infiltration of storm flows; and increased sedimentation into the San Juan River. Presently, there is severe erosion on 82,500 acres of rangeland yielding 236,460 tons (136 acre-feet) of sediment annually and 17,600 acres of cropland yielding 216,480 tons (124 acre-feet) of sediment annually to the San Juan River. In addition, bank erosion is producing 87,000 tons (50 acre-feet) of sediment annually. The total salt load from these sources is 15,230 tons annually.

## 10.5 AGRICULTURAL OPPORTUNITIES

Improvement of water use efficiency is one way to realize additional monetary benefits from an existing supply. Delivery systems can be upgraded by lining high-seepage areas in canals with concrete or plastic lining and by installing pipelines. Improving or rebuilding diversion structures and installing effective measurement and management controls can also increase efficient use of water.

On-farm irrigation efficiency improvements can make the water go further. This can be done by installing sprinklers or improving existing flood irrigation methods.

The Bluff Bench Project was a large agricultural project proposed for development in the 1970s.[5] Located on the mesa northeast of Bluff, the project would include a total of about 4,900 acres; 4,200 acres to grow orchards and vineyards and 700 acres for farmsteads, roads and windbreaks. Water was to be pumped from the San Juan River requiring a lift of 300 to 500 feet in elevation in addition to pressure for sprinkler irrigation. Test plots were planted and irrigated and it was determined the soils, water quality and climate were satisfactory to support a large-scale agricultural project. However, the high cost of pumping water from the San Juan River to the cropland made the project economically infeasible.

The West Bluff Project was also investigated to determine the feasibility of irrigation in this area. There were about 1,200 acres of irrigable land including 150 acres owned by the Navajo Indians. This area was located in a 5-mile strip along the San Juan River and would produce alfalfa and small grains. This project was never completed due to inadequate funding.

The Dolores Project was built by the Bureau of Reclamation during the 1980s. Use of some of the water developed has been investigated through the joint efforts of San Juan County and the San Juan Water Conservancy District. This project includes the possibility of an irrigated agricultural development near the Utah-Colorado border. There is no action on this project at the present time. Costs will be the deciding factor on developing this water for agriculture. See Section 9 for more information on this project.

Strip-cropping to reduce erosion

The San Juan Water Conservancy District has an annual allocation of 20,000 acre-feet of water in the San Juan River. This water should be considered for development in the future. The most difficult problems to overcome include constructing and maintaining a diversion works and control of the large silt-load.

The current accelerated erosion rates need to be reduced. The best way is to establish a healthy watershed. Terracing and strip cropping will reduce erosion as will planting the rangeland with a variety of grasses and forbes along with brush in the lower watershed areas. These practices will require an intensive rehabilitation program along with effective grazing management. ❑

# Contents

Section 11

# Southeast Colorado River Basin

**Utah State Water Plan**

## Drinking Water

### 11.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan provides information and data on the treatment, distribution and regulation of public drinking water supplies. Information and data are also presented on organizations, regulations and problems associated with the development and distribution of drinking water for public systems.

### 11.2 SETTING

There are 53 public water systems within the Southeast Colorado River Basin, 14 in Grand County and 38 in San Juan County. These include 20 public community systems and 24 public non-community systems regulated by the Utah Division of Drinking Water (DDW) and 9 "Other Navajo Indian Community" systems regulated by the Navajo Nation Public Water System Supervision Program (PWSSP).

Blanding municipal reservoir

There are 4 community and 10 non-community systems in Grand County. San Juan County has 16 community and 14 non-community systems of which 9 community systems (2 San Juan School District and 7 Navajo Tribal Utility Authority) and one non-community system (Goulding Trading Post & Lodge) are located within the Navajo Indian Reservation and one community system is operated by the Ute Mountain Ute Tribe at White Mesa. The public community water systems are shown in Table 11-1 and on Figure 11-1. The public non-community water systems appear in Table 11-2.

*High quality water quenches thirst, is necessary for most household tasks and helps provide a quality life.*

The DDW monitors systems under their responsibility to assure that public community and public non-community drinking water adheres to state and federal regulations. The Navajo Tribal Utility Authority (NTUA) and the Navajo Nation PWSSP regulate and operate the public community systems on the reservation. All of these systems are monitored to meet the requirements of the federal Safe Drinking Water Act.

Three of the public community systems, Blanding, Halchita/ Mexican Hat and Monticello are supplied by surface water treatment plants. Four communities rely all or partly on springs and the other communities use wells. About 79 percent of the culinary water supply comes from groundwater and about 21 percent comes from surface water. All of the individual domestic systems get water from private wells.

Table 11-1
PUBLIC COMMUNITY SYSTEMS WATER USE - 1996[14,15]

| Water System | Regulated By [a] | Residential (ac-ft) | Commercial (ac-ft) | Institutional (ac-ft) | Industrial (ac-ft) | Total M&I (ac-ft) | People Served | Per Capita Use (g/cd) |
|---|---|---|---|---|---|---|---|---|
| **GRAND COUNTY** | | | | | | | | |
| Day Star Adventist Academy | DDW | 4 | 0 | 1 | 0 | 5 | 37 | 121 |
| Grand Water & Sewer Service Agency | DDW | 511 | 39 | 11 | 0 | 561 | 2,238 | 224 |
| Moab City | DDW | 1,017 | 382 | 149 | 0 | 1,548 | 5,000 | 276 |
| Thompson Water Improvement District | DDW | 19 | 24 | 6 | 0 | 49 | 70 | 625 |
| **Grand County Total** | | **1,551** | **445** | **167** | **0** | **2,163** | **7,345** | **263** |
| **SAN JUAN COUNTY** | | | | | | | | |
| Blanding City Public Works Department | DDW | 637 | 71 | 4 | 1 | 752 | 3,299 | 203 |
| Eastland Special Service District | DDW | 5 | 0 | 0 | 0 | 5 | 60 | 74 |
| Hall's Crossing Marina (NPS) | DDW | 46 | 18 | 32 | 1 | 97 | 330 | 262 |
| Monticello Municipal Water System | DDW | 315 | 19 | 11 | 2 | 347 | 2,100 | 148 |
| Monument Valley H.S. (SJ School Dist) | DDW | 13 | 0 | 32 | 0 | 45 | 60 | 670 |
| Navajo Mtn H.S. (San Juan School Dist) | DDW | 2 | 0 | 2 | 0 | 4 | 50 | 71 |
| San Juan Service Area #1 (Bluff) | DDW | 22 | 29 | 10 | 0 | 61 | 300 | 182 |
| San Juan Co SSD #1 (Mexican Hat) | DDW | 2 | 30 | 1 | 0 | 33 | 110 | 268 |
| White Mesa (Ute Mountain Ute Tribe) | DDW | 29 | 0 | 0 | 0 | 29 | 325 | 80 |
| **San Juan County Subtotal** | | **1,071** | **167** | **92** | **4** | **1,334** | **6,634** | **180** |
| **Navajo Tribal Utility Authority (NTUA)** | | | | | | | | |
| Aneth Community | DDW, PWSSP | 24 | 5 | 0 | 29 | 51 | 370 | 123 |
| Holly Village Community | DDW, PWSSP | 3 | 0 | 0 | 0 | 3 | 60 | 45 |
| Mexican Hat/Halchita Community | DDW, PWSSP | 13 | 5 | 13 | 0 | 31 | 320 | 86 |

Table 11-1 PUBLIC COMMUNITY SYSTEMS WATER USE - 1996 (continued)

| Water System | Regulated By [a] | Residential (ac-ft) | Commercial (ac-ft) | Institutional (ac-ft) | Industrial (ac-ft) | Total M&I (ac-ft) | People Served | Per Capita Use (g/cd) |
|---|---|---|---|---|---|---|---|---|
| Montezuma Creek Community | DDW, PWSSP | 15 | 3 | 25 | 4 | 47 | 240 | 175 |
| Oljato Community | DDW, PWSSP | 21 | 2 | 0 | 0 | 23 | 300 | 68 |
| Red Mesa Community | DDW, PWSSP | 11 | 0 | 1 | 0 | 12 | 240 | 45 |
| Todohaidekani Community | DDW, PWSSP | 8 | 0 | 0 | 0 | 8 | 120 | 60 |
| **Navajo Tribal Utility Authority Total** | | **95** | **15** | **39** | **33** | **182** | **1,650** | **98** |
| **Other Navajo Indian Community Water Systems** | | | | | | | | |
| Aneth Boarding School (BIA) | PWSSP | 50 | 0 | 0 | 0 | 50 | 300 | 149[b] |
| Goulding Trading Post & Lodge[c] | DDW, PWSSP | [44] | [82] | [0] | [0] | [126] | [300] | [375] |
| Monument Valley Mission/Hospital[d] | PWSSP | [10] | [0] | [17] | [0] | [27] | [190] | [127] |
| Monument Valley Tribal Park | PWSSP | 27 | 0 | 0 | 0 | 27 | 250 | 95[e] |
| Navajo Mountain Boarding School (BIA) | PWSSP | 8 | 0 | 12 | 0 | 20 | 50 | 357 |
| Navajo Mountain Chapter House | PWSSP | 8 | 0 | 0 | 0 | 8 | 75 | 95 |
| Navajo Mountain Health Clinic | PWSSP | 8 | 0 | 0 | 0 | 8 | 50[f] | 143[b] |
| Rainbow Village | PWSSP | 27 | 0 | 0 | 0 | 27 | 255 | 95 |
| Shonto Chapter House | PWSSP | 16 | 0 | 0 | 0 | 16 | 150[f] | 95[e] |
| **Other Navajo Indian Community Systems Total[g]** | | **144** | **0** | **12** | **0** | **156** | **1,130** | **123** |
| **Navajo Nation Community Systems Total[g]** | | **239** | **15** | **51** | **33** | **338** | **2,780** | **109** |
| **San Juan County Total[g]** | | **1,310** | **182** | **143** | **37** | **1,672** | **9,414** | **159** |
| **BASIN TOTAL[g]** | | **2,861** | **627** | **310** | **37** | **3,835** | **16,759** | **204** |

[a] DDW - Utah Division of Drinking Water; PWSSP - Navajo Nation Public Water System Supervision Program.
[b] Average of Aneth and Montezuma Creek NTUA community systems.
[c] Trading post is considered a public non-community system by the Utah Division of Drinking Water (See Table 11-2) and public community system by the Navajo Nation. It also supplies water to Monument Valley Mission /Hospital. Public community system totals do not include this system.
[d] Served by wells at Goulding Trading Post and Lodge.
[e] Average of NTUA community systems gallons per capita day.
[f] Estimated population served.
[g] Totals do not include Goulding Trading Post and Lodge and Monument Valley Mission/Hospital.
Note: Data based on a local study for the City of Moab and Grand Water and Sewer Service Agency are given in Section 11.6.

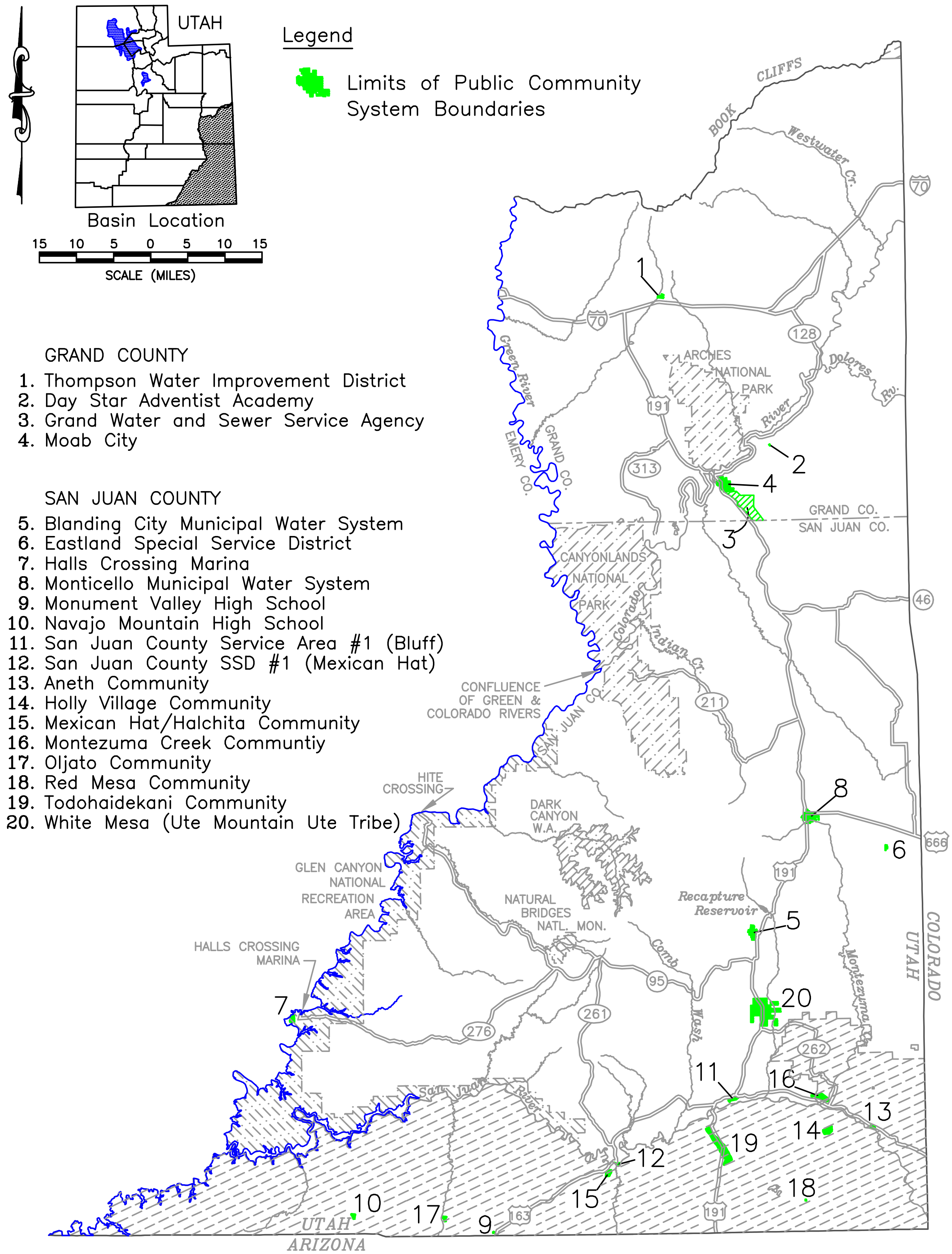



Figure 11-1

PUBLIC COMMUNITY SYSTEMS BOUNDARIES
Southeast Colorado River Basin

Table 11-2
PUBLIC NON-COMMUNITY SYSTEMS WATER USE - 1996[14,15]

| System Name | Regulated By[a] | Residential (ac-ft) | Commercial (ac-ft) | Institutional (ac-ft) | Total (ac-ft) |
|---|---|---|---|---|---|
| **Grand County** | | | | | |
| Forest Service, Warner Campground & Guard Station | DDW | 0.0 | 0.0 | 0.4 | 0.4 |
| National Park Service | | | | | |
| Arches National Park, Headquarters | DDW | 3.0 | 0.0 | 6.7 | 9.7 |
| Arches National Park, Devils Garden | DDW | 0.0 | 0.0 | 1.9 | 1.9 |
| State Parks & Recreation, Dead Horse Point State Park | DDW | 0.6 | 0.0 | 1.6 | 2.2 |
| Other Systems | | | | | |
| Bucks Grill House | DDW | 1.0 | 1.0 | 0.0 | 2.0 |
| Canyonlands Field | DDW | 1.0 | 1.0 | 0.0 | 2.0 |
| Grand County Lions Park | DDW | 0.0 | 0.0 | 3.0 | 3.0 |
| Matrimony Spring | DDW | 0.0 | 0.0 | 0.3 | 0.3 |
| Moab KOA Campground | DDW | 0.0 | 4.0 | 0.0 | 4.0 |
| Slickrock Campground | DDW | 0.0 | 11.8 | 0.0 | 11.8 |
| **Grand County Total** | | **5.6** | **17.8** | **13.9** | **37.3** |
| **San Juan County** | | | | | |
| Forest Service | | | | | |
| Buckboard Campground | DDW | 0.0 | 0.0 | 0.1 | 0.1 |
| Dalton Springs Campground | DDW | 0.0 | 0.0 | 0.1 | 0.1 |
| Devils Canyon Campground | DDW | 0.0 | 0.0 | 0.3 | 0.3 |
| Nizhoni Campground | DDW | 0.0 | 0.0 | 0.2 | 0.2 |
| National Park Service | | | | | |
| Canyonlands National Park, Island in the Sky | DDW | 0.3 | 0.0 | 0.6 | 0.9 |
| Canyonlands National Park, Needles District | DDW | 0.9 | 0.0 | 2.6 | 3.5 |
| Glen Canyon Recreation Area, Dangling Rope Marina | DDW | 1.6 | 4.2 | 1.0 | 6.8 |
| Hovenweep National Monument | DDW | 0.4 | 0.0 | 0.9 | 1.3 |
| Natural Bridges National Monument | DDW | 0.4 | 1.9 | 0.0 | 2.3 |
| Bureau of Land Management, Wind Whistle Campground | DDW | 0.0 | 0.0 | 0.1 | 0.1 |
| Other Systems | | | | | |
| Kane Springs Highway Rest Stop | DDW | 0.0 | 0.0 | 2.5 | 2.5 |
| Montezuma Trailer Park | DDW, PWSSP | 0.0 | 0.5 | 0.0 | 0.5 |
| Goulding Trading Post Lodge/Monument Valley Hospital[b] | DDW, PWSSP | 53.4 | 82.2 | 17.0 | 152.6 |
| Pack Creek Ranch | DDW | 0.0 | 3.0 | 0.0 | 3.0 |
| **San Juan County Total w/0 Goulding Trading Post** | | **[3.6]** | **[9.6]** | **[8.4]** | **[21.6]** |
| **Basin Total w/o Goulding Trading Post** | | **[9.2]** | **[27.4]** | **[22.3]** | **[58.9]** |
| **San Juan County Total** | | **57.0** | **91.8** | **25.4** | **174.2** |
| **Basin Total** | | **62.6** | **109.6** | **39.3** | **211.5** |

[a] DDW - Utah Division of Drinking Water; PWSSP - Navajo Nation Public Water System Supervision Program.
[b] This system is also listed in Table 11-1 under “Other Navajo Indian Community Water Systems.”

## 11.3 ORGANIZATION AND REGULATIONS

Federal regulations, state rules and local government requirements are enforced and/or administered by a number of public agencies to ensure that the general public is provided with a safe and reliable source of drinking water.

### 11.3.1 Local Facility Owners and Operators

Owners and operators of individual treatment and distribution systems are directly responsible for the quality of water delivered to the public within their respective service areas. The day-to-day operation of drinking water treatment facilities must be done in a manner that assures compliance with state rules and federal regulations for drinking water (See Section 7).

Currently, there are three plants that treat local surface water sources to bring them up to culinary drinking water standards. The Blanding, Halchita/Mexican Hat and Monticello treatment plants divert water from Johnson/Indian Creek, the San Juan River and Blue Mountain Springs/Loyd's Lake, respectively. These treatment plants are described in Table 11-3.

Blanding water treatment plant

Utah regulated public water systems that, for any reason, pose a threat to public health must be reported to the Utah Division of Drinking Water. Follow-up evaluations are used to revise system operational policies to minimize the likelihood of similar situations in the future. Sanitary surveys are conducted every three years to allow state and local health authorities to grade each public water system. The Navajo Nation Environmental Protection Agency carries out these functions on the reservation.

Table 11-3
WATER TREATMENT PLANTS

| Name | Capacity (mgd) | Storage (No./1,000 gal) | Treatment |
|---|---|---|---|
| Blanding | 2.6[a] | 1/1,000[b] | Flocculation, sedimentation, filtration, disinfection |
| Halchita | 0.125 | 2/200 | Pre-sedimentation, flocculation, chlorination, fluoridation |
| Monticello | 1.4 | 2/1,250 | Turbidity, disinfection |

[a] Capacity has been increased with polymer flocculating agent.
[b] Treated water discharges into a 100,000-gallon clear well and then flows by gravity to the storage tank.

### 11.3.2 State Drinking Water Regulations and Programs

Title 19, Chapter 4, of the Utah Code Annotated is referred to as the Utah Safe Drinking Water Act (USDWA). The Act created a Drinking Water Board with power and authority to regulate and protect the quality of all public drinking water supplies in the State. The USDWA authorized the Drinking Water Board (DWB) to: 1) Establish standards for drinking water quality; 2) establish standards and regulations for the design and construction of new and expanded water treatment and conveyance facilities; 3) protect watersheds and other sources of raw public water supplies; 4) provide technical and financial assistance to local water provider agencies to promote clean water programs, train treatment plant and/or system operators, construct new treatment and distribution facilities to meet expanding drinking water demands, and/or renovate existing treatment and distribution facilities to improve existing treatment processes; 5) administer federal programs that provide technical and financial assistance to local water provider agencies; 6) implement emergency plans in the event of natural disasters resulting in the contamination of public drinking water supplies; and 7) provide enforcement of both state rules and federal drinking water regulations.

The DDW acts as the administrative staff for the Drinking Water Board. In general, state drinking water regulations are consistent with comparable federal regulations. State regulations can be more stringent than federal regulations if the DWB and DDW feel federal regulations do not adequately protect the health and well-being of the state's populace.

Public drinking water systems are categorized as "community;" "non-transient, non-community;" and "non-community" systems. "Community" water systems are those which serve a minimum of 15 connections or regularly serve 25 or more residents on a year-round basis. "Non-transient, non-community" systems regularly serve at least 25 of the same persons over six months of the year. "Non-community" systems are typically individual wells that provide water to fewer than 15 connections for residential, commercial and/or industrial water uses.

The DDW takes an active role in promoting the quality and quantity of drinking water supplies. As an example, they: 1) Preview and approve engineering plans for proposed drinking water system modifications; 2) administer loan programs for drinking water projects; 3) conduct regular inspections of drinking water systems; 4) maintain a rating system for existing facilities; 5) issue administrative orders to noncomplying systems; 6) issue variances and exemptions when federal rules are inappropriate; and 7) administer a source protection program to safeguard the state's drinking water sources.

Aneth water tank

### 11.3.3 Navajo Nation Drinking Water Systems

There are 16 Navajo Indian public water systems located on the reservation. These are monitored by the Navajo Nation Environmental Protection Agency, Public Water System Supervision Program. Seven of these are operated by the Navajo Tribal Utility Authority and are also regulated by the Utah Division of Drinking Water. These systems are all monitored to assure they are in compliance with the federal Safe Drinking

Water Act. Refer to Table 11-1 for more information.

The Navajo Indian Health Service, Office of Environmental Health and Engineering is responsible for water projects to improve existing drinking water systems or to install new facilities. They currently have eight active projects and three more in various stages of planning.

**11.3.4 Federal Drinking Water Programs**

With the passage of the federal Safe Drinking Water Act (SDWA) in 1974, the federal government established national drinking water regulations to protect the public from water borne disease. Congress expanded and strengthened the SDWA in 1986 and 1996. These amendments significantly increased the responsibility of the federal Environmental Protection Agency (EPA), Division of Drinking Water, and local provider agencies. These responsibilities now:

- set the establishment of maximum levels of contamination for all regulated pollutants;
- set compliance deadlines for owners/operators of treatment facilities in violation of federal regulations;
- regulate surface water treatment associated with lead removal and wellhead disinfection;
- strengthen the enforcement of all regulations in the initial act;
- create federal funding for state revolving loans;
- require all community water systems to have certified operators by the planning year 2001;
- require the operators of all public water systems to publish annual consumer confidence reports;
- include the authority to examine the financial, technical, and managerial capabilities of water systems.

Chemical, physical, radiological, and bacteriological substances in drinking water which pose a health risk to the public are regulated by the EPA under provisions given in the SDWA. The EPA has established an extensive list of maximum contaminant levels (MCL's) for most common organic and inorganic contaminants.

"Primary" MCLs have been established for a number of chemical and biological contaminants. These primary standards are designed to establish treatment requirements to protect public health and safety.

To control and improve the aesthetic quality of drinking water supplies, the SDWA also includes a list of secondary maximum contaminant levels (SMCLs) for water aesthetics such as taste, odor and color. Although the evaluation of these qualities is subjective, the measurement of SMCL's has allowed for a reasonable level of consistency in water aesthetics from one system to another.

The SDWA also requires state and local water provider agencies to monitor a specified list of both regulated and unregulated contaminants. The selection of contaminants is dependent on the number of people served, the water source and contaminants likely to be found. The standardized monitoring frame-work is administered over three, three-year compliance cycles for a nine-year total monitoring period beginning in 1992. The completion of the first nine-year monitoring period will be followed by a second nine-year period.

The 1986 Amendments to the SDWA require all states to develop wellhead protection programs. The DDW has created the Drinking Water Source Protection Rule (DWSPR) which outlines the general requirements to protect wellheads from outside surface contamination. Requirements of the DWSPR include the preparation of a

Drinking Water Source Protection Plan for each groundwater source and providing proof of ownership and maintenance of all land in and around wellheads where surface water contamination may occur.

The Safe Drinking Water Act Amendments of 1996 effectively created the first federally funded state revolving loan fund (SRLF) for construction of drinking water infrastructure. The amendment authorized a total of nearly $10.0 billion of funding for drinking water projects on a national level. The funds are to be spent by planning year 2003. These funds will provide relief for many financially challenged systems in need of federal assistance to comply with SDWA and related regulations. The EPA must offer to enter into agreements with eligible states to allocate grants to capitalize on SRLF programs. Utah has identified a current need for over $66.9 million for drinking water improvement projects.

The (DDW) anticipates having between $6 million and $6.6 million annually through the year 2003 for project funding (See Section 7.5). The state is expected to provide an additional 20 percent of each appropriation as matching cost-share funds. In addition to the project funds, the Drinking Water Board expects to have a portion of its federal appropriations available for regional water system planning.

The SRLF can only be used for health protection associated with community and non-profit non-community water systems. Financial assistance may be used by a public water system only to cover expenditures (not including monitoring, operation, and maintenance) of a type or category that will facilitate compliance with National Primary Drinking Water Regulations (NPDWR) applicable to the system or to otherwise significantly further the health protection objectives of the SDWA.

SRLF recipients must have a viable system. Prior to providing assistance to a public water system that is in significant noncompliance with any requirement of an NPDWR or variance, the DDW must conduct a review to determine whether the intended project will provide the technical, managerial, and financial capability to ensure compliance with the requirements of the updated SDWA.

Intended use plans are also required to qualify for SRLF assistance. Each state that has entered into a capitalization agreement is required to annually prepare a plan that identifies the intended uses of the amounts available to the SRLF. This plan is known as the intended use plan (IUP). When preparing an IUP, states must provide public notice as well as an opportunity for public comment.

The IUP must include: 1) A list of projects to be assisted in the first fiscal year that begins after the date of the plan (including a description of the project); 2) expected terms of financial assistance, and the size of the community served); 3) criteria and methods established for the distribution of funds; and, 4) a description of the financial status of the state loan fund and the short-term and long-term goals of the state loan fund.

Indian tribes also may qualify for SRLF assistance. The EPA may use up to 1.5 percent of the amounts appropriated annually to make grants to Indian tribes that have not otherwise received either grants from the EPA or assistance from other state loan funds. These grants may only be used for expenditures by tribes for public water systems.

### 11.4 CURRENT AND PROJECTED DRINKING WATER DEMAND

The 1996 drinking water use was 5,570 acre-feet. This includes 3,870 acre-feet public community, 210 acre-feet public non-community and 1,490 acre-feet domestic uses. With a 1996 basin population of approximately 21,827, the average per capita water use was about 228 gallons per capita per day (gpcd). Grand County use was about

319 gpcd and San Juan County use was about 168 gpcd. With a projected population of 39,447 by the planning year 2020 and with no allowance for water conservation, drinking water demand is projected to be 11,140 acre-feet per year and will be 27,980 acre-feet by 2050 with a population of 90,070. See Table 9-2 for more detailed information. The current supply and projected demand are shown in Table 11-4 and Table 11-5.

These projections may be skewed when the non-resident tourist population is taken into account, particularly in Moab. During the peak of the tourist season, the transient population is larger than the number of permanent residents.

The current culinary water demand of 132 gpcd by the Navajo Nation including Goulding Trading Post is less than the 185 gpcd for the balance of San Juan County. In order to put the projected demands on and off the Navajo Indian Reservation in perspective, data for the Navajo Nation is summarized below. The total culinary water use in 1996 was about 484 acre-feet annually serving an estimated population of 3,270 people. Future demands will increase based on recommendations by the Navajo Nation Department of Water Resources, Water Management Branch. These recommended projections are 2.48 percent population growth rate with a demand of 160 gpcd. This will increase the demand to 1,053 acre-feet by 2020 with an estimated population of 5,885 people. By 2050, the demand will be about 2,198 acre-feet for 12,275 people. This data only includes those served by water systems now in place. New systems installed in additional communities will increase the projected demands. See Tables 11-4 and 11-5.

## 11.5 DRINKING WATER PROBLEMS

The population growth throughout the basin is increasing the demand for water supplies in many communities (Tables 11-4 and 11-5). Perhaps the more acute problems exist with providing the Indians culinary water. Many of the small and isolated Navajo Nation communities have no drinking water distribution systems. A significant number of homes require weekly, and in some cases daily, deliveries of water from tanker trucks to fill small personal jugs and/or containers.

The ability of the public community systems to deliver water is shown in Table 11-6. Moab has the largest delivery deficit by 2020 amounting to nearly 1,200 acre-feet. Five other communities also have delivery deficits. The ability of some Navajo Nation systems to meet future demands is not known. See Table 11-6.

All of the residents of the Town of Castle Valley currently obtain their culinary water from individual wells. They also use septic tanks for waste disposal. With the accelerated growth in the community, there could be a shortage of groundwater to meet the future demand. There could also be contamination from the increased use of septic tanks.

### 11.5.1 Treatment Plants at Blanding and Mexican Hat

Blanding and Mexican Hat (Halchita) use surface water treatment plants. These communities have come to a point where major system upgrades are necessary to meet the growing local demand. As a result, the city of Blanding has made application for state funding to enlarge and update its existing water treatment and distribution facilities. Mexican Hat has applied for assistance to build a culinary water treatment plant to provide better quality water supplies. They are also considering building capacity to supply the Navajo Nation community of Halchita.

### 11.5.2 Water Distribution Within Indian Reservations

The Navajo Indian Reservation covers all of the area south and some of the area north

Table 11-4
PUBLIC COMMUNITY SYSTEMS WATER SUPPLY AND DEMAND

| Water Supplier | Total Population 1996 | 2020 | 2050 | Water Supply (ac-ft) | Demand 1996 (acre-feet) | Sur/Def [a] 1996 (acre-feet) | Demand 2020 (acre-feet) | Sur/Def 2020 (acre-feet) | Demand 2050 (acre-feet) | Sur/Def 2050 (acre-feet) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Grand County** | | | | | | | | | | |
| Day Star Adventist Academy | 37 | 50 | 50 | 130 | 5 | +125 | 7 | +123 | 7 | +123 |
| Grand Water & Sewer Service Agency[b] | 2,238 | 5,532 | 16,419 | 3,620 | 561 | +3,059 | 1,387 | +2,233 | 4,117 | -497 |
| Moab City[b] | 5,000 | 12,360 | 36,684 | 6,386 | 1,548 | +4,838 | 3,827 | +2,559 | 11,359 | -4,973 |
| Thompson Water Improvement Dist | 70 | 173 | 513 | 137 | 49 | +88 | 121 | +16 | 359 | -222 |
| **Grand County Total** | **7,345** | **18,156** | **53,666** | **10,273** | **2,163** | **+8,110** | **5,342** | **+4,931** | **15,842** | **-5,569** |
| **San Juan County** | | | | | | | | | | |
| Blanding City Public Works Dept | 3,299 | 4,483 | 6,464 | 2,912 | 752 | +2,160 | 1,022 | +1,890 | 1,474 | +1,438 |
| Eastland Special Service District | 60 | 82 | 118 | 61 | 5 | +56 | 7 | +54 | 10 | +51 |
| Hall's Crossing Marina (NPS) | 330 | 448 | 646 | 211 | 97 | +114 | 132 | +79 | 190 | +21 |
| Monticello Municipal Water System | 2,100 | 2,854 | 4,115 | 1,372 | 347 | +1,025 | 472 | +900 | 681 | +691 |
| Monument Valley High School | 60 | 88 | 133 | 168 | 45 | +123 | 66 | +102 | 100 | +68 |
| Navajo Mountain High School | 50 | 73 | 111 | 10 | 4 | +6 | 6 | +4 | 9 | +1 |
| San Juan Co Ser Area #1 (Bluff) | 300 | 408 | 588 | 177 | 61 | +116 | 83 | +94 | 120 | +57 |
| San Juan Co SSD #1 (Mexican Hat) | 110 | 149 | 215 | 92 | 33 | +59 | 43 | +49 | 62 | +30 |
| White Mesa (Ute Mtn Ute Tribe) | 325 | 442 | 637 | 77 | 29 | +48 | 39 | +38 | 56 | +21 |
| **San Juan County Subtotal** | **6,634** | **9,027** | **13,027** | **5,080** | **1,373** | **+3,707** | **1,870** | **+3,210** | **2,702** | **+2,378** |

Table 11-4 (continued)
PUBLIC COMMUNITY SYSTEMS WATER SUPPLY AND DEMAND

| Water Supplier | Total Population 1996 | 2020 | 2050 | Water Supply (ac-ft) | Demand 1996 (acre-feet) | Sur/Def[a] 1996 (acre-feet) | Demand 2020 (acre-feet) | Sur/Def 2020 (acre-feet) | Demand 2050 (acre-feet) | Sur/Def 2050 (acre-feet) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Navajo Nation - NTUA** | | | | | | | | | | |
| Aneth Community | 370 | 540 | 815 | 144 | 51 | +93 | 74 | +70 | 112 | +32 |
| Holly Village Community | 60 | 88 | 133 | 69 | 3 | +66 | 4 | +65 | 6 | +63 |
| Mexican Hat/Halchita Community | 320 | 467 | 705 | 226 | 31 | +195 | 45 | +181 | 68 | +158 |
| Montezuma Creek Community | 240 | 350 | 528 | 1,612 | 47 | +1,565 | 69 | +1,543 | 104 | +1,508 |
| Oljato Community | 300 | 438 | 661 | 95 | 23 | +72 | 34 | +61 | 51 | +44 |
| Red Mesa Community | 240 | 350 | 528 | 190 | 12 | +178 | 18 | +172 | 27 | +163 |
| Todohaidekani Community | 120 | 175 | 264 | 121 | 8 | +113 | 12 | +109 | 18 | +103 |
| **Navajo Nation - NTUA Total** | **1,650** | **2,408** | **3,634** | **2,457** | **175** | **+2,282** | **256** | **+2,201** | **386** | **+2,071** |
| **San Juan County Total** | **8,284** | **11,435** | **16,661** | **7,537** | **1,547** | **+5,990** | **2,126** | **+5,411** | **3,088** | **+4,449** |
| **Basin Total** | **15,629** | **29,591** | **70,327** | **17,810** | **3,711** | **+14,100** | **7,468** | **+10,342** | **18,930** | **-1,120** |

[a] Sur/Def - Surplus or + and deficit or - for the projected time period.
[b] Data based on a local study for the City of Moab and Grand Water and Sewer Service Agency are given in Section 11.6.
Note: The population projections for the Navajo Nation communities are based on data provided by the Governor's Office of Planning and Budget. The water demand projections are based on 1996 use rates and projected populations.

Table 11-5
NAVAJO NATION COMMUNITY SYSTEMS WATER SUPPLY AND DEMAND[a]

| Water Supplier | Total Population 1996 | 2020 | 2050 | Water Supply (ac-ft) | Demand 1996 (acre-feet) | Sur/Def 1996 (acre-feet) | Demand 2020 (acre-feet) | Sur/Def 2020 (acre-feet) | Demand 2050 (acre-feet) | Sur/Def 2050 (acre-feet) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Navajo Tribal Utility Authority (NTUA) Community Systems** | | | | | | | | | | |
| Aneth Community | 370 | 666 | 1,389 | 144 | 51 | +93 | 119 | +25 | 249 | -105 |
| Holly Village Community | 60 | 108 | 225 | 69 | 3 | +66 | 19 | +50 | 40 | +29 |
| Mexican Hat/Halchita | 320 | 576 | 1,201 | 226 | 31 | +195 | 103 | +123 | 215 | +11 |
| Montezuma Creek Community | 240 | 432 | 901 | 1,612 | 47 | +1,565 | 77 | +1,535 | 161 | +1,451 |
| Oljato Community | 300 | 540 | 1,126 | 95 | 23 | +72 | 97 | -2 | 202 | -107 |
| Red Mesa Community | 240 | 432 | 901 | 190 | 12 | +178 | 77 | +113 | 161 | +29 |
| Todohaidekani Community | 120 | 216 | 450 | 121 | 8 | +113 | 39 | +82 | 81 | +40 |
| **NTUA Community Systems Total** | **1,650** | **2,970** | **6,193** | **2,457** | **175** | **+2,282** | **531** | **+1,926** | **1,109** | **+1,348** |
| **Other Navajo Nation Community Systems** | | | | | | | | | | |
| Aneth Boarding School (BIA) | 300 | 540 | 1,126 | 100E | 50 | +50 | 97 | +3 | 202 | -102 |
| Goulding Trading Post & Lodge | 300 | 540 | 1,126 | 153 | 126 | +27 | 97 | +56 | 202 | -49 |
| Monument Valley Mission/Hospital[b] | 190 | 340 | 710 | 27 | 27 | 0 | 61 | -44 | 127 | -110 |
| Monument Valley Tribal Park | 250 | 450 | 940 | 50E | 27 | +23 | 81 | -3 | 168 | -118 |
| Navajo Mountain Boarding School (BIA) | 50 | 90 | 190 | 20 | 20 | 0 | 16 | +4 | 34 | -14 |
| Navajo Mountain Chapter House | 75 | 135 | 280 | 8 | 8 | 0 | 24 | -16 | 50 | -42 |
| Navajo Mountain Health Clinic | 50 | 90 | 190 | 20 | 8 | +12 | 16 | +4 | 34 | -14 |
| Rainbow Village | 255 | 460 | 960 | 47 | 27 | +20 | 82 | -35 | 172 | -125 |
| Shonto Chapter House | 150 | 270 | 560 | 30E | 16 | +14 | 48 | -18 | 100 | -70 |
| **Other Navajo Nation Community Systems** | **1,620** | **2,915** | **6,082** | **455** | **309** | **+146** | **522** | **-49** | **1,089** | **-644** |
| **Navajo Nation Community Systems Total** | **3,270** | **5,885** | **12,275** | **2,912** | **484** | **+2,428** | **1,053** | **+1,877** | **2,198** | **+704** |

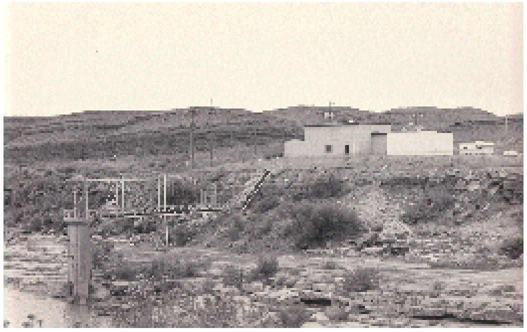
[a] The population and water use for 1996 are data from the Utah Division of Water Resources and the Navajo Nation based on current per capita use rates. The projected demand and population are based on 160 gpcd and a growth rate of 2.48 percent used by the Navajo Nation Water Management Branch. Some of the data are estimated for “Other Navajo Nation Community Systems.” Data includes Goulding Trading Post wells.
[b] This community is supplied water by the Goulding Trading Post & Lodge wells.
E - Estimated.

Table 11-6
PUBLIC COMMUNITY SYSTEMS CAPACITY[14]

| Water Supplier | Total M&I Use 1996 (acre-feet) | Total M&I Use 2020 (acre-feet) | Water Supply (ac-ft) | System Capacity (ac-ft) | Surplus[a] Deficit 2020 (ac-ft) |
|---|---|---|---|---|---|
| **Grand County** | | | | | |
| Day Star Adventist Academy | 5 | 12 | 130 | NA | NA |
| Grand Co WCD/Sp Valley W&SD | 561 | 1,387 | 3,620 | 1,588 | +2 01 |
| Moab City | 1,548 | 3,827 | 6,386 | 2,669 | -1,158 |
| Thompson Water Impr Dist | 49 | 121 | 137 | 57 | -64 |
| **San Juan County** | | | | | |
| Blanding City Pub Wks Dept | 752 | 1,022 | 2,912 | 1,290 | +268 |
| Eastland Spec Service Dist | 5 | 7 | 61 | 33 | -26 |
| Halls Crossing Marina (NPS) | 97 | 132 | 211 | 97 | -35 |
| Monticello Municipal Water System | 347 | 472 | 1,372 | 634 | +162 |
| Monument Valley High School | 45 | 66 | 168 | NA | NA |
| Navajo Mountain H.S. S.J. School District | 4 | 6 | 10 | | |
| San Juan County Service Area #1(Bluff) | 61 | 83 | 177 | 80 | -3 |
| San Juan Co SSD#1 (Mexican Hat) | 33 | 43 | 92 | 40 | -3 |
| White Mesa (Ute Mountain Ute Tribe) | 29 | 39 | 77 | 41 | +2 |
| **Navajo Tribal Utility Authority** | | | | | |
| Aneth Community | 51 | 71 | 144 | 69 | -2 |
| Holly Village Community | 3 | 4 | 69 | NA | NA |
| Mexican Hat/Halchita Comm | 31 | 45 | 226 | 118 | +73 |
| Montezuma Creek Community | 47 | 69 | 1,612 | 727 | +658 |
| Oljato Community | 23 | 34 | 95 | NA | NA |
| Red Mesa Community | 12 | 18 | 190 | NA | NA |
| Todohaidekani Community | 8 | 12 | 121 | NA | NA |

[a]The system capacity is always limiting in ability to meet demands. The surplus or deficit is the ability to deliver the 2020 population demand.

Source: Municipal and Industrial Water Supply Studies by the Division of Water Resources.


Halchita water treatment plant

and east of the San Juan River in the southern-most portion of San Juan County. It includes part of seven chapters and all of one (Aneth) chapter within Utah. Each chapter contains a number of small isolated communities and individual homes. Culinary water systems within the Navajo Nation typically consist of individual wells, small pump stations and distribution systems at the main communities in each chapter. These systems are shown on Figure 11-2. Outlying communities and individual homes usually do not have wells or distribution systems so water is trucked to these areas for domestic use. This method of water distribution does not meet the needs of these people.

The problems associated with constructing a reliable and safe water distribution system for these outlying Indian communities should be investigated cooperatively by both the Bureau of Indian Affairs and the Division of Drinking Water. In addition, the Navajo Department of Water Resources, Navajo Tribe Utilities Authority and Indian Health Service should be involved. Other agencies with technical expertise or financial resources include the federal Environmental Protection Agency, Bureau of Reclamation and U.S. Department of Agriculture.

## 11.6 ALTERNATIVES

There are several alternatives to provide drinking water supplies for those communities that will be facing future shortages. These alternatives are discussed in the following sections. The final decision to use one of the alternatives presented or another one will be made by the local entity involved.

### 11.6.1 City of Moab

The City of Moab acquired the rights for one-half of Skakel Spring to serve the original townsite. The City of Moab has now acquired water rights for four additional springs providing a total of 965 acre-feet per year. In addition, they have perfected rights and are proving up the rights for six wells with a total of 8,204 acre-feet per year. This provides a current total of 9,169 acre-feet per year or 7.324 million gallons per day.

The Moab Irrigation Company provides water to shareholders for outside irrigation within the city and for unincorporated areas to the north and west. In 1994, Moab Irrigation Company installed pressurized pipelines to replace the open ditch system within Moab.

Grand County and the City of Moab collaborated in preparing a build-out study in 1994. The study determined the density limit under the current zoning regulations of the land within Moab and the “islands” of unincorporated county areas within the city limits. Subsequent impact fee studies used 305 gallons per capita per day and 2.77 persons per household to determine the build-out population of 18,473.

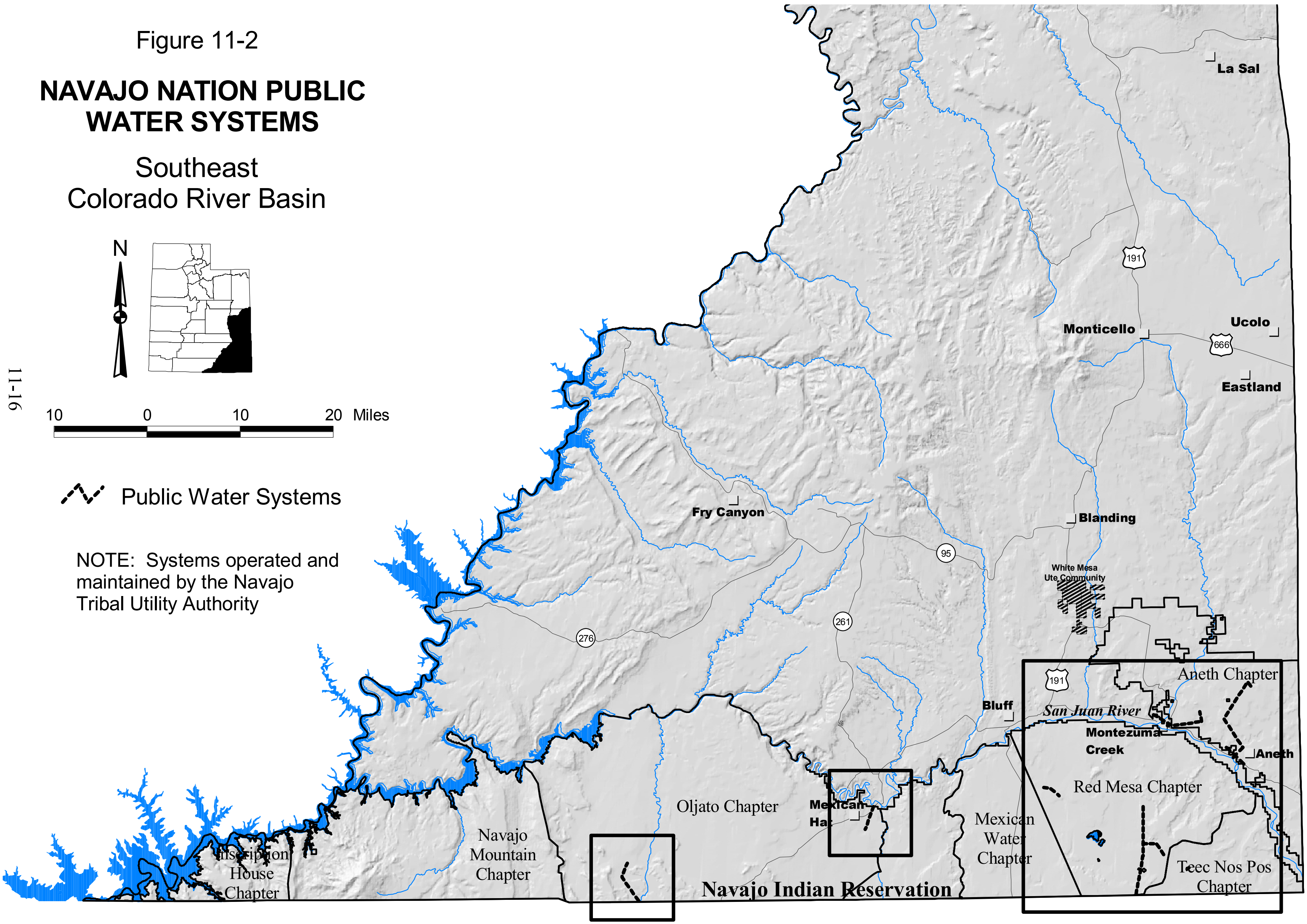
The estimated build-out peak demand is 6.019 million gallons per day, well below the present source capacity of 7.324 million gallons per day. If water is provided to the corridor north of Moab and Arches National Park visitors center and/or the city boundary is expanded, this surplus may disappear.

For the immediate future, construction of an additional 1.0 million gallon storage tank would provide adequate system capacity. Also, additional water could be acquired through purchase of the remaining one-half of Skakel Spring. The continued use of Moab Irrigation Company water for outside irrigation would reduce the demand on the

Figure 11-2

**NAVAJO NATION PUBLIC WATER SYSTEMS**

Southeast
Colorado River Basin



high quality culinary water. There is also groundwater in the bedrock aquifers of the Glen Canyon Group in Spanish Valley that can be developed. The Grand County Regional Drinking Water Facilities Plan contains two recommendations for the City of Moab: 1) Construction of an additional water storage tank, and 2) development of an outside secondary water system.

### 11.6.2 Grand Water and Sewer Service Agency

Prior to 1999, Spanish Valley Water and Sewer Improvement District retailed water produced by Grand County Water Conservancy District (GCWCD) under a contract that provided for delivery of up to 650 acre-feet per year. This water was obtained by GCWCD through an exchange agreement whereby irrigation quality water produced from the Ken's Lake/Mill Creek Project was exchanged for the use of two culinary quality wells used for irrigation purposes. The exchange provided for the economical development of additional sources of culinary water and the full development of surface water associated with the Mill Creek Project. This arrangement is now included in the recent merger of these entities into the Grand Water and Sewer Service Agency (GWSSA).

If growth in Spanish Valley continues at the present rate, the culinary water demand will soon exceed the current supply of high quality supplies. The (GWSSA) would be short 4,234 acre-feet to meet the demand when full build-out occurs. Rights already exist for 3,582 acre-feet of groundwater and they are planning to obtain 650 acre-feet of surface water from the Colorado River. The Grand County Regional Public Drinking Facilities Plan recommends a study to quantify the amount of high quality groundwater that can be developed in the Glen Canyon Group aquifer. This study is now underway.

### 11.6.3 City of Blanding

The City of Blanding has developed a culinary water supply that will meet projected demands beyond the year 2050. There is a need to increase the capacity of their water treatment plant and to construct an additional storage tank. Plans are underway to construct these facilities.

### 11.6.4 Town of Castle Valley

The Town of Castle Valley has a study underway to determine the impact of additional septic tank systems on the existing groundwater supply. The study will also determine how much development can occur within the alluvial aquifer. At some point in time, consideration should also be given to installing a community culinary water system along with a sewerage system to replace the existing individual wells and septic tanks.

### 11.6.5 Navajo Nation

There is a dire need for additional culinary water development within the Navajo Indian Reservation, not only to meet current needs but for projected demands as well. The Navajo Nation has eight projects that need to be implemented in the near future with planning on an additional three projects. There are an additional 55 projects that have been proposed. Total cost for these projects is estimated at about $26 million. ❑

# Contents

Section 12

# Southeast Colorado River Basin

**Utah State Water Plan**

## Water Quality

### 12.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan discusses the water quality along with the state and federal clean water regulations. Emphasis is placed on background and the roles played by local, state and federal agencies involved in the development and enforcement of current water quality regulations. Some discussion of local water quality issues and problems is also included.

### 12.2 SETTING

Historically, the Southeast Colorado River Basin has been relatively free of major water quality concerns or problems, primarily due to the isolated nature of the smaller streams and the low population densities. This water supply is limited and its quality should be protected. Most of the water quality problems are in the larger Colorado and San Juan rivers.

#### 12.2.1 Surface Water Quality

The surface waters within the basin are generally of suitable chemical quality for agricultural, municipal and industrial uses, although treatment is required for drinking water. The total dissolved-solids (TDS) increase as the water flows downstream because of lower quality groundwater inflow and return flows from irrigation.

The surface water quality is generally adequate for irrigation of crops with the exception of Onion Creek and McElmo Creek. The Dolores River near Cisco has salinity limitations for irrigation of some crops. Although the long-term average salinity in most streams is below state standards, there are periods when total dissolved-solids are high, especially during low flows.

> Pristine water flows from the high mountain watersheds providing a high quality supply to the users downstream. Good water quality is easier to protect than recover.

Onion Creek Spring is fed by groundwater which leaches salts from the Paradox formation. These salts end up in Onion Creek about six miles above its confluence with the Colorado River. A measurement taken in 1966 with a flow of 55 gallons per minute showed the total dissolved-solids were 9,120 mg/L. Although McElmo Creek delivers large concentrations of dissolved-solids (up to 2,600 mg/L) to the San Juan River, irrigation is still practiced downstream where the total dissolved-solids are less than 700 mg/L.[66]

Surface water quality measurements have been taken at locations throughout the basin. The data for selected stations for the period of record are shown in Table 12-1. Location of the water quality monitoring stations are shown on Figure 12-1. The water quality at selected sites is shown on Figure 12-2.

#### 12.2.2 Groundwater Quality

Groundwater is found in two types of aquifers, alluvial deposits and consolidated rocks. The

**Table 12-1**
**SURFACE WATER QUALITY AT SELECTED STATIONS**

| Stream Gage Number and Name | Electro Conductivity (micromhos/Cm @ 25° C) | | | Total Dissolved Solids (mg/L) | | | No. of Samples |
|---|---|---|---|---|---|---|---|
| | Max | Min | Ave | Max | Min | Ave | EC/TDS |
| 09315000 Green River at Green River | 2,520 | 7 | 670 | 2,330 | 212 | 464 | 937/791 |
| 09180000 Dolores River near Cisco | 15,400 | 240 | 1,131 | 8,220 | 147 | 712 | 1,005/785 |
| 09180500 Colorado River near Cisco | 14,690 | 290 | 924 | 2,350 | 197 | 620 | 1,547/1,104 |
| 09182000 Castle Creek above Diversions | 300 | 140 | 204 | | | | 39/0 |
| 09183000 Courthouse Wash near Moab | 1,200 | 260 | 618 | | | | 54/0 |
| 09184000 Mill Creek near Moab | 820 | 110 | 211 | | | | 183/0 |
| 495646 Pack Creek at U-191 Crossing | 545 | 490 | 504 | 350 | 328 | 334 | 2/2 |
| 495915 Coyote Wash below Wilcox Trespass Reservoir | 5,300 | 1,140 | 2,129 | 3,340 | 690 | 1,221 | 4/4 |
| 495890 La Sal Creek at Utah-Colorado State Line | 685 | 185 | 278 | 312 | 108 | 174 | 17/17 |
| 495600 Kane Canyon Creek - Upper Site | 1,000 | 725 | 780 | 620 | 486 | 513 | 2/2 |
| 495604 Hatch Wash at mouth | 1,110 | 1,080 | 1,086 | 716 | 658 | 704 | 2/2 |
| 495581 Cottonwood Creek at Beef Basin Road Crossing | 615 | 484 | 559 | 360 | 282 | 328 | 7/7 |
| 09185800 Indian Creek Tunnel near Monticello | 360 | 160 | 211 | | | | 36/0 |
| 09378100 North Creek above Ranger Station near Monticello | 410 | 140 | 191 | | | | 12/0 |
| 09378170 South Creek above Reservoir near Monticello | 300 | 210 | 276 | | | | 8/0 |
| 100501350351 Monticello Municipal Watershed | | | | 192 | 88 | 125 | 0/4 |
| 09378200 Montezuma Creek at Golf Course at Monticello | 2,230 | 170 | 268 | | | | 27/0 |

Table 12-1 SURFACE WATER QUALITY AT SELECTED STATIONS (Continued)

| Stream Gage Number and Name | Electro Conductivity (micromhos/cm @ 25° C) | | | Total Dissolved Solids (mg/L) | | | No. of Samples |
|---|---|---|---|---|---|---|---|
| | Max | Min | Ave | Max | Min | Ave | EC/TDS |
| 495236 Dark Canyon above confluence/Colorado River | 1,225 | 85 | 1,223 | 768 | 596 | 768 | 2/2 |
| 09378600 Montezuma Creek near Bluff (@Montezuma Creek) | 3,240 | 560 | 1,635 | | | | 23/0 |
| 09378650 Recapture Creek below Johnson Creek near Blanding | 390 | 120 | 191 | | | | 32/0 |
| 100501250151 Blanding Municipal Watershed | | | | 440 | 110 | 194 | 0/8 |
| 495344 Recapture Wash at U-262 Crossing | 1,807 | 200 | 495 | 1,444 | 126 | 365 | 5/5 |
| 09378700 Cottonwood Wash near Blanding | 1,050 | 1 | 196 | 230 | 230 | 230 | 80/1 |
| 495330 Cottonwood Wash at U-163 Crossing | 935 | 329 | 536 | 940 | 226 | 541 | 18/18 |
| 09372200 McElmo Creek near Bluff (near Aneth) | 3,500 | 1,410 | 2,236 | | | | 32/0 |
| 371251109112110 San Juan River above McElmo Creek at Aneth | 1,750 | 1,750 | 1,750 | 1,230 | 1,230 | 1,230 | 1/1 |
| 09379500 San Juan River near Bluff (near Mexican Hat) | 2,310 | 237 | 677 | 1,800 | 7 | 490 | 1,970/1,303 |
| 495315 Comb Wash at U-163 Crossing | 4,850 | 610 | 1,050 | 2,936 | 260 | 458 | 10/9 |

Source: U.S. Geological Survey Water Resources Data.

Figure 12-1

**WATER QUALITY MONITORING STATIONS**

Southeast
Colorado River Basin

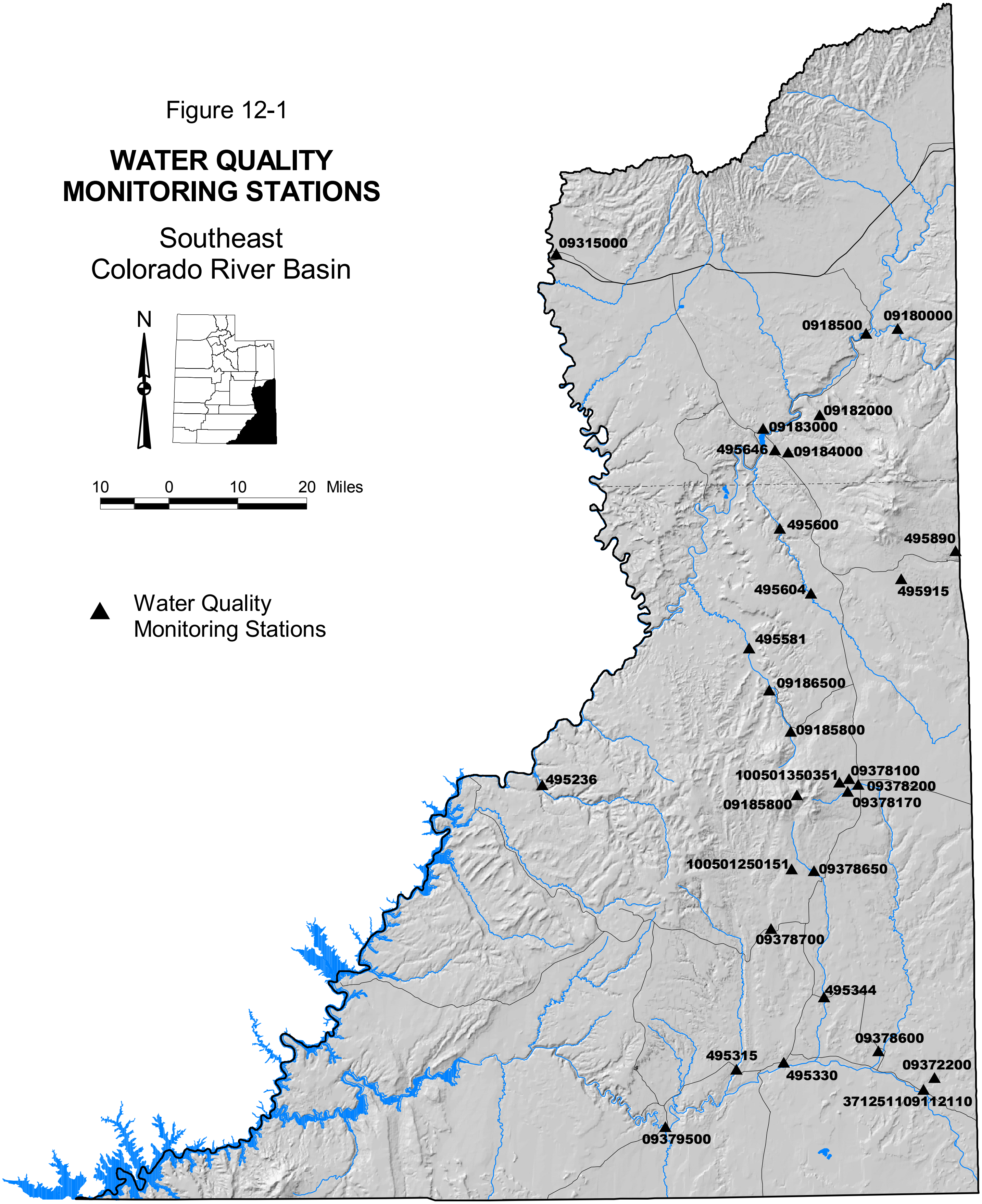
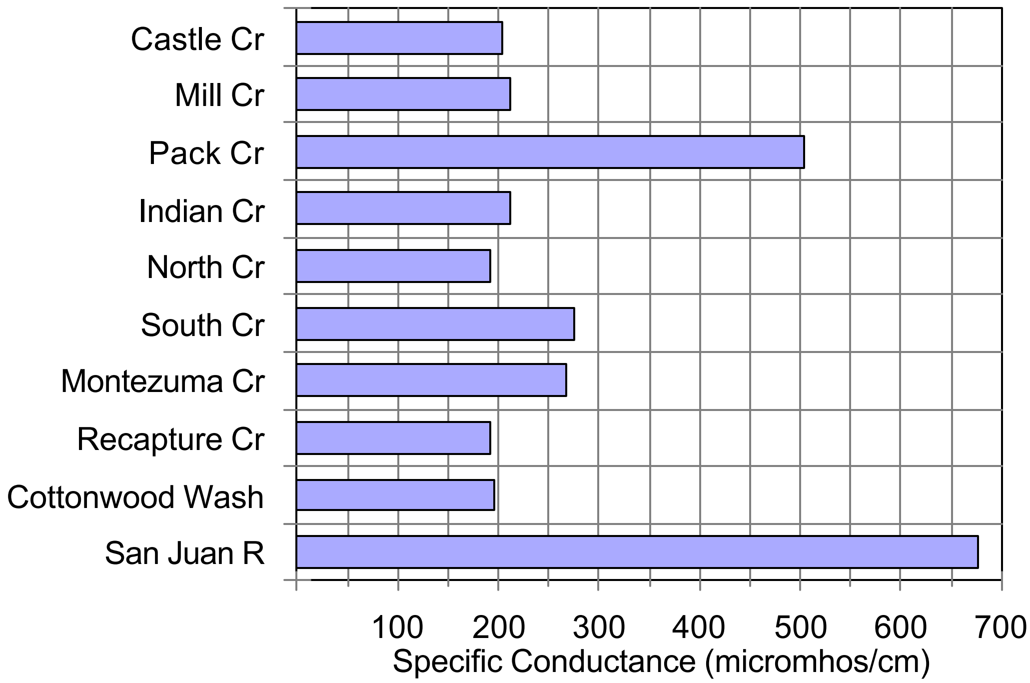


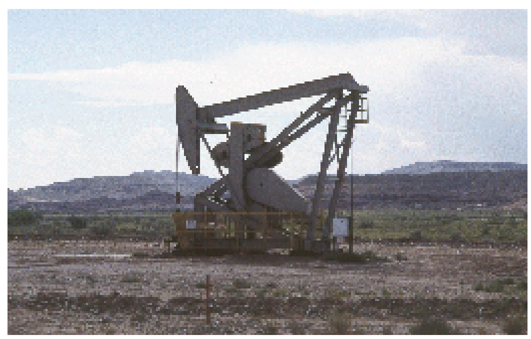
**Figure 12-2**
SURFACE WATER QUALITY




only significant alluvial aquifers are found in Spanish Valley, Castle Valley and the San Juan River flood plain. Water from these aquifers is of adequate quality to be used for culinary purposes without treatment although there are problems with taste in some locations. All other usable alluvial aquifers are small and isolated.

Consolidated rock formations containing groundwater aquifers underlie most of the area but yields are usually low. The volume and quality of water in consolidated rock aquifers depends upon the permeability, thickness, depth and location.

The most prolific consolidated rock water-bearing formation is the Navajo sandstone, the uppermost member of the Glen Canyon Group. Wells in the Spanish Valley area generally produce water with total dissolved-solids concentrations less than 500 mg/L (848 µmhos/cm) and over two-thirds of these wells with less than 250 mg/L (424 µmhos/cm).[36]



Groundwater contamination from oil wells

Samples taken from the Cutler formation in Castle Valley had total dissolved-solids ranging from 497 mg/L (842 µmhos/cm) to 2,572 mg/L (4,360 µmhos/cm). This aquifer contains calcium-magnesium-sulfate or calcium-magnesium-sodium-sulfate type water.[29,36] Wells sampled in the alluvial aquifer ranged from 211 mg/L (357 µmhos/cm) to 1,156 mg/L (1,960 µmhos/cm).

The Navajo sandstone is also the best water yielding formation in the **N aquifer** designation used in San Juan County (See Section 19). The Navajo sandstone is recharged from the Book Cliffs, La Sal Mountains, along the flanks of the Abajo Mountains, Sleeping Ute Mountain and the Carrizo Mountains.

Water in the recharge areas is fresh and mostly of calcium-bicarbonate or calcium-magnesium-bicarbonate types. As the water moves deeper and to more distant areas, the total dissolved-solids increase. Most of the bedrock aquifers yield water that is fresh (0 to 1,000 mg/L) to moderately saline (3,000 to 10,000 mg/L). The **D aquifer** contains fresh water except in areas where the recharge comes from areas underlain by the Mancos shale or its sediments. The **M aquifer** contains fresh water but the salinity increases with distance from surface recharge areas. Water in the **N aquifer** is fresh to moderately saline except near Aneth where it is very saline (10,000 to 35,000 mg/L) to briny (more than 35,000 mg/L). This aquifer is at its greatest depth in this area. The **P aquifer** water increases from 1,000 mg/L north of Monticello to more than 10,000 mg/L deeper and farther away. See Figure 3-5 and Section 19 for a description and additional data on these aquifers. Wells and springs have been sampled at many locations, at various depths and with many geologic sources. Data from selected samples are shown in Table 12-2.

## 12.3 ORGANIZATIONS AND REGULATIONS

Water quality is important to all users. Leadership in improving and maintaining water quality rests with local governments along with assistance from state and federal regulatory agencies.

### 12.3.1 Local

City, town and county units of government have the responsibility to follow and enforce state and federal laws and regulations in operation of their facilities. They take an active role in protecting wells, springs, and recharge areas, and in treating culinary and waste water. The Southeastern Utah District Public Health is also involved in water quality matters, checking waste treatment facilities such as septic tanks, lagoons and waste water treatment plants.

### 12.3.2 State

Utah has long been aware of the importance of maintaining adequate levels of surface and groundwater quality. With the passage of the Utah Water Pollution Control Act of 1953 (UWPCA), the present Water Quality Board came into being and was given a number of responsibilities including the power to adopt, enforce and administer regulations designed to protect the state's water quality. The Division of Water Quality (DWQ) assists the board in this responsibility. This includes enforcement of the Utah Water Quality Act and the federal Clean Water Act. The board and division are charged to maintain acceptable levels of water quality for a growing population. Increasing numbers of people also bring more recreational activity with added potential for pollution of surface streams and reservoirs as well as groundwater. This will require water quality agencies and water rights administrators to correlate their activities to assure state surface water and groundwater standards are met.

The Clean Water Act gives responsibility to the Department of Environmental Quality (DEQ) for the enforcement of regulations dealing with point and nonpoint source discharges. The DWQ is responsible for administration of the National Pollutant Discharge Elimination System (NPDES) and the Nonpoint Source (NPS) Program. The agricultural portion of the NPS program is carried out by the Utah Department of Agriculture and Food under contract with DEQ. Municipal wastewater treatment facilities and

Table 12-2
GROUNDWATER QUALITY AT SELECTED WELLS AND SPRINGS

| Location | Geologic Source | Date | Specific Conductance (µS/cm) |
|---|---|---|---|
| (D-25-23)17 Castle Valley near Placer Creek | Cutler formation | 12-95 | 2,900 |
| (D-25-23)7 Castle Valley nr confluence Placer & Castle Creeks | Alluvium | 12-95 | 300 |
| (D-23-21)27 Arches National Park | Wingate sandstone | 8-86 | 515 |
| (D-26-22)15 Moab, 2 miles Southeast between Mill & Pack Creeks | Glen Canyon Group | 8-85 | 360 |
| (D-39-24)13 Hatch Trading Post | Bluff sandstone | 8-60 | 598 |
| (D-29-23)4 Near La Sal Junction | Navajo sandstone | 1-64 | 760 |
| (D-31-23)32 Near Church Rock (junction of US-191 & SR 211) | Navajo sandstone | 4-83 | 305 |
| (D-34-23)1 Montezuma Creek, 1 mile South of Monticello | Dakota sandstone | 4-54 | 880 |
| (D-36-22)26 East side of Blanding | Burro Canyon formation | 3-83 | 510 |
| (D-38-22)23 White Mesa Community | San Rafael Group | 5-80 | 360 |
| (D-39-24)13 Hatch Trading Post | Bluff sandstone | 8-60 | 598 |
| (D-40-21)25 Bluff | San Rafael Group | 11-82 | 560 |
| (D-41-25)17 Aneth | Navajo sandstone | 10-64 | 11,100 |
| (D-41-25)4 Aneth, 3 miles North | Glen Canyon Group | 4-83 | 4,890 |
| (D-40-24)17 Montezuma Creek, 3 miles North | San Rafael Group | 9-54 | 3,990 |
| (D-40-24)20 Montezuma Creek, 3 miles North (spring) | Morrison formation | 9-54 | 867 |
| (D-41-24)31 Montezuma Creek, 6-1/2 miles South-Southwest | Recapture member-Morrison fm | 10-54 | 1,030 |
| (D-43-23)32 Montezuma Creek, 15 miles South (spring) | Wingate sandstone | 8-49 | 662 |
| (D-42-22)29 Bluff, 15 miles South (spring) | Navajo sandstone | 10-54 | 384 |
| (D-42-19)7 Mexican Hat | Cutler-Halgaito Tongue member | 4-56 | 1,190 |

Note: All sites are wells unless otherwise noted.

Moab waste water treatment plant

industries discharging pollutants into Utah waters are issued a Utah Pollutant Discharge Elimination System permit. These permits are valid for five years. Since the initial passage of the Utah Water Pollution Control Act, nine wastewater treatment facilities have been constructed in the basin. These facilities include one plant employing mechanical secondary treatment and eight plants employing lagoon systems. A summary of these plants and their respective treatment processes is given in Table 12-3.

The DWQ developed a "Ground Water Quality Protection Strategy" based on an executive order by the governor in 1984. This strategy requires groundwater discharge permits for activities with the potential for pollution. The DWQ has also established classifications for surface water based on beneficial use. To help control water quality, the streams, reservoirs and lakes are assigned standards for maximum contaminant levels according to four major beneficial use designations. These uses are: 1) Drinking water, 2) swimming and indirect contact recreation, 3) stream, lake, and wetland dependent fish and wildlife, and 4) agriculture. Table 12-4 shows the current beneficial use of water quality classes for lakes and storage facilities. Table 12-5 shows the use classification for streams.

In addition to the assigned use classes, some surface waters are designated as High Quality Waters - Category 1. Indian Creek and its tributaries through Newspaper Rock State Park to the headwaters fall in this category.

**12.3.3 Federal**

Congress passed the federal Water Pollution Control Act in 1972 to establish regulatory programs to improve the quality of the nation's waters. In 1977, the act was amended and became known as the Clean Water Act (CWA). Additional amendments were made in 1987. The CWA amendments provided additional regulations to deal with the growing national toxic water pollutant problem. The act further refined EPA's enforcement priorities and substantially increased the authority to enforce new federal mandates.

In the mid-1950s, the federal government began offering funding programs to state water pollution control agencies to assist in the ongoing construction of wastewater treatment facilities. These early grants provided funding to cover 30 to 55 percent of all construction costs for a given wastewater treatment facility. Federal grants, along with monies provided through the Utah Water Pollution Control Act (UWPCA), funded the construction and expansion of three wastewater treatment facilities in the Southeast Colorado River Basin. Since 1972 federal and state water quality assistance programs have provided over $400,000 and $2.7 million in grants and loans, respectively, for various improvements to treatment facilities owned and operated by the City of Moab, Spanish Valley Water and Sewer Service Agency and the San Juan County Special Service District No. 1.

Although there are no Colorado River Salinity Control Program projects located in the Southeast Colorado River Basin, the McElmo Creek and Paradox Valley projects in Colorado impact waters flowing into and through Utah. On-farm irrigation system improvements are being installed to reduce the salt loading to McElmo Creek, the San Juan River and Colorado River. The Paradox Valley Unit intercepts saline brines before they reach the Dolores River and disposes of them by deep well injection, reducing the salt loading to the Colorado River up to 128,000 tons annually. Other federal agencies also have strong interests

| Table 12-3<br>SUMMARY OF WASTEWATER TREATMENT FACILITIES | | |
|---|---|---|
| Facility | Opening Agency | Treatment Process |
| **Grand** | | |
| Moab | City of Moab | Tickling Filter with Primary Clarification and Sludge Digestion |
| **San Juan County** | | |
| Blanding | City of Blanding | Facultative Lagoons |
| Dangling Rope | National Park Service | Total Containment Lagoons |
| Hall's Crossing | National Park Service | Total Containment Lagoons |
| Hite Marina | National Park Service | Total Containment Lagoons |
| Monticello | City of Monticello | Facultative Lagoons |
| Natural Bridges NM | National Park Service | Total Containment Lagoons |
| San Juan County SSD No. 1 | San Juan County SSD No. 1 | Total Containment Lagoons |
| San Juan Marina | | Total Containment Lagoons |

Source: State Division of Water Quality data base.

Table 12-4
SURFACE STORAGE CLASSIFICATIONS

| Name | Capacity (acre-feet) | Beneficial Use Classes | | | | | | Trophic Status |
|---|---|---|---|---|---|---|---|---|
| | | 1C | 2A | 2B | 3A | 3B | 4 | |
| Blanding City No. 4 | 520 | X | | X | X | | X | 46.74 |
| Ken's Lake | 2,820 | | | X | X | | X | 45.01 |
| Loyd's Lake | 3,500 | X | | X | X | | X | 47.02 |
| Monticello Lake | 27 | | | X | X | | X | 45.46 |
| Recapture Creek | 9,319 | | | X | X | | X | 44.50 |

Trophic Status Index (TSI) refers to the nutrient status, biological production and morphological characteristics of the water. TSI less than 40 = Oligotrophic, TSI 40 to 50 = Mesotrophic, TSI over 50 = Eutrophic. The lower the number, the better the water.
See Table 12-5 for beneficial use classifications.
Source: Division of Water Quality.

| Table 12-5<br>STREAM CLASSIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| Stream Reach | Use Classification | | | | | |
| San Juan River and tributaries, from Lake Powell to Colorado state line except as listed below. | 1C | 2B | | 3B | | 4 |
| Johnson Creek and tributaries, from confluence with Recapture Creek to headwaters | 1C | 2B | 3A | | | 4 |
| Verdure Creek and tributaries, from highway US-191 crossing to headwaters | | 2B | 3A | | | 4 |
| North Creek and tributaries, from confluence with Montezuma Creek to headwaters | 1C | 2B | 3A | | | 4 |
| South Creek and tributaries, from confluence with Montezuma Creek to headwaters | 1C | 2B | 3A | | | 4 |
| Spring Creek and tributaries, from confluence with Vega Creek to headwaters | | 2B | 3A | | | 4 |
| Montezuma Creek and tributaries, from U.S. Highway 191 to headwaters | 1C | 2B | 3A | | | 4 |
| Colorado River and tributaries from Lake Powell to Colorado state line except as listed separately | 1C | 2B | | 3B | | 4 |
| Indian Creek and tributaries, from confluence with Colorado River to Newspaper Rock State Park | | 2B | | 3B | | 4 |
| Indian Creek and tributaries, through Newspaper Rock State Park to headwaters | 1C | 2B | 3A | | | 4 |
| Kane Canyon Creek and tributaries, from confluence with Colorado River to headwaters | | 2B | | | 3C | 4 |
| Mill Creek and tributaries, from confluence with Colorado River to headwaters | | 2B | 3A | | | 4 |
| Dolores River and tributaries, from confluence with Colorado River to Colorado state line | | 2B | | | 3C | 4 |
| Rock Creek and tributaries, from confluence with Dolores River to headwaters | | 2B | 3A | | | 4 |
| La Sal Creek and tributaries, from Colorado state line to headwaters | | 2B | 3A | | | 4 |
| Lion Canyon Creek and tributaries, from Colorado state line to headwaters | | 2B | 3A | | | 4 |

Table 12-5 (Continued)
STREAM CLASSIFICATIONS

| Stream Reach | Use Classification | | | | | |
|---|---|---|---|---|---|---|
| Little Dolores River and tributaries, from confluence with Colorado River to Colorado state line | | 2B | | | 3C | 4 |
| Bitter Creek and tributaries, from confluence with Colorado River to headwaters | | | | | 3C | 4 |

| | |
|---|---|
| Class 1 | Culinary raw water source |
| Class 1C | Domestic use with prior treatment |
| Class 2 | Instream recreational use and aesthetics |
| Class 2A | Primary human contact - swimming |
| Class 2B | Secondary human contact - boating, wading, etc. |
| Class 3 | Instream use by aquatic wildlife |
| Class 3A | Habitat maintenance for cold water game fish, water-related wildlife and food chain organisms |
| Class 3B | Habitat maintenance for warm water game fish, water-related wildlife and food chain organisms |
| Class 3C | Habitat for non-game fish, water-related wildlife and food chain organisms |
| Class 3D | Habitat for water fowl, shore birds, water-related wildlife and food chain organisms |
| Class 4 | Agricultural - livestock and irrigation water |

Source: Division of Water Quality

and responsibilities concerning the quality of local surface and groundwater supplies. These agencies include the Environmental Protection Agency (EPA), Bureau of Land Management, National Park Service, Forest Service and Bureau of Reclamation. The EPA administers federal water quality law and regulations including the Clean Water Act.

## 12.4 WATER QUALITY PROBLEMS AND NEEDS

It is important to maintain or improve the water quality as more development and use tend to increase pollution. A major water quality issue is degradation of surface streams due to nonpoint source contaminants. The loss of ground cover within some drainages has increased the concentration of some contaminants and levels of total dissolved-solids in local streams. There is also potential for contamination of critical groundwater aquifers by human waste disposal and by large mining operations. Groundwater is the most difficult to restore once it has been contaminated.

### 12.4.1 Watershed Water Quality Study

The Division of Water Quality has initiated an intensive monitoring program within the basin. This program is designed to set the benchmarks for further studies which will define sources of pollutants entering rivers and streams. Further studies of chemical and biological loadings will be conducted where water quality parameters exceed state standards. The approach is to determine where the problems are, quantify them, and then develop a systematic approach to improve the water quality deficiencies where possible. In situations where it is impossible to reduce the concentration of certain pollutants to meet established water quality standards, an analysis will be made to evaluate changing the beneficial use classifications to meet the real world use of existing stream and river systems. A summary of findings and the resulting recommendations to control contamination is due in the near future.

Data is available from the latest DWQ report submitted to the Environmental Protection Agency in 1998. Table 12-6 lists the water bodies where the total maximum daily loads (TMDLs) need to be addressed in order to bring them into compliance with current regulations. Water bodies with Utah Pollution Discharge Elimination System discharge permits are also listed. If it is determined that the status of a water body is changed or that it is meeting the designated beneficial uses, then the listing can be changed.

The water quality in the Navajo sandstone aquifer deteriorates as it moves downdip from the recharge areas where it generally contains less than 250 mg/L of dissolved solids.[21] The recharge areas are in Dry Valley and surrounding areas north of Monticello, the headwaters of Cottonwood Wash northwest of Blanding, and the Nokaito Bench south of Bluff. Water in the recharge areas comes from surrounding high mountains. The water quality also changes from a calcium bicarbonate type to sodium chloride type and the dissolved-solids concentration increases.

### 12.4.2 Moab Uranium Tailings Pile Contamination

There has been concern for some time over groundwater and Colorado River water contamination caused by the uranium tailings pile at the north edge of Moab. This tailings pile containing 10.5 million tons was left by the Atlas Corporation after the Moab uranium mill closure. The pile, which includes much of the dismantled mill, is about 40 feet high and covers about 150 acres. The tailings pile is near the banks of the Colorado River and also covers an area where groundwater outflow from Spanish Valley moves toward the river. A study was commissioned by the federal Department of Energy to determine possible contamination. The Oak Ridge National Laboratory conducted the study in 1997. It was determined about one-half pound of uranium was being leached into the Colorado River every day. Even if the tailings pile were capped, there would still be seepage of nearly four gallons per minute (57,600 gallons per day) into the river. There were also other more serious toxic contaminants getting into the river with ammonia being the most detrimental.

Moab uranium tailings pile

There is concern the contaminants will threaten the existence of the four species of endangered fish. Also, the lower Colorado River water users are concerned the contaminants from the tailings pile will pollute the drinking water supply for millions of people in southern California.

### 12.4.3 Spanish Valley Groundwater Contamination

The largest unconsolidated aquifer located in Grand and San Juan counties is in the Spanish Valley. Well samples taken had total dissolved-solids concentrations ranging from 154 to 1,820 mg/L. Most of the wells showed total dissolved-solids concentrations less than 1,000 mg/L. Nitrate concentrations were found up to 26 mg/L, over 2.5 times the state water quality standard of 10 mg/L. The nitrate plus nitrite concentrations in the groundwater ranged from

| Table 12-6<br>WATER QUALITY IMPAIRED WATER BODIES | | | |
|---|---|---|---|
| Water Body/ Name | Pollutant or Stress Factor | Priority for TMDL | Target for TMDL (4/2000) |
| **Reservoir** | | | |
| Blanding City #4 | Dissolved oxygen, pH | Low | No |
| Dark Canyon | Dissolved oxygen | Low | No |
| Ken's Lake | Temperature, pH | High | Yes |
| Loyd's Lake | Dissolved oxygen | Low | No |
| Recapture Creek | Total phosphorus, dissolved oxygen, temperature, pH | Low | No |
| **River/Stream** | | | |
| San Juan R w/ exceptions | Lead, copper, zinc, total dissolved solids, sediment | Low | No |
| Montezuma Creek | Dissolved oxygen, lead, zinc, total dissolved solids, sediment | Low | No |
| Verdure Creek | Total dissolved solids, sediment | Low | No |
| North Creek | Total dissolved solids, sediment | Low | No |
| South Creek | Total dissolved solids, sediment | Low | No |
| Spring Creek | Total dissolved solids, sediment | Low | No |
| Dolores River & tributaries | Total dissolved solids, iron, ammonia, sediment | Low | No |
| **Water Bodies Needing UPDES Discharge Permit Renewals** | | | |
| Hatch Wash/ Kane Canyon Creek [a] | Oil and grease, COD, pH, radium 226, total dissolved- solids, total suspended solids, uranium | High | Yes |
| Montezuma Creek [a] | BOD, fecal coliform, total coliform, pH, suspended solids, total suspended solids | High | Yes |

[a] Receiving water not listed as impaired.

Note: A TMDL (total maximum daily load) is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources. The allowable load must include a margin of safety and allow for seasonal variations.
Source: Utah's 1998 303(d) List of Waters

0.04 to 5.87 mg/L. The nitrate plus nitrite concentrations in the central part of the valley of greater than 3 mg/L could come from human activities, probably the use of septic tanks.

### 12.4.4 Comb Wash Degradation

The intense grazing practices beginning in the 1880s depleted the native vegetation and allowed increased erosion and down-cutting of the stream channels in many drainages. Deposition was documented in the Comb Wash area during the 1940s and 1950s in many of the valley bottoms. These conditions have allowed a growth of pinyon-juniper covering over 180,000 acres to the point there is little understory vegetation, creating an erosion and wildfire hazard. There has also been an increase in pollutants in streams. Specific trend studies for the Comb Wash grazing allotments can be found in the Comb Wash Watershed Assessment and Soil Survey of San Juan County, 1993.

In addition, the use of the area by recreationists has increased the human waste problem. Samples taken on Comb Wash at the SR-163 bridge have exceeded the state standards for fecal coliform during the period 1978-81 and total coliform standards were exceeded in 1981. No data are available since then.

There were 31 water samples taken during September 1995 of spring water in Road Canyon.[56] Of these, 14 samples with total dissolved-solids of about 1,092 mg/L (1,850 µS/cm) exceeded the state standard. Five samples taken on Arch Canyon at the March Creek mouth had a maximum of 590 mg/L (1,000 micromhos/cm), a minimum of 186 mg/L (316 micromhos/cm) averaging 28.2 mg/L (478 micromhos/cm). At Comb Wash below Fish Creek, samples showed a maximum of 3,540 mg/L (6,000 micromhos/cm), a minimum of 628 mg/L (1,064 micromhos/cm) with an average of 798 mg/L (1,352 micromhos/cm).

In the lower part of the Comb Wash drainage, the suitability for range seeding is poor because of the low precipitation. Seeding can be done in some areas using native plants such as prostrate kochia or wheatgrass. Proper grazing management with scattered water developments can maintain or improve the watershed condition. Use of the area should be restricted to activities that will not contribute to the problems.

### 12.4.5 Potential Industrial Groundwater Contamination

The region has supported a significant mining industry, especially for uranium ore. The processing of raw ore typically required significant quantities of water and generated large tonnages of spent or processed ore in stockpiles near local processing plants. Contamination of groundwater from the infiltration of process water from lagoons and the infiltration of leachate from spent ore piles are serious concerns. The Division of Water Quality has measured increased concentrations of various contaminants in the regional aquifer around Moab.

Mining tailings pond

Preliminary investigations to assess the movement of water within local aquifers indicate the possible source of contamination to be leachate from local mining lagoons and ore piles. An example is the oil well brine being disposed of in lagoons between Bluff and Montezuma Creek. Water from wells tested in the Bluff area varied in specific conductance from 405 to 780 µS/cm (239 to 460 mg/L) and was of sodium bicarbonate type. In the Aneth area, samples from the Navajo sandstone aquifer showed a median specific conductance of about 3,000 μS/cm (1,770 mg/L).[61] Samples from 56 wells ranged from 145 mg/L to 17,300 mg/L with 17 wells testing less than 1,000 mg/L. This indicates possible contamination as a result of oil development in the Aneth area. Another example is the remains of uranium processing piles such as the one at Moab. See Section 12.4.2 for more detail on the uranium pile near Moab.

## 12.5 ISSUES AND RECOMMENDATIONS

There are two issues. These discuss septic tanks and mining tailing ponds.

### 12.5.1 Septic Tank and Drain Field Contamination

Issue - The continued installation of residential septic tanks and drain fields pose a threat to local groundwater aquifers.

Discussion - The more populated areas of the basin are experiencing moderate rates of population growth producing equal rates of domestic waste. The Castle Valley and Spanish Valley areas of the basin have residential developments that are not served by a community sewer disposal system. As a result and with the indicated population growth, domestic septic tank effluent is entering local groundwater aquifers at increasing rates. Areas of high contamination potential should be identified with appropriate limitations placed on future development in these areas. The indicated limitations should be implemented by changes in local zoning ordinances and related city/county planning regulations.

Recommendation - The extent or scope of a potential groundwater contamination problem from individual domestic waste systems should be evaluated by local health districts, the Division of Drinking Water and Division of Water Quality.

### 12.5.2 Regional Contamination by Mining Tailing Ponds

Issue - The operation of tailing ponds at some local mining operations potentially threaten to contaminate regional groundwater aquifers with heavy metals and other contaminants.

Discussion - The Southeast Colorado River Basin contains relatively large deposits of a number of minerals and petroleum resources subject to heavy mining and processing activity. The most prominent activities are associated with the mining of various precious metals, uranium deposits and the operation of oil and gas fields.

All of the indicated mining activities incorporate tailing ponds as a major element of the overall processing requirement. Most of these ponds are constructed and operated to standards established by either or both, state and federal regulations. However, leakage from local processing or tailings ponds occurs for a number of reasons that typically include substandard construction, installation of faulty liner materials, poor operation, and poor reclamation management of abandoned or shutdown plants.

Materials found in tailing ponds are generally toxic, carcinogenic and subject to strict state and federal drinking water standards. The migration of these contaminants into regional groundwater systems is potentially disastrous to municipal water systems that pump water from these aquifers. Currently, there are over 20 mines in active operation and an estimated 70 mines in various active-inactive states of operation or reclamation. Operations at 5 mines have been suspended due to potential groundwater contamination from onsite processing ponds. These mines are currently subject to groundwater monitoring programs administered by the State Division of Oil Gas and Mining; Division of Water Quality (DWQ); and the federal Nuclear Regulatory Commission (NRC).

The NRC administers permits that regulate the operation of tailing ponds used in the uranium mining and milling industry. Operators of uranium tailing ponds must install and maintain groundwater wells to monitor any potential migration of uranium contaminated leachate to underlying groundwater aquifers.

The DWQ administers permit programs regulating the operation of the remaining mining industries that utilize tailing ponds in the overall milling process. The DWQ administers both NPDES permits for surface water discharge and groundwater contamination permits for all tailing pond installations in the basin.

In recent years, the DWQ has registered concern and disagreement with the NRC's administration of groundwater monitoring programs for uranium tailing ponds within the state. The DWQ feels that current NRC requirements allow for an unacceptable level of probability for major groundwater contamination events. As a result, the DWQ will require the operators of uranium mining and milling plants to meet more stringent state regulations for groundwater contamination in the near future.

<u>Recommendation</u> - The Nuclear Regulatory Commission and Division of Water Quality must continue to aggressively monitor existing groundwater conditions in the immediate area of existing tailing ponds and strictly enforce all NPDES permit requirements associated with the operation of existing mining operations. ❑

# Contents

Section 13

# Southeast Colorado River Basin

**Utah State Water Plan**

## Disaster and Emergency Response

### 13.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan discusses naturally occurring disasters and emergency response programs along with measures to reduce personal injury and loss of property. Information and data are provided on past disasters along with organizations where assistance can be obtained.

### 13.2 BACKGROUND

The Southeast Colorado River Basin consists of a number of small drainages that discharge to the Green, Dolores and San Juan rivers and ultimately to the Colorado River. Those drainages with perennial streams often have communities located in close proximity. Many of the remaining drainages are dry washes in isolated or sparsely populated areas with only minimal opportunity for major flood-related damage. In all of the tributaries, high intensity cloudbursts will produce flash floods. If this happens in an area where there is development, there will be damage and possible loss of life.

Droughty cropland

The National Flood Insurance Program (NFIP) was established by Congress in 1968 to relieve taxpayers of large financial subsidies when flooding destroyed property, disrupted daily activities and threatened lives. This program is administered by the Federal Emergency Management Agency (FEMA) and requires flood insurance on all development within the 100-year flood plain if assistance is requested. Lack of insurance denies use of any federal or federally insured funds for development in flood plains. To date, there has been limited mapping of flood plains and there is little involvement in the NFIP.

> Often with no warning, disasters damage the resources, destroy cultural developments and take human lives. This can be mitigated with proper preparedness planning and action.

The basin is regularly subjected to varying degrees of drought. During the time-periods of 1886-1896, 1932-1937, and 1950-56, precipitation was extremely low. There were other years when precipitation was below normal and water supplies were below average such as 1977 and 1995-6. The lowest annual precipitation records for three stations were Blanding, 4.93 inches, 1956; Moab, 4.79 inches, 1954; and Monticello, 6.56 inches, 1950. Monticello has the highest average annual precipitation with 15.5 inches.

Blanding reports about 13 inches of annual precipitation and Moab has 9 inches. Precipitation in the upper watersheds of the La Sal Mountains is over 30 inches and in the Abajo Mountains reaches 25 inches. With only this amount of precipitation on relatively small areas, the groundwater storage in the upper watersheds is inadequate to sustain flows in the lower reaches of the streams. This also impacts the flow of springs in the lower elevations. As a result, lower than normal precipitation will soon result in a drought situation.

Other types of disasters or emergencies are not as prevalent. There are no major active faults and there is not a high volume of hazardous materials shipped through the area.

### 13.3 ORGANIZATIONS AND REGULATIONS

Natural disasters can cause extreme damage as well as impact lives. To effectively prepare for the most common types of disasters and manage the eventual cleanup and rebuilding process, a complex organization must be in place consisting of local, state and federal agencies and organizations. This organization begins at the local level.

In the event of a disaster, assistance is first provided by local agencies. This response is directed by the assigned Local Disaster Coordinating Officer (LDCO) who is responsible for coordinating all efforts by local fire departments, police, emergency medical staff and utility agencies. The LDCO will establish a local operations center from which to direct all emergency and first response efforts and to report the status of all assistance and relief efforts to state and federal authorities. The position responsible for disaster response in each county is shown in Table 13-1.

To provide an effective "first response" to a natural disaster, local governments have been directed to:

- Prepare an operations plan for the coordination of responses with other agencies
- Provide the necessary resources to support natural disaster emergency relief operations.
- Assign and train the personnel required to perform natural disaster relief functions.
- Provide the State Disaster Coordinating Officer (SDCO) with copies of current emergency operations plans.

In the event property damage and personal injury exceed the management and response capability of local agencies, the governor, at his discretion, can declare a "State of Emergency" and provide state assistance and request federal assistance. Once a "State of Emergency" is declared, the Governor's State Disaster Coordinating Officer (SDCO) assumes all responsibility. The SDCO will work with, and generally manage, the activities of local disaster coordinators so assistance and aid are properly distributed to disaster victims in an efficient and timely manner. The SDCO also serves as the governor's primary point of contact between the

Table 13-1
DISASTER RESPONSE RESPONSIBILITY

| **County** | **Responsible Position** |
|---|---|
| Grand | Director, c/o Grand County Sheriff’s Office |
| San Juan | Director, San Juan Co. Emergency Services |
| Navajo Nation | Department of Emergency Management |

Federal Coordinating Officer and state and local government disaster management officials.

The Division of Comprehensive Emergency Management (CEM) is the responsible agency at the state level for disaster related programs and for providing assistance. They assist towns, cities and counties to prepare emergency response and management plans. CEM also works closely with other state and federal agencies to assure needed manpower, equipment, materials and funding reach areas seriously impacted by a major disaster.

State and federal support agencies include the heads and staff of all state departments and divisions, the Governor's Office and FEMA. As part of the state's overall disaster response plan, selected state agencies should develop individual plans compatible and consistent with their full-time assigned responsibilities. The plan should outline specific procedures offering assistance and aid to reconstruct or reestablish damaged facilities.

When a state of emergency is declared by the governor, additional assistance can be requested at the federal level. At this point, the President can declare a "Federal Emergency" or "Major Disaster." This makes the impacted state eligible for federal emergency assistance through FEMA programs under Public Law (PL) 93-288.

A "federal emergency" is limited to funding required to save lives, protect property, restore essential public services that threaten public health or reduce the threat of personal injury and further loss of property. A "Major Disaster" provides funding to restore both public and private damaged property and to change existing conditions, either man made or natural, that would contribute to future disasters of the type and magnitude previously experienced.

Aid and assistance from federal disaster programs must be distributed under the direction of the Federal Coordinating Officer in direct cooperation with both the FEMA and the SDCO. At the local level, this assistance will be the responsibility of state and federal personnel assigned to the disaster field offices.

## 13.4 DISASTER PROBLEMS

As previously indicated, the Southeast Colorado River Basin will more likely be subjected to two kinds of disasters; floods and droughts.

### 13.4.1 Flooding Problems

The threat of a major flash flood is real and occurs on a regular basis. With the exception of Moab, the areas subject to flash flooding are sparsely populated and major property damage and personal injury are minimal or nonexistent.

Three climatological reporting stations recorded over three inches of precipitation in one day. These precipitation amounts could be the result of a short-duration cloudburst which can produce flash flooding. These record precipitations are: Moab, 3.99 inches; Cedar Point, 3.75 inches; and Monticello, 3.38 inches. It is also possible to have flash floods produced with less precipitation if it occurs in a short time-period.

Flood plain studies have been conducted on some drainages. The Corps of Engineers (COE) has completed studies on miscellaneous tributaries of the Colorado River above Lees Ferry, the San Juan River, and a number of small studies within the Navajo Nation to address the potential for flooding and related property damage. These studies determined that major flood control projects are not economically feasible.

Flooding in Mill Creek (Courtesy City of Moab)

Grand County was mapped by FEMA in 1983 for existing flood hazards. The county has chosen not to participate in the NFIP. As a result, all individual residences and commercial and industrial businesses in unincorporated communities and areas of the county do not qualify for NFIP. In addition, emergency funding may also be limited in the event of a presidentially declared flood disaster.

The COE has made the most comprehensive effort to quantify and map flooding events in the more populated areas. A study completed in 1994 identified the 100-year flood plain for both Mill and Pack creeks near the town of Moab and determined that the 100-year flood event was 10,500 cfs and 7,800 cfs, respectively. Although the 100-year flood for Mill Creek is expected to approach the wastewater treatment facility and hospital, the impact is projected to be minimal.

Moab is the only community in Grand County participating in the NFIP. There are about 56 flood insurance policies with a total coverage of over $3.8 million. Figure 13-1 shows the 100-year flood plain for the City of Moab.

San Juan County started participating in the NFIP in 1985. There are no listed active flood insurance policies. However, some individual residences and smaller communities within rural San Juan County are actively participating in the NFIP as an overall participating community. Monticello has identified special flood hazard areas but has elected not to participate in the NFIP. As a result, they would only receive limited funding in the event of a presidentially declared flood disaster. A flood plain map for Monticello was prepared in 1976. This is shown on Figure 13-2.

### 13.4.2 Drought Problems

The Southeast Colorado River Basin experiences periodic drought conditions at frequent intervals. These result in large losses of cultivated crops and rangeland vegetation.

The water supply for Spanish Valley is more consistent than other tributary streams in the basin. There were only three years during the 1950-93 period of record where the flow was less than 50 percent of the long-term average and only six additional years where it was less than 75 percent of average. The impact of drought has been more moderate here than in the rest of the basin.

The water supply in the Monticello/Blanding area is much more erratic. There were 14 years during the 1966-98 period of record where the stream flow was less than 50 percent of the long-term average and only 2 years where it was between 50 and 75 percent of average.

Alkali playa - sign of drought

Due to a severe drought extending from the fall of 1995 into the summer of 1996, the U.S. Department of Agriculture declared Grand and San Juan counties primary disaster areas in June of 1996. At the same time, the Governor of Utah declared these counties official disaster areas. This made the farmers and ranchers eligible for federal disaster relief assistance.

### 13.4.3 Other Disaster Problems

Other disaster or emergency situations include earthquakes, hazardous waste spills and wildfire. The Colorado Plateau is essentially devoid of any major earthquake activity. There has never been an earthquake larger than magnitude 4.0 on the Richter scale recorded in this area. The danger from hazardous spills is low. The only major transportation routes are I-70 and the Denver and Rio Grand Railroad, both in the

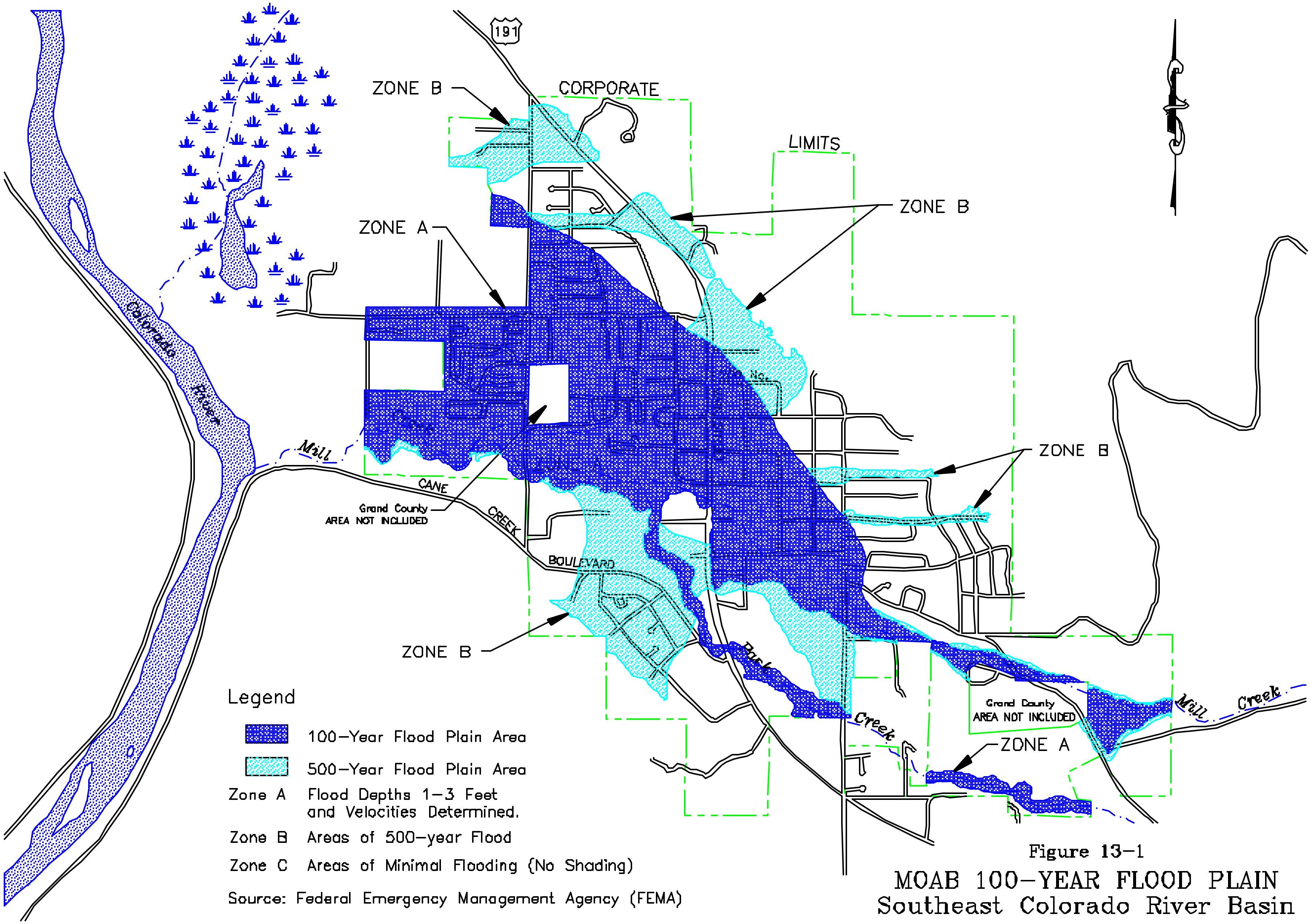
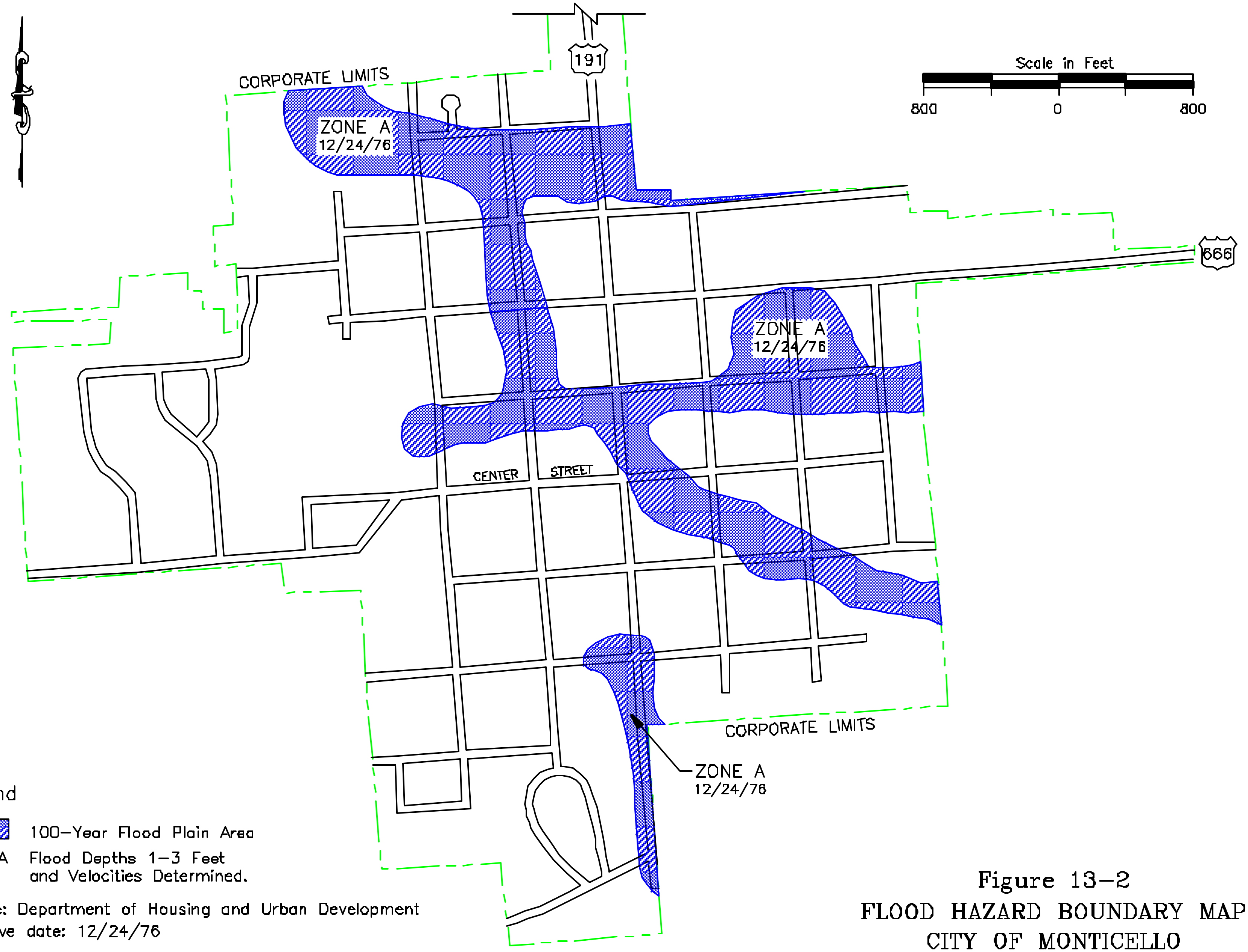



Figure 13-1
MOAB 100-YEAR FLOOD PLAIN
Southeast Colorado River Basin




Legend

100–Year Flood Plain Area

Zone A Flood Depths 1–3 Feet and Velocities Determined.

Source: Department of Housing and Urban Development
Effective date: 12/24/76

Figure 13–2
FLOOD HAZARD BOUNDARY MAP
CITY OF MONTICELLO
Southeast Colorado River Basin

northern part of the basin and U.S. Highway 191, running north and south. It is unlikely there will be spills along these routes.

The pinyon and juniper tree population in the lower washes of the basin have increased, primarily due to the loss of ground cover beginning in the 1880s. One area of concern is west of Monticello and Blanding in Comb Wash Canyon. The density of juniper trees has resulted in a fuel build-up with potential for wildfire.

The Bureau of Land Management (BLM) Moab District Fire Management Plan identifies an estimated 180,000 acres of local forest land, primarily in Comb Wash Canyon, as having a high risk for wildfire. Local land management agencies, including the Bureau of Land Management, are studying feasible options to reduce the wildfire potential. Possible solutions include changes in livestock grazing management, woodland management and recreation use patterns. More specific recommendations are presented in the BLM Watershed Management Plan.[55]

## 13.5 MITIGATION ALTERNATIVES

In order to respond to natural disasters and emergencies, local governments need to prepare Emergency Operation (Disaster Response) Plans and response teams must be prepared to act. This requires maintaining contact with local, state and federal agencies as needed. They should assess and update effective communications, medical facilities, survival equipment and education programs. Also, Emergency Action Plans need to be in place for all privately-owned water storage dams.

The Water Management Branch, Navajo Nation is working closely with the Corps of Engineers to delineate flood-hazard prone areas and 100-year flood plain management strategies. This effort was authorized in the Water Resources Development Act of 1999. Portions of the San Juan River flood plain were delineated by Morrison-Mairle Inc. in the late 1980s.

The Navajo Nation has received funding from the Bureau of Reclamation to develop a "Drought Response Plan" during fiscal year 2000. The appropriate drought response will be based on the Standard Precipitation Index.

## 13.6 ISSUES AND RECOMMENDATIONS

There is one issue. This discusses the need for flood plain management.

### 13.6.1 Flood Plain Management

Issue - Most local governments do not have flood plain management plans.

Discussion - Many communities are located along or near the mouths of streams. These drainages can produce devastating floods causing property damage and endangering the health and welfare of the residents. Most of these floods are caused by high-intensity cloudburst storms which produce high flows for a short period of time.

The purpose of the National Flood Insurance Program is to: 1) Reduce flood loss, 2) prevent unwise development in flood plains, and 3) provide affordable flood insurance to the public. The requirements to qualify for benefits are discussed earlier in this section. The Division of Comprehensive Emergency Management coordinates this program. They can assist local communities in the implementation of the flood plain objectives.

Recommendation - Non-participating entities should become qualified to participate in the National Flood Insurance Program. The Division of Comprehensive Emergency Management should assist. ❑

# Contents

Section 14

# Southeast Colorado River Basin

**Utah State Water Plan**

## Fisheries and Water Related Wildlife

### 14.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan describes the fisheries and other water-related wildlife. A number of water-related issues affecting the status of fish and wildlife populations and their habitat are also discussed. Recommendations are given to improve management of water resources in order to protect and enhance fish and wildlife. The needs of sensitive, threatened and endangered species are emphasized. At the same time, it is recognized that game species must remain abundant in order to provide important recreational opportunities valued by people of all ages.

### 14.2 BACKGROUND

Prior to the influx of modern-day settlers, the area was home to generally healthy populations of native fish and wildlife species. These species were well established from high mountain to desert environments. In more recent times, populations of many fish and wildlife species have declined. This was brought about by several things, all a part of the settlement and development of the area.

A wide diversity of fish, wildlife and plant species are still found, interacting together as a functioning ecosystem. Table 14-1 presents a list of some fish and wildlife species present.

Water is needed for all wildlife and their habitat. Water creates wetlands needed by waterfowl. Along streams, riparian vegetation is used by a variety of wildlife for nesting, feeding and hiding. These plants also provide the shade needed to keep water temperatures suitable for coldwater species of fish and aquatic invertebrates. Riparian zones increase habitat diversity and are used by wildlife as travel and migration corridors.

> Sky, land and water; these provide the habitat for the birds, animals and fish that are here for the enjoyment of man.

Federally listed threatened or endangered species include the humpback chub, bonytail chub, Colorado pikeminnow, razorback sucker, bald eagle, peregrine falcon, Mexican spotted owl, and southwestern willow flycatcher. The Colorado River cutthroat trout, a state identified sensitive species, is covered by a conservation agreement. Many other state sensitive species of fish, birds, mammals, amphibians, reptiles and mollusks also occur in the basin.

#### 14.2.1 Sport Fish

Fishing is a popular pastime due to the diversity of sport fish species. Game fish range from trout at high elevations to warmwater species in the lower areas. There are native and introduced trout species, whereas all warmwater game species are exotic.

The Division of Wildlife Resources (DWR) manages the sport fish resources, primarily by stocking and fishing regulations. The type and level of fish stocking at each stream or lake is based on habitat capacity and angler use. Many

Table 14-1
SELECTED FISH AND WILDLIFE SPECIES*

**GAME FISH**
arctic grayling(E)
black bullhead(E)
black crappie(E)
bluegill(E)
brook trout(E)
brown trout(E)
channel catfish(E)
cutthroat trout(N,E)
green sunfish(E)
largemouth bass(E)
northern pike(E)
rainbow trout(E)
smallmouth bass(E)
striped bass(E)
walleye(E)
yellow bullhead(E)

**NONGAME FISH**
bluehead sucker(N)
bonytail chub(N)
brassy minnow(E)
bullhead minnow(E)
Colorado pikeminnow(N)
common carp(E)
fathead minnow(E)
flannelmouth sucker(N)
goldfish(E)
humpback chub(N)
leatherside chub(E)
mosquitofish(E)
mottled sculpin(N)
plains killifish(E)
razorback sucker(N)
red shiner(E)
redside shiner(E)
roundtail chub(N)
sand shiner(E)
speckled dace(N)
threadfin shad(E)
triploid grass carp(E)
Utah chub(E)
white sucker (E)

**FURBEARING MAMMALS**
badger(N)
beaver(N)
bobcat(N)
coyote(N)
grey fox(N)
kit fox(N)
mink(N)
muskrat(N)
racoon(E)
red fox(N)
ringtail(N)
river otter(N)
weasel(N)

**AMPHIBIANS**
boreal chorus frog(N)
boreal toad(N)
bullfrog(E)
canyon treefrog (N)
great basin spadefoot(N)
great plains toad (N)
New Mexico spadefoot(N)
northern leopard frog(N)
plains spadefoot(N)
red-spotted toad(N)
tiger salamander(N)
Woodhouse's toad(N)

**REPTILES**
Glen Canyon chuckwalla(N)
great plains rat snake(N)
many-lined skink(N)
painted desert glossy snake(N)
smooth green snake(N)
Utah milk snake (N)
Utah night lizard(N)

**GAME BIRDS**
California quail(E)
chukar partridge(E)
forest grouse(N)
Gunnison sage grouse(N)
mourning dove(N)
ringnecked pheasant(E)
waterfowl(N)
wild turkey(N)

**NONGAME BIRDS**
bald eagle(N)
ferruginous hawk(N)
golden eagle(N)
Mexican spotted owl(N)
osprey(N)
peregrine falcon(N)
shorebirds(N)
red-tail hawk(N)
rough-legged hawk(N)
southwestern willow flycatcher(N)

**BIG GAME MAMMALS**
desert bighorn sheep(N)
elk(N)
mule deer(N)
pronghorn antelope(N)
Rocky Mtn. bighorn(N)
rainbow trout(E)

**SMALL GAME MAMMALS**
black bear(N)
cottontail rabbit(N)
cougar(N)

**NONGAME MAMMALS**
black-footed ferret(N)
praire dog(N)

* N - native (indigenous) and E - exotic (introduced).

reservoirs and streams are stocked each year. Wild fish waters rely on natural reproduction to sustain the fishery. Most trout streams and warmwater environments are wild fish waters.

The lakes and reservoirs containing sport fish are shown in Table 14-2. Some of these waters have been classified by beneficial use (see Table 12-4). The DWR classification system for lakes is described as follows:

Reservoirs provide fisheries

**Class I Lakes -** These are large bodies of water that satisfy heavy fishing pressure. They support a large game fish population of one or more species in good condition. Natural reproduction and/or stocking of small fish maintain an excellent sport fishery.

**Class II Lakes** - These lakes are important because of their recreational value and support a large fish population in good condition of one or more species of game fish. Coldwater lakes in this class require stocking of small fish to maintain good fishing. Some Class II lakes are smaller and may have lower esthetic ratings or biological deficiencies.

**Class III Lakes and Reservoirs** - These normally provide fishing for those who reside within 50 miles. Some are in an area where there is little fishing and may be very important locally.

**Class IV, V, and VI Lakes and Reservoirs** - These contribute little to fishing opportunities. Some provide fishing where little fishery exists except when stocked with catchable trout.

Most streams have been classified for fish habitat to assist in management decisions. The classification for selected streams is shown in Table 12-5. Stream classifications are described as follows:

**Class I Streams -** These are top quality fishing waters and should be preserved and improved for fishery and similar recreational uses. These streams are generally outstanding in natural beauty and are of a unique type. They support large fish populations of one or more species of the more desirable game fish in good condition. Natural reproduction or the stocking of small fish maintains an excellent sport fishery.

**Class II Streams** - These are of great importance for fishing and are productive streams with high aesthetic value. Fishing and other recreational uses should be a primary consideration. They are moderate to large in size and may have some human development. Many Class II streams may be comparable to Class I except for size.

**Class III Streams** - These are the most common and support the bulk of stream fishing pressure. Water developments involving Class III waters should be planned to include fisheries as an important use.

**Class IV Streams** - These are typically poor in quality with limited fishery value. Fishing should be considered a secondary use. A few provide an important catchable fishery in areas where no other exists.

**Class V Streams** - These are now practically valueless for sport fishing but often important to nongame fish and other wildlife.

Table 14-2
RESERVOIR PHYSICAL AND BIOLOGICAL DATA

| Reservoir/Lake | Elevation (feet) | Surface area (acres) | Maximum depth (feet) | Fish species* |
|---|---|---|---|---|
| **Moab area:** | | | | |
| Ken's Lake | 5,048 | 86 | 70 | RT,BT,LB,BG |
| Blue Lake | 10,097 | 3 | 15 | RT,GR |
| Clark Lake (Oowah) | 9,358 | 1 | 8 | BK |
| Dark Canyon Lake | 9,950 | 6 | 30 | RT,BK |
| Don's Lake | 8,740 | 3 | 9 | RT |
| Hidden Lake | 8,800 | 2 | 13 | RT |
| Medicine Lake | 10,017 | 2 | 6 | RT,BK |
| Oowah Lake | 8,795 | 5 | 17 | RT,BK |
| Warner Lake | 9,348 | 2 | - | RT |
| South Mesa Lake | 7,580 | 10 | - | RT |
| **Monticello area:** | | | | |
| Foy Lake | 8,336 | 5 | 14 | RT,BK |
| Loyd's Lake | 7,055 | 104 | 66 | RT |
| Monticello Lake | 8,600 | 3 | 18 | RT,BK |
| **Blanding area:** | | | | |
| Recapture Creek Res. | 6,068 | 265 | 113 | RT,LB,GS,BB,GF |
| Blanding #3 | 6,480 | 17 | 22 | RT,LB |
| Blanding #4 | 6,600 | 32 | 46 | RT |

* BB - black bullhead, BG - bluegill, BK - brook trout,
BT - brown trout, GF - goldfish, GR - arctic grayling,
GS - green sunfish, LB - largemouth bass, RT - rainbow trout.

**Class VI Streams** - These have stream channels which are dewatered for significant time periods during the year. Many stream sections could support good to excellent fish populations if appropriate minimum flows could be provided.

### 14.2.2 Native Fish

Native fish species are also diverse within the basin and include both coldwater and warmwater species. See Table 14-1. Protection of these species is important to keep functioning ecosystems intact.

Colorado River cutthroat trout are the only native fish which are also considered a sport fish species. While once abundant in small streams, distribution of this species is now extremely limited. Other native species have also been extirpated in local areas.

### 14.2.3 Wildlife, Riparian Areas and Wetlands

The diversity of wildlife species requires suitable habitat to maintain healthy and self-sustaining populations. In general, wildlife benefit from and many species need the same habitat which provides good conditions for fish. Riparian areas generally offer all four major habitat components needed by wildlife: food, water, cover and living space. Where there is adequate water and deep soils, production of plant and animal biomass increases. The contrast with the surrounding desert-like vegetation in much of the basin increases the habitat diversity. Linear riparian zones increase the "edge" and serve as connectors between habitat types and provide travel lanes and migration routes for such animals as birds, bats, deer and elk.

Because riparian areas are so important to wildlife, even streams with naturally low or intermittent flows, and streams which do not support fisheries need to be protected for amphibians and other wildlife. Protection of riparian vegetation will produce benefits including absorption of flood waters, reduced erosion, filtering of sediment and chemicals from runoff, esthetic and recreational values.

Other wetlands are also important to wildlife, especially waterfowl and amphibians. There are 100,600 acres of wetlands/open water areas within the water budget areas. In addition, there are other wetlands/riparian/open water areas outside the water budget areas. Most of the vegetation is cattails, bullrushes, sedges, carex, willows and cottonwood trees.

The Matheson Wetland Preserve near Moab has been established as a managed wetlands area. This 896-acre area provides habitat for waterfowl and wildlife in a region where this is a scarce resource. The Matheson Wetland Preserve is owned equally by The Nature Conservancy and the Division of Wildlife Resources.

Construction of water storage facilities has expanded distribution of some wildlife and increased recreational opportunities. At the same time, the increased demand for water by communities has been in direct conflict with the needs of many wildlife species. Any activities that directly impact wetlands or riparian areas usually require a federal and/or state permit.

Matheson wetlands

The DWR, U.S. Fish and Wildlife Service, Corps of Engineers and other agencies comment on these proposals and recommend mitigation for loss of wildlife habitat.

#### 14.2.4 Upper Colorado River Basin Endangered Fishes Recovery Program

The Colorado River system, including the Green and San Juan rivers, contains four endangered fish. These are the Colorado pikeminnow, humpback chub, bonytail chub and razorback sucker. Efforts to recover these species are overseen by the Recovery Implementation Program (RIP) for Endangered Fishes of the Upper Colorado River Basin. Recovery efforts on the San Juan River are covered under the San Juan RIP.

The Upper Colorado River Basin RIP is a 15-year, interagency partnership aimed at recovering these four endangered fishes. The program was launched in 1988 when the governors of Colorado, Utah and Wyoming, the Secretary of the Interior, and the Administrator of Western Area Power Administration signed a cooperative agreement committing each participant to implementing the program's elements. The recovery program elements include: habitat management; habitat development; native fish propagation and genetic management; non-native species and sport fishing; research, monitoring, and data management; and public information and involvement. Accomplishments in the Southeast Colorado River Basin include the following:

- FWS has waived charges for new depletions less than 100 acre-feet per year.
- DWR stocked 2,000 bonytails in the Colorado River during 1995-97 and 6,000 bonytails near Dewey Bridge in 1996 and 1998.
- DWR stocked about 100,000 Colorado pikeminnow in the San Juan River in 1996, 100,000 in 1997 and 10,000 in 1998.
- FWS stocked 3,400 razorback suckers in the Gunnison River and 1,600 in the San Juan River in 1997. They also stocked 2,000 razorback suckers in the Green and Colorado rivers in 1995 and 1996 and stocked 350 in 1998.
- Federal and state biologists completed a comprehensive report summarizing the first seven years of efforts to track endangered, native and non-native fish populations. Biologists continue to conduct annual monitoring efforts to track Colorado pikeminnow and sympatric species. In 1998, the program was expanded to include the humpback chub and razorback sucker.
- Federal and state wildlife agencies in Colorado, Utah and Wyoming have finalized an agreement on stocking of non-native sport fish.
- Recovery Program participants have coordinated public involvement activities on key program actions.
- The Recovery Program has developed and distributed a wide range of informational products to the public.
- The Recovery Program has established a web site.

Planned activities include:

- Acquire easements from willing landowners to restore riverside wetland areas for young endangered fish.
- About 20,000 bonytail and 1,000 to 2,000 razorback suckers were to be stocked in 1999. Project biologists planned to release 1,000,000 larval Colorado pikeminnow in the San Juan River in 1999.
- Non-native fish that prey upon and compete with endangered fish were to be removed from the Green, Colorado and Gunnison rivers in 1999.

Colorado River

## 14.3 ORGANIZATIONS AND REGULATIONS

Local, state and federal agencies have a part in passing and enforcing laws to regulate management of water and other related facilities affecting wildlife. Private organizations also work with public entities to protect fish and wildlife habitat.

### 14.3.1 Local

The most common local organizations are mutual non-profit irrigation companies. There are also water conservancy districts, special service districts and water users organizations.

These entities manage most of the water resources, primarily for purposes of the individual organization. Where possible, they take fish and wildlife habitat into consideration. There are no instream flow rights so any consideration is voluntary except Mill Creek.

There are several wildlife groups involved in the policy making process through the Regional Advisory Council. This group makes recommendations to the Utah Wildlife Board.

### 14.3.2 State

The DWR has responsibility for the management, protection, propagation and conservation of the state's wildlife resources. Planning for wildlife habitat needs is recognized as an integral part of basin water planning. Fishing, hunting and nongame wildlife activities contribute financially to the local and state economy.

The DWR assesses water development project plans and identifies benefits and adverse impacts and recommends possible mitigation and minimization of impacts. If mitigation is not possible, DWR may suggest project termination. DWR also provides factual information regarding consequences of unmitigated and mitigated impacts to wildlife resources.

Title 73-3-3 of the *Utah Code Annotated* allows the division to file for minimum instream flow water rights. They can also file requests for permanent changes in the operation of certain streams and rivers to preserve critical fish habitat and to provide permanent enhancement of the state's stream and river fisheries.

Purchase of water rights in a storage reservoir or direct flow rights in a stream could be used to provide instream flows. However, a change from the existing use to an instream flow could affect downstream water rights and impacts would have to be mitigated or compensation paid.

### 14.3.3 Federal

The U. S. Fish and Wildlife Service (FWS) is charged with carrying out the Fish and Wildlife Coordination Act and the Endangered Species Act. See Section 16.3.8 for more information on the Fish and Wildlife Service.

## 14.4 FISH, WILDLIFE, AND HABITAT PROBLEMS AND NEEDS

Water-related problems in the Southeast Colorado River Basin include degradation of range and riparian areas with a resulting increase in stream sediment loads and loss of habitat. These have, in turn, caused a loss of indigenous cutthroat trout populations, conflicts between native and nonnative species, and the possibility of federal listings as threatened and endangered species. Other wild fish populations are especially sensitive to alterations and impacts to their habitat. This deterioration of fish and wildlife habitat has occurred for many reasons. Water development, livestock grazing, energy development, mining, timber harvesting, road building and recreation have all contributed.

Water development in some areas has dewatered streams, destroyed and fragmented fish habitat and connected drainages that should be isolated to maintain genetic integrity of fish populations. Most perennial streams are either captured in storage reservoirs or are diverted, primarily for irrigation, during the growing season.

Many people are attracted to live and play in this area because of the unique year-round recreational attractions and facilities. Increased numbers of people result in more pressure on the environment as a whole and on the water resources in particular. There are some groups that advocate preserving the resources from all development and use, while others depend on these and other resources to be developed for their livelihood, quality of life and recreation. Rather than opposition, cooperative solutions should be sought.

Whirling disease has been found in the some streams in the La Sal Mountains. Whirling disease causes mortality in young trout and is a significant threat to wild, reproducing trout populations. There are miles of streams, many reservoirs and lakes, and several private fishing ponds located in the basin. Many of these are managed as wild trout fisheries, including some streams containing native Colorado River cutthroat trout. Care should be taken to prevent transporting whirling disease from infected waters to disease-free habitat.

## 14.5 ALTERNATIVE SOLUTIONS

Usually there is more than one way to mitigate the effects of human activities on fish and wildlife. Where possible, it is easier and better to plan development projects to avoid the need for mitigation. Early communication with DWR in the planning process could identify and alleviate impacts on fish, wildlife and habitat resources. Where mitigation becomes necessary, it can be made a part of project plans. Water-related mitigation alternatives include maintenance of native fish communities and habitat, or replacement of these values with similar facilities in a nearby location.

Recovery efforts for native Colorado River cutthroat trout are needed to expand the range of the species and prevent federal listing as a threatened or endangered species. A Conservation Agreement and Strategy have been formulated to aid those efforts. Current copies of those documents can be obtained from DWR. It is in the best interests of water developers and managers to support activities outlined in those documents. Otherwise, major obstacles to water development could occur.

Habitat can be classified according to value. Four categories of habitat are used in Utah. These are: critical, high-priority, substantial-value and limited-value. Mitigation goals vary with habitat value, wildlife species and project plans.

Whenever reservoir storage projects are constructed, consideration should be given for interested groups and DWR to purchase conservation pools or storage water. This may improve fish and wildlife values, provide holdover storage during dry periods and enhance instream flows for sport fisheries. Purchase of conservation pools should also be considered in existing reservoirs. Rehabilitation of disturbed areas should also be a part of projects.

One way to reduce problems of livestock overgrazing in riparian areas and thus reduce mitigation needs is to provide water away from stream banks. Options include upland ponds, horizontal wells, and wind power or solar energy to pump water. Fencing of riparian habitat may be needed in areas with the most severe problems in order for recovery to occur.

Construction of instream and bank structures can accelerate regrowth on riparian areas. These may include small impoundments or low head dams (much like those built by beavers), rock weirs, streambank modifications, rock or log barbs and vanes, vegetative plantings, and anchoring trees or rocks to streambanks to prevent further erosion. The value of beaver dams in raising the water table, enhancing riparian areas, and improving water quality should be recognized. While there may be some individual cases where beavers cause problems, they can also provide an overall benefit.

Determining wildlife habitat needs is recognized as an integral part of basin planning. Fishing, hunting, and nongame wildlife activities contribute financially to the economy and need to be considered. The DWR will assume the lead role in determining potential impacts (positive and negative) to wildlife resources from water development projects. The role of DWR in water planning is to:

1. Assess water development plans and, specifically,

   a. Identify potential benefits to wildlife and their habitats,
   b. Identify potential adverse impacts to wildlife and their habitats,
   c. Recommend a course of action to mitigate project impacts to wildlife and their habitat for the public interest,
   d. Recommend termination if mitigation is not feasible or possible.

2. Provide factual information to decision makers regarding consequences of unmitigated and mitigated impacts to wildlife resources.

Established policies on stocking of public waters and private reservoirs and ponds should be followed. Owners should be encouraged to obtain DWR inspections and permits before stocking. The public should be educated on preventing the spread of whirling-disease. Irrigation canal systems allowing fish movement between drainages should be changed to prevent the potential transfer of whirling disease. The DWR should work with local entities and the public on controlling and preventing further spread of whirling disease.

The DWR is currently working on management plans for the drainages in the basin. These plans identify major resource issues and solutions, and they outline management objectives and strategies for aquatic resources and recreational waters.

Riparian areas are important

## 14.6 ISSUES AND RECOMMENDATIONS

State and federal agencies and conservation groups have become heavily involved in water issues and the protection of habitat for fish and wildlife populations. While DWR manages fish and wildlife populations, water developers/managers, other state, and federal agencies must take primary responsibility for protecting and enhancing habitat. Ways this can be done are discussed in the issues described below.

### 14.6.1 Loss of Wetlands and Riparian Habitat

Issue - There is a need to protect wetlands and riparian habitat and reduce sedimentation of lakes, reservoirs and streams.

Discussion - There are wetlands, riparian areas and open water throughout the basin. All wetlands should be protected because of their importance to wildlife and humans. Matheson Wetland Preserve is the only managed waterfowl habitat. Other locations providing resting areas during the wetter periods include farm ponds, reservoirs, springs and seeps. These are used primarily as resting areas for migrating birds although some species stay year-round. The majority of wildlife species are associated with wetlands at some point in their life cycle.

When riparian areas are in good condition, they provide streambank stability, maintain channel contours, reduce sedimentation, regulate water flow, and enhance water quality. A good riparian community has abundant and diverse plant life covering most of the soil and showing a diversity in age distribution and structure. Poorly located, designed, and maintained roads and other developments can contribute significant amounts of sediment to lakes and streams.

Recommendation - The DWR should identify wetlands and riparian areas with significant wildlife values to aid in their protection. Best Management Practices should be used to protect and enhance wetlands and riparian areas.

### 14.6.2 Irrigation Diversion Dams

Issue - Improper design and location of irrigation diversions negatively affect fisheries management goals.

Discussion - There are problems with location and design of diversions in the La Sal Mountains. Ditches in the area connect several streams, allowing free movement of exotic trout into streams harboring native Colorado River cutthroat trout. The purity of native fish has been lost in some streams due to hybridization, while in other streams, native trout have been crowded out. One of the few remaining pure populations of Colorado River cutthroat trout in the basin, perhaps the only one, could be lost if the irrigation diversion system is not modified. Changes in design of the system would aid expansion of native trout populations in the area, decreasing the likelihood of the fish being federally-listed as threatened or endangered.

Recommendation - DWR should assist irrigators, water developers, and water managers to modify existing irrigation diversion structures and obtain criteria for the design of all new structures such that they are compatible with fisheries management needs.

### 14.6.3 Winter Fish Kills

Issue - Some irrigation storage reservoirs are frequently dewatered, resulting in winter fish kills and lost or reduced recreational opportunities.

Recommendation - Conservation pools should be purchased if opportunities allow at various reservoirs such as Kens's Lake, Loyd's Lake, and Recapture Creek Reservoir.

### 14.6.4 Tourism Impacts

Issue - The increased demand for recreational facilities and activities is impacting resources.

Discussion - The Southeast Colorado River Basin contains several national and state parks and monuments, a recreation area, national forest, and large expanses of proposed wilderness. The basin is truly a destination recreational area. Tourism has increased and will continue to do so along with a growing population. There will be increasing pressure on fish populations and demand for associated facilities. Increasing numbers of visitors and residents and continued development may destroy or disturb areas of fish and wildlife habitat and reduce wildlife populations.

Planning should minimize environmental impacts and improve recreational facilities and management. Fish and wildlife aquatic and terrestrial habitats should be protected, created and restored where possible. The DWR may be interested in financially participating in projects that provide benefits to fish and wildlife resources.

Recommendation - Local governments should assure coordination between all interested groups to plan for the future growth of tourism. ❑

# Contents

Section 15

# Southeast Colorado River Basin

**Utah State Water Plan**

## Water Related Recreation

### 15.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan discusses the major aspects of recreational opportunities and related land use. These include the use of state and federal parks, commercial recreation and a number of issues relating to both water and nonwater-related outdoor recreation.

### 15.2 SETTING

The area within Grand and San Juan counties supports a number of major water-related recreational sites. The Colorado and San Juan rivers, many lakes and reservoirs, and several rivers and streams provide exceptional boating, sightseeing, rafting and miscellaneous water sport opportunities.

Although the area is isolated and to some, desolate, water-related recreation is big business and a major element of the local economy. There are three state parks. Two of these, Dead Horse Point and Goosenecks of the San Juan State Park, provide world-class views of the Colorado River and San Juan River, respectively, from nearly 2,000 feet above. Combined, the two parks draw an estimated 250,000 guests each year, the majority out-of-state and foreign visitors. The Edge of the Cedars State Park Museum draws visitors to enjoy an unequaled collection of Anasazi pottery and other ancient Indian artifacts. The remains of an Ancestral Pueblo Indian Village is part of the museum.

The Colorado and San Juan rivers are the major water recreation corridors through the basin. Minor, but very important hiking and touring stream corridors include Indian, Westwater, Grand Gulch, Cottonwood and Recapture creeks. The high plateaus are punctuated by the Abajo Mountains west of Monticello and the La Sal Mountains east of Moab which are part of the Manti-La Sal National Forest. Old trails and mining roads criss-cross the area; many providing access to remote canyons through nearby rivers and small streams. The area is very popular for hiking, mountain biking, trail riding with off-road vehicles, horse-back riding, rafting, canoeing, kayaking, personal water craft boating and power boating. Colorado River trips are a popular activity as shown in Table 15-1.

> White water rafting down the Colorado River, exploring the parched Monument Valley, biking along the slickrock canyons and hiking through the lush, green forests of the La Sal and Abajo mountains; this is a mecca for the tourist and recreationalist.

In addition, the basin is further enhanced by significant populations of big game, waterfowl and fish species indigenous to the area. More detailed information regarding wildlife and fisheries is given in Section 14.

There are also a number of historic and general sightseeing trails that enhance the recreational experience at existing reservoirs and rivers. New recreational trails are being established along the Colorado River upstream from Moab and along Mill Creek in Moab.

Rafting on the Colorado River

## 15.3 ORGANIZATIONS AND REGULATIONS

Good management of the recreational facilities often determines their popularity and provides an enjoyable experience for the users. The responsibility for these facilities is at the local, state and federal levels.

### 15.3.1 Local

About 18 percent of the basin is in the Navajo Indian Reservation. Grand and San Juan counties are located in the Southeastern Association of Governments Multi-County Planning District. Most larger communities provide infrastructure and services such as parks and playgrounds, swimming pools, golf courses, hotels, motels, restaurants, equipment leasing and tour guide services for local use as well as for the tourism/ recreation industry.

### 15.3.2 State

The Division of Parks and Recreation is the "recreation authority" under state statute, with a mission to "...enhance the quality of life in Utah through parks, people and programs." The division enforces the state boating laws, off-highway vehicle laws and state park regulations, including the Antiquities Act.

The division also administers several federal programs associated with the development and operation of recreational facilities. These programs include the Land and Water Conservation Fund and matching grant program, the River Enhancement Program, and the Non-Motorized Trail Grant Program. They also mange the state parks.

### 15.3.3 Federal

The federal government is the largest administrator of recreational facilities in the

Table 15-1
COLORADO RIVER TRIPS

| **1996** | **Commercial** | **Private** |
|---|---|---|
| Trips | 2,075 | 3,500 |
| Passengers | 34,546 | 29,000 |
| Passenger Days | 37,429 | 33,350 |
| **1997** | **Commercial** | **Private** |
| Trips | 1,460 | 3,300 |
| Passengers | 35,926 | 27,025 |
| Passenger Days | 38,542 | 23,500 |

basin. The Bureau of Land Management, National Park Service, Forest Service and Bureau of Indian Affairs operate a number of local water-related recreational facilities that include boating marinas at Halls Crossing and Hite and a number of river rafting sites providing access to the Colorado River at Cisco, Dewey's Bridge, Hallet Ranch, Moab and Westwater.

Federal funding through the Utah Trail Grants Program provides for the development of "non-motorized trails". The popularity of mountain biking is growing with a number of trails being developed throughout Grand and San Juan counties. A summary of non-motorized trails along with funding expenditures associated with each trail is given in Table 15-2.

## 15.4 OUTDOOR RECREATION FACILITIES AND USE

Although most of the day-to-day use of recreational facilities is by seasonal tourists, local parks are heavily used by local community and church groups and private residents. Water-related facilities are also popular.

### 15.4.1 Local Recreation Facilities

Most of the local popular recreation facilities and sites are located in the population centers of Blanding, Bluff, Moab, Monticello and Montezuma Creek. The most frequented facilities include the municipal golf courses in Moab and Monticello, the Navajo Visitors Center and Goulding Trading Post. Information and visitor centers are located in Moab, Glen Canyon National Recreational Area and Edge of the Cedars State Park Museum.

The communities of Blanding, Moab and Monticello have a number of parks and recreational sites. The Matheson Wetlands Reserve near Moab provides fish and wildlife habitat in addition to being a scenic attraction.

Moab has the largest number of recreational facilities including a municipal golf course, local parkway corridor, various walking trails and a

Table 15-2
NON-MOTORIZED TRAILS MATCHING FISCAL ASSISTANCE AWARDS, 1991-1996

| County | Project Description | Grant |
|---|---|---|
| Grand County | Moab City Millcreek Parkway Trail | $ 95,000 |
| | Grand County Moab Mountain Bike Patrol | 10,000 |
| | Arches NP Delicate Arch Trail | 9,000 |
| | Moab BLM Colorado River Trailheads | 7,000 |
| | BLM Slickrock Bike Trailhead | 57,000 |
| | Miner's Basin Trailhead, USFS | 20,000 |
| | Kokopelli's Trail & Dewey Bridge | 25,000 |
| | BLM Poison Spider Mesa Trailhead | 35,400 |
| | BLM Fisher Towers Trailhead | 12,500 |
| San Juan County | Monticello BLM-Butler Wash/Interpretive | 2,900 |
| All F.S. Ranger Districts | Trail Construction Tractor | 19,500 |
| **Total** | | **$293,300** |

town park. Moab has also developed a large tourist trade based on seasonal river rafting on the Colorado River and off-road vehicle drives and rallies. The Division of Parks and Recreation contributed $41,000 to Lions Park improvements in Moab in 1997.

The city of Monticello provides a number of recreational facilities including public and private golf courses and a number of small parks. Other small commercial businesses cater to seasonal tourist traffic providing Indian craft and jewelry shops, natural history museums and restaurants.

Moab water park

Blanding has a park/picnic area, public swimming pool and displays of Anazasi Indian remains. There are also nearby reservoirs for fishing.

Most of the local communities utilize hundreds of miles of mining roads for biking and walking trails. Sightseeing tours along old mining roads are staged out of Blanding, Bluff and Moab. In all, there are over 16 major trails and trailhead facilities recently improved through the assistance of state recreational programs.

A number of privately owned businesses cater to tourism and recreational activities in addition to the state and federal recreation sites. The most popular of these include white water rafting, jeep (four wheel drive) tours and jet boating.

### 15.4.2 State Parks

To take advantage of the many scenic opportunities in the basin, the Division of Parks and Recreation manages the Dead Horse Point and Goosenecks of the San Juan state parks and Edge of the Cedars State Park Museum. These parks are unique and offer tourists scenic views of river canyons in addition to cultural and historic information about the basin. A summary of tourist and general site information for each park is given in Table 15-3.

Rangers are assigned full time at Dead Horse Point and Edge of the Cedars state parks. Winter snowmobiling patrols are also provided at some popular winter recreational sites.

Dead Horse Point State Park - Dead Horse Point State Park is one of Utah's most spectacular state parks. Towering nearly 2,000 feet above the Colorado River, the park provides a breathtaking panorama of sculptured pinnacles and buttes found only in Canyonlands Country.

Table 15-3
STATE PARKS VISITATION

| State Park | 1996 Visitation | Related Water Area | Camp Units |
|---|---|---|---|
| Dead Horse Point | 202,452 | River overlook | 21 |
| Goosenecks of the San Juan | 45,356 | River overlook | 4 (primative) |
| Edge of the Cedars Museum | 29,948 | Recapture Res 160 acres | Day use |

Dead Horse State Park is on State Route 313, 18 miles off U.S. Highway 191, 8 miles north of Moab. The park has a visitor center, interpretive museum, modern rest rooms, a twenty-one unit campground, sewage disposal station, group camping area, pavilion and large overlook shelter. Although the campground is a full service facility, water is limited since it is hauled into the park. Visitors are encouraged to fill their recreation vehicles before entering the park.

Edge of the Cedars State Park Museum - Edge of the Cedars State Park Museum in Blanding is the site of a pre-Columbian Pueblo Indian ruin and a modern museum, which is the regional archaeological repository. Remains of the Ancestral Pueblo Indian Village with its unique architectural structures is a testament to the Indian civilization that once flourished in southeastern Utah. Edge of the Cedars Museum houses an excellent collection of Anasazi pottery and other exceptional ancient Indian artifacts. Additional exhibits display cultural materials and information about Navajo and Ute Indians. A picnic area is available; however, the park does not have camping facilities.

Goosenecks of the San Juan State Park - Four miles off State Highway 163 near Mexican Hat, Goosenecks of the San Juan State Park offers a scenic view of a 2,000-foot deep chasm carved through the Pennsylvania formation by the silt-laden San Juan River. The river flows for more than five miles while progressing only one linear mile toward Lake Powell. A paved access road is provided to the park site with primitive camping and vaulted rest rooms.

Goosenecks of the San Juan

### 15.4.3 Federal Recreation Facilities

The Bureau of Land Management, Forest Service and National Park Service operate and maintain a number of recreational facilities in the basin. These include the Dark Canyon Wilderness Area; Manti-La Sal National Forest; Glen Canyon National Recreation Area; Hovenweep, Natural Bridges and Rainbow Bridge National Monuments; and Canyonlands and Arches National Parks. A summary of federally administered recreational sites is given in Table 15-4. Recreation services are also provided on Navajo Nation lands. Typical activities include local scenic tours, rafting, camping and retail sales of native products or crafts.

Commercial river running is a large portion of the area’s overall annual tourist business. Over 380 white-water rafting tours were booked in 1996 involving over 4,400 rafters through Canyonlands National Park. Additional rafting tours are made on the San Juan River. In general, the rafting industry is policed and administrated by the Bureau of Land Management, National Park Service and the Utah Division of Parks and Recreation. Most of the river-rafting outfitters are located in Moab. Table 15-5 provides additional information regarding a number of other private recreational activities.

## 15.5 RECREATION ACTIVITY PROBLEMS AND NEEDS

Most of the recreational activities in the basin are centered around water sports, natural scenic attractions and ancient Indian archeological sites. Problems associated with these local recreation activities are water safety, the preservation and use of local wilderness areas, and natural scenic features.

Table 15-4
MAJOR FEDERAL RECREATION AREAS

| Area | Name of Site | Camping | Day Use | Boating |
|---|---|---|---|---|
| Manti-La Sal NF | Dalton Spring | Yes (10) | Yes | – |
| | Devil Canyon | Yes (30) | | |
| | Buckboard | Yes (13) | | |
| | Warner | Yes (20) | | Lake rafting |
| | Lake Oowah | Primitive | | |
| | Pack Creek | Primitive | Yes | – |
| Canyonlands NP | Squaw Flat | Yes (31) | Yes | – |
| | Upheaval Dome | | Yes | _ |
| Hovenweep | Square Tower Ruins | Yes (31) | Yes | _ |
| Natural Bridges | Natural Bridge NM | Yes (14) | Yes | – |
| Arches | Devils Garden | Yes (53) | Yes | |
| Rainbow | Rainbow Bridge NM | None | | Boat marina |
| BLM | Wind Whistle | | | |
| | Campground | | | |
| | Needles Overlook | | | |
| | Anticline Overlook | | | |
| | Sand Island [a] | Yes (15) | Yes (5) | Raft launching |
| | Green River Overlook | None | Yes | |
| | Hatch Point | Yes (10) | | |

[a] Water will be piped in by 2000.

Table 15-5
VISITOR USE REPORTED BY PRIVATE CONCESSIONAIRES, 1996

| Concession Recreational Service | Number of Customers: |
|---|---|
| Combination Jetboat and Jeep Tour | 3,565 |
| Canoe Rental-Pickup | 2,189 |
| Shuttle Services | 508 |
| Jetboat Scenic tour | 558 |
| River Rafting[a] | 4,400 |
| Totals | 11,220 |

[a] Source: Bureau of Land Management for Colorado River only.

#### 15.5.1 Water Safety

A primary concern to boating enthusiasts and local safety patrol officers is the growing number of personal water craft (PWC). These small, but powerful, motor boats are beginning to show up in growing numbers creating congested and dangerous situations within major reservoirs and at some isolated river locations. PWCs now represent over 20 percent of all boating activity within the state. A recent study has shown that over 115 boating accidents with an average of five fatalities occur each year within state reservoirs, a significant number related to PWCs.

#### 15.5.2 Protection and Preservation of Cultural Areas

There is considerable concern regarding the protection and preservation of the area's outstanding cultural resources. The destruction of ancient Indian burial sites, transportation and sale of illegally secured artifacts, and other problems associated with archeological resources are occurring at an alarming rate.

#### 15.5.3 Scenic and Wilderness Problems

The basin includes two national parks, three national monuments, a national recreational area, one national forest, one wilderness area, and three state parks. Although the Dark Canyon Wilderness Area is the only designated wilderness area, others are being studied. The designated wilderness study areas as of April 1999 are listed in Table 16-1. The area offers some of the most scenic recreation and wilderness sites in the United States. An effort is being made by national wilderness advocates to limit motorized access to a number of these areas. A recent land trade in Arches National Park has expanded the park's boundaries in an effort to protect outstanding resources.

#### 15.5.4 Economic Values of Recreation and Leisure

Current studies are underway to analyze and measure recreational values. The area is rapidly becoming a prime recreation destination site as evidenced by the rapid growth of local recreational based businesses. A recent study by the Division of Parks and Recreation has determined that every dollar spent by tourists and recreationists, generates approximately $2.50 to $3.00 within the community's economy. However, with the rapid growth in tourism, the impact on private, state and federal parks and recreational areas and other local resources needs to be assessed.

#### 15.5.5 Recreational Activity Conflicts in the Slick Rock Area

The use of remote trails by motorized and non-motorized bikes has generated a number of conflicts throughout the basin. The use of common trails for both types of recreation bikes has resulted in a number of injuries and deaths and has raised concerns regarding the management of these areas by local and state recreation agencies.

Trails were originally established within the "slick rock" area by motorcyclists in the 1970s and 1980s. In recent years, non-motorized mountain bike activity has grown at a considerable rate creating an overcrowded condition on these trails.

Slick rock 4-wheeling

### 15.6 ALTERNATIVES

To address the issue of water safety, the Division of Parks and Recreation is stepping up their efforts to provide boating safety classes in the area. Topics discussed during these classes typically include state regulations and laws relating to the use and management of boating craft throughout the state.

To preserve and protect the cultural resources, the state Legislature increased fines and penalties for the destruction of ancient Indian archeological sites through the existing state antiquity laws. Other suggestions or actions have included more programs by local museums and schools to educate the general public regarding the sanctity and importance of this heritage resource. The Edge of the Cedars State Park Museum has expanded its storage and laboratory areas to help preserve this resource. More needs to be done to follow through on enforcing and increasing these activities.

The solution to overcrowding on bike trails seems to be a public education program aimed at promoting "trail etiquette" among both types of bike enthusiasts. Signing and resource programming should also be considered through a joint effort between the Division of Parks and Recreation, other state and federal agencies, and local agencies dealing with the operation and maintenance of public recreational facilities. Programs that are currently available through the division include "know before you go," and "leave no trace" programs. These programs promote certification of youth bikers with the goal of promoting an understanding of environmental impacts created by all types of outdoor recreation, personal etiquette, safe use of equipment, respect for private property and enjoyment of the sport. ❑

# Contents

Section 16

# Southeast Colorado River Basin

**Utah State Water Plan**

## Federal Water Planning and Development

### 16.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan briefly describes the current roles and level of responsibility of the 14 federal agencies involved directly or indirectly with the planning and development of water resources within the basin. Their roles vary from regulation, planning, design and construction of water development projects to the protection of water quality, the environment and habitat for various fish and wildlife species. Some federal programs have been reduced or eliminated forcing local water agencies to seek technical and financial assistance from state water resources agencies or from other sources.

### 16.2 BACKGROUND

The over-riding role of the federal government in the area of water resources has changed significantly over the years. From the late 1930s to as recently as the early 1990s, federal agencies were involved in the planning, design and construction of major water and land reclamation projects. Most of these projects have resulted in the development of affordable and reliable sources of water for all domestic water users.

However, future water development projects will, in all likelihood, be pursued by local and state agencies as the role of some federal agencies has significantly changed. Agencies such as the Bureau of Reclamation are more actively involved with environmental issues and programs to improve the operations of existing project facilities. The Natural Resources Conservation Service has changed from watershed programs for primarily flood control and irrigation water management to assistance with water quality, erosion and other environmental concerns. As a result, water provider organizations, municipalities and some private industries are relying more on state agencies to replace federal water project development expertise and related funding programs.

> As a major land holder, activities of the federal government impact nearly everyone who lives in or visits the area.

### 16.3 FEDERAL PROGRAMS AND FUTURE WATER PLANNING AND DEVELOPMENT

Perhaps the largest federal players in water and land development are the agencies within the departments of Agriculture, Army, Interior, Environmental Protection Agency and Federal Emergency Management Agency. The programs provided by these agencies are comprehensive and impact most all aspects of water development, quality, supply, distribution, use and disaster management. These agencies and their activities are briefly described below.

### 16.3.1 Bureau of Indian Affairs

The Bureau of Indian Affairs has area offices throughout the country. The office in Phoenix, Arizona covers southeastern Utah and there is a field office in Blanding. The bureau works cooperatively with the Indian people and their tribal leaders. The protection of rights comes from the Office of the Director of Trust Responsibilities. This includes matters involving water rights, land titles, hunting and fishing rights and regulation, zoning, and other land uses.

The goal of the bureau is to assure effective and productive use and development of the resources, including water resources. They work with the Navajo Tribe and the Ute Indian Tribe in San Juan County and the Northern Ute Tribe regarding lands in Grand County.

### 16.3.2 Bureau of Land Management

The Federal Land Policy and Management Act of 1976 gives the Bureau of Land Management (BLM) authority for administration of all public lands and resources under its jurisdiction. The quantity and quality of water resources are key factors in managing land and aquatic and recreational resources on public lands throughout the state. The BLM manages riparian habitats of springs, seeps, streams, lakes, reservoirs and ponds to help provide high quality water resources for beneficial downstream uses. BLM participated in the Montezuma Creek River Basin Study. This was an interagency study to quantify the aerial extent and amount of erosion and to determine the feasibility for treatment of problem areas.

The BLM manages the Dark Canyon and Grand Gulch Primitive Area, and the Mule Canyon/Butler Wash and Sand Flats/Moab Slickrock Bike Trail Recreation Sites.

There are 34 wilderness study areas listed in the “1999 Wilderness Inventory Report to the Secretary of the Interior” that are located in the Southeast Colorado River Basin. This inventory was implemented to reevaluate the original study completed under the 1976 Federal Land Policy and Management Act. The wilderness study areas are now the subject of considerable debate. The wilderness study areas designated in the 1999 report are listed in Table 16-1 and are shown on Figure 16-1.

### 16.3.3 Bureau of Reclamation

Historically, the Bureau of Reclamation had the responsibility to design and construct large water projects and related facilities.
The bureau recently completed the Dolores River Project in the upper reaches of the Dolores River Basin in Colorado. This project could provide supplemental water for municipal, commercial, industrial and agriculture uses to several communities in San Juan County. In the future, the bureau’s responsibilities will likely change more to the study of water quality, recreation and dam safety issues at its major facilities or projects.

Grazing on public lands

### 16.3.4 Cooperative Research, Education and Extension Services

This agency is assigned the responsibility of administering various programs associated with cooperative state and other research programs. They are the information and education arm of the Department of Agriculture.

### 16.3.5 Corps of Engineers

The Army Corps of Engineers (COE) offers assistance to a number of public agencies/entities to deal with water related problems that are relatively large in scope and beyond the capabilities of smaller agencies to manage. An agency can take advantage of

Table 16-1
WILDERNESS STUDY AREAS

| Wilderness Study Areas | | Area Inventoried (acres) | | | Area With Wilderness Characteristics (acres) | | |
|---|---|---|---|---|---|---|---|
| No. | Name | Federal | State | Total | Federal | State | Total |
| 104 | Arch & Mule Canyons | 13,600 | 1,260 | 14,860 | 0 | 0 | 0 |
| 119 | Beaver Creek | 32,600 | 2,300 | 34,900 | 26,000 | 1,500 | 27,500 |
| 116 | Behind the Rocks | 7,800 | 1,000 | 8,800 | 3,400 | 500 | 3,900 |
| 112 | Bridge Jack Mesa | 27,300 | 3,380 | 30,680 | 23,500 | 2,900 | 26,400 |
| 113 | Butler Wash | 3,000 | 1,820 | 4,820 | 2,000 | 1,780 | 3,780 |
| 93 | Cheese Box Canyon | 16,080 | 3,050 | 19,130 | 13,600 | 2,800 | 16,400 |
| 103 | Comb Ridge | 16,400 | 1,000 | 17,400 | 14,000 | 800 | 14,800 |
| 106 | Cross Canyon | 2,100 | 490 | 2,590 | 1,400 | 400 | 1,800 |
| 107 | Dark Canyon | 67,400 | 5,400 | 72,800 | 66,400 | 5,400 | 71,800 |
| 100 | Fish and Owl Creeks | 28,480 | 5,800 | 34,280 | 26,410 | 5,200 | 31,610 |
| 120 | Fisher Towers | 17,400 | 2,100 | 19,500 | 17,000 | 2,100 | 19,100 |
| 94 | Fort Knocker Canyon | 12,800 | 800 | 13,600 | 12,800 | 800 | 13,600 |
| 115 | Goldbar | 13,100 | 2,000 | 15,100 | 6,500 | 1,600 | 8,100 |
| 114 | Gooseneck | 8,900 | 360 | 9,260 | 4,800 | 60 | 4,860 |
| 99 | Grand Gulch | 49,570 | 9,310 | 58,880 | 47,800 | 8,090 | 55,890 |
| 121 | Granite Creek | 6,200 | 500 | 6,700 | 5,400 | 500 | 5,900 |
| 95 | Gravel and Long Canyons | 37,100 | 5,100 | 42,200 | 37,100 | 5,100 | 42,200 |
| 96 | Harmony Flat | 10,200 | 600 | 10,800 | 10,100 | 500 | 10,600 |
| 111 | Harts Point | 63,200 | 9,000 | 72,200 | 18,000 | 1,700 | 19,700 |
| 117 | Hatch Wash | 24,100 | 3,500 | 27,600 | 12,000 | 2,100 | 14,100 |
| 118 | Hunter Canyon | 4,630 | 1,260 | 5,890 | 4,600 | 1,200 | 5,800 |
| 110 | Indian Creek | 20,850 | 3,810 | 24,660 | 19,000 | 2,640 | 21,640 |
| 126 | Lost Spring Canyon | 12,920 | 2,000 | 14,920 | 11,770 | 1,900 | 13,670 |
| 97 | Mancos Mesa | 73,900 | 9,300 | 83,200 | 62,600 | 9,000 | 71,600 |
| 124 | Mary Jane Canyon | 25,400 | 3,000 | 28,400 | 25,000 | 3,000 | 28,000 |
| 122 | Mill Creek Canyon | 6,710 | 5,080 | 11,790 | 2,910 | 1,310 | 4,220 |

| Table 16-1 WILDERNESS STUDY AREAS (Continued) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Wilderness Study Areas | | Area Inventoried (acres) | | | Area With Wilderness Characteristics (acres) | | |
| No. | Name | Federal | State | Total | Federal | State | Total |
| 123 | Negro Bill Canyon | 13,900 | 2,040 | 15,940 | 2,500 | 900 | 3,400 |
| 98 | Nokai Dome | 93,500 | 7,900 | 101,400 | 93,500 | 7,900 | 101,400 |
| 101 | Road Canyon | 13,960 | 5,450 | 19,410 | 11,850 | 5,150 | 17,000 |
| 102 | San Juan River | 14,700 | 600 | 15,300 | 14,200 | 500 | 14,700 |
| 109 | Shafer Canyon | 3,100 | 300 | 3,400 | 1,900 | 0 | 1,900 |
| 108 | Sheep Canyon | 4,700 | 640 | 5,340 | 4,700 | 640 | 5,340 |
| 105 | Squaw & Papoose Canyons | 3,750 | 1,240 | 4,990 | 3,680 | 1,240 | 4,920 |
| 125 | Westwater Canyon | 2,990 | 340 | 3,330 | 2,220 | 340 | 2,560 |
| | **Total** | **752,340** | **101,730** | **854,070** | **608,640** | **79,550** | **688,190** |

assistance programs by initially petitioning the COE, or for larger projects petitioning Congress. Once petitioned, the COE can investigate a number of aspects of a given problem including various economic, technical, social and environmental issues. During the process, close coordination is maintained with local interests, the state and other impacted federal agencies.

The Corps of Engineers can also participate in environmental stream and river restorations. These can include the restoration of fish and wildlife habitat, wetland and meander restoration, restoration of riparian areas, and stabilization of riverbanks and riverbed. These projects are cost shared with a local sponsor. The Corps also has authority under its Flood Plain Management Services Program to delineate areas of potential flood and debris flow threats for local communities at no charge.

The COE has been involved with a number of water-related studies and projects within the basin. Under the Continuing Authorities Project program, the COE completed a study of flood erosion in Mill Creek upstream of the existing crossing at 300 South Street in Moab. The study was initially requested by the City of Moab to determine the feasibility of improving the hydraulic carrying capacity of the existing flood channel. The study determined that a project was feasible and resulted in the placement of over 500 feet of rip-rap lining in Mill Creek.

The Energy and Water Development Act of 1984 directed the COE to conduct special flood control studies in Utah to determine specific ways and means to alleviate future flooding. To date, three studies have been completed for selected sections of the Colorado River and various tributaries within the Southeast Colorado River Basin.

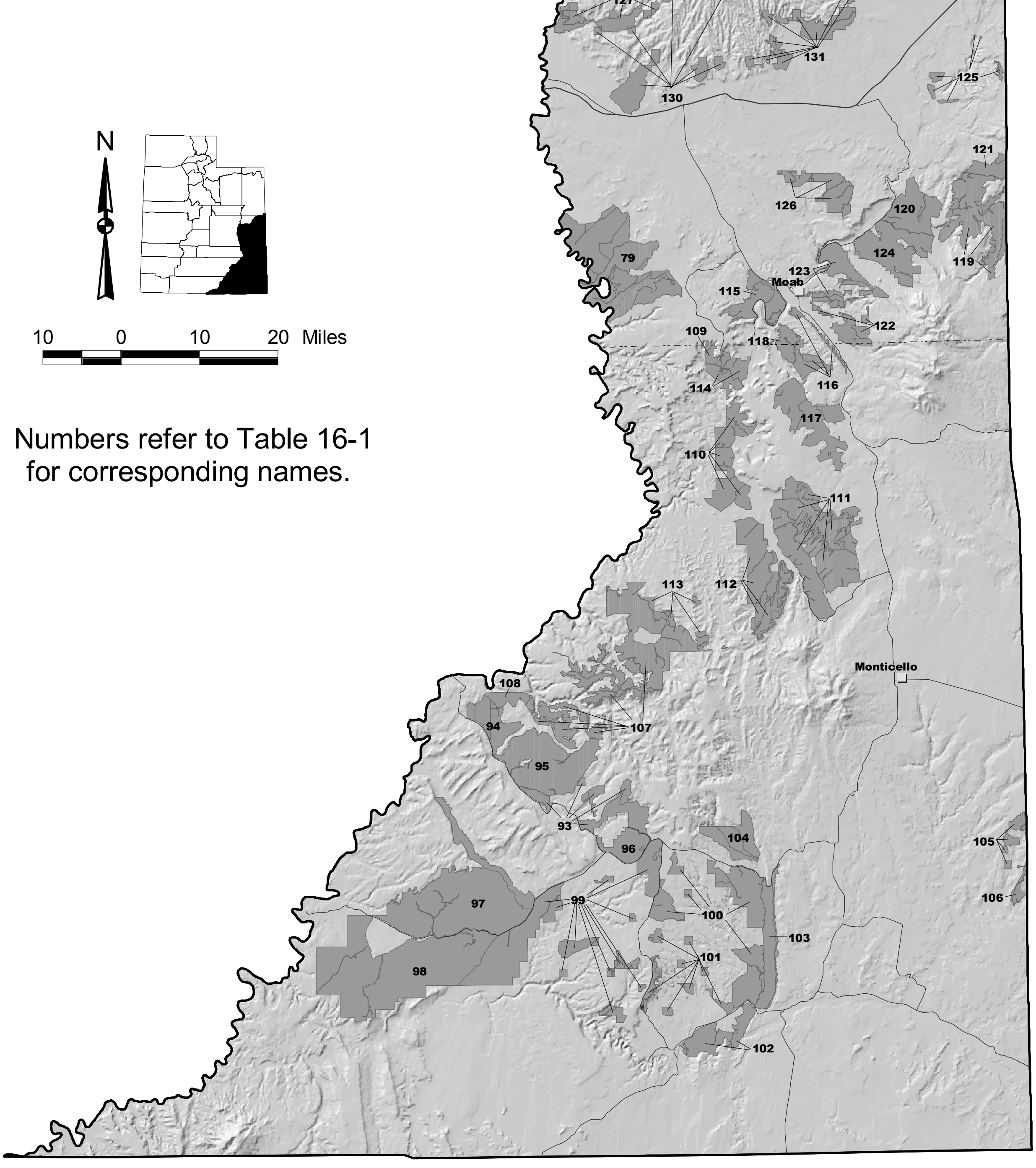
A 1975 study assessed the severity of flooding on the Colorado River and tributaries above Lee's Ferry. The study included a detailed evaluation of flooding on Mill Creek and the San Juan River Basin in Utah, Colorado and New Mexico. The study determined that only a minor flood control project was feasible on Mill Creek. However, the project was never constructed due to a lack of local support.

Two additional flood control studies have been completed for Mill Creek over the past seven years. A 1990 study identified the need for flood protection in and around the Mill Creek

Figure 16-1

## WILDERNESS STUDY AREAS

Southeast
Colorado River Basin



Park and Recreation Area. A 1994 study attempted to determine the 100- year flood plain for Mill and Pack creeks within the City of Moab and Spanish Valley area. Although both studies identified a potential for periodic out-of-bank flow within the City of Moab, no significant flood control project was ever constructed. See Figure 13-1.

### 16.3.6 Environmental Protection Agency

The mission of the Environmental Protection Agency (EPA) is to coordinate all efforts between federal, state and local governmental agencies to effectively abate and control pollution within the environment; more specifically, point and nonpoint source pollution to existing surface and groundwater systems. Of particular interest are the federal regulations and programs of the Federal Water Pollution Control Act of 1972, the Safe Drinking Water Act of 1974, amended, and the Clean Water Act of 1987, amended. The regulations to implement these acts have set limits on a broad spectrum of biological and chemical contaminants.

Point source pollution and non-point source pollution programs are the responsibility of the EPA but primacy has been given to the Utah Division of Water Quality. Reviews of state actions are carried out periodically.

Point source pollution programs include the National Pollutant Discharge Elimination System (NPDES) program, the Pretreatment and Municipal Pollution Prevention Program, the National Sludge Management Program and the Enforcement Program. The NPDES program requires that all wastewater treatment facilities meet or exceed limitations placed on certain water contaminants discharged into receiving streams. The Pretreatment and Municipal Pollution Prevention Program applies to industrial businesses that discharge effluent to domestic sanitary sewers with extreme concentrations of certain toxic pollutants. The National Sludge Management Program pertains to the management and disposal of wastewater sludge or biosolids.

Initially, the Construction Grants Program provided federal funding for most levels of municipal wastewater treatment facilities. However, the program was phased out and replaced with a revolving state loan program administered by the Division of Water Quality.

EPA programs designed to offer technical and financial assistance include: Clean Water Act (CWA) 104 Grants to promote and support research, investigations and training programs; CWA 106 Grants to assist states in the overall administration of individual state water quality management programs; state revolving loan funds supported by capitalization grants to construct and renovate publicly owned treatment facilities; Pilot Grants and Technical Assistance; Municipal Technology Programs; a number of Small Community Assistance Programs; and, Section 319 funds for starting basin management plans associated with non-point source pollution problems.

Federal regulations associated with Section 319 of the CWA provide standards aimed at improving the overall quality of water within a given watershed in accordance with established water use designations. These improvements generally include structural and non-structural or management measures to reduce pollutant discharge to existing streams and rivers. They also include the reduction of surface discharges contaminated with animal waste and nutrient residues from farm and ranch lands.

### 16.3.7 Farm Service Agency

The Farm Service Agency (FSA) administers farm commodity, crop insurance and conservation programs for farmers and ranchers. As of October 1995, FSA also administers the farm ownership and operating loans formerly provided by the Farmers Home Administration. The Agricultural Conservation Program (ACP) and the Emergency Conservation Program (ECP) have been replaced by other programs in other agencies. Elements of these programs have been transferred to the Natural Resources

Conservation Service. There are two programs administered by the FSA that are water related. These are the Conservation Reserve Program and the Flood Risk Reduction Program.

The Conservation Reserve Program reduces soil erosion, protects the nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

The Flood Risk Reduction Program was established to allow farmers who voluntarily enter into contracts to receive payments on lands with high flood potential. In return, participants agree to forego certain U.S. Department of Agriculture program benefits. These contract payments provide incentives to move farming operations from frequently flooded land.

Conservation seeding protects sensitive land

### 16.3.8 Federal Emergency Management Agency

The National Flood Insurance Program (NFIP) is administered by the Federal Insurance Administration (FIA), a component of the Federal Emergency Management Agency (FEMA), an independent agency. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and the NFIP Reform Legislation of 1994.

The NFIP enables property owners to purchase insurance protection against losses from flooding. The insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by severe flooding events.

Participation in the NFIP is based on an agreement between local communities and the federal government which states that if a community will implement and enforce measures to reduce future flood risks in special flood hazard areas, the federal government will make flood insurance available through private insurers within the community as financial protection against flood losses which do occur.

FEMA is the federal coordinating agency for emergency response, disaster relief funding and mitigation and preparedness planning. They provide technical assistance through loans and grants following declared disasters.

Presidential Declared Disaster - After a presidential declaration of a major disaster, usually after a state request, grants are available to state and local governments for mitigation of disaster related damage.

Assistance Grants - FEMA can provide grants on a matching basis to help individual states develop and improve disaster preparedness plans and develop effective state and local emergency management organizations. Grants are also available to develop earthquake preparedness capabilities.

Flood Plain Management - FEMA can provide technical assistance to reduce potential flood losses through flood plain management planning. This includes flood hazard studies to delineate flood plains, advisory services to prepare and administer flood plain management ordinances, and assistance to private individuals, communities, and various businesses when enrolling in the NFIP. FEMA can also assist with the acquisition of structures in critical flood plains subject to chronic flooding. Currently, the City of Moab and unincorporated San Juan County are the only public entities that are covered by the NFIP (See Section 13).

### 16.3.9 Fish and Wildlife Service

The Fish and Wildlife Service (FWS) has the responsibility for insuring the long-term conservation and protection of certain federal trust resources including threatened and endangered species, migratory birds, wetlands, and fish and wildlife resources that may be impacted by federally permitted or funded projects. Additionally, the FWS manages fish and wildlife habitat in the National Wildlife Refuge system. Authority is derived from the Endangered Species Act, the Clean Water Act, the Migratory Bird Treaty Act, the Bald Eagle Protection Act, the Fish and Wildlife Coordination Act, the National Environmental Policy Act and the National Wildlife Refuge System Administration Act.

The Endangered Species Act (ESA) does not apply directly to non-federal water-related activities where a federal permit is not required. Owners and operators of non-federal projects are not affected as long as the normal and ongoing operations do not result in the taking of one of these species.

In the event federal permits are required to develop a water resource or modify existing facilities, the Fish and Wildlife Service will review the project. The scope and overall intent of the proposed project or change will be assessed to decide the effect on fish and wildlife in the immediate area.

Endangered plants are treated differently than endangered animals on private property. Threats to these plant species will not stop development activities in an area where federal permits are not required. The endangered, threatened and candidate species are shown in Table 16-2.

### 16.3.10 Forest Service

Water-related programs of the Forest Service include watershed management; special use authorization for water development projects; and coordination with local, state and federal agencies. They also manage wilderness areas located on national forest lands. The Forest Service manages the Manti-La Sal National Forest.

Watershed Management - Watershed protection insures that activities do not cause undue soil erosion and stream sedimentation, reduce soil productivity or otherwise degrade water quality. Water yields may be affected through snow pack and/or vegetative management as a result of timber harvests controlled by predetermined forest management plans. Potential increases may approach one-half acre-foot per acre for some treated areas, but multiple-use considerations and specific on-site conditions may limit actual increases.

Special-use permits for development

Special Use Authorization - Construction and operation of reservoirs, conveyance ditches, hydro-power facilities and other water resources developments require special use authorization and usually an annual fee. Authorization contains conditions necessary to protect the use of all other resources. Coordination of water

Table 16-2
CANDIDATE, THREATENED AND ENDANGERED SPECIES

| Common Name | Scientific Name |
|---|---|
| | Endangered Species |
| black-footed ferret | Mustela nigripes |
| least chub | Iotichthys phlegethontis[a] |
| peregrine falcon | Falco peregrinus |
| southwestern willow flycatcher | Empidonax traillii extimus |
| autumn butter | Ranunculus aestivalis |
| Colorado pikeminnow | Ptychocheilus lucins |
| humpback chub | Gila cypha |
| bonytail chub | Gila elegans |
| razorback sucker | Xyrauchen texanus |
| | Threatened Species |
| Mexican spotted owl | Strix occidentalis lucida |
| Utah prairie dog | Cynomys parvidens |
| heliotrope milkvetch | Astragalus montii |
| Jones cycladenia | Cycladenis humilis va. jonesii |
| last chance townsendia | Townsendia aprica |
| Ute ladies'-tresses | Spiranthes diluvialis |
| | Candidate Animal Species |
| spotted frog | Rana luteiventris |

[a]Proposed to be listed as endangered.

development projects requires communication early in the planning process to guarantee environmental concerns are addressed.

### 16.3.11 Geological Survey

The Geological Survey (USGS) was established by an act of Congress in 1879 to provide a permanent federal agency to conduct the systematic and scientific classification of the public lands and examination of the geological structure, mineral resources and products of the national domain. A number of publications have been completed by the USGS in recent years regarding water quality and groundwater storage in the basin. A list of USGS publications addressing water resources information can be acquired from the agency's Salt Lake City Office. Also, refer to the bibliography in Section B.

Ongoing USGS activities include the gathering of additional water resources related data and the maintenance of existing data bases for various water agencies to plan, design, operate, and manage existing and potential water projects throughout the basin. The USGS is currently taking water quality data from eight field monitoring stations located at South Creek near Monticello, Recapture Creek near Blanding, San Juan River near Bluff, Colorado River at the Colorado/Utah state line, Colorado River near Cisco, Dolores River near Cisco, Castle Creek below Castleton, and Mill Creek at Sheley

Tunnel. Data for all stations is found in Table 12-1. An itemized summary of all water resources data can be obtained from the annual USGS report entitled "Water Resources Data for Utah." This data is also available on the internet. The costs to install and operate a majority of the active stream gaging stations are shared by the USGS on a 50-50 basis with state and local agencies utilizing data from these stations.

### 16.3.12 National Park Service

The National Park Service (NPS) promotes and regulates use of national parks, monuments and similar reservations to "conserve the scenery, natural historic objects and wildlife." The NPS also provides for the enjoyment of these resources in such manner and by such means as will leave them unimpaired for the benefit of future generations." The long-range objectives of the NPS are as follows:

1. To conserve and manage the parks for their highest purpose; the natural, historical and recreational resources.
2. To provide the highest quality of use and enjoyment by millions of visitors.
3. To develop the parks through inclusion of additional areas of scenic, scientific, historical and recreational value.
4. To communicate the cultural, natural, inspirational and recreational significance of the American heritage.

Arches National Park

In fulfillment of these objectives, NPS performs the following functions.

- Manages the Arches and Canyonlands national parks.
- Manages the Hovenweep, Rainbow Bridge and Natural Bridges national monuments.
- Manages the Glen Canyon National Recreation Area.
- Conducts the recreational aspects of water project implementation studies.
- Conducts congressionally authorized Wild and Scenic River, and Natural Historic and Scenic Trails studies.
- Through comparative agreements, administers recreation lands under the jurisdiction of other federal agencies.
- Provides professional and administrative support to the national, regional and park advisory boards.

### 16.3.13 Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) provides technical and financial assistance to conserve soil, water and related resources on non-federal land through local soil conservation districts. In addition to working with individual landowners and units of government, the NRCS administers programs to inventory existing soil and snow pack conditions, protect watersheds, and to plan for both flooding and drought events.

Soil Surveys - Published soil surveys contain descriptions of an area's soils and the use, management and maps depicting the extent of these soils. The NRCS has prepared seven soil surveys to cover the basin. These surveys are: Grand County, Utah; Canyon Lands Area; San Juan County, Central Part; San Juan Area, Utah; Navajo Indian Reservation-San Juan County, Utah; La Sal Mountain Lower, San Juan

County; and La Sal Mountain Upper, San Juan County.

Snow Surveys - Through the snow survey program, the NRCS measures snow water equivalents and precipitation at either a manually measured snow course station or at a snotel site which can be accessed electronically. There are two snow courses in the basin, Buckboard Flat in the Abajo Mountains and the La Sal Mountains Lower. The two snotel sites are located at Camp Jackson in the Abajo Mountains and the La Sal Mountain site. Data from these survey stations are summarized and made available to the general public in monthly and annual reports. Data is also available on the internet. Also see Table 3-2.

Environmental Quality Incentives Program (EQIP) - The Environmental Quality Incentives Program provides technical, educational and financial assistance to eligible farmers and ranchers to address soil, water and related natural resources concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with federal, state and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation. The purposes of the program are achieved by cost-sharing the implementation of a conservation plan, which includes structural, vegetative and land management practices on eligible land. Fifty percent of the funding will be targeted at natural resources concerns relating to livestock production, primarily in priority areas.

Watershed and River Basin Planning and Installation - Technical and financial assistance is provided in cooperation with local sponsoring organizations, state and other public agencies to voluntarily plan and install watershed-based projects on private lands. The program empowers local people or decisionmakers, builds partnerships and requires local and state funding contributions. The purpose of watershed projects includes watershed protection; flood prevention; water quality improvements; soil erosion reduction; rural, municipal and industrial water supply; irrigation water management; sedimentation control; fish and wildlife habitat enhancement and creation and restoration of wetlands and wetland functions.

Section 3 of Public Law 83-566 provides assistance to sponsoring local organizations to develop plans for watersheds not exceeding 250,000 acres. During planning, problems such as water quality, flooding, water and land management, and sedimentation are evaluated and works of improvement are proposed to alleviate problems. The resulting watershed plans estimate benefits, costs, cost-sharing rates and arrange for operation and maintenance necessary to justify federal assistance to install works of improvement.

Section 6 of Public Law 83-566 provides for cooperation with federal, state and local agencies in making investigations and surveys of river basins as a basis for the development of coordinated water resource programs. Reports of the investigations and surveys serve as guides for the development of water, land and related resources in agricultural, rural and urban areas within upstream watershed settings. They also serve as a basis for coordination with major river systems and other phases of water resource management and development.

The Emergency Watershed Protection Program (EWP) was set up by Congress to respond to emergencies created by natural disasters. It is designed to relieve imminent hazards to life and property caused by floods, fires, windstorms and other natural occurrences. The purpose of EWP is to help groups of people with a common problem. It is generally not an individual assistance program. All projects undertaken must be sponsored by a political subdivision of the state, such as a city, county, general improvement district or conservation district.

On-farm soil and water conservation

Wetlands Reserve Program - The Wetlands Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The NRCS provides technical and financial support to help landowners with their wetland restoration efforts. The goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection.

Resource Conservation and Development Program - The purpose of the Resource Conservation and Development (RC&D) program is to accelerate the conservation, development and utilization of natural resources, improve the general level of economic activity, and to enhance the environment and standard of living in authorized RC&D areas. It improves the capacity of state, tribal and local units of government and local nonprofit organizations in rural areas to plan, develop and carry out programs for resource conservation and development. The program also establishes or improves coordination systems in rural areas. Current program objectives focus on improvement of quality of life achieved through natural resources conservation and community development which leads to sustainable communities, prudent use (development), and the management and conservation of natural resources. NRCS can provide grants for land conservation, water management, community development and environmental needs in authorized RC&D areas.

### 16.3.14 Rural Development

Rural Development is authorized to provide financial assistance for water and waste disposal facilities in rural areas and towns of up to 10,000 people. Priority will be given to public entities in areas smaller than 5,500 people to restore, improve or enlarge a water facility. To be eligible for loan and grant funds, water or waste disposal systems must be consistent with state or subdivision development plans and regulations. Loans for RC&D projects are also available through the service. Rural Development has provided nearly $17 million in cost-share, loans and/or grants for projects in the basin between 1992 and 1996. ❑

# Contents

Section 17

# Southeast Colorado River Basin

**Utah State Water Plan**

## Water Conservation

### 17.1 INTRODUCTION

This section of the Southeast Colorado River Basin Plan provides a comprehensive assessment of water conservation programs, practices and policies for residential, commercial, industrial and agricultural water uses. Conservation has been a way of life for generations. When early settlers carried water from the creek or ditch to the house, they learned to appreciate the number of trips required each day. Shortages caused by population growth, droughts or system failures can be mitigated by conservation to meet priority demands.

Significant reductions in water use can be made when people understand the reasons to conserve. This is evidenced by the public willingness to reduce water use during times of drought. By learning the benefits of implementing long-term water conservation practices, people will be more likely to accept and support these programs when they are presented.

People in the Southeast Colorado River Basin have always been aware of the limited water supply and the cost of its development. Now is the time to consider the place of water conservation as a part of meeting future demands.

### 17.2 BACKGROUND

Whenever water is discussed, the term conservation will most likely be included; especially in the arid west. Water is a finite resource and the demands on its use and consumption are growing at unprecedented rates.

> You don't miss the water 'til the well goes dry. Conserve now to provide for the future.

Conservation can occur at any point during the supply, delivery and use process. One fact that needs to be understood is the difference between diversions and depletions. Diversions are the withdrawal of water from a supply source. Depletion is the water consumed at the point of use that will not return to the system for reuse. A diversion must be sufficient to deliver the required water to the point of use and also allow for any losses along the way. Most of the loss will return to users downstream or make its way to groundwater aquifers.

Water quality is important whether the use is for agricultural, municipal or industrial purposes. The highest quality water is needed for culinary supplies while lower quality water will be adequate for most other uses. Use of lower quality (secondary) water for lawn and garden irrigation will reduce the need for high quality culinary water and extend the existing supply.

The goal of a conservation measure may be aimed at reducing diversions, depletions or both. This applies to both agricultural and municipal and industrial water.

### 17.2.1 Municipal and Culinary Water

The total municipal and industrial (M&I) water use was 8,740 acre-feet in 1996. About 79 percent of the M&I water comes from groundwater, either wells or springs. At present, all of the surface water use is in San Juan County. As time goes on, a larger proportion will come from surface water supplies requiring treatment when needed to meet culinary standards.

If the population increases by the year 2020 as presently projected, seven communities will not be able to meet future demands with the delivery capacity of their existing systems. Moab will need to increase its present system capacity by 1,158 acre-feet. By 2020, they should still have an excess of over 2,500 acre-feet of water supply available. See Table 11-4 and Table 11-6.

Municipal water conservation will delay more construction

The basin's primary source of domestic and municipal drinking water is groundwater, mostly wells, with some systems obtaining their supplies from springs. Although the impact on local aquifers from increased pumpage is not known at this time, it is reasonable to expect there will be increased drawdown with more demand. As a result, the implementation of prudent water conservation measures by local water providers will lessen the impact on underlying aquifers and allow more judicial use of existing water supplies by a growing number of users. Projections made in this report do not include conservation.

Water rates may provide strong incentives to use municipal water more efficiently. Where data is available, current rates are shown in Table 17-1.

The average drinking water use from public community systems for Grand County is 263 gallons per capita per day (gpcd) and for San Juan County it is 162 gpcd, 185 gpcd excluding the Navajo Nation. The basin average is 206 gpcd, 61 gpcd less than the state-wide average of 267 gpcd.

Monticello residents have no financial incentive to use water efficiently. Although meters have been installed, they are not read and billings are made at a flat rate. Commercial firms face a relatively flat volume rate for each successive block of water, providing a mild incentive to use less. By promoting wise use, the Monticello water supply is adequate. Moab has the lowest base rate with mild incentives in the volume charges.

### 17.2.2 Agricultural Water

Agricultural water is mostly diverted from streams and reservoirs and conveyed to the cropland through canals and/or pipelines. There is also some use from groundwater. The systems used to convey the water can lose about 10 to 20 percent or more of the total flow. Additional water is lost when on-farm efficiencies are low. Where water supplies are from direct flow diversions, it is more difficult to make use of water saved by increased efficiency.

Farmers have been installing pipelines and sprinkler systems to replace flood irrigation methods, making the overall irrigation efficiency an estimated 50 percent in the Southeast Colorado River Basin. This is above average when compared to other areas around the state. On-farm irrigation efficiencies can be as high as 60 to 70 percent with sprinkler irrigation systems. The total water diverted for irrigation is 34,950 acre-feet of which 18,430 acre-feet are depleted.

Table 17-1
WATER RATES FOR SELECTED COMMUNITIES

| City/Town | Per Capita (gpcd) | Base Rate ($) | Base Amount (gallons) | First Overage ($) | First Overage (1,000 gal) | Second Overage ($) | Second Overage (1,000 gal) | Third Overage $/1,000 gal |
|---|---|---|---|---|---|---|---|---|
| Moab[a] | 276 | $5.50 | 2 ,000 | 0.44 | 2-10 | 0.60 | all | |
| GW & SS Agency | 224 | | | | | | | |
| Residential | | 0.50/1,000 | 10,000 | .75/1,000 | 10-15 | 1.25/1,000 | all | |
| Commercial | | 1.00/1,000 | 10,000 | 1.50/1,000 | all | | | |
| Blanding | 204 | 15.20 | 5,000 | 0.63 | 5-20 | 0.83 | 21-30 | 1.04/31-50; 1.35 all |
| Bluff | 180 | 20.00 | 5,000 | 0.60 | 5-10 | 0.80 | 10-25 | 0.95/25-50 1.15/+50 |
| Monticello | 147 | | | | | | | |
| Residential | | 18.00 | flat rate | no meters | | | | |
| Commercial | | 13.00 | 5,000 | 0.90 | all | | | |

[a]Rates for residences and commercial establishments served outside city limits are twice these rates.

### 17.3 WATER CONSERVATION OPPORTUNITIES

Water use has changed from primarily agricultural and domestic purposes to include the broader spectrum of municipal and industrial demands. In order to provide an adequate water supply, comprehensive conservation programs must be implemented for all uses.

#### 17.3.1 Municipal and Industrial Water

Water supplied to municipal buildings and facilities, residential housing developments, institutions, commercial and industrial businesses and office buildings is defined as municipal and industrial (M&I) use.

The ability of a municipal supplier to deliver water can be limited by two things; the supply available and the capacity of the delivery system. If the populations increase by the year 2020 as presently projected, seven communities will not be able to meet future demands because of inadequate system capacities although they have an adequate water supply (See Table 11-6). Moab will have the largest system deficiency of 1,158 acre-feet and Thompson Water Improvement District will be short 64 acre-feet. The other five community system inadequacies are minor.

By 2050, three communities will not have an adequate supply of water to meet the projected demand (See Table 11-4). These shortages are based on projected populations without savings from future conservation programs. Municipal and industrial water conservation measures are discussed below.

Residential Water - Residential uses include both indoor and outside water. The implementation of typical conservation programs for residential uses can potentially save between five and 50 percent of gross annual diversions. Residential indoor/outdoor use is typically 40 percent and 60 percent, respectively. The potential for significant water savings through conservation is generally more viable for outdoor uses.

Indoor water use can be reduced by replacing high flow fixtures in the home, replacing old water intensive appliances with newer and more efficient models, and by keeping existing plumbing in good repair. More specific, indoor water conservation measures include: conducting regular inspections of existing toilets, fixtures and plumbing; replacing old high-flow toilets with low flush units; installing low-flow showerheads; taking shorter showers; and minimizing flows when using kitchen garbage disposals and by washing all dishes and clothes in fully loaded machines.

Sprinklers can reduce water use

Irrigation water for residential or commercial landscaping is typically supplied by either culinary or secondary water systems. Although there are a number of municipalities that supply only culinary water to residential and commercial developments, secondary water should be used for outdoor uses whenever possible. The use of secondary instead of culinary water reduces the demand for high quality supplies and can save costs for most public systems. In addition, reuse of treated waste water where conditions are favorable can help augment secondary water supplies.

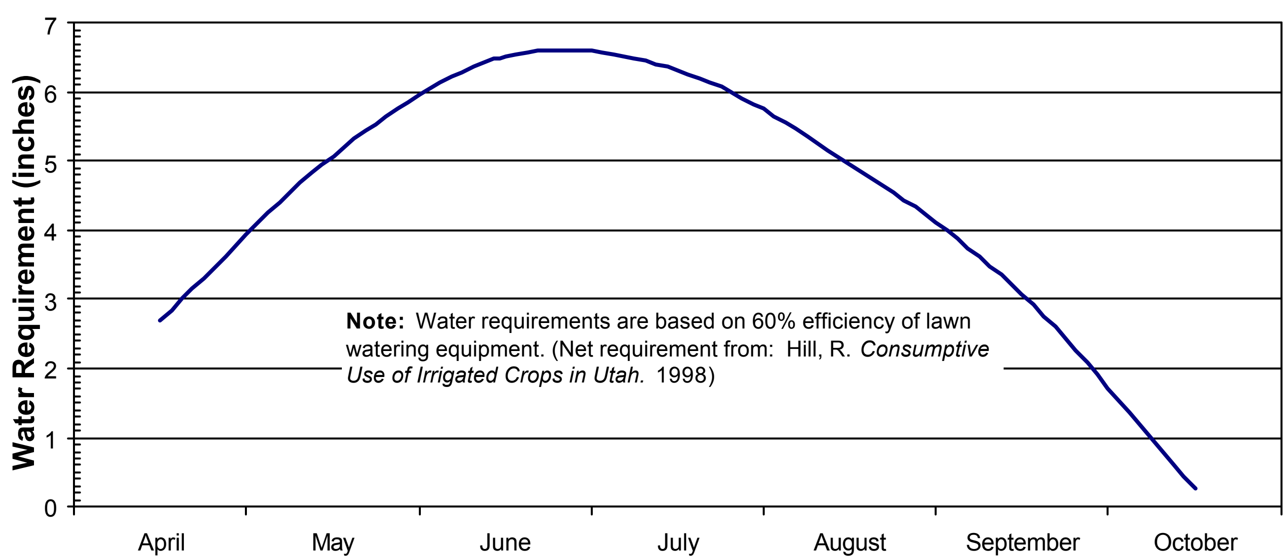
In many cases, the practice of flood irrigating lawns, gardens and shrubbery results in significant losses of water to deep percolation or infiltration into soil profiles beyond established root zones. Use of more efficient application methods such as sprinkler and drip irrigation systems should be considered for all residential and commercial landscape irrigation systems.

However, the use of a sprinkler system with an automatic timer can be very inefficient if it is not operated properly. Setting the timer system to meet summer requirements and allowing it to operate throughout the irrigation season applies water whether it is needed or not. The system should be adjusted to supply only the water needed as the year moves from spring to fall. A well managed system using a hose and sprinkler can be more efficient than a poorly operated sprinkler system with an automatic timer.

Figure 17-1 shows the irrigation water requirement for lawns in the Blanding area. As can be seen, the water needs in the spring and fall are about one-half the peak uses during the hotter summer months. If a timed system is set to meet the peak summer needs throughout the year, considerable water will be wasted early and late in the season. Timed systems need to be adjusted throughout the year to be the most efficient.

The total amount of water applied per irrigation depends on the time and rate of application. Most homeowners are not aware of actual consumptive use requirements and tend to over-irrigate on a regular basis. As a result, irrigation efficiencies are often low. The amount of water applied can be determined by placing small cans around the area being sprinkled and measuring the depth applied for a given time. Also, water applied between the hours of 6:00 p.m. and 10:00 a.m. will lose less to evaporation. Each irrigation should apply the depth of water needed to refill the root zone. In addition, staggering lawn watering days will reduce the demand on the community delivery system and can also save water. Deep, less frequent watering is better than light applications on a daily basis. Reducing over-watering of lawns, gardens and landscaping can save from 20 to 30 percent of the outside water use.

**Figure 17-1**
**LAWN WATER REQUIREMENTS - Blanding**



Consideration should also be given to replacing water intensive landscaping with water efficient landscapes. Utah State University Extension Service offices in Moab and Monticello have information on low water-using plants and vegetation to assist in developing xeriscaping schemes. The use of hardscapes can also reduce the amount of water needed. Hardscapes include decks, patios, walkways and play areas for children. Turf should be used in activity areas where its resilient nature can be utilized. However, because of its high water requirement, turf should not be used alone for an aesthetic ground cover but should be selectively interspersed with plants using less water. All landscapes should be designed so they can be easily maintained and efficiently irrigated.

Significant water conservation can also be achieved by eliminating or reducing the amount of water used to wash vehicles, driveways, sidewalks and exterior portions of the home. In times of drought, these types of outdoor water uses are the first subjected to water restrictions.

Other outdoor conservation measures include: 1) Inspection and repair of irrigation equipment; 2) use of brooms to clean driveways, sidewalks and patios; 3) elimination of continuously flowing water hoses when washing vehicles; 4) removal of handles from outside hose bibs when children are prone to leave water running; and 5) use of float valves for stock watering connections.

Education of the water-using public can help reduce the amount of water used. Reminders to adjust automatic sprinkler irrigation systems to apply only the amount needed can be included with water billings. Communities can also convert turf areas around city buildings into demonstration landscaped areas with a combination of grass, plants with moderate and low water use requirements and hardscaping.

<u>Commercial Water</u> - Commercial water uses are generally associated with small retail businesses such as grocery stores and gas stations. The largest commercial water users are restaurants, laundries, linen suppliers, motels, commercial office buildings and car washes. Conservation measures include water audits of existing distribution and handling systems, replacement of high volume fixtures with more efficient models, recycling where possible and the reduction of high-use landscaped areas.

<u>Institutional Water Uses</u> - This includes water for municipal and public recreational buildings and facilities such as schools, health care facilities, golf courses, athletic fields and major landscaped areas such as parks and cemeteries. Water consumption by these facilities generally accounts for 10 to 15 percent of all M&I uses.

An evaluation of water losses from municipal conveyance systems begins with an audit of existing pipelines, canals, ditches, and all related hydraulic structures and appurtenances. As field measurements have substantiated, leakage from pipes and open water distribution systems ranges from 5 to 20 percent. The lower limit (5 percent) is considered an acceptable level of system water loss. However, losses that approach the 20 percent range generally require an investigation of the existing distribution system and proposals for corrective action.

Water system audits effectively identify areas of excessive loss. These audits generally include: 1) An accounting of diversion and delivery records; 2) pressure testing of pipe systems; and 3) installation of groundwater observation wells to assess open channel seepage. System audits can assess overall distribution efficiencies, locate and determine severe losses and provide information to develop short-and long-term system rehabilitation and water conservation programs. Annual spot examinations can update results of previous audits.

Additional conservation measures include maintaining existing indoor and outdoor distribution systems, use of sprinkler and drip irrigation systems, and replacement of extensive landscaped areas with low-water-use shrubbery. Some areas can be graveled or hard surfaced to reduce water needs.

Irrigation of large grass areas such as parks, churches, cemeteries, and golf courses can be more efficient through the use of automated sprinkler systems with moisture probes and rain shutoff switches. Automated sprinkling systems can optimize the amount of water applied by continually monitoring actual consumptive use and by applying only the water needed during the evening and early morning hours.

Moab Golf Course

Industrial Water - Each industrial facility usually has its own unique water use and water-related in-plant processes requiring a case-by-case assessment to determine effective water conservation practices. However, many of the standard water conservation measures applicable to commercial businesses can also be applied to heavy industry. The most effective of these includes comprehensive audits of process water requirements and existing water supply systems. Water is a part of their operating expenditures and as such, it is a good practice to reduce this cost as much as possible.

### 17.3.2 Agricultural Water

Crop production uses the largest amount of water and therefore has the greatest potential for conservation. Although irrigated agriculture has shown some signs of decline, current estimates indicate this use still accounts for 34,950 acre-feet of total annual diversions. The use of storage reservoirs for irrigation water allows more efficient use by extending the available supply for use in the late part of the growing season or as holdover for the following year. Although farmers have been installing pipelines and sprinkler systems to replace flood irrigation methods, there is still room for improvement.

Agricultural water conservation measures are evaluated from two standpoints. First, to consider the overall conveyance of water supplies from the source to individual farms, and second, to evaluate on-farm methods of applying irrigation water to crops.

Agricultural Water Conveyance Systems - Agricultural distribution systems provide water for farms and ranches as well as for other uses such as lawn and garden watering inside communities. The delivery efficiency of these systems will vary depending on whether it is conveyed in an earth canal or a pipeline. Many of the irrigation systems have installed pipelines to deliver water to the individual users. However, there are still systems where the delivery efficiency could be improved by upgrading the method of conveyance. In addition, using pipelines provides the opportunity to install more efficient on-farm irrigation methods.

Agricultural On-Farm Irrigation Practices - In recent years, many traditional flood irrigation systems have been converted to sprinklers, borders and gated pipe. These practices have allowed on-farm irrigation efficiencies of 60 to 70 percent for sprinklers and up to 90 percent for level borders. Gated pipe system efficiency will vary from 40 to 90 percent depending on whether irrigation is corrugation, furrow or border methods. Irrigation efficiencies can be improved by optimizing the operation and layout of existing sprinkler or flood irrigation practices. Irrigation scheduling can help maximize the use of the available water supply. In all cases, the farmer needs to schedule an irrigation to refill the root zone before the crop goes into stress. However, this requires the water to be available "on call."

#### 17.3.3 Wastewater Reuse

Effluent from wastewater treatment facilities represents a significant source of secondary irrigation water. Existing wastewater treatment facilities at Blanding, Moab and Monticello could potentially be a source of secondary irrigation water to local parks, cemeteries, golf courses, and other isolated landscaped areas. Blanding now uses effluent in sprinkler irrigation systems for agricultural uses. Moab has filed for permission to use effluent and Monticello has it under consideration.

Utilizing treated wastewater as a source of secondary irrigation water allows a more efficient use of the overall water supply by freeing up substantial volumes of higher quality water for culinary uses. The potential for wastewater use as irrigation water should be investigated to determine the criteria, requirements, and costs to install pumping stations and upgrade treatment and distribution systems from each of the existing treatment facilities.

Although the use of wastewater effluent for secondary irrigation is an efficient use of the overall water supply, the practice is limited and subject to stringent regulations by both state and federal health regulations. Current regulations prohibit the use of treated wastewater where it would result in direct human contact, either by aerosols generated from sprinkler discharges or by ingestion of foods irrigated with wastewater effluent. However, state and federal regulations do allow treated wastewater effluent to be used as irrigation water as long as the required conditions are met regarding human contact.

#### 17.3.4 Water Conservation Advisory Board

The October 1995 publication entitled Water Conservation Recommendations by the Utah Water Conservation Advisory Board offers a number of programs and means to effectively conserve a substantial percentage of M&I water. These recommendations include: 1) Development of water management and conservation plans by major water provider agencies; 2) reduction of secondary water by replacing high water-consuming landscaping with xeriscaping or landscaping with reduced water needs; 3) better overall management of water intensive businesses and large conveyance systems; 4) implementation of water pricing measures/policies; and, 5) use of low-flow water fixtures in new residential homes and commercial buildings.

### 17.4 ISSUES AND RECOMMENDATIONS

There is considerable growth in some areas which makes conservation an important component of the plans for meeting future needs. Two policy issues are discussed below.

#### 17.4.1 Community Water Management and Conservation Plans

Issue - Every community should have plans for meeting future growth demands.

Discussion - Developing additional sources of water for residential use is costly. Conserving high quality water sources to serve portions of future growth will be increasingly competitive with the development of new supplies.

The 1997 and 1998 Water Conservation Plan Act requires all conservancy districts and water retailers serving over 500 residents to prepare water conservation plans. An updated plan must be submitted every five years. To receive funding from the Board of Water Resources, Drinking Water Board or Water Quality Board, a community must have a current water conservation plan. At the present time, four community systems and suppliers have submitted conservation plans and one has not.

Water suppliers need to identify conservation goals in relation to supplies and demands. Alternatives to provide water to meet projected demands should be identified. The Division of Water Resources has recently completed an inventory of present supplies, system capacities and has estimated projected demands. Refer to

Section 11 for data on these items. This can be the basis for preparing a water supply and use plan with conservation as an important component. The plan should also look at including fringe areas in the public water system service area. This will reduce the need for additional domestic wells.

In addition to efforts by the Division of Water Resources, San Juan County completed a water development and use master plan that includes information on water conservation at the local level. Samples of conservation plans can be obtained from the Division of Water Resources.

Recommendations - Water management and conservation plans should be developed by the public water suppliers who have not complied with the 1998 Water Conservation Plan Act.

### 17.4.2 Water Pricing

Issue - Public water supplier rate schedules can be used to conserve water use.

Discussion - A pricing strategy may be among the most powerful conservation tools at a water utility's disposal. Cities and water districts are finding certain rate schedules can help modify customer water use and meet conservation goals. Those responsible for maintenance of large areas of turf should be billed for the cost of water, even if it is the municipality. This would bring about recognition of the cost.

Conservation rate structures should have the following characteristics:

**Equity** - Each customer group will be treated the same. Each customer group may be assigned a goal which defines the upper limit of efficient water use. For residential customers, the goal is based on the number of people per household served and outdoor water needs.

**Revenue Stability** - This will avoid the decrease in revenue that traditionally accompanies conservation actions by customers. To avoid the rise and fall of revenues, 100 percent of the fixed cost may be recovered with a base service charge. Charges for water used over the base amount are calculated separately. With all fixed costs covered by the service fee, revenues during droughts and periods of wet weather are adequate.

**Credibility** - The rate structure should be based on defensible information that is logical, simple and is credible in the eye of the customer. Credibility is also gained by providing customers data on water needs based on lot size, continuous customer education about the rates, incentives, penalties and the need for water efficiency.

**Building a Conservation Ethic** - Conservation practiced now can delay expensive new water investments in the short term and reduce chronic shortages in the future. Through continuing education, customers generally understand that wasted water is expensive water. The combination of an equitable, logical and credible rate structure with price incentives to achieve goals, starts the process of building a long-term water conservation ethic.

The introduction of a conservation rate structure may increase phone calls and visits from customers. Customer calls can provide valuable information and opportunities to explain how landscape watering or indoor water-use practices can conserve water.

The impact of a well thought-out conservation rate structure may save up to 15 percent for residential water users in general and up to 45 percent for landscape irrigation. Charging increased rates for high water use will generate revenues for other conservation programs. Therefore, pricing strategies can serve as both a conservation measure and a financial tool.

Setting water prices to encourage more efficient use requires consideration of several principles. They are as follows:

- **Conservation rate structures encourage lower water use without causing a shortfall in revenues.** To avoid revenue shortages, the rate schedule should include a base charge for all customers to cover all fixed costs. These are costs that do not vary regardless of water use.

- **Conservation rate structures produce excess revenue from overage charges.** To cover the variable costs with the amount of water delivered, an overage charge would be made for water delivered in addition to the base volume allowed. Part of the overage charge could include a conservation overage charge. This revenue would be used to encourage and pay for conservation programs.
- **Conservation rate structures identify waste, reward efficient use and penalize excessive use.** Communities with sophisticated billing equipment and adequate staff can develop a target use for each customer. The target would be based on the weather, landscaped area and other pertinent use factors. With a bill showing the excess or efficient use and rates charged, the customer will be able to make choices on water uses.

- **Conservation rate structures are supported by staff who can respond to customer calls.** When customers request assistance on reducing their water use, staff should respond by providing information or giving on-site assistance. This can also include water audits for large users.

Water rates can be structured in several ways to accomplish the desired goals. Three examples are given in the following tables. Two show commonly used rate structures and one is new to Utah.

**A Flat Rate** is easy to administer and understand. There is a base charge every month regardless of water use. In addition, all metered water use is charged at a flat rate or commodity charge. This is shown in Table 17-2.

**The Increasing Block Rate** is more complex but simple to administer if computers are used for billing. Table 17-3 shows how this rate structure works.

Another advantage is both the flat and increasing block rates can be constructed to encourage efficient water use without causing a shortfall in revenue. This is done by having the base charge set to cover fixed costs and the commodity or overage charge set to cover variable costs.

**The Ascending Block Rate** is more complex. It uses a water use target for each customer based on the individual situation. An example is given in Table 17-4. ❑

| Table 17-2<br>FLAT RATE | | | | |
|---|---|---|---|---|
| Month | Usage (kgals) | Base Charge ($) | Commodity Charge ($1.10/kgal) | Total ($) |
| Jan | 5 | 10.00 | 5.50 | 15.50 |
| Feb | 6 | 10.00 | 6.60 | 16.60 |
| Mar | 9 | 10.00 | 9.90 | 19.90 |
| Apr | 13 | 10.00 | 14.30 | 24.30 |
| May | 38 | 10.00 | 41.80 | 51.80 |
| Jun | 48 | 10.00 | 52.80 | 62.80 |
| Jul | 53 | 10.00 | 58.30 | 68.30 |
| Aug | 48 | 10.00 | 52.80 | 62.80 |
| Sep | 29 | 10.00 | 31.90 | 41.90 |
| Oct | 13 | 10.00 | 14.30 | 24.30 |
| Nov | 9 | 10.00 | 9.90 | 19.90 |
| Dec | 6 | 10.00 | 6.60 | 16.60 |
| **TOTALS** | **277** | **120.00** | **304.70** | **424.70** |

| Table 17-3<br>INCREASING BLOCK RATE | | | | | | |
|---|---|---|---|---|---|---|
| Month | Usage (1,000 gal) | Base Charge ($) | Commodity Charge 0 to 10[a] $0.90 | Overage Charge 10 to 20[a] $1.00 | Over 20[a] $1.25 | Total ($) |
| Jan | 5 | 10.00 | 4.50 | | | 14.50 |
| Feb | 6 | 10.00 | 5.40 | | | 15.40 |
| Mar | 9 | 10.00 | 8.10 | | | 18.10 |
| Apr | 13 | 10.00 | 9.00 | 3.00 | | 23.00 |
| May | 38 | 10.00 | 9.00 | 10.00 | 22.50 | 51.50 |
| Jun | 48 | 10.00 | 9.00 | 10.00 | 35.00 | 64.00 |
| Jul | 53 | 10.00 | 9.00 | 10.00 | 41.25 | 70.25 |
| Aug | 48 | 10.00 | 9.00 | 10.00 | 35.00 | 64.00 |
| Sep | 29 | 10.00 | 9.00 | 10.00 | 11.25 | 40.25 |
| Oct | 13 | 10.00 | 9.00 | 3.00 | | 22.00 |
| Nov | 9 | 10.00 | 8.10 | | | 18.10 |
| Dec | 6 | 10.00 | 5.40 | | | 15.40 |
| **TOTALS** | **277** | **120.00** | **94.50** | **56.00** | **145.00** | **415.50** |

[a] Gallons are in 1,000s.

Table 17-4
ASCENDING BLOCK

| Month | Usage (1,000 gal) | Base Chg. ($) | Target use (1,000 gal) | Et. ac-in [1] | Discount @ \$0.83 [2] | Conserve Base @ \$1.10 [3] | Ineff. Use @ \$2.20 [4] | Wasteful Use @ \$4.40 [5] | Irres. Use @ \$8.80 [6] | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 5 | 10.00 | 11.25 | 0 | 4.13 | | | | | 14.13 |
| Feb | 6 | 10.00 | 11.25 | 0 | | | | | | 16.60 |
| Mar | 9 | 10.00 | 11.25 | 0 | | | | | | 19.90 |
| Apr | 13 | 10.00 | 26.00 | 4 | | | | | | 24.30 |
| May | 38 | 10.00 | 35.84 | 6.67 | | 41.80 | | | | 51.80 |
| Jun | 48 | 10.00 | 41.85 | 8.30 | | 46.04 | 13.52 | | | 69.56 |
| Jul | 53 | 10.00 | 46.17 | 9.20 | | 49.69 | 17.22 | | | 76.91 |
| Aug | 48 | 10.00 | 41.85 | 8.30 | | 46.04 | 13.52 | | | 69.56 |
| Sep | 29 | 10.00 | 29.69 | 5 | | 31.90 | | | | 41.90 |
| Oct | 13 | 10.00 | 26.00 | 4 | | 14.30 | | | | 24.30 |
| Nov | 9 | 10.00 | 11.25 | 0 | | 9.90 | | | | 19.90 |
| Dec | 6 | 10.00 | 11.25 | 0 | | 6.60 | | | | 16.60 |
| **TOTALS** | **277** | **120.00** | **302.66** | **45.47** | **4.13** | **277.07** | **44.26** | | | **445.46** |

Days in Billing Period = 30    Application Efficiency = 0.65    Indoor Use = 100 gcd    Irrigated Area = 0.21 ac.    Family Size = 5

[1] Evapotranspiration in Acre-Inches
[2] Discount for using less than 50% of target. Price is 75% of base price.
[3] Base price charged for all water used between 50% and 100% of target.
[4] First penality charged for water used 101% to 150% over target.
[5] Second penality charged for water use 151% to 200% over target.
[6] Third penality charged for water use. All water used beyond 201% of target.

# Contents

Section 18

# Southeast Colorado River Basin

**Utah State Water Plan**

## Industrial Water

**18.1 INTRODUCTION**

This section of the Southeast Colorado River Basin Plan provides a brief accounting of industrial development in Grand and San Juan counties in addition to presenting information and data concerning current industrial water use. Water is used for industrial purposes such as mining and mineral extraction, processing and ready-mix concrete. There are no hydroelectric power production plants in the area and no sites have been recently evaluated.

**18.2 BACKGROUND**

The history of large scale industry in the basin parallels the boom and bust eras of various mining operations over more than one hundred years. The initial growth in the local mining industry was directly related to the discovery of gold, silver and copper. In later years, activity was centered on the development of relatively large petroleum and uranium deposits at various sites throughout the basin.

Shortly after the arrival of Mormon settlers and miscellaneous entrepreneurs in the 1860s and 1870s, small amounts of gold and silver were discovered along the banks of both the San Juan and Colorado rivers. Although the initial discoveries were small, gold fever attracted thousands of prospectors from throughout the western territories and California by the early 1890s. However, by the turn of century, the hope of finding the big strike dissipated as no significant gold or silver deposits were ever discovered.

After the turn of the century, low grade deposits of copper were discovered in White Canyon and Lisbon Valley. The deposits were initially assumed to be of sufficient size to warrant the construction of the Big Indian processing plant near La Sal. This required significant volumes of water and resulted in the construction of a 6.5-mile water line to the plant site at La Sal from nearby mountain streams and springs. However, mining completely shut down by the late 1930s due to a decline in copper prices.

> Industrial water use is a small but important part of the total resource. It is also subject to more variability, fluctuating with market

Oil was discovered in 1882 when gold and silver prospectors noticed brownish-black liquid floating on the lower San Juan River. By the turn of century, oil exploration reached an all-time high. By 1909, twenty-five wells had been drilled with a success rate of over 80 percent.

Although the demand for uranium did not reach significant levels until the completion of World War II, local uranium deposits were actively mined as early as the late 1890s. Prior to the development of nuclear weapons in the 1940s, uranium was used in the manufacture of a number of domestic products including paint pigments, ceramics, steel alloys, luminescent surfaces and as a treatment for cancer. This early demand was the main driving force in the search for uranium. Of all the mining ventures in the basin, vanadium, uranium and potash were the most lucrative and have had the biggest impact.

An $8 million uranium processing plant was built near Moab in 1955, making this community the "Uranium Capitol of the World." This boom put a high demand on all the resources, including water. Since then, this mill has been closed leaving a large tailings pile that is contaminating the groundwater and the nearby Colorado River. Efforts to remedy the situation over the years have been fruitless until recently. There is still discussions on whether to cap the tailings pile in place or whether to remove it to another location where it will not contaminate the groundwater. The latest proposal is to fund the pile removal from a Congressional appropriation and oil reserve revenues from lands restored to the Northern Ute Indians. A detailed discussion is given in Section 12.4.2.

A uranium processing mill was also constructed near Monticello because of the high volume of ore being mined in the area. During this boom period, processing of uranium ore jumped from 700 tons to 17,800 tons annually. This mill has been removed and the site has been cleaned up under the Environmental Protection Agency's Superfund Program.

During the 1980s, Energy Fuels constructed a processing plant on White Mesa near Blanding. Amid considerable controversy, the plant, now owned by International Uranium Corporation, is still in operation. The plant recently started alternate feed operations (reprocessing of uranium tailings).

Although uranium mining helped develop the local economy, it also came with a significant cost. Most of the mining operations have been abandoned leaving large stock piles of spent uranium ore tailings that pose a threat to underlying groundwater aquifers and nearby rivers and streams. There is concern by state and federal water quality agencies that over an extended period of time, contaminants will leach to existing natural systems. As a result, the Division of Oil Gas and Mining is actively managing the long term cleanup of a number of the most sensitive of these sites.

**18.3 INDUSTRIAL WATER USE**

Over the years, and primarily as secondary developments to mining, a number of other industries have grown in the basin. These businesses generally include metal finishing plants, lumber processing mills, oil refineries, various construction and rock product operations, and meat processing plants. Water use by these industries varies to a significant degree by business or plant type and operation. A recent inventory of municipal and industrial water use in the basin gathered data for 1996. The estimated self-supplied water use by industrial businesses was 2,030 acre-feet per year. In addition, 30 acre-feet of culinary water from public community systems was used for industrial purposes. There are plans to start a mining operation in the Lisbon Valley area soon. This operation will require use of groundwater. Self-supplied industrial water use is projected to reach 4,560 acre-feet by 2020 and 6,720 acre-feet by 2050. Table 18-1 shows the current and projected industrial water use. ❑

White Mesa Mill

Table 18-1
INDUSTRIAL WATER USE

| Year/Category | Grand County (acre-feet) | | San Juan County (acre-feet) | | Total (acre-feet) | |
|---|---|---|---|---|---|---|
| | Diversion | Depletion | Diversion | Depletion | Diversion | Depletion |
| **1996** | | | | | | |
| Culinary Industrial | 0 | 0 | 30 | 25 | 30 | 25 |
| Self-Supplied Industrial | 940 | 820 | 1,090 | 950 | 2,030 | 1,770 |
| **Total** | **940** | **820** | **1,120** | **975** | **2,060** | **1,795** |
| **2020** | | | | | | |
| Culinary Industrial | 0 | 0 | 40 | 35 | 40 | 35 |
| Self-Supplied Industrial | 1,050 | 920 | 3,510 | 3,050 | 4,560 | 3,970 |
| **Total** | **1,050** | **920** | **3,550** | **3,085** | **4,600** | **4,005** |
| **2050** | | | | | | |
| Culinary Industrial | 0 | 0 | 60 | 50 | 60 | 50 |
| Self-Supplied Industrial | 1,210 | 1,140 | 5,510 | 4,710 | 6,720 | 5,850 |
| **Total** | **1,210** | **1,140** | **5,570** | **4,760** | **6,780** | **5,900** |

# Contents

Section 19

# Southeast Colorado River Basin

**Utah State Water Plan**

## Groundwater

### 19.1 INTRODUCTION

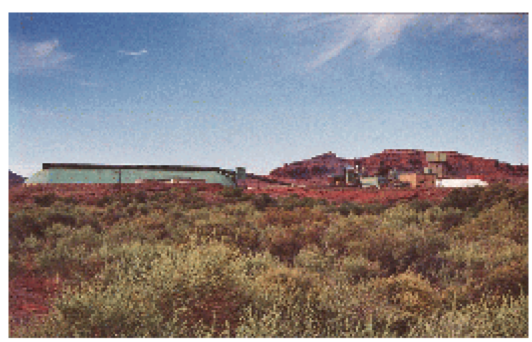
This section of the Southeast Colorado River Basin Plan discusses the groundwater resources. The development and management of groundwater is more complex than surface water. While surface water occurs in readily discernible drainage basins with topographic boundaries, groundwater occurs in aquifers that are hidden from view. The boundaries of an aquifer are physical, thus they may outcrop, be offset by faulting against an impermeable rock unit, may grade laterally into a lower permeability deposit due to changes in the depositional environment, or they may thin and disappear. At any given location, the land surface may be underlain by several aquifers. Each aquifer may have a different chemical quality and a different hydraulic potential. Each of these aquifers may be recharged in different locations and flow in different directions. Groundwater divides do not necessarily coincide with surface water divides.

Groundwater has been developed from two types of aquifers, consolidated rock and unconsolidated alluvial deposits. Water-yielding consolidated rock units underlie most of the basin at varying depths. In most areas, unconsolidated alluvial deposits are thin and of limited extent. Only in Castle Valley and Spanish Valley is much water produced from the alluvial aquifer.

### 19.2 AQUIFER CHARACTERISTICS

Alluvial aquifers are shallow and thus often closely connected to surface water sources making them susceptible to contamination. Consolidated aquifers are generally deeper and more expensive to develop. They also tend to be more distantly connected to sources of recharge but less liable to become contaminated from human sources. The important consolidated rock aquifers in the Southeast Colorado Basin are rocks of Mesozoic age, although the Cutler Formation of Paleozoic age is important locally. The aquifer properties of the Mesozoic rocks are given in Table 19-1. Younger rocks are only locally preserved while most rocks older than Mesozoic age contain brackish or saline water. The geologic stratigraphy is shown on Figure 3-3.

Groundwater is an unseen, complex resource found in many locations but often difficult to develop.



Moab Salt Incorporated

Table 19-1
CHARACTERISTICS OF AQUIFERS OF MESOZOIC AGE

| Aquifer[a] | Formation | Permeability (ft/d) | Transmissivity ($ft^2/d$) | Storage Coefficient |
|---|---|---|---|---|
| D | Dakota-Cedar Mountain | 0.5 to 50 | 5 to 2,000 | NA |
| D | Burro Canyon | NA[b] | NA | NA |
| M | Morrison | 0.5 to 5 | 50 to 80 | NA |
| M | Bluff | NA | NA | NA |
| N | Entrada | 0.5 to 50 | 5 to 200 | 0.0001 |
| N | Carmel | 0.5 to 500 | 11 to 200 | 0.0001 |
| N | Navajo | 0.5 to 50 | 1 to 5,500 | 0.001 to 0.1 |
| N | Kayenta | 0.5 to 5 | NA | NA |
| N | Wingate | 0.5 to 50 | NA | NA |
| | Chinle | 0.5 to 5 | NA | NA |
| | Moenkopi | 0.5 to 5 | 5 to 270 | 0.0001 |

Source: Schlotthauer & others, 1981, Table 9.
[a]USGS aquifer designation from Avery (1986). Also see Figure 3-3.
[b]NA = Data not available.

**19.2.1 Consolidated Rock Aquifers**

All of the consolidated rocks can be water bearing to some degree depending on permeability, thickness and location with respect to recharge areas. Some of the consolidated rock aquifers contain good quality water although many yield water that is more saline. The U.S. Geological Survey has grouped these formations into regional aquifer systems in the San Juan County area with each group containing one or more formations.[21] These hydrologic units from oldest to youngest are: **P aquifer, C aquifer, N aquifer, M aquifer and D aquifer.** Also see Figure 3-3. There has also been some grouping of these formations in the Grand County area.[36]

**P and C aquifers** (Cutler formation) - The Cutler formation of Paleozoic age and primarily the **Cedar Mesa sandstone** member provides small quantities of water to seeps and springs on Cedar Mesa and in parts of Canyonlands National Park. The Cedar Mesa sandstone member is a fine-to coarse-grained, thickly cross-bedded, eolian deposition in a shallow-marine foreshore environment. It is an important aquifer in San Juan County.

The **White Rim sandstone** is medium-to coarse-grained, well-sorted and is the nearshore and sandbar-complex facies. It provides small quantities of water to springs and seeps on Cedar Mesa and in parts of Canyonlands National Park. There are also three wells in the White Rim sandstone in Canyonlands National Park. However, in most of the basin, it is either elevated or drained and contains little developable water, or it contains brackish water. It may yield water to wells recharged locally, such as along the margins of Castle Valley.

**N aquifer** (Wingate, Kayenta, Navajo, Carmel and Entrada formations) - The **Wingate sandstone** is a massive, fine grained, thickly cross-bedded, eolian sandstone. It erodes to vertical cliffs which are commonly coated with a dusky-red desert varnish. Thickness of the Wingate sandstone ranges from about 300 to 400 feet. It yields water to springs and wells where permeability has been enhanced by fracturing.

The **Kayenta formation** is an irregularly interbedded, fluvial fine to coarse-grained sandstone, siltstone and shale. Thin beds of shale-pellet conglomerate and freshwater limestone are present locally. The sandstone facies predominate. In many places there is a prominent siltstone bed near the top of the formation which locally perches water in the overlying parts of the Kayenta formation and the Navajo sandstone. The Kayenta formation erodes to cliffs and benches and caps many mesas and narrow benches. Thickness of the Kayenta formation is about 240 feet in the western part of the Grand County area and decreases to nearly zero as it moves east in the eastern part of the area.

The **Navajo sandstone** is the most prolific water-yielding formation. This formation is one of the shallowest and most permeable in the Grand County area, while in most of San Juan County, the Navajo sandstone is covered by younger formations. It produces water with low total dissolved-solids concentrations and is therefore a prime source of drinking water. Near Bluff, some wells in the Navajo sandstone exceed drinking water standards in arsenic.[21]

The Navajo sandstone is a massive, fine grained, thickly cross-bedded sandstone of windblown origin. It erodes to massive cliffs and domes alternating with depressions. The thickness of the Navajo sandstone is about 400 feet in the western part of the Grand County area and decreases to the east. The Navajo sandstone is absent in the extreme eastern part of the area.

The **Carmel formation** crops out south of the City of Green River but pinches out towards the eastern part of Grand County. This formation is a confining unit and is not known to yield water. The Carmel formation has created flowing-well conditions in Gothic Creek Wash south of Bluff where it confines water in the underlying Navajo sandstone.

The **Entrada sandstone** is divided into three members: the Dewey Bridge, Slick Rock and the Moab sandstone members. The Dewey Bridge member is composed of siltstone and fine grained sandstone. The Slick Rock member is a massive, medium grained, cross-bedded sandstone of windblown origin. The Moab sandstone member is a single crossbed set of medium grained, massive sandstone at the top of the formation. Thickness of the Entrada sandstone is as much as 550 feet in the western part of the area and decreases to the east.

The **D aquifer** - The **Dakota sandstone and Burro Canyon sandstone** provide the principal groundwater source near Blanding and Monticello. Where recharged locally, they yield water of good quality. Because they do not have much storage, individual well yields are small.

#### 19.2.2 Alluvial Aquifers

Alluvial aquifers are generally characterized by high transmissivities (up to 14,000 $ft^2$/yr) and high storage coefficients (up to 20 percent). Alluvial fills occur along existing rivers and streams where water is actively moving and depositing sand and gravel. The occurrence of alluvial aquifers in the basin is minimal with water-bearing depths of less than 200 feet in most areas. The largest and most developed alluvial aquifers are in Spanish Valley, Castle Valley and the flood plain of the San Juan River near Bluff.

## 19.3 STRUCTURAL SUBDIVISIONS

The permeability of aquifer rocks and their position with respect to natural recharge and discharge is determined by geologic structure. The distribution and thickness of unconsolidated alluvial deposits is likewise a function of geologically recent structural adjustments of the earth's crust. The Southeast Colorado River Basin can be subdivided into structural provinces as shown in Figure 19-1.

### 19.3.1 Green River Desert and Uncompahgre Uplift

Little exploration has taken place in the Green River Desert and Uncompahgre Uplift. As a result, little is known of local aquifer characteristics or groundwater production.

### 19.3.2 Salt Anticlines

The northern part of the area is characterized by several northwest-southeast trending valleys and alluvial basins formed by the upwelling of deeply buried salt formations. These include Salt Valley of Arches National Park, Castle Valley, Spanish Valley and Paradox Valley. Some, such as Salt Valley, are cored by salt at or near the surface, and groundwater is saline (Rush and others, 1980). Where such structures are crossed by the Colorado River, such as Castle Valley and Spanish Valley, the near-surface salt has been dissolved and replaced by thick deposits of alluvial sand and gravel. These alluvial deposits contain groundwater of varying quality depending on location with respect to recharge or to remaining salt bodies.

### 19.3.3 Laccolithic Domes

The laccolithic La Sal, Abajo (Blue) and Navajo mountains are igneous intrusions which have domed the overlying sedimentary layers. Although their elevation enhances the potential for recharge, aquifers above the Navajo sandstone are generally at high elevations, dip away from the mountains, are drained, and well

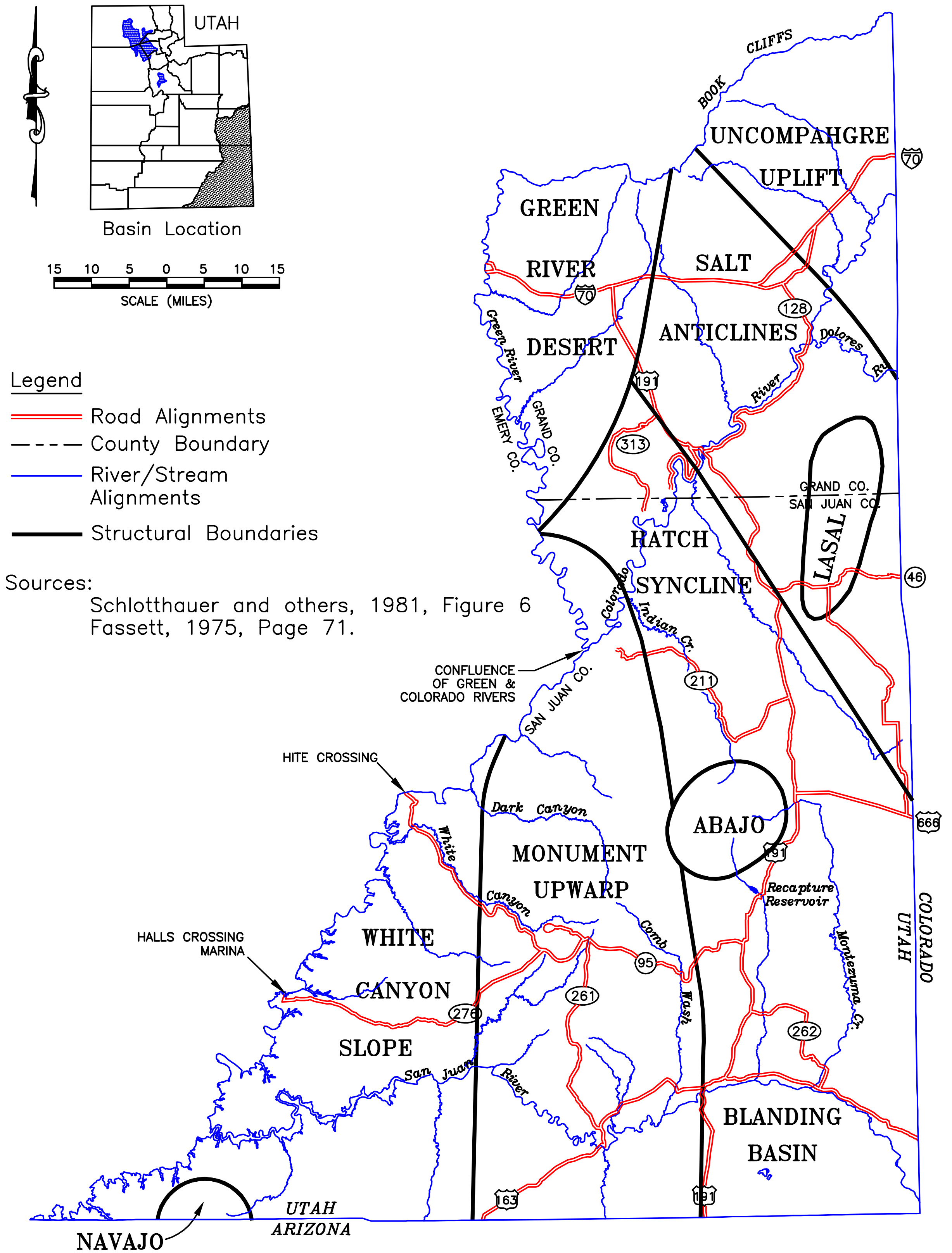
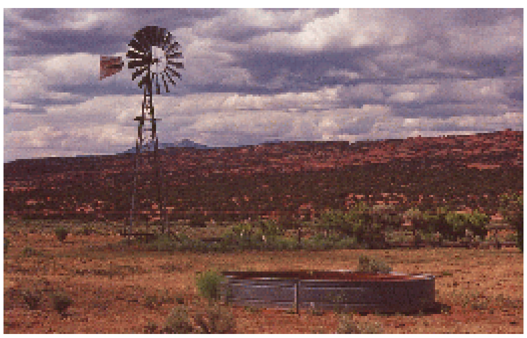



Figure 19–1
GEOLOGICAL STRUCTURAL ELEMENTS
Southeast Colorado River Basin

yields are low. Near Moab, the Navajo sandstone is well exposed at moderate elevations, receives abundant recharge from streams draining the La Sal Mountains, is well fractured, and yields water readily to wells. Most of the intrusions of the Abajo Mountains are above the elevation of the Navajo sandstone and deeper formations preventing recharge.

**19.3.4 Hatch Syncline and Blanding Basin**

A structural basin containing most of the Mesozoic aquifer units extends SSE from the Colorado River to Bluff. Because it is a plateau cut by canyons, the aquifers above the Carmel formation are drained or only partly saturated. Wells in the Dakota and Burro Canyon formations at Monticello and Blanding yield small to moderate amounts of fresh water.



Windmill pumps water for livestock

Tests of the Navajo sandstone near Monticello and Blanding have been disappointing, with deep static levels and low yields. At the elevation of Bluff near the San Juan River, the Navajo sandstone has artesian pressure and is a good producer. The Cutler formation of Paleozoic age is deeply buried in the Blanding basin and contains brackish or saline water. The Cutler formation is exposed to the north in Canyonlands National Park. Where it is recharged locally, it produces small amounts of fresh water.

**19.3.5 Monument Upwarp**

Little exploration has taken place in the Monument Upwarp. It can be seen as a large blank area (Weigel, 1987). The Mesozoic aquifers have been uplifted and mostly eroded. Erosional remnants cut by canyons are well drained. The underlying Paleozoic rocks generally have poor quality water with limited recharge by overlying streams.

**19.3.6 White Canyon Slope**

On the White Canyon Slope, rock layers dip gently westward toward Lake Powell from the Monument Upwarp. Little exploration has occurred in this unpopulated region. Groundwater is likely available where Mesozoic or Paleozoic aquifers are recharged from Lake Powell.

**19.3.7 Navajo Nation Lands**

The portions of Utah classified as the Blanding Basin, Monument Upwarp and White Canyon Slope and lying mostly south of the San Juan River are on Navajo Nation lands. Water development here has been the province of federal agencies, and the state of Utah has had little opportunity to participate. Data on groundwater on Navajo Nation land can be found in Avery, 1986 [21] and USGS, 1963.[59]

**19.4 SALT AND BRINE**

The Southeast Colorado River Basin is underlain by the Paradox formation which consists largely of evaporite deposits. Evaporites are soluble minerals evaporated from an ancient sea and contain sodium and potassium salts as well as gypsum. In contact with groundwater, these minerals dissolve to form brine. Studies by the U.S. Geological survey show that the eastern two-thirds of San Juan County is underlain by a thick layer of briney groundwater with a total dissolved solids concentration greater than 10,000 mg/l. The top of this brine layer ranges in elevation from below sea level to 6,540 feet.

Where the salt is near the surface, as in Castle Valley, Spanish Valley and Paradox Valley, it may come in contact with circulating groundwater. As a result, changing prehistoric groundwater gradients or aquifer pressures by pumping creates the potential for aquifer contamination by salt water intrusion.

Salt water intrusion is apparently occurring in the Aneth area where salinity has been increasing in several wells in the Navajo sandstone aquifer. An analysis of this problem has shown that the contaminating salt is not from the oil field brine which is re-injected into the oil reservoirs, but is probably from the upper paleozoic briney aquifer which underlies the Navajo sandstone even though it is separated by one or more confining layers.[20] The brine may be reaching the Navajo sandstone through a breach in the intervening confining layers which could be either natural fractures, abandoned drill holes or poorly cemented casings of oil wells.

## 19.5 GROUNDWATER WITHDRAWALS

Division of Water Rights public supply records from reporting communities indicate about 6,046 acre-feet are annually withdrawn from wells and springs in the basin. These data are shown in Table 19-2. This table does not include several towns or communities (Aneth, Blanding, Monticello) which have not reported well pumpage and does not include pumpage from private domestic wells which is a significant part of the total supply in some communities. The natural discharge of many unmonitored springs also is not included. The total groundwater diversions as determined during the Division of Water Resources M&I inventories and from Navajo Nation data indicate the total diversions were: springs, 2,770 acre-feet and wells, 12,220 acre-feet.[14,15,84] Also see Table 5-4. Figures 19-2 and 19-3 show location of springs and wells.

## 19.6 CONSOLIDATED ROCK GROUNDWATER DEVELOPMENT POTENTIAL[21,23,25,34,35,36]

The groundwater aquifers are found at varying depths over large areas of the basin. They include rocks from Cretaceous to Permian age, although not all formations are present in all areas. In general, the shallower aquifers nearer to the recharge areas contain better quality water. A brief discussion of each system from oldest to youngest follows:

**P and C Aquifers** (Lower Permian Cutler formation) - The Cutler formation underlies most of the basin, often at depths which along with poor water quality, often makes development unfeasible. In San Juan County, the **P Aquifer** consists of the Cedar Mesa sandstone and the **C Aquifer** consists of the DeChelly sandstone. Both the Cedar Mesa sandstone and the White Rim sandstone members of the Cutler formation yield water to wells in the Needles area of Canyonlands National Park and near the confluence of the Green River with the Colorado River. Additional wells could produce small quantities of water.

The **P Aquifer** or undifferentiated Cutler formation in Castle Valley furnishes water to about 30 wells along the west side at depths of 150 to 300 feet where there is a possible hydraulic connection to the salt layers of the Paradox formation. Five wells each discharge from 20 to 40 gallons per minute. Some of the wells are unsuitable for domestic use without treatment. There is also some use in the Needles area of the Canyonlands National Park.

The **C Aquifer** or De Chelly sandstone is the only source of water in some of the Navajo Nation chapters. The groundwater moves northward from Arizona towards the San Juan River.

**N Aquifer** (Middle and Lower Jurassic Entrada sandstone, Carmel formation, Navajo sandstone, Kayenta formation and Wingate sandstone) - The **N Aquifer** is the main aquifer throughout the basin. The Navajo sandstone, Kayenta formation and Wingate sandstone form the Glen Canyon Aquifer found in the southern half of Grand County, primarily in the Spanish Valley/Moab area. The Entrada sandstone and Carmel formation are part of the **N Aquifer** in middle and southern San Juan County. Where

Table 19-2
Estimated Annual Groundwater Diversions

| Entity | Sources | Diversion (acre-feet) | Year |
|---|---|---|---|
| **Grand County** | | | |
| Grand County WCD | 6 wells | 1,111 | 1996 |
| Moab City | 3 springs, 5 wells | 2,032 | 1996 |
| NPS Arches | 2 wells | 6 | 1996 |
| **Grand County Subtotal** | | **3,149** | |
| **San Juan County** | | | |
| Blanding | 4 wells used for irrigation of parks and golf courses | ND | |
| Bluff | 3 wells | 61 | 1996 |
| Eastland SSD | 3 wells | 9 | 1996 |
| Mexican Hat | 2 wells | 28 | 1995 |
| Mexican Hat (SJSSD#1) | 1 well | 34 | 1995 |
| Monticello Municipal | 6 wells | ND | |
| NPS Halls Crossing Marina | 2 wells | 0.3 | 1996 |
| NPS Hite Marina | NA | 12 | 1996 |
| Self-supplied industry | well | 997 | 1996 |
| **San Juan Co Subtotal** | | **1,141** | |
| **NTUA** | | | |
| Aneth Community | Wells | 144 | 1996 |
| Montezuma Creek Comm | Wells | 1,612 | 1996 |
| **NTUA Subtotal** | | **1,756** | |
| **Basin Total** | | **6,046** | |

Source: State Engineer's Public Supply Records

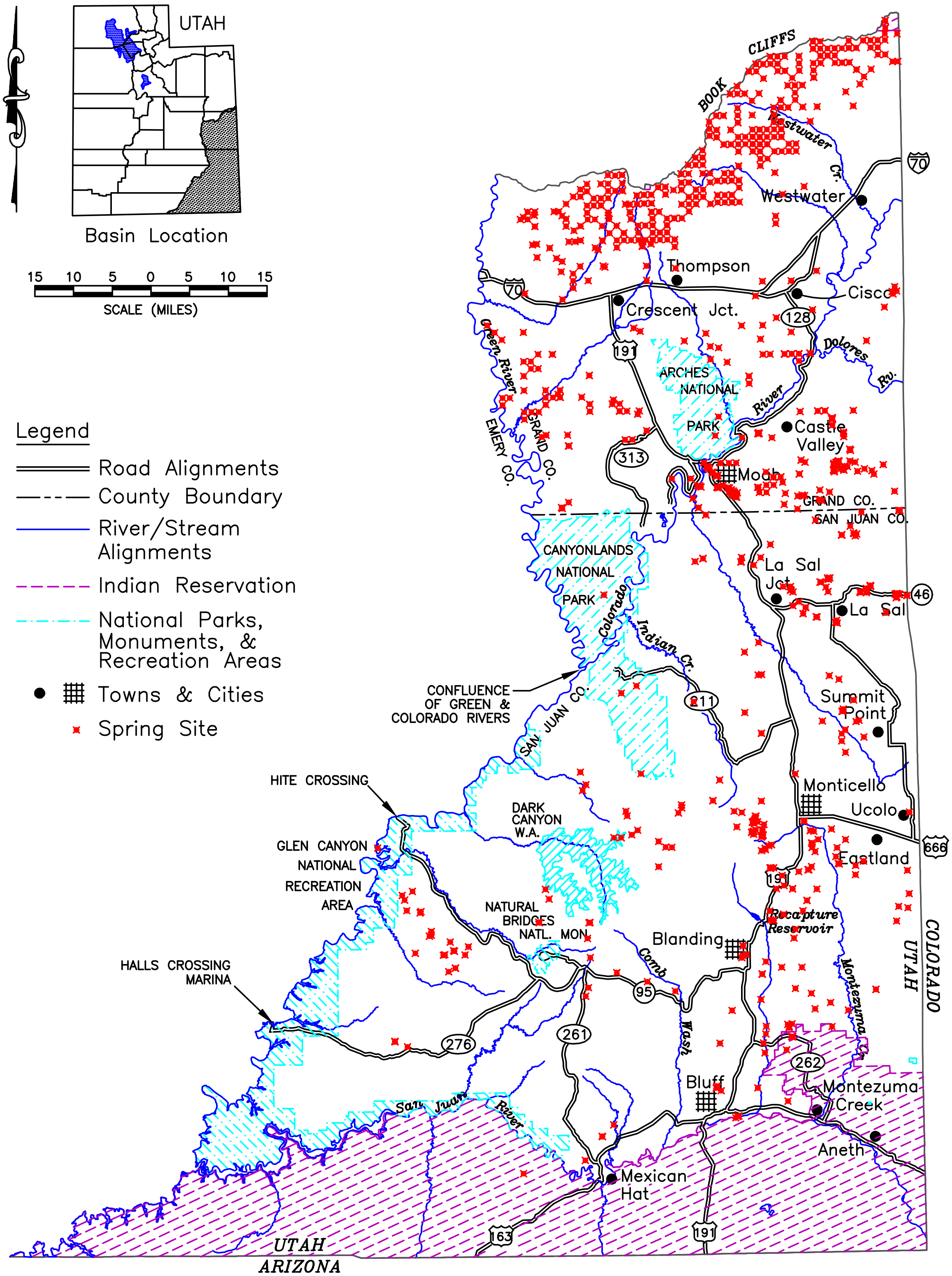



Figure 19–2
SPRING LOCATIONS
Southeast Colorado River Basin

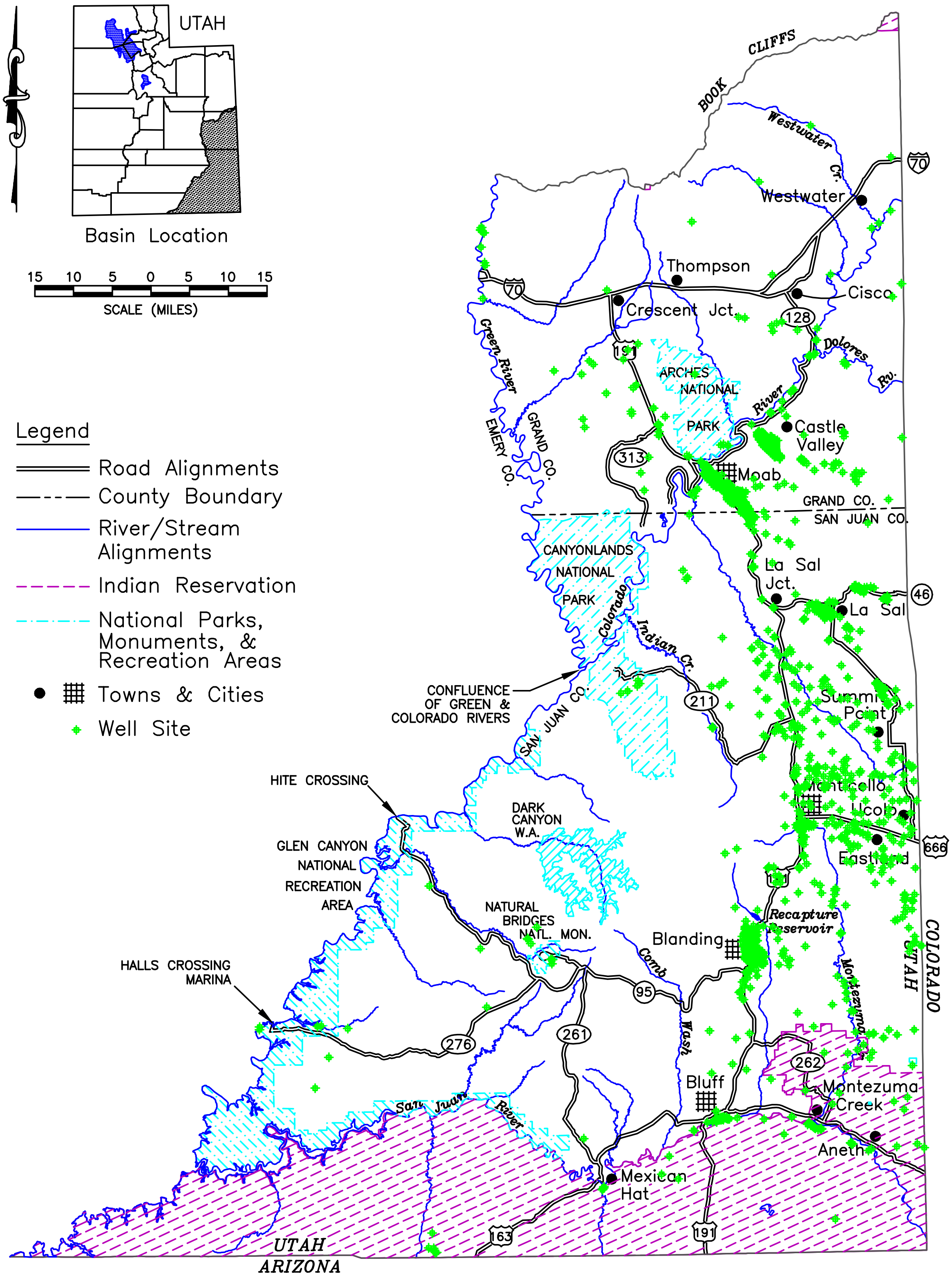



Figure 19-3
WELL LOCATIONS
Southeast Colorado River Basin

the Navajo sandstone and Kayenta formation are flat lying, springs issue from the base of the Navajo sandstone. Spring discharge ranges from less than 5 to more than 300 gpm. Well discharge is as much as 2,500 gpm in the Spanish Valley/Moab area. The **N Aquifer** is a major or only source of water in Bluff, Eastland, the Spanish Valley /Moab area, and the Aneth, Mexican Water and Red Mesa chapters of the Navajo Nation. The water is suitable for culinary use. There is potential for development of about 5,000 acre-feet annually along the San Juan River corridor from Aneth to Bluff. There is also potential for drilling wells in the Eastland area and on White Mesa. The Glen Canyon Aquifer in the Spanish Valley/Moab area is a potential source for additional development of groundwater.

**M Aquifer** (Upper Jurassic Morrison formation) - This aquifer includes the Bluff sandstone and Westwater Canyon, Recapture, and Saltwash members of the Morrison formation. Recharge areas are found in the Book Cliffs, on the flanks of the La Sal Mountains, in Montezuma Creek Canyon and other canyons north of Bluff, and in areas south of the San Juan River. The best potential use is for private domestic wells and stock wells in southeastern and northeastern San Juan County and southeastern Grand County. The more likely areas are south of the high mesas in central San Juan County and north of the San Juan River where the **D Aquifer** is missing and the **N Aquifer** is deep. Yields will be low. The Saltwash member yields small quantities of water to seeps and springs northwest of Moab.

**D Aquifer** (Cretaceous Dakota sandstone and Burro Canyon formation) - This aquifer is exposed in the Book Cliffs area, in the La Sal area, around Monticello and in the Sage Plain, and near Blanding and in the White Mesa area. It is covered by alluvial deposits on the flanks of the La Sal and Abajo mountains. In other areas, it is overlain by the Mancos shale which prevents recharge. Annual recharge is estimated at about 39,000 acre-feet in the San Juan County area. The water quality varies. The **D aquifer** is found around Blanding, Eastland, La Sal and Monticello. Wells exist in the Blanding and Monticello areas along with private domestic wells in east-central and northeastern San Juan County and southeastern Grand County. It also yields water to a few small springs. Yields are low and the aquifer could be easily mined by excessive pumping.

### 19.7 CASTLE VALLEY ALLUVIAL AQUIFER[29,35]

Castle Valley is a collapsed salt anticline lying between the La Sal Mountains and the Colorado River. The cliffs of Porcupine Rim and Parriott and Adobe mesas define the southwest and northeast borders respectively.

Hydrogeology - Castle Valley is surrounded by Permian to Tertiary sedimentary and igneous rocks. It is part of a large, regional collapsed salt anticline that includes Paradox Valley to the southeast.

The valley fill consists of alluvial-fan deposits and stream alluvium. Holocene stream deposits along Castle Creek and Placer Creek are generally poorly sorted sand, silt and clay with some gravel lenses, particularly in the higher reaches. Course-grained older alluvium is exposed in the higher parts of Castle Valley and in the valley proper. Alluvial-fan deposits form apron-like gentle slopes at the base of Porcupine Rim consisting of poorly sorted boulders, cobbles and gravels in a fine-grained matrix.

Groundwater is found in both fractured rock and valley fill. Most of the water entering the local aquifers falls initially as snow in the La Sal Mountains. All of the homes in the valley use groundwater for both culinary and secondary uses. However, high mineral content at some wells has been a problem in terms of drinking water standards.

Groundwater Quality - The quality of groundwater in Castle Valley varies widely depending on well location and aquifer type. Most of the groundwater in the alluvial aquifer is classified as either Class IA or II. Wells sampled in this aquifer ranged from 357 micromhos/cm (211 mg/L) to 1,960 michromhos/cm (1,156 mg/L).[36] Water in the Cutler formation aquifer is mostly Class II but in some areas may be Class III with specific conductance as high as 3,260 µS/cm (1,923 mg/L). Refer to Table 12-2 for more information. The source of dissolved-solids is assumed to be remnants of Paradox evaporites within the core of the anticline. A few wells in the Cutler formation have been identified as producing water with excessive concentrations of selenium and sulfate. The probable cause of the poor water quality is assumed to be associated with a long aquifer residence time and related flow path, dissolved fine-grained constituents of the Cutler formation, and the hydraulic connection to the Paradox formation evaporites beneath the Cutler formation.

Recharge and Discharge - Approximately 30 wells receive water from the Cutler formation aquifer along the base of Porcupine Rim on the west side of the Valley. Well depths are generally 150 to 300 feet below land surface. Recharge to the aquifer is partially from the La Sal Mountains. The Chinle and Moenkopi formations are important confining units overlying the Cutler formation. Regionally, the Wingate sandstone is an important fractured rock aquifer, but exposures in Castle Valley are too localized and do not receive sufficient recharge.

Measured potentiometric surface elevations have indicated that groundwater flow patterns generally follow a northwest direction paralleling Castle and Placer creeks. Most of the recharge to the valley fill aquifer is from Castle and Placer creeks which originate high in the La Sal Mountains. As Castle Creek crosses the coarse-grained valley fill in the southeastern part of the valley, much of the flow percolates into the aquifer. Castle Creek is a losing stream except near the town of Castle Valley. Other sources of local groundwater recharge include direct percolation of precipitation, percolation and seepage of irrigation water, and inflow from adjacent fractured rock aquifers. Aquifer discharge is to local irrigation canals that intercept groundwater tables, wells, evapotranspiration of shallow groundwater aquifers, and underflow to the Colorado River.

One study has just been completed to determine the impacts of the wells and septic tanks on the alluvial aquifer.[29] Another study is under way to determine the impact of a growing population.

## 19.8 SPANISH VALLEY ALLUVIAL AQUIFER[23,25,36]

The Mill Creek and Spanish Valley drainage includes an estimated 44 square miles of land southeast of Moab and is one of the more developed areas in the Southeast Colorado River Basin. Water for both irrigated agriculture and municipal uses has been developed from surface and groundwater sources. However, groundwater is the primary source of culinary water.

Hydrogeology - The local groundwater system has a complex hydrogeologic makeup and consists of both alluvium and consolidated rock. These aquifer materials include the **N aquifer** (Navajo, Kayenta, and Wingate sandstone formations; also called the Glen Canyon Group).

Groundwater Quality - Groundwater quality is generally good with only moderate concentrations of dissolved solids and sulfates. However, these levels increase at various locations within the local aquifer.

Water quality characteristics typical of water in the Entrada, Navajo and Wingate sandstone aquifers include low to moderate concentrations of dissolved solids, calcium bicarbonate and calcium magnesium bicarbonate. Dissolved-solid concentrations are typically in the range of 200 to 300 milligrams per liter and the water is considered hard. Concentrations of dissolved-solids and sulfate increases west and south of the City of

Moab's well field. This is because an increasingly larger proportion of the groundwater comes from alluvium in upper Spanish Valley, which probably contains remnants of evaporates in the core of the anticline. Concentrations of dissolved solids in the Navajo sandstone aquifer also are higher along the Moab fault, suggesting that the fault penetrates to the deeper brine-bearing formations.

Recharge and Discharge - Recharge to the consolidated rock aquifers typically occurs where the formations crop out or are overlain by unconsolidated sand deposits. Recharge is enhanced where the sand deposits are saturated at a depth of more than about six feet below the land surface as the effects of evaporation decreases rapidly with depth. Recharge to the Wingate sandstone aquifer typically occurs by downward movement of water from the Navajo sandstone aquifer through the Kayenta formation, and primarily occurs where the Navajo sandstone, Kayenta formation and the Wingate sandstone are fractured.

The principal area of discharge from the Navajo sandstone aquifer in the Mill Creek-Spanish Valley area occurs in and near the City of Moab's well field, near the northeast canyon wall of Spanish Valley. Discharge from one well is reportedly as large as 2,000 gallons per minute, and discharge from one spring near the well field is reportedly over 300 gallons per minute.

Discharge from springs issuing from the **N aquifer** typically is less than about 10 gallons per minute and discharge from wells ranges from 5 to 30 gallons per minute. In the Mill Creek-Spanish Valley area, discharge from springs issuing from the **N aquifer** ranges from 15 to over 300 gallons per minute and discharge from wells ranges from less than 10 to about 2,000 gallons per minute. The larger discharge rates occur where the formations are fractured and faulted. Water levels declined from the early 1960s to about 1979, and then rose as much as 39.5 feet from 1979 to 1987. The larger than normal amount of precipitation beginning in 1977 probably is a substantial factor in the rising water levels.

In addition and on an annual basis, substantial groundwater draw down is experienced at the Moab well fields toward the late summer months with subsequent recovery during the fall to early summer months. As a result, it is believed that the long-term change in storage in the local reservoir is minimal with groundwater levels fluctuating in near direct response to annual precipitation and rate of pumpage. The 1996 rate of annual pumpage and spring diversions for culinary water demand was over 2,100 acre-feet in the Moab-Spanish Valley area.

## 19.9 POLICY ISSUES AND RECOMMENDATIONS

The major groundwater issues center around the development of long-range groundwater management and development plans.

### 19.9.1 Development of Long Range Groundwater Management Plans

Issue - A long-range groundwater master plan is needed to identify potential contamination problems and to establish necessary management criteria.

Discussion - Groundwater is an important source of culinary water in the basin and will become more so in the future. Instances of excessive groundwater level draw-down and water quality problems have been identified and attributed to population growth. More detailed assessments of groundwater capacity and water quality projections need to be made. In the more populated areas including Moab, Castle Valley, Blanding and the Navajo Nation, comprehensive groundwater management plans should be prepared to adequately assess: 1) The ability of local aquifers to meet projected demands; and, 2) the impact on continued residential development on groundwater quality.

Recommendation - Plans should be prepared for the total development of the groundwater resources in areas of high projected growth.

### 19.9.2 Need for Regional Groundwater Exploration and Inventory

Issue - The existing capability of local aquifers to provide a significant supply of water for future demands should be quantified.

Discussion - Because surface water supplies are limited, groundwater is a vital source for present and future supplies in the Southeast Colorado River Basin. Groundwater development, especially from the deeper bedrock aquifers, has been slow because of the expense and uncertainty of exploration.

The population of some communities is expected to increase so the present culinary water supply will not be adequate to meet the projected demand. Most of this water will probably come from groundwater aquifers. There is a need to obtain new "hard data" regarding the ability of various aquifers to yield culinary quality water. Some of the most recent data is nearly 15 years old and was not much beyond a reconnaissance level of study.

Groundwater studies are currently underway in Castle Valley and Spanish Valley. The Division of Water Rights is completing a study of the alluvial aquifer in Castle Valley to determine if the groundwater is being contaminated by septic systems, if the groundwater is being depleted and to prepare a water budget.

The Town of Castle Valley also has a study underway to explore the groundwater aquifers in more depth to determine future impacts of additional septic tank systems on groundwater development. This study is being carried out by the Division of Water Resources and the Utah Geological Survey in cooperation with other federal and state agencies.

A Regional Public Drinking Water Management Plan is being prepared for the Spanish Valley area with a block grant from the Department of Community and Economic Development. This study will determine if there is additional developable water in the aquifers that can be used by the Grand Water and Sewer Service Agency and the City of Moab to meet future culinary water demands.

Recommendation - The state should provide support to local entities by compiling existing groundwater information and by underwriting exploration programs where existing knowledge is insufficient to predict the quantity, quality, or production cost of developing new groundwater sources. ❑

Section A

# Southeast Colorado River Basin

**Utah State Water Plan**

## ACRONYMS, ABBREVIATIONS AND DEFINITIONS

### A.1 ACRONYMS AND ABBREVIATIONS

Many names, titles, programs, organizations, legislative acts, measurements and activities are abbreviated to reduce the volume of words and to simplify communications. A few of the abbreviations and acronyms used in the Southeast Colorado River Basin Plan are listed below.

#### A.1.1 State and Local Agencies and Organizations

| | |
|---|---|
| CEM | Division of Comprehensive Emergency Management |
| DDW | Division of Drinking Water |
| DWQ | Division of Water Quality |
| DWR | Division of Wildlife Resources |
| DWRe | Division of Water Resources |
| DWRi | Division of Water Rights |
| MCD | Multi-County Planning District |
| SDCO | State Disaster Coordinating Office |
| SHMT | State Hazard Mitigation Team |
| UGS | Utah Geological Survey |
| UWQB | Utah Water Quality Board (WQB) |

#### A.1.2 Federal Agencies

| | |
|---|---|
| BIA | Bureau of Indian Affairs |
| BLM | Bureau of Land Management |
| BR | Bureau of Reclamation |
| COE | Corps of Engineers |
| EPA | Environmental Protection Agency |
| FSA | Farm Service Agency |
| FEMA | Federal Emergency Management Agency |
| FWS | Fish and Wildlife Service |
| NRCS | Natural Resources Conservation Service |
| USDA | United States Department of Agriculture |
| USGS | Geological Survey |

#### A.1.3 Programs/Acts

| | |
|---|---|
| CERCLA | Comprehensive Environmental Response and Comprehensive Liability Act |
| CFR | Code of Federal Regulations |
| CRP | Conservation Reserve Program |
| CWA | Clean Water Act |

| | |
|---|---|
| DWSPR | Drinking Water Source Protection Rule |
| ESA | Endangered Species Act |
| NAWQA | National Water Quality Assessment |
| NFIP | National Flood Insurance Program |
| NPDES | National Pollution Discharge Elimination System |
| RPDWS | Rules for Public Drinking Water Systems |
| SCORP | State Comprehensive Outdoor Recreation Plan |
| SDWA | Safe Drinking Water Act |
| UPDES | Utah Pollution Discharge Elimination System |
| USDWA | Utah Safe Drinking Water Act |
| UWPCA | Utah Water Pollution Control Act |
| UWQA | Utah Water Quality Act |

**A.1.4 Measurements**

| | |
|---|---|
| Ac-Ft | Acre-feet |
| CFS(cfs) | Cubic feet per second |
| gpcd | Gallons per capita day |
| gpm | Gallons per minute |
| MCL | Maximum contaminant level |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| µmhos/cm | Micromhos per centimeter |
| µS/cm | Microsiemens per centimeter |
| Mw | Megawatt |
| PMP | Probable maximum precipitation |
| SMCL | Secondary maximum contaminant level |
| TDS | Total dissolved solids |
| TMDL | Total Maximum Daily Load |

**A.1.5 Miscellaneous**

| | |
|---|---|
| BMP | Best Management Practices |
| EAP | Emergency Action Plan |
| EOP | Emergency Operations Plan |
| FIRE | Finance, insurance and real estate |
| M&I | Municipal and industrial |
| OHV | Off-highway vehicle |
| RC&D | Resource Conservation and Development |
| RMP | Resource Management Plan |
| TCPU | Transportation, communications and public utilities |
| WWTP | Wastewater treatment plant |

## A.2 WATER RESOURCES DEFINITIONS

Many terms used in the water business have different meanings depending on the source, and are sometimes confusing. Some words are used interchangeably. A few commonly used water terms are defined for use in this document.

### A.2.1 Water Use Terms

Water is often said to be "used" when it is diverted, withdrawn, depleted, or consumed. But it is also "used" in place for such things as fish and wildlife habitat, recreation and hydropower production. These are instream uses.

Commercial Use - Uses normally associated with small business operations which may include drinking water, food preparation, personal sanitation, facility cleaning and maintenance and irrigation of landscapes.

Consumptive Use - Consumption of water for residential, commercial, institutional, industrial, agricultural, power generation and recreational purposes. Naturally occurring vegetation and wildlife also consumptively use water. Water consumed is not available for other uses within the system.

Cropland Irrigation Use - Water used for irrigation of cropland. Residential lawn and garden uses are not included.

Depletion - Net loss of water through consumption, export and other uses to a given area, river system or basin. The terms consumptive use and depletion, often used interchangeably, are not the same.

Diversion/Withdrawal - Water diverted from supply sources such as streams, lakes, reservoirs, springs or wells for a variety of uses including cropland irrigation and residential, commercial, institutional, and industrial purposes. The terms diversion and withdrawal are often used interchangeably.

Industrial Use - Use associated with the manufacturing or assembly of products which may include the same basic uses as commercial business. The volume of water used by industrial businesses, however, can be considerably greater than water use by commercial businesses.

Institutional Use - Uses normally associated with general operation of various public agencies and institutions including drinking water; personal sanitation; facility cleaning and maintenance; and irrigation of parks, cemeteries, playgrounds, recreational areas and other facilities.

Municipal Use - This term is commonly used to include residential, commercial and institutional. It is sometimes used interchangeably with the term "public water use."

Municipal and Industrial (M&I) Use - This term is used to include residential, commercial, institutional and industrial uses.

Private or Domestic Use - Includes water from private wells or springs for use in individual homes, usually in rural areas not accessible to public water supply systems.

Residential Use - Water used for residential cooking; drinking; washing clothes; miscellaneous cleaning; personal grooming and sanitation; irrigation of lawns, gardens, and landscapes; and washing automobiles, driveways, and other outside facilities.

**A.2.2  Water Supply Terms**

Water is supplied by a variety of systems for many uses. Most water supply systems are owned by an irrigation company or a municipality, but in some cases the owner/operator is a private company, or is a state or federal agency. Thus, a "public" water supply may be either publicly or privately owned. Also, systems may supply treated or untreated water.

Culinary Water Supply - Water meeting all applicable safe drinking water requirements for residential, commercial and institutional uses. This is also known as potable water.

Municipal and Industrial (M&I) Water Supply - A supply that provides culinary/secondary water for residential, commercial, institutional and industrial uses.

Public Water Supply - Includes culinary water supplied by either privately or publicly owned community systems which serve at least 15 service connections or 25 individuals at least 60 days per year. Water from public supplies may be used for residential, commercial, institutional, and industrial purposes, including irrigation of publicly and privately owned open areas.

Secondary / Non-Potable Water Supply - Pressurized or open ditch water supplies of untreated water for irrigation of privately or publicly owned lawns, gardens, parks, cemeteries, golf courses and other open areas. These are sometimes called "dual" water systems.

**A.2.3  Groundwater Terms**

Aquifer - A saturated body of rock or soil which will yield water to wells or springs

Groundwater - Water which is contained in the saturated portions of soil or rock beneath the land surface. Excludes soil moisture which refers to water held by capillary action in the upper unsaturated zones of soil or rock.

Mining - Long-term groundwater withdrawal in excess of recharge.

Phreatophyte - A plant species which extends its roots to the saturated zone under shallow water table conditions and transpires groundwater. These plants are high water users and include such species as tamarisk, greasewood, willows and cattails.

Recharge - Water added to the aquifer/groundwater reservoir or the process of adding water to the aquifer/groundwater reservoir.

Recoverable Reserves - The amount of water which could be reasonably recovered from the groundwater reservoir with existing technology.

Safe Yield - The amount of water which can be withdrawn from an aquifer on a long-term basis without serious quality, environmental or social consequences, or seriously depleting the reservoir.

Total Water in Storage - A volume of water derived by estimating the total volume of saturated aquifer and multiplying by the porosity (intergranular space containing water).

### A.2.4 Other Water Terms

Some water terms are peculiar to the water industry.

Call - The ability to order a quantity or flow of water at a given time and for a given period of time.

Carriage Water - Water needed for hydraulic operation of a delivery system.

Drinking Water - Water used as a potable/culinary supply.

Export Water - A water diverted from a river system or basin other than by the natural outflow of streams, rivers and groundwater. The means by which is exported is sometimes called a transbasin diversion.

Instream Flow - Water flow maintained in a stream for the preservation and propagation of wildlife or aquatic habitat and for aesthetic values.

Non-Point Source Pollution - Pollution generated and discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by such things as sediment and nutrients carried to lakes and streams by surface runoff.

Point Source Pollution - Pollutants discharged from any identifiable point, including pipes, ditches, channels and containers.

Potable/Culinary - Water suitable for drinking or cooking purposes. The terms culinary and potable are often used interchangeably.

Reuse - The reclamation of water diverted from a municipal or industrial wastewater conveyance system.

Riparian Areas - Land areas adjacent to rivers, streams, springs, bogs, lakes and ponds. They are ecosystems composed of plant and animal species highly dependent on water.

Water Quality - Water quality data was taken from reports and other material prepared by various agencies over different periods of time. For this reason, water quality measurements were made in different units. It has been decided to report the data in milligrams per liter as this terminology is more familiar to the lay reader.

The chemical concentration of dissolved solids is given in milligrams per liter (mg/L), a unit expressing the weight per unit volume. A mg/L is equivalent to parts per million (ppm). Specific conductance is often measured in lieu of concentration of dissolved solids as it is more economical and can be done in the field. Specific conductance is a measure of the ability of the water to conduct electricity, which is a function of the dissolved solids. Specific conductance is given in micromhos per centimeter (µmhos/cm). Specific conductance is also reported in microsiemens per centimeter (µS/cm). A µmho/cm is equal to a microsiemens per centimeter. For concentrations of 100 to 5,000 µmhos/cm, specific conductance can be converted to dissolved solids by the equation: mg/L = 0.59 multiplied by specific conductance (µmhos/cm). In all cases, the lower the number, the better the water quality.

Watershed - The total area of land above a given point on a waterway that contributes runoff water to the flow at that point; a drainage basin or a major subdivision of a drainage basin.

Water Yield - The runoff from precipitation that reaches water courses and therefore may be available for human use.

Wetlands - Areas where vegetation is associated with open water and wet and/or high water table conditions.

Wet/Open Water Areas - Includes lakes, ponds, reservoirs, streams, mudflats and other wet areas.

## A.3 OTHER DEFINITIONS

Soils Descriptions - Following are four terms used to describe soil horizons or conditions.

The **Argillic Horizon** is a horizon below the surface layer in which silicate clays have accumulated.

**Aquic Conditions** are where soils have a continuous or sufficient time period of water saturation for reduced pore conditions or lack of oxygen.

A **Calcic Horizon** in which secondary calcium carbonates or other carbonates have accumulated.

**Mollic Epipedon** is a thick dark mineral surface layer having more than 50 percent base saturation, and an organic carbon content of 0.6 percent or more.

Section B

# Southeast Colorado River Basin

**Utah State Water Plan**

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Prepared by the State Water Plan Coordinating Committee


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