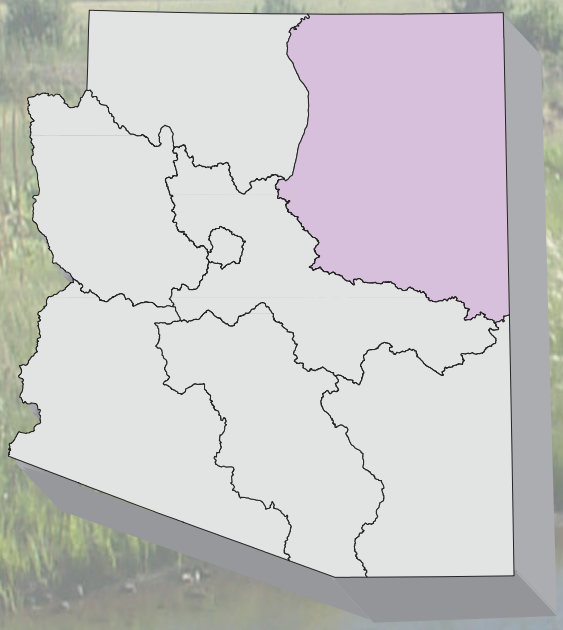
Arizona Department
of Water Resources
May 2009

ARIZONA WATER ATLAS

VOLUME 2

EASTERN PLATEAU PLANNING AREA



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Special note about the Atlas Team
Completion of the Atlas would not have been possible without the dedicated professionals that compose the Atlas Team. Most have been involved with the project from its inception in 2003 and their contributions to the success of the project cannot be overstated.

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ARIZONA WATER ATLAS
VOLUME 2 –EASTERN PLATEAU PLANNING AREA

PREFACE

Volume 2, the Eastern Plateau Planning Area, is the second in a series of nine volumes that comprise the Arizona Water Atlas. The primary objectives in assembling the Atlas are to present an overview of water supply and demand conditions in Arizona, to provide water resource information for planning and resource development purposes and help to identify the needs of communities. The Atlas also indicates where data are lacking and further investigation may be needed.

The Atlas divides Arizona into seven planning areas (Figure 2.0-1). There is a separate Atlas volume for each planning area, an executive summary volume composed of background information (Volume 1) and a resource sustainability assessment volume (Volume 9). "Planning areas" are an organizational concept that provide for a regional perspective on supply, demand and water resource issues. A complete discussion of Atlas organization, purpose and scope is found in Volume 1. Also included in Volume 1 is general background information for the state and a summary of water supply and demand data for all planning areas. Appendices in Volume 1 describe data sources and methods of analysis, provide information on water law, management and programs and Indian water rights claims and settlements.

There are additional, more detailed data available to those presented in this volume. These data may be obtained by contacting the Arizona Department of Water Resources (Department).

SECTION 2.0 Overview of the Eastern Plateau Planning Area

The Eastern Plateau Planning Area is unique in that it is composed of one groundwater basin, the Little Colorado River Plateau Basin. The planning area is relatively high in elevation and is geographically diverse with the highest peaks in the state as well as deep sandstone canyons and large mesas. Almost two-thirds of the land area is under tribal ownership. Elevations range from over 12,600 feet in the San Francisco Peaks north of Flagstaff to 4,200 feet where the Little Colorado River exits the Basin at Cameron. Parts of three counties are contained within the Eastern Plateau Planning Area: Apache (90% of the county), Coconino (41%) and Navajo (89%) counties. All or parts of three Indian reservations are located within the planning area – the Hopi, Navajo, and Zuni reservations. San Juan Southern Paiute tribal members occupy lands located within the Navajo reservation. The Joseph City Irrigation Non-expansion Area (INA) was designated west of Holbrook in Apache County due to insufficient groundwater to provide a reasonably safe supply for irrigation (A.R.S. § 45-431) (Figure 2.0-2).

Much of the planning area is sparsely populated. Flagstaff is the largest metropolitan area with almost 52,900 residents in 2000 and an estimated population of 64,200 in 2007. Other

Navajo Generating Station. The planning area has a large industrial water use sector due to several electrical generating stations, large coal mining operations and a paper mill.

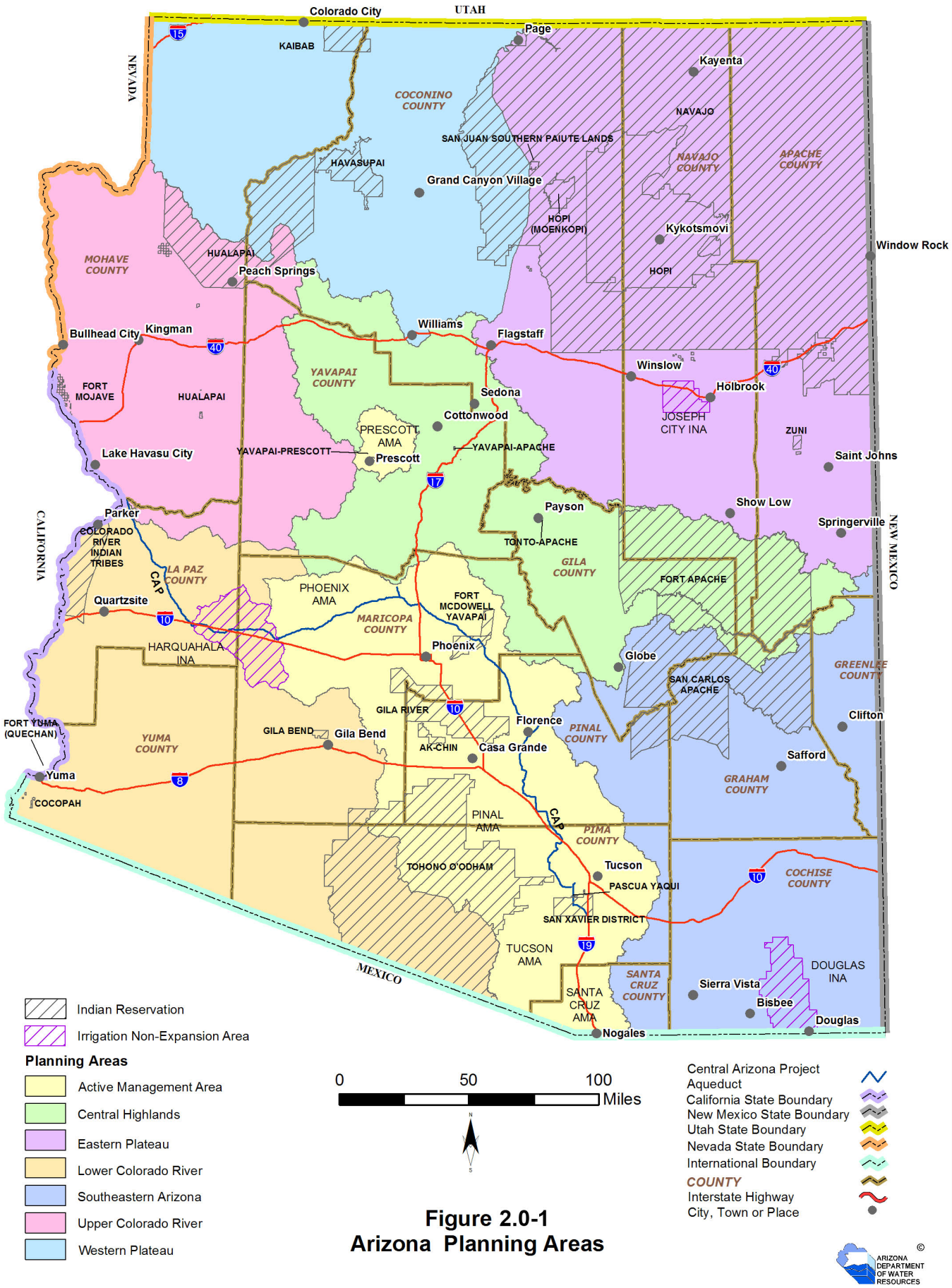
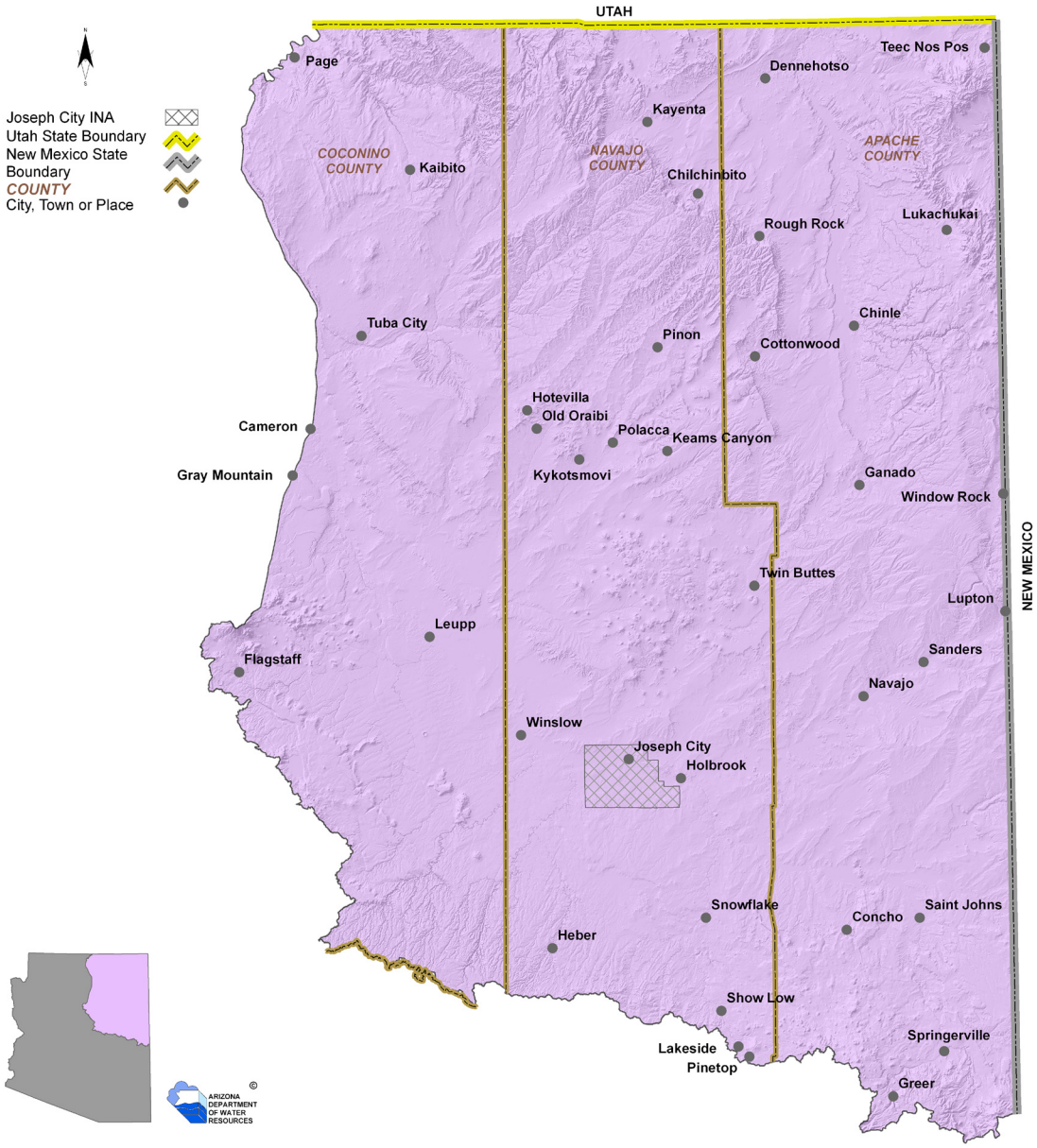


Figure 2.0-1
Arizona Planning Areas

population centers include Show Low/Pinetop/ Lakeside, Winslow/Holbrook, Page, and Tuba City, Window Rock, Chinle and Kayenta on the Navajo Reservation. The 2000 Census planning area population was almost 250,000.

An annual average of about 170,500 acre-feet of water per year was used during the period 2001-2005 in the planning area for agricultural, municipal and industrial uses (cultural water demand). The water supplies utilized to meet these demands include primarily groundwater (104,800 acre-feet), surface water from the Colorado River and other streams (50,800 acre-feet) and effluent (14,900 acre-feet). The planning area has a large industrial water use sector due to the presence of several electrical generating stations, large coal mining operations and a paper mill. Industrial water use is currently about 83,100 acre-feet per year (AFA). Municipal sector average annual demand is approximately 45,000 acre-feet. Agricultural demand is relatively small-scale with an estimated annual demand of 42,400 acre-feet.

Figure 2.0-2 Eastern Plateau Planning Area

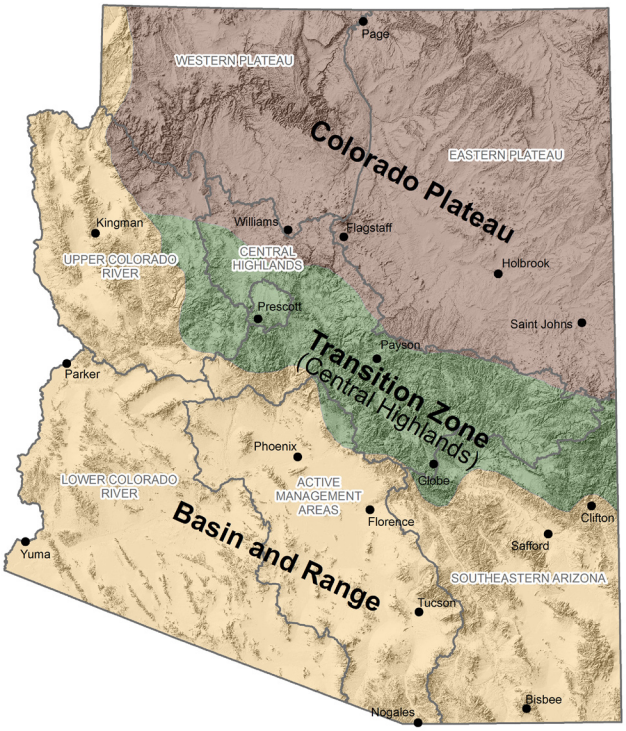


2.0.1. Geography[1]

The Eastern Plateau Planning Area encompasses 26,700 square miles (sq. mi.) in the northeastern portion of the state. The planning area consists of one groundwater basin, the Little Colorado River Plateau Basin. Counties and prominent cities, towns and places are shown in Figure 2.0-2. The planning area is bounded on the north by the Arizona-Utah border, on the east by the Arizona-New Mexico border, on the south by the Mogollon Rim, and on the west by the Coconino Plateau Basin and Paria Basin in the Western Plateau Planning Area, whose boundaries coincide closely with U.S. Highway 89 (Figure 2.0-1). The Mogollon Rim is an escarpment almost 2,000 feet high in some places, extending from central Arizona to the Mogollon Mountains in New Mexico. It forms a hydrologic boundary between the Eastern Plateau Planning Area and the basins of the Central Highlands and Southeastern Arizona planning areas. The Eastern Plateau Planning Area includes parts of four watersheds, which are discussed in Section 2.0-2. All of the Hopi Indian Reservation (2,534 sq. mi.), approximately 56% (14,680 sq. mi.) of the Navajo Indian Reservation, 2% of the Zuni Reservation (16 sq. mi.) and less than 0.2% of the Apache Reservation are located within the planning area. Ninety percent of the Navajo lands in Arizona are located in the Eastern Plateau Planning Area. Many members of the San Juan Southern Paiute Tribe reside in several distinct communities located on the Navajo Reservation. The San Juan Southern Paiute is a relatively small tribe of approximately 265 members. The largest community is located at Willow Springs near Tuba City (ITCA, 2003).

As shown in Figure 2.0-3 the planning area is almost entirely within the Colorado Plateau physiographic province, which covers the northern two-fifths of Arizona. This province is characterized by mostly level, horizontally

Figure 2.0-3 Physiographic Regions of Arizona



Data source: Fenneman and Johnson, 1946

stratified sedimentary rocks that have been eroded into canyons and plateaus, and by some high mountains. Major mountain ranges are the San Francisco Peaks near Flagstaff, the White Mountains in the southeastern portion of the planning area and the Chuska and Lukachukai mountains located along the Arizona-New Mexico border (Figure 2.1-1). The Chuskas reach an elevation of almost 10,000 feet and much of the rain and snow that falls in the Chuskas drains westward into Canyon de Chelly. The Hopi Reservation is characterized by three mesas that rise to an elevation of 7,200 feet. Elevations vary from 12,633 feet at Humphreys Peak near Flagstaff, the state's highest point, to 4,200 feet at Cameron. The average elevation of the planning area is 6,061 feet.

Unique geographic features of the planning area include its relatively high elevation plateaus and mountains, steep cliffs, deeply

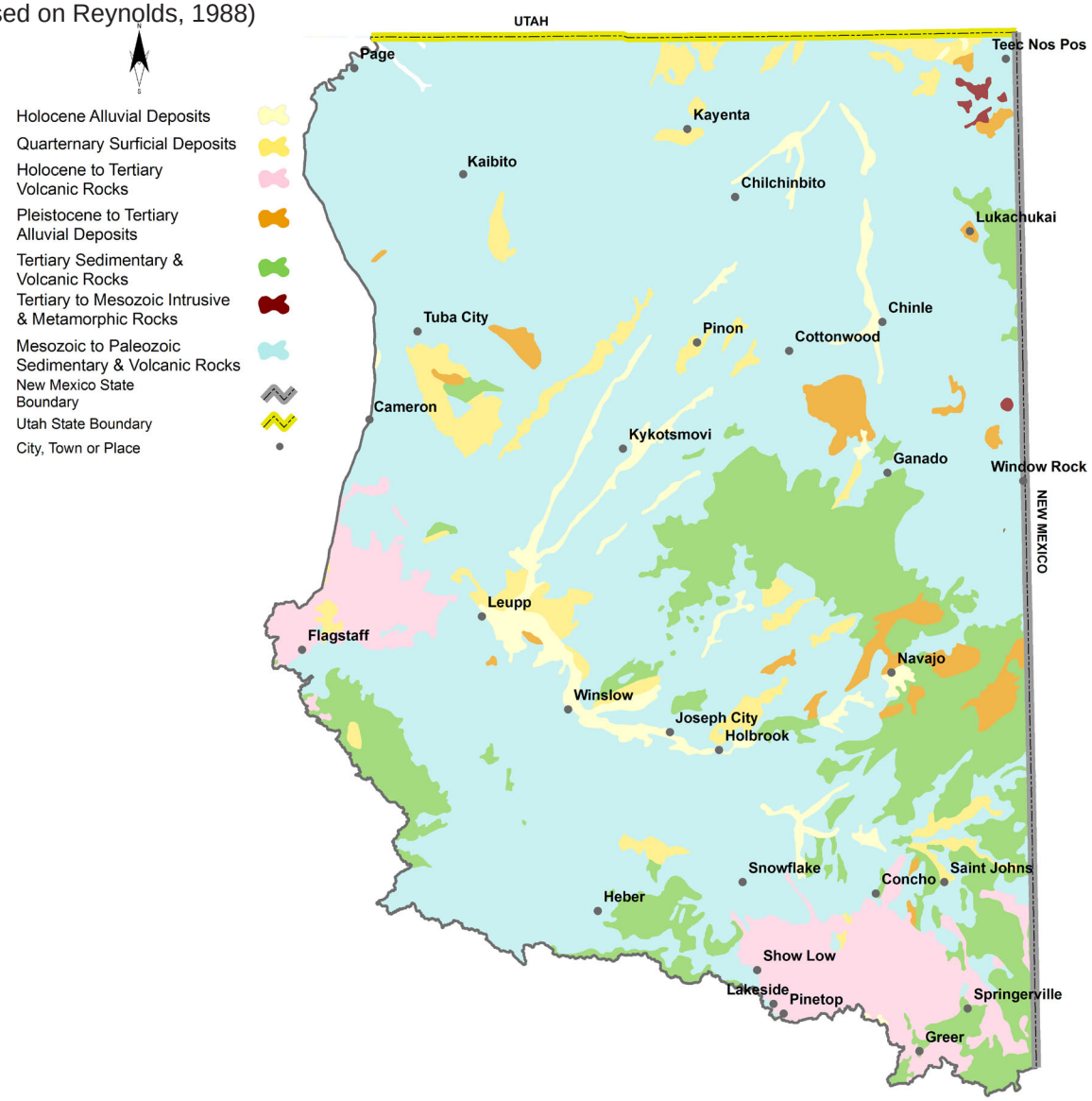
[1] Except as noted, the information in this section is taken from the Arizona Water Resources Assessment, Volume II, ADWR, August 1994.

incised sandstone canyons, and the painted desert consisting of multicolored badland hills and mesas that stretch across much of the mid-section of the planning area. The southern boundary of the planning area marks part of the southern extent of the Colorado Plateau that occupies northern Arizona, northwestern New Mexico, eastern Utah and western Colorado. The Colorado Plateau is at least 500 million years old and has remained "structurally intact" while the surrounding Rocky Mountains and basin and range province were being formed. Huge amounts of sediment were deposited in the region which hardened into sedimentary rock several miles thick. (Grahame and Sisk, 2002)

Another geographic feature of the planning area is the relatively large number of volcanic cinder cones and peaks. Mt. Baldy in the White Mountains and the San Francisco Peaks are volcanic in origin and the San Francisco Peaks are considered potentially active. Sunset Crater northeast of Flagstaff erupted as recently as 1065 AD (Parra and others, 2006). Figure 2.0-4 shows the location of volcanic rocks in the vicinity of Flagstaff and the White Mountains, as well as other geologic information.

Much of the planning area is arid with few perennial or intermittent streams; however a significant number of perennial streams and lakes are found at higher elevations along its

Figure 2.0-4 Surface Geology of the Eastern Plateau Planning Area
(Based on Reynolds, 1988)



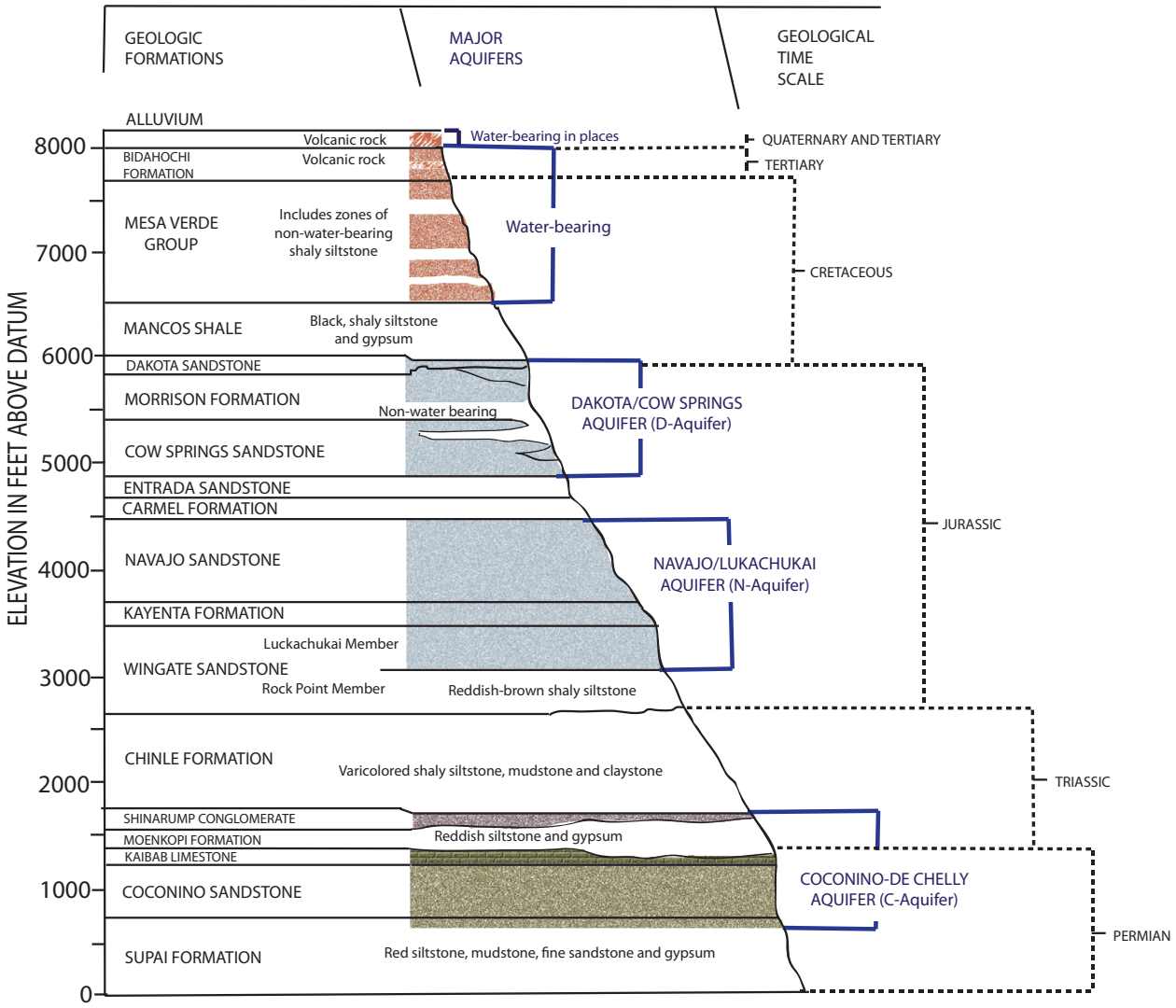
southern boundary, and the Colorado River defines the extreme northwestern boundary of the planning area (Figure 2.1-5).

2.0.2 Hydrology[2]

Groundwater Hydrology

A significant portion of the planning area is underlain by Mesozoic to Paleozoic sedimentary and volcanic rocks (Figure 2.0-4) that form the area's regional aquifers. The sedimentary rocks consist of sandstones and limestones stacked on top of one another that are generally separated by low permeability shales and siltsones. The three largest regional aquifers are the D-, N-, and C-aquifers. Each has a very large areal extent within the basin and except for the D- and N- aquifers, there is little vertical hydrologic connection between them. These water-bearing formations gain thickness towards the center of the basin resulting in artesian conditions. Primary recharge areas are along the southern and eastern periphery of the planning area. It is estimated that there are about 508 million acre-feet (maf) in storage in Little Colorado River Plateau aquifers (ADWR, 1990a). Figure 2.0-5 shows a generalized cross-section of the water-bearing formations of the planning area. In addition to these regional aquifers, several local aquifers are important groundwater sources. One of the most extensive is the Bidahochi aquifer

Figure 2.0-5 Water Bearing Formations of the Little Colorado River Plateau Basin



[2] Ibid

in the east central part of the planning area, composed of tertiary sedimentary and volcanic rocks (See Figure 2.1-7 for the location of large local and regional aquifers).

The C-aquifer is the largest and most productive aquifer in the planning area with an areal extent of 21,655 square miles. It is named for its primary water-bearing unit, the Coconino Sandstone. The C-aquifer extends from the Mogollon Rim in the south to an area west of the Little Colorado River and northeast into New Mexico. Water flow in the aquifer is generally in a west-northwest direction. Recharge to the aquifer is along the Mogollon Rim and on the Defiance Plateau (Hart and others, 2002). The major discharge from the C-aquifer is at Blue Springs along the lower Colorado River. ADWR (1990) estimated there was about 413 maf of C-aquifer water in storage in the planning area.

Water levels measured in selected wells drilled in the C-aquifer varied in depth from 37 feet to almost 2,000 feet below land surface (bls) (Figure 2.1-8). Of the 24 wells measured in 2003-2004, 14 wells showed water level declines since 1990-1991. Most declines were between -1 to -15 feet, however declines of more than 30 feet were measured near Springerville and St. Johns in the vicinity of power plants, and near Flagstaff in the Lake Mary wellfield.

The C-aquifer is utilized as a water supply south of the Little Colorado River and along the southern edge of the basin by Flagstaff, Heber, Overgaard, Show Low, Snowflake and Concho. North of the river the C-aquifer is too deep to be economically useful, or is unsuitable for most uses because of high concentrations of total dissolved solids. In general, the water quality of the C-aquifer degrades with increasing distance from recharge areas and at increasing depths (USBOR, 2006).

The N-aquifer occurs north of the Little Colorado River and has an areal extent of 6,250 square miles. The Navajo and Wingate Sandstones are the main water-bearing units in the N-aquifer. Groundwater flow direction varies as shown in Figure 2.1-7 and is generally south and west or north and west. The aquifer is generally unconfined but there are artesian conditions in the Black Mesa area and near Window Rock and much of the aquifer underlying the Hopi Reservation is unconfined (ADWR, 2008a). Natural recharge to the N-aquifer has recently been estimated at 2,600 to 20,246 AFA (OSM 2008). Water is discharged via springs, baseflow to streams and as underflow to drainages. N-aquifer storage estimates vary from 166 maf to 526 maf (ADWR, 1989; ADWR, 2008a).

Water levels measured in selected wells drilled in the N-aquifer vary in depth from 17 feet to 851 feet bls as shown in Figure 2.1-8. Water level changes between 1990-1991 and 2003-2004 varied in these measured wells (see Figure 2.1-7). Recent adjudication investigation on the Hopi reservation showed median well depths of 745 feet for claimed wells (ADWR, 2008a).

N-aquifer water quality is generally good and is a source of supply for the Navajo and Hopi Reservations. However, there are sites of uranium and heavy metal contamination due to past uranium mining and milling operations. Groundwater remediation activities are underway near Tuba City where a plume of groundwater contamination extends south and southeast of an uranium ore mill operation and 37 extraction wells convey water to an onsite treatment plant (DOE, 2008a)

The N-aquifer is utilized for mining operations at the Black Mesa Coal Mine operation. Until 2005, N-aquifer water was also used for the Black Mesa Coal Mine slurry pipeline that delivered coal to the Mohave Generating Station at Laughlin, Nevada. From the pre-mining period to 2003, the median water level decline was more than 23 feet in 26 wells and declines were approximately 72 feet for 12

wells in the confined part of the aquifer. (Truini, et al., 2005) To relieve impacts on the N-aquifer from pumping at Black Mesa, a proposal to use C-aquifer water withdrawn near Leupp was considered and a study undertaken that was completed in 2005 (Leake, et al., 2005). The Mohave Generating Station suspended operation in 2005, which has significantly reduced the need for N-aquifer withdrawals.

The D-aquifer overlays portions of the N- and C-aquifer in the planning area and is the smallest of the three regional aquifers. It covers about 3,125 square miles under the Navajo and Hopi reservations. The D-aquifer is composed of the Dakota, Cow Springs and Entrada sandstones. Flow direction is toward the southwest in the southern part of the aquifer and toward the northwest in the northern portion (Figure 2.1-7). Annual recharge is estimated at 5,392 acre-feet (GeoTrans and Waterstone, 1999). Recharge probably occurs along the eastern slope of Black Mesa where units of the aquifer outcrop (Lopes and Hoffman, 1997), and also locally along washes. There is some connection between the D-aquifer and the underlying N-aquifer and D-aquifer discharge also occurs via springs, baseflow to streams and as underflow along washes (ADWR, 2008a). ADWR (1989) estimated that there are 15 maf in storage in the D-aquifer.

Little Colorado River near Springerville. Local aquifers include alluvial deposits that occur along washes and stream channels, including along the Little Colorado River and its tributaries.

Water level data from a well collected in 2003-2004 in the D-aquifer showed a depth to water at 271 feet bls and no water level decline since 1990-1991. Median water levels at 48 claimed wells on the Hopi reservation were 268 feet (ADWR, 2008a). Water quality is marginal to unsuitable for domestic use due to high concentrations of dissolved solids. Nevertheless, it is utilized in the north-central parts of the planning area for domestic use.

Local aquifers are important for domestic uses where the regional aquifers are too deep or have unsuitable water quality. Local aquifers include alluvial deposits that occur along washes and stream channels, including along the Little Colorado River and its tributaries, sedimentary and volcanic rocks of the Bidahochi and other formations and some sandstones. The Bidahochi formation forms a local aquifer in the central part of Apache and Navajo counties and south of Sanders. Most recharge to the Bidahochi aquifer probably occurs from direct precipitation. In the southeastern part of Navajo County, saturated basaltic rocks together with underlying sedimentary rocks are locally known as the Lakeside-Pinetop aquifer, which is an important supply for the area. The aquifer covers an area of about 16 square miles and is composed of two distinctive but hydrologically well-connected water-bearing zones (Overby, 2007). Undifferentiated sandstones west of Show Low along the Mogollon Rim and in the Springerville-Eagar area form aquifers that are also locally important supplies.

The City of Flagstaff has become more dependent on groundwater from several distinct aquifers. The aquifer in the vicinity of Flagstaff is complex and composed of sandstones, siltstones and limestones. Groundwater flow in the aquifer is poorly understood because

of its depth and complex geologic structure. Recent geologic mapping indicate structural features such as faults and fractures that have important effects on the occurrence and flow of groundwater in this aquifer. Unconsolidated sediments and volcanic rocks in this area may also be waterbearing, but their areal extent is limited and yields are generally low. The Woody Mountain and Lake Mary well fields extract water from this aquifer. Water levels in these well fields show seasonal fluctuations and long-term declines due to pumping. (Bills and others., 2000) The San Francisco Peaks caldera, known as the Inner Basin, contains an aquifer that historically supplied much of the municipal water for the City of Flagstaff (Grahame and Sisk, 2002). In the Fort Valley area northwest of Flagstaff, a perched aquifer at a depth of a few hundred feet is utilized by individual land owners (Pinkham and Davis, 2002).

As shown in Figure 2.1-9, well yields are typically low (<100 gpm) north of the Little Colorado River, and higher in the south-central and southeast part of the planning area where wells encounter the C-aquifer. D-aquifer well yields are comparatively low, with yields up to 20 to 25 gpm reported (ADWR, 1989).

Groundwater quality data from selected sampling sites are shown in Table 2.1-7 and mapped on Figure 2.1-10. The most frequently exceeded constituents, measured in order of greatest occurrence, were arsenic, radionuclides, thallium, lead and total dissolved solids (TDS). North of Highway 264, thallium and radionuclides were most frequently reported. Between Highway 264 and Interstate 40, the parameter most frequently exceeded at measured sites was arsenic. South of Interstate 40, arsenic and cadmium were the most frequently exceeded constituents.

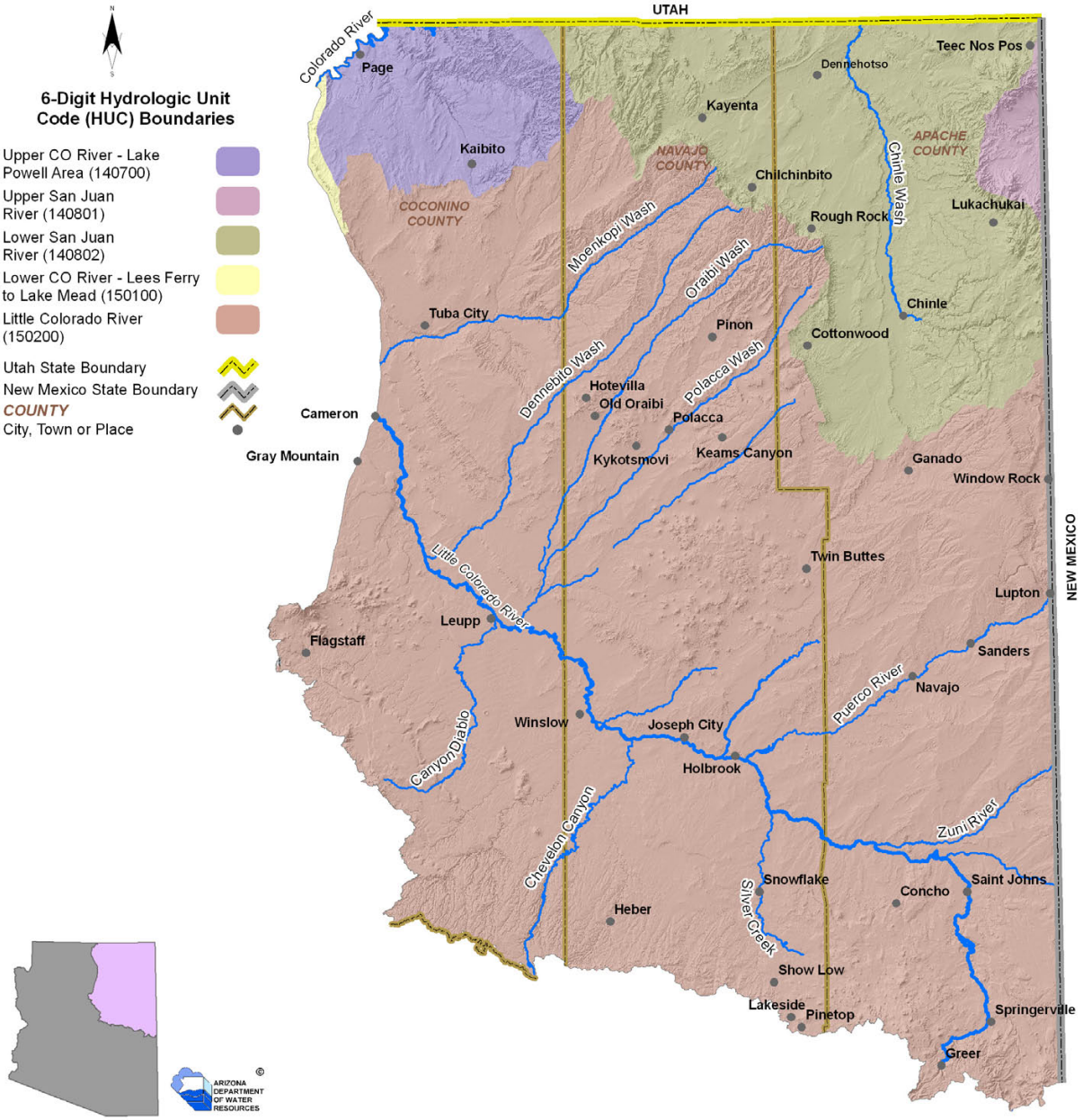
Surface Water Hydrology

The U.S. Geological Survey (USGS) divides and subdivides the United States into successively smaller hydrologic units based on hydrologic features. These units are classified into four levels. From largest to smallest these are: regions, subregions, accounting units and cataloging units. A hydrologic unit code (HUC) consisting of two digits for each level in the system is used to identify hydrologic area (Seaber et al., 1987). A 6-unit code corresponds to accounting units, which are used by the USGS for designing and managing the National Water Data Network. There are portions of five watersheds in the planning area at the accounting level: the Little Colorado River, the Lower San Juan River, the Upper Colorado River-Lake Powell Area, the Upper San Juan River and a very small portion of the Lower Colorado River-Lees Ferry to Lake Mead (see Figure 2.0-6). The two largest watersheds, the Little Colorado River and the Lower San Juan River are discussed briefly below.

The Little Colorado River is the main drainage for the planning area, flowing from the White Mountains area and leaving the basin at Cameron. The northeastern part of the planning area drains northward toward the San Juan River as part of the Colorado River Watershed. In this area, Chinle Creek collects the majority of the surface water runoff. The southern two-thirds of the basin are within the Little Colorado

Little Colorado River near Greer. The river was formerly perennial throughout its length but it now flows perennially only in some areas.

Figure 2.0-6 Eastern Plateau Planning Area USGS Watersheds
(Data Source: USGS 2005)



River watershed. Streams and runoff in this area generally flow toward the Little Colorado River.

Little Colorado River

The Little Colorado River Watershed covers most of the planning area and extends west into the Coconino Plateau Basin where it drains to the Colorado River. The eastern part of the watershed extends into New Mexico. The watershed area is approximately 27,051 square miles and covers about 19% of the state (Parra and others, 2006). The Little Colorado River is the major surface drainage in the watershed, originating in the White Mountains and flowing northwest to the Colorado River. The river was formerly perennial throughout its length but it now flows perennially only from its headwaters to Lyman Lake, north of Springerville (Tellman and others, 1997), below its confluence with Silver Creek and below Blue Springs near its confluence with the Colorado River in the

Western Plateau Planning Area. Elsewhere it is intermittent due primarily to impoundments, diversions and falling groundwater levels (Tellman and others, 1997). A number of perennial and intermittent streams occur at higher elevations in the watershed, including Silver Creek and Chevelon Creek (see Figure 2.1-6). Ninety-six percent of the streams in the watershed are ephemeral or intermittent (Parra and others, 2006).

There are currently 21 active streamgage stations in the watershed. The maximum recorded annual flow in the watershed was 587,869 acre-feet at a discontinued gage on the Little Colorado River at Grand Falls located downstream of Leupp. The median flow at this station was 162,171 acre-feet (see Table 2.1-2)

Most of the 70 major springs in the planning area are located in the Little Colorado River Watershed. Approximately a quarter of the major springs have discharge rates of 100 gpm or more. Discharges from most springs were measured during or prior to 1990 and may not be indicative of current conditions. There are clusters of major springs near Tuba City, in the vicinity of Pinetop-Lakeside and in the Saint Johns-Concho area. The largest spring, with a measured discharge of over 3,600 gpm is Silver Springs (Table 2.1-5). Silver Springs discharges water from the volcanic portion of the Pinetop-Lakeside aquifer and maintains perennial flow in Silver Creek. Historically, Silver Springs provided the majority of the surface water supply for the Silver Creek Irrigation District. White Mountain Lake is the major water storage reservoir for the District (ADWR, 1990b). There are 94 large reservoirs in the planning area. Information on their storage capacity or surface area, type of use and owner/operator are listed in Table 2.1-4.

Within the watershed, reaches of the Little Colorado River and Nutrioso Creek have impaired water quality due to levels of turbidity, lead, copper and silver in excess of use standards. In addition, eight lakes are impaired due primarily to concentrations of mercury exceeding use standards (see Table 2.1-7).

Lower San Juan River

The Lower San Juan River Watershed drains most of the northeastern portion of the planning area. Chinle Creek is the major drainage, collecting most of the surface water runoff in the area that originates primarily in the Chuska Mountains and the Defiance Plateau (Grahame and Sisk, 2002). The watershed drains northward toward Utah and the San Juan River which in turn is tributary to the Colorado River. Chinle Creek is perennial for approximately six miles near the Utah border (ADWR, 1994a).

Only one of the four streamgages shown on Figure 2.1-5 is currently active; a real-time gage at Chinle Creek near Mexican Water close to the Utah border. The others were discontinued during 2005-2006. The maximum recorded flow in the watershed was measured at this remaining active gage with a flow of almost 67,700 acre-feet in 1982. Median flow at this gage is about 15,500 AFA (see Table 2.1-2).

There are seven major springs identified in the watershed. The largest is an unnamed spring west of Kayenta with a discharge rate of 30 gpm. There are seven large reservoirs in the watershed including the fourth largest in the planning area, Many Farms Lake. The dam was constructed in 1937 for irrigation purposes at the community of Many Farms north of Chinle.

2.0.3 Climate[3]

The Eastern Plateau Planning Area is a semi-arid, relatively high elevation region with cooler average temperatures than in other parts of Arizona. Average annual maximum temperatures in the planning area range from

[3] Information in this section was provided by Institute for the Study of Planet Earth, Climate Assessment for the Southwest (CLIMAS), May, 2006

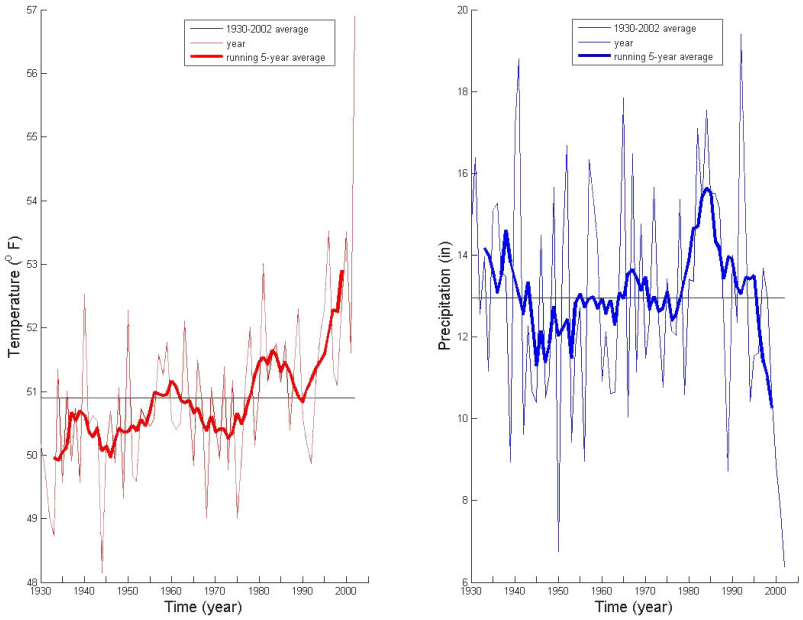
61˚F at Greer to 82˚F at Cameron. Annual average temperature is 50.8°F, compared to the state-wide average of 59.9°F. Eastern Plateau temperatures display a long-term warming trend (Figure 2.0-7), as in other parts of Arizona.

Parts of the Eastern Plateau Planning Area downwind of high elevation mountains along its southern boundary receive diminished precipitation due to the "rain shadow effect." As moisture-laden air flows over topographic features such as mountain ranges, the air is lifted and cooled, resulting in greater precipitation on the windward side of the mountain. In contrast, the leeward side of mountain ranges receive much less precipitation as the air sinks, warms, and dries, creating a "rain shadow."

Precipitation in the Eastern Plateau Planning Area is characterized by a multi-peaked distribution similar to much of Arizona (Figure 2.0-8). Precipitation is highest during July and August when the area receives over 43% of yearly precipitation, while the driest months on average are April, May and June. Average annual precipitation ranges from about four inches at Monument Valley in the far northeastern part of the planning area to 36 inches in the White Mountains, Mogollon Rim and San Francisco Peak areas. Most of the Navajo and Hopi Reservation lands receive less than 10 inches of rainfall a year. The highest precipitation on the Navajo Reservation is in the Chuska Mountains with an average annual precipitation of 25 inches (Navajo Nation, 2001).

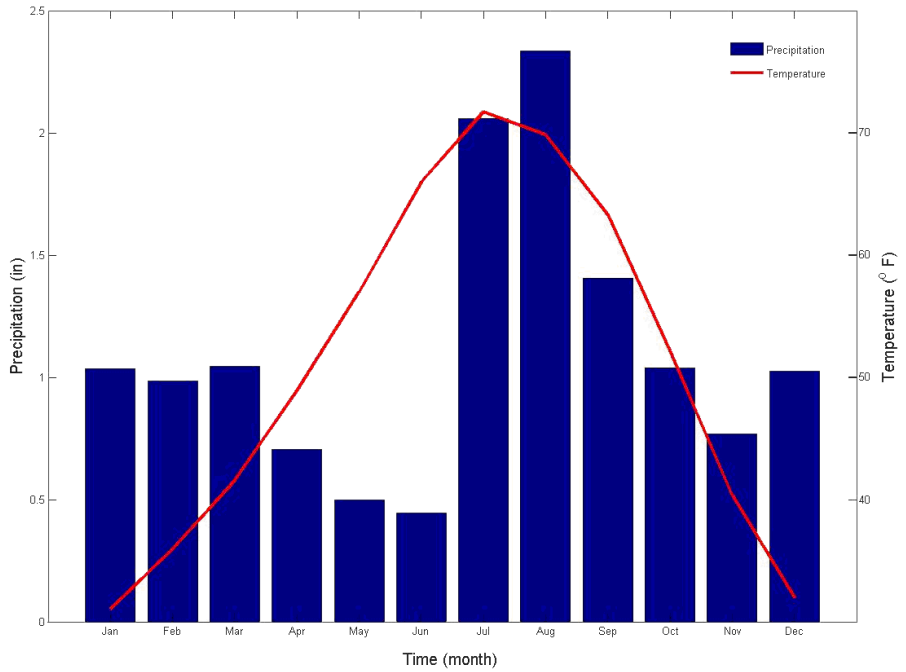
Much of the state's snowfall occurs along the Mogollon Rim and White Mountains in the Eastern Plateau and Central Highlands Planning Areas. Snowfall is an important water source and is often defined in terms of snow-water equivalent (SWE). SWE is dependent on snow density and describes the amount of liquid water present in a melted sample of

Figure 2.0-7 Average Temperature and Total Precipitation in the Eastern Plateau Planning Area From 1930-2002.



Horizontal lines are average temperature (50.8 °F) and precipitation (13.0 inches), respectively. Light lines are yearly values and highlighted lines are 5-year moving average values. Data are from selected Western Regional Climate Center cooperative weather observation stations located south of the Little Colorado River. (http://www.wrcc.dri.edu/summary/climsmaz.html). Figure author: CLIMAS

Figure 2.0-8 Average Monthly Precipitation and Temperature in the Eastern Plateau Planning Area, 1930-2002.



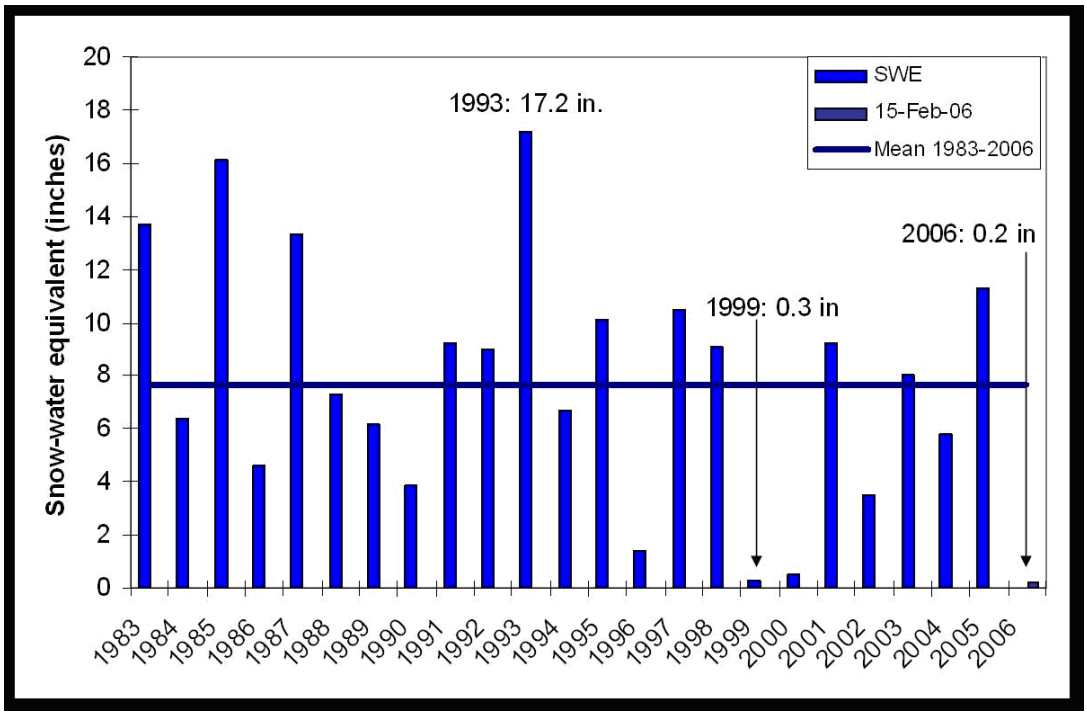
Data are from selected Western Regional Climate Center cooperative weather observation stations located south of the Little Colorado River. (http://www.wrcc.dri.edu/summary/climsmaz.html). Figure author: Ben Crawford, CLIMAS.

snow; light, powdery snow yields less water than dense wet snow. Observations recorded March 1st from 1983 to 2006 at Mt. Baldy in the southeastern portion of the planning area show SWE variations from 1983 to the present (Figure 2.0-9). The Mt. Baldy record shows relatively high snow pack during the 1980s and early-to-mid 1990s, followed by substantially lower snow pack since 1999.

Two important features of precipitation in this region are variability between individual years, and shifts between wetter and drier than average periods on longer, 10-20 year (decadal) time scales (Figure 2.0-7 and Figure 2.0-10). Winter precipitation records dating from 1000 A.D., estimated from tree ring reconstructions for Arizona climate divisions, show extended periods of above and below average precipitation in every century. A climate division is a region within a state that is generally climatically homogeneous. Arizona has been divided into seven climate divisions. Climate Division 2 (Coconino, Navajo and Apache Counties) includes the entire Eastern Plateau Planning Area and extends west and south.

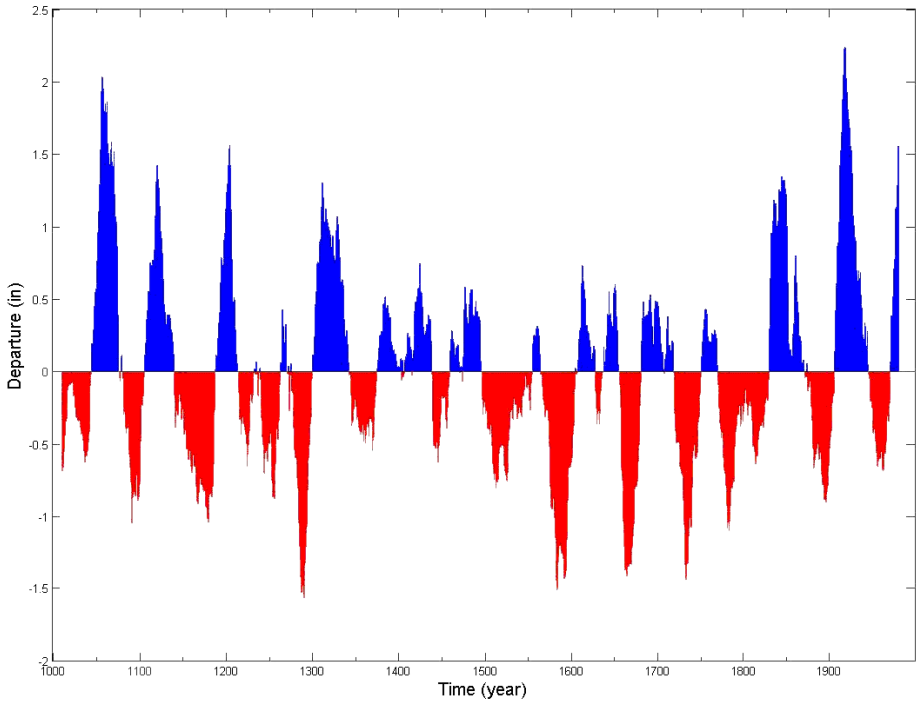
There have been multiple extended periods of above and below-average winter precipitation in the planning area during every century since 1000 A.D. (Figure 2.0-10). The 1200s, 1500s, and 1700s were notably dry; in contrast, the mid-1000s, early 1300s and early 1900s that were notably wet. More recently, the 1950s were relatively dry, whereas the 1980s received above-average precipitation (Figure 2.0-7). These decadal shifts are related to circulation changes in the Pacific Ocean. On time scales of 2-7 years, the El Niño-Southern Oscillation (ENSO) in the Pacific Ocean, with its phases of El Niño and La Niña, is associated with precipitation variations in the region, most notably during winter months (November-April). During El Niño episodes, there is a

Figure 2.0-9 Mt. Baldy Snow-Water Equivalent (SWE) for 1983-2006.



Observations were recorded March 1st for each year except 2006, where February 15 was used. The horizontal, bold line is average SWE from 1983-2006 and highest SWE years (1993) and lowest SWE years (1999 and 2006) are highlighted. Figure author: CLIMAS

Figure 2.0-10 Arizona NOAA Climate Division 2 (Northeastern Arizona; Coconino, Navajo, and Apache Counties) Winter (November-April) Precipitation Departures From Average, 1000-1988, Reconstructed From Tree Rings



Data are presented as a 20-year moving average to show variability on decadal time scales. The average winter precipitation for 1000-1988 is 6.1 inches. Data: Fenbiao Ni, University of Arizona Laboratory of Tree-Ring Research and CLIMAS. Figure author: CLIMAS.

greater likelihood of increased precipitation; nevertheless El Niño winters can produce below-average precipitation. Generally, La Niña conditions are associated with drought in the region.

2.0.4 Environmental Conditions

Environmental conditions reflect the impacts of geography, climate and cultural activities and may be a critical consideration in water resource management and supply development. Discussed in this section is vegetation, riparian protection through the Arizona Water Protection Fund Program, instream flow claims, threatened and endangered species, public lands protected from development as national parks, monuments and wilderness and unique waters.

Vegetation

Information on ecoregions and biotic (vegetative) communities in the planning area are shown on Figure 2.0-11. Most of the Eastern Plateau Planning Area is located in the Colorado Plateau Shrublands ecoregion while higher elevation areas are located in the Arizona Mountains Forests ecoregion. Biotic communities range from Great Basin desertscrub at lower elevations to areas of subalpine grassland. Plains and Great Basin grasslands are the predominant biotic community in the planning area. Due to grazing and fire suppression efforts, pre-settlement environmental conditions have been permanently altered in the region. Woodland communities have expanded considerably and the increase in ponderosa pine density has led to both an increase in the severity and size of wildfires, and to a decrease in stream and spring flows due to less soil absorption of precipitation (Grahame and Sisk, 2002).

In Arizona, alpine tundra is found only at the highest elevations on the San Francisco Peaks, generally over 12,000 feet. (This small area is not distinguishable on Figure 2.0-11). Only specially adapted species can survive the harsh climate including small, ground-hugging mosses, lichens and herbs. An area of the San Francisco Peaks has been closed to travel to protect an endemic groundsel (*Senecio franciscanus*), a threatened species. Areas of subalpine grassland are found at high elevations in the White Mountains, in the Chuska Mountains and on the San Francisco Peaks. (Grahame and Sisk, 2002).

High-elevation subalpine conifer forests are limited to relatively small isolated mountaintop stands on the San Francisco Peaks, White Mountains and Chuska Mountains at elevations of 8,500 to almost 12,000 feet with annual precipitation from 30 to 40 inches a year. These forests consist of dense stands of fir, spruce

Aspen forest on Escudilla Mountain in the White Mountains. High elevation subalpine conifer forests are limited to relatively small isolated mountaintop stands on the San Francisco Peaks, White Mountains and Chuska Mountains at elevations of 8,500 to almost 12,000 feet with annual precipitation from 30 to 40 inches a year.

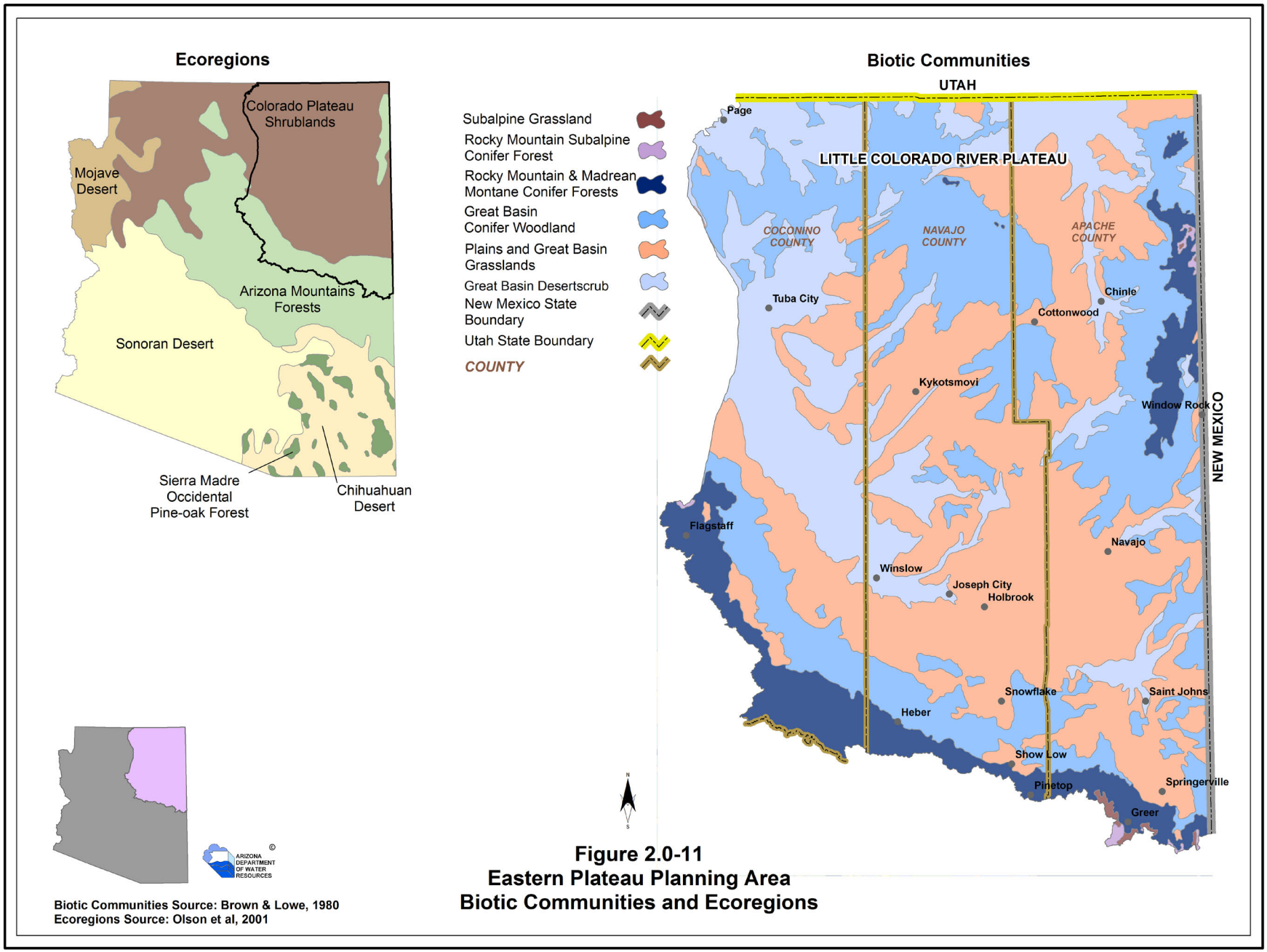


Figure 2.0-11
Eastern Plateau Planning Area
Biotic Communities and Ecoregions

and aspen trees. Much of the precipitation is snow, but summer rainfall is also a substantial component of annual precipitation. Bristlecone pine stands occur at elevations around 11,000 feet on the San Francisco Peaks (Brown, 1982). Significant stands of aspen occur in places, especially in areas that have been burned. Natural fires are relatively uncommon in subalpine conifer forests (Graham and Sisk, 2002). Recent surveys of aspen sites show that low-elevation dry sites on the Coconino National Forest (<7,500 feet) experienced 95% mortality since 2000. Sites surveyed on the Apache-Sitgreaves National Forest above 7,500 feet showed 40% mortality in both mid- and high-elevation sites. Researchers found that while insects and disease were associated with the mortality, they appeared to be secondary agents on already drought-stressed trees. (USDA, 2008)

Rocky Mountain (Petran) and Madrean Montane conifer forests commonly occur between about 7,200 to 8,700 feet. Above 8,000 feet, in areas that receive from 25 to 30 inches of annual rainfall, the forest contains a mix of conifers that may include Douglas-fir, white fir, limber pine, blue spruce, and white pine, with ponderosa pine on warmer slopes. Aspen and Gambel oak are prominent in these forests following disturbances. Below 8,000 feet, in areas that receive about 18 to 26 inches of annual precipitation, the mix of species give way to almost pure stands of ponderosa pine. The forest stretching from near Flagstaff along the Mogollon Rim to the White Mountains region is the largest ponderosa pine forest on the continent (Grahame and Sisk, 2002). About half of the precipitation occurs during the growing season, which permits forests to exist on less than 25 inches of annual rainfall, making them some of the driest forests in North America (Brown, 1982). In the planning area these forests extend across the entire southern boundary and are also found along the northeastern boundary in the Chuska and Lukachukai Mountains and the Defiance Plateau.

Great Basin Conifer (piñon-juniper) woodlands cover large areas below the ponderosa pine forest at elevations between about 5,000 and 7,500 feet that receive about 10 to 20 inches of annual precipitation. Extensive stands exist throughout the planning area as shown on Figure 2.0-11. Bark beetle infestations have affected large areas of piñon pine and juniper on the Navajo reservation and in the White Mountains in recent years although activity decreased in most areas in 2007 (USDA, 2008).

Plains and great basin grasslands, primarily composed of mixed or short-grass communities, are widespread in the planning area at elevations above about 4,000 feet that receive between 11 and 18 inches of annual precipitation. These grasslands extend almost unbroken through the entire length and width of the planning area. Native bunchgrasses have been largely replaced by Eurasian annual species such as cheatgrass and shrubs have invaded the grasslands due to grazing and fire-suppression practices (Grahame and Sisk, 2002).

Great Basin desertscrub occurs in northern Arizona mostly at elevations of 4,000 to 6,500 feet where an average of about 7 to 12 inches of rainfall occurs. This vegetative community is dominated by multi-branched, aromatic shrubs with evergreen leaves, primarily sagebrush, blackbrush and shadscale. Great Basin desertscrub is found throughout the planning

Great Basin desertscrub near the base of the Lukachukai Mountains.

area but primarily in the western portion. In addition to shrubs, vegetation consists primarily of grasses. Grazing has heavily impacted native grasses in this community, which have been replaced by exotic species including cheatgrass. Cheatgrass is highly flammable, and where it is a significant component of sagebrush stands, the incidence of fire is greatly increased (Brown, 1982).

Riparian vegetation has been mapped along East Clear Creek, Chevelon Creek, the Little Colorado River, Chinle Creek and at a number of other locations in the planning area (see Figure 2.0-13). Using Arizona Game & Fish Department data, Parra and others (2006), identified approximately 5,226 acres of riparian vegetation and ten different riparian types in the Little Colorado River watershed. Wet meadow, conifer oak and tamarisk groups comprised the largest amount of riparian vegetation. The Little Colorado River headwaters area had the greatest amount of wetland vegetation. Less abundant were mixed broadleaf, mountain scrub and mesquite (Parra and others, 2006). In the other planning area watersheds Russian olive and tamarisk are widely found. At higher elevations and along streams draining the Chuska Mountains and Defiance Plateau, conifer oak, wet meadow and mixed broadleaf occur (AZGF, 1997 & 1993).

Webb and others (2007) studied changes in riparian vegetation along a number of watercourses in the Southwestern United States. Watercourses studied in the Eastern Plateau Planning Area include the Little Colorado River and Moenkopi Wash. They noted that reaches of the Little Colorado River historically supported groves of cottonwood trees although the spatial distribution was not known. A series of floods and downcutting, and drainage of the alluvial aquifer, resulted in removal of most of this riparian vegetation. Woody riparian vegetation, primarily tamarisk but some native species, now populate terraces and parts of the channel.

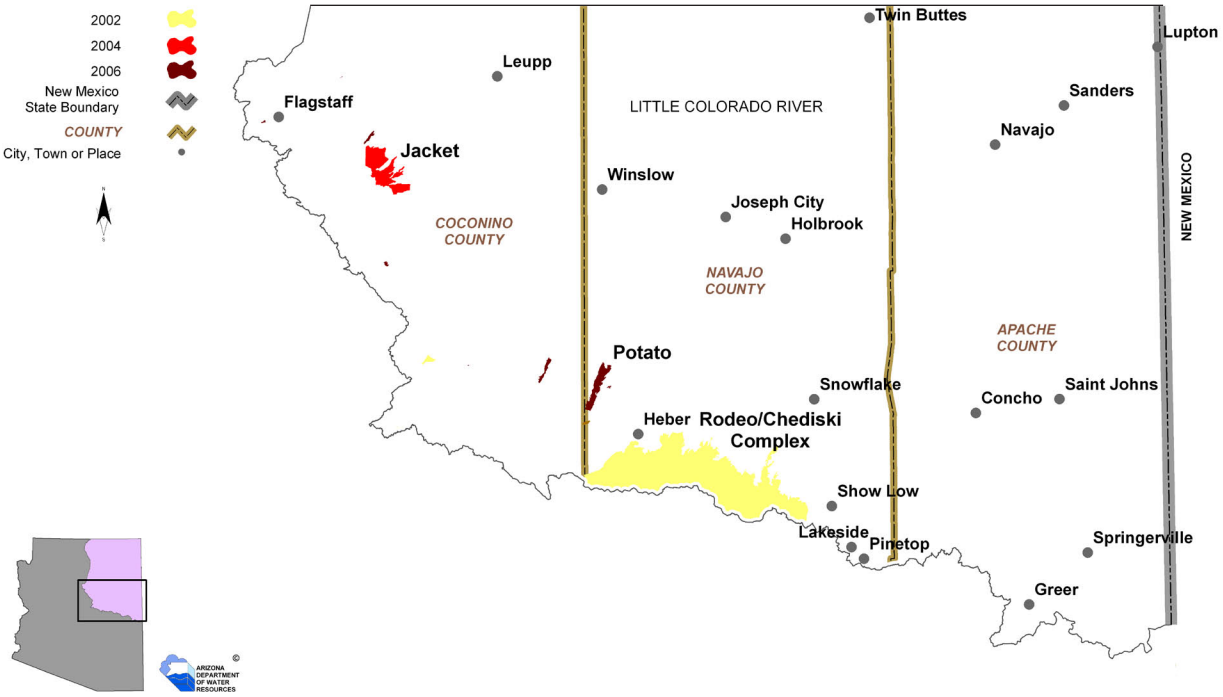
Tamarisk on Chevlon Creek.

Moenkopi Wash was a wide, barren channel in the early 1930s but development of a low floodplain during the 1940s has allowed establishment of tamarisk and scattered cottonwood groves.

Several major wildfires occurred in the Eastern Plateau Planning Area during the severe drought years between 2002 and 2006 (see Figure 2.0-12). The Rodeo-Chedeski fire in 2002, Arizona's largest-ever, consumed about 462,600 acres in the Eastern Plateau and Central Highlands planning areas. The Jacket Fire, southeast of Flagstaff and the largest recorded fire in the Coconino National Forest, burned over 17,200 acres in 2006.

In the Southwest, fire can be among the most significant watershed disturbance agents, particularly to peak stream flows. In areas severely burned by the Rodeo-Chedeski Fire, peak flows were as much as 2,350 times greater than previously measured peak flows, the highest known post-fire peak flow in the Southwest. Increased peak flows can degrade stream channels and make them unstable, increase sediment production and cause flood damage. (Neary and others, 2003) Drought, wildfire and long-term climate change involving warmer temperatures with earlier Spring season and less snow cover could result in vegetative changes in the planning area with implications on runoff, infiltration and water supplies.

Figure 2.0-12 Eastern Plateau Planning Area Location of Major Wildfires, 2002-2006 (Source: USFS 2007a)



Extended drought combined with high tree densities resulted in the largest outbreak of pine bark beetle populations ever recorded in Arizona during 2002 – 2004 with massive mortality, particularly in the Kaibab National Forest in the Western Plateau Planning Area (USDA, 2006). By 2007, bark beetle activity in Arizona had decreased substantially with the exception of the Apache-Sitgreaves National Forest, much of which is located in the Eastern Plateau Planning Area. Also noted in 2007 were large outbreaks of pine sawflies in several locations. This outbreak defoliated ponderosa pines in an area between Pinedale and Overgaard where many trees had been previously damaged in the 2002 Rodeo-Chediski fire, and on Navajo tribal lands. Study plots were established in Arizona in 2003-2004 to monitor the impacts from bark beetle infestations on fuel loading and fire behavior. Preliminary analysis shows that mortality plots have significantly higher fuel loads than areas with no mortality (USDA, 2008).

Fire damage from Rodeo-Chedeski fire near Show Low. Photo taken in 2009.

Arizona Water Protection Fund Programs

The objective of the Arizona Water Protection Fund Program (AWPF) is to provide funds for protection and restoration of Arizona's rivers and streams and associated riparian habitats. Thirty-two projects were funded in the planning area through 2008. Many of these were for the purpose of fencing and for stream and watershed restoration. A list of projects and types of

projects funded in the Eastern Plateau Planning Area through FY 2008 is found in Appendix A of this volume. A description of the program, a complete listing of all projects funded, and a reference map is found in Volume 1 and on the Department's website.

Nutrioso Creek at EC Bar Ranch. One of the AWPF projects in the Eastern Plateau Planning Area.

Instream Flow Claims

An instream flow water right is a non-diversionary appropriation of surface water for recreation and wildlife use. Four applications for instream flow claims have been filed in the Eastern Plateau Planning Area, listed in Table 2.0-1. All applications are currently pending. As shown in Figure 2.0-13, the length of the instream flow claims for Chevelon Creek and East Clear Creek/Clear Creek are extensive. All claims are located in creeks south of the Little Colorado River.

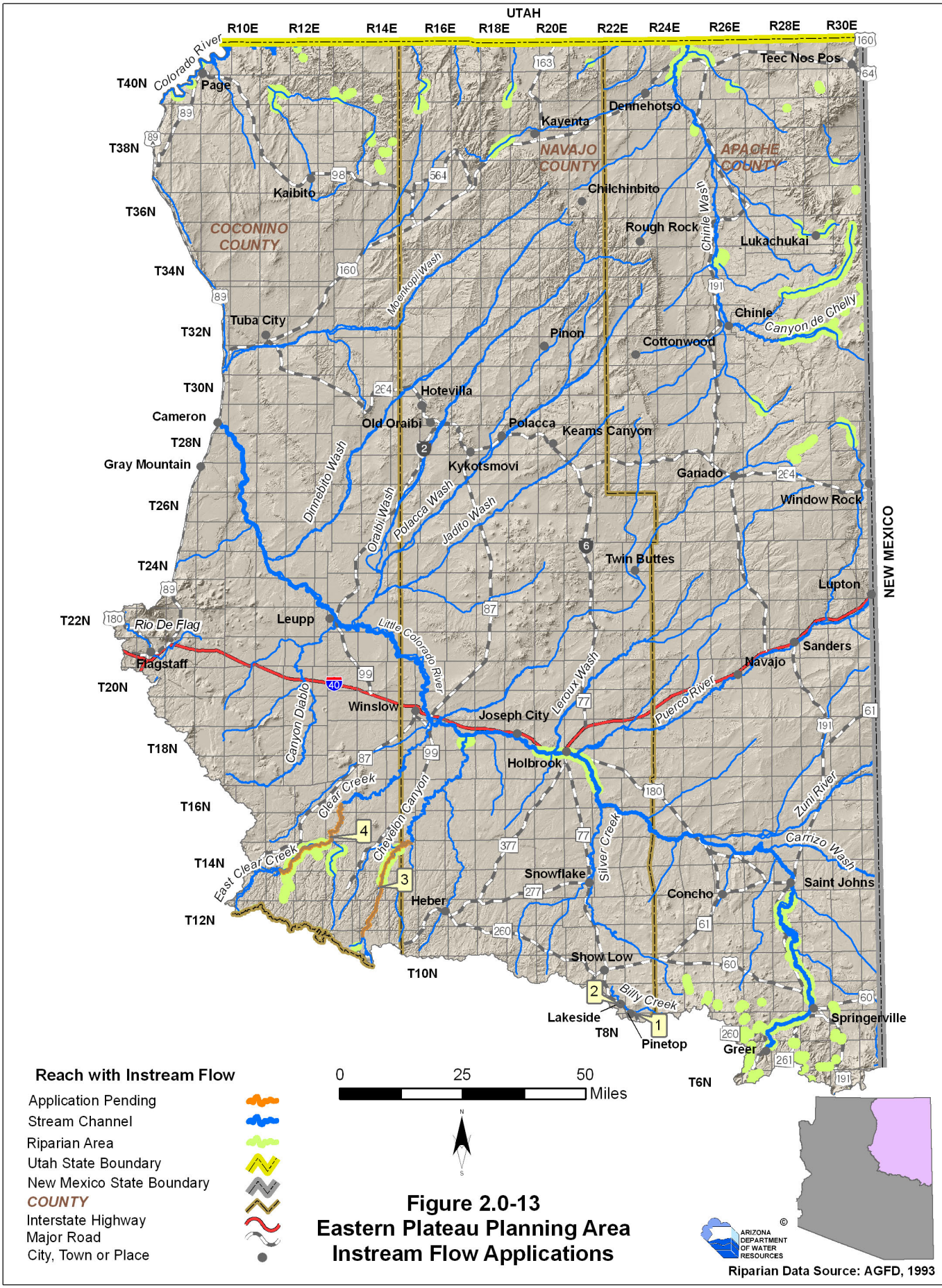
Threatened and Endangered Species

A number of listed threatened and endangered species are present in the Eastern Plateau Planning Area. Those listed by the U.S. Fish and Wildlife Service (USFWS) as of 2008 are shown in Table 2.0-2.[4] Presence of a listed species may be a critical consideration in water resource management and supply development in a particular area. The USFWS should be contacted for details regarding the Endangered Species Act (ESA), designated critical habitat and current listings.

Table 2.0-1 Instream flow claims in the Eastern Plateau Planning Area

Map Key	Stream	Applicant	Application No.	Permit No.	Certificate No.	Filing Date
1	Billy Creek	Cartier, David N.	33-94853.0	Pending	Pending	9/14/1989
2	Billy Creek	Walker, F. Duane	33-94847.0	Pending	Pending	9/14/1989
3	Chevelon Creek	Apache-Sitgreaves National Forest	33-96707.0	Pending	Pending	2/13/2002
4	Clear Creek/East Clear Creek	Coconino National Forest	33-90107.0	Pending	Pending	7/29/1985

[4] An "endangered species" is defined by USFWS as "an animal or plant species in danger of extinction throughout all or a significant portion of its range," while a threatened species" is "an animal or plant species likely to become endangered within the forseeable future throughout all or a significant portion of its range


UTAH
NEW MEXICO
R10E
R12E
R14E
R16E
R18E
R20E
R22E
R24E
R26E
R28E
R30E
T40N
T38N
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Colorado River
Page
Kaibito
Tuba City
Cameron
Gray Mountain
Rio De Flag
Flagstaff
Leupp
Winslow
Joseph City
Holbrook
Heber
Snowflake
Show Low
Lakeside
Pinetop
Greer
Springerville
Saint Johns
Concho
Sanders
Navajo
Lupton
Window Rock
Ganado
Twin Buttes
Kykotsmovi
Polacca
Keams Canyon
Hotevilla
Old Oraibi
Pinon
Cottonwood
Chinle
Canyon de Chelly
Rough Rock
Chilchinbito
Lukachukai
Teec Nos Pos
Dennehotso
Kayenta
NAVAJO COUNTY
APACHE COUNTY
COCONINO COUNTY
Moenkopi Wash
Dinnebito Wash
Oraibi Wash
Polacca Wash
Jadito Wash
Chinle Wash
Little Colorado River
Canyon Diablo
Clear Creek
East Clear Creek
Chevelon Canyon
Leroux Wash
Silver Creek
Billy Creek
Puerco River
Zuni River
Carrizo Wash
Reach with Instream Flow
Application Pending
Stream Channel
Riparian Area
Utah State Boundary
New Mexico State Boundary
COUNTY
Interstate Highway
Major Road
City, Town or Place
0
25
50
Miles
N
S
Figure 2.0-13
Eastern Plateau Planning Area
Instream Flow Applications
ARIZONA DEPARTMENT OF WATER RESOURCES
©
Riparian Data Source: AGFD, 1993

Table 2.0-2 Threatened and endangered species in the Eastern Plateau Planning Area

Common Name	Threatened	Endangered	Elevation/Habitat
Apache Trout	X		>5000 ft./cold mountain streams
Bald Eagle	X		Varies/large trees or cliffs near water
Black-footed ferret		X	<10,500 ft./grassland plains
California Brown Pelican		X	Varies/lakes and rivers
California Condor		X	Varies/high desert canyonlands and plateaus
Chiricahua Leopard Frog	X		3,300-8,900 ft./streams, rivers, backwaters, ponds, stock tanks
Little Colorado Spinedace	X		4,000-8,000 ft./moderate to small streams in pools & riffles
Loach Minnow	X		<8,000 ft./benthic species of small to large perennial streams
Mexican Gray Wolf		X	4,000-12,000 ft. /chapparal, woodland, forests
Mexican Spotted Owl	X		4,100-9,000 ft./canyons, dense forests with multi-layered foliage structure
Navajo Sedge	X		5,700-6,000 ft./silty soils at shady seeps and springs
Peebles Navajo Cactus		X	5,400-5,600 ft/gravely soils of the Shinarump conglomerate
San Francisco Peaks Groundsel	X		10,900 ft+/Alpine tundra
Southwestern Willow Flycatcher		X	<8,500 ft./cottonwood-willow and tamarisk along rivers and streams
Zuni Fleabane	X		7,300-8,000 ft./selenium-rich red or gray detrital clay soils derived from the Chinle and Baca formations

Sources: AZGF 2008, USFWS 2008

National Parks, Monuments and Wilderness Areas

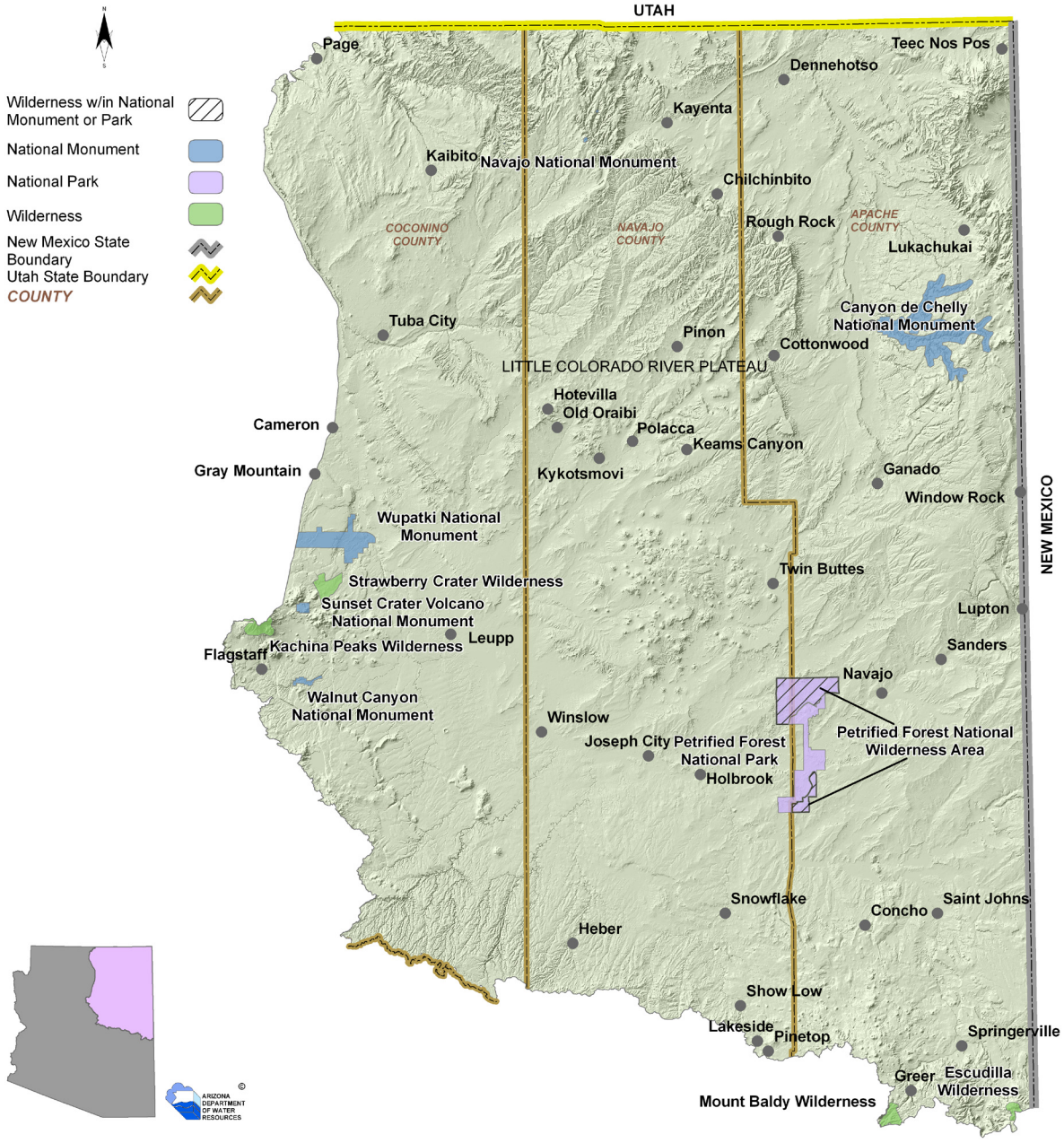
The Eastern Plateau Planning Area contains relatively few federally protected areas considering its large size. (see Figure 2.0-14) It contains one national park, five national monuments and five wilderness areas. In total there are approximately 436,600 acres of protected federal lands, accounting for 2.5% of the land area.

Petrified Forest National Park encompasses approximately 218,533 acres. Originally established in 1906 as a national monument to protect fossilized wood deposits, the addition of mostly Painted Desert land in 1932 helped

to upgrade the national monument to national park status in 1962. In 1970, over 50,000 acres of the park were designated as wilderness. In 2004, an additional 125,000 acres of land were added to the park, more than doubling its size. Over 250 fossil plant, invertebrate and vertebrate sites have been identified in the park (NPS, 2008a).

Several national monuments exist near Flagstaff including Sunset Crater Volcano, Wupatki and Walnut Canyon National Monuments. The 3,040 acre Sunset Crater Volcano National Monument was established in 1930 to protect its volcanic formations. Nearby, Wupatki National Monument was established in 1924 to preserve Citadel and Wupatki pueblos. Monument boundaries have been expanded several times to include additional pueblos and other archeological resources to a total of 35,422 acres. East of Flagstaff, Walnut Canyon National Monument was established in

Figure 2.0-14 Eastern Plateau Planning Area Protected Areas (Wilderness Data Source: National Atlas of the United States 2005, Land Ownership Data Source: ALRIS 2005)



Painted Desert, Petrified Forest National Park. The Eastern Plateau Planning Area contains relatively few federally protected areas considering its large size; one national park, five national monuments and five wilderness areas.

1915 to preserve ancient cliff dwellings. The monument contains a variety of archeological and natural resources on approximately 3,600 acres.

Canyon de Chelly and Navajo National Monuments are located within the Navajo Reservation. Canyon de Chelly, located east of Chinle, was initially established in 1931 to protect the canyon's archeological resources. At approximately 83,840 acres in size, it is unique among National Park Service (NPS) units as it is comprised entirely of Navajo Tribal Trust Land that remains home to the canyon community. The NPS works in partnership with the Navajo Nation to manage park resources and sustain the Navajo community living within the monument (NPS, 2008b). Navajo National Monument, located west of Kayenta, was created in 1909 to protect 13th century cliff dwellings and other archeological resources. Currently monument boundaries include 600 acres encompassing three distinct and non-contiguous sections, Betatakin, Keet Seel and Inscription House. Monument lands are inholdings within the reservation. Local Navajo are integral in supporting the park and participating in its activities and the monument is an important socio-cultural and economic component of the region (Rothman, 1991).

All or portions of five wilderness areas, encompassing 91,568 acres, are located within the Eastern Plateau Planning Area. Wilderness areas are designated under the 1964 Wilderness Act to preserve and protect the designated area in its natural condition. Designated areas, their size and a brief description of the area are listed in Table 2.0-3. The Eastern Plateau Planning Area contains the smallest number of wilderness acres, by far, compared with any of the state's planning areas.

Table 2.0-3 Wilderness areas in the Eastern Plateau Planning Area

Wilderness Area	Acres	Description
Escudilla	5,200 (Partial)	Mountain meadows and Escudilla Mountain (10,912 ft)
Kachina Peaks	18,615 (Partial)	Mt. Humphrey's (11,500 ft) and only arctic-alpine vegetation in the state
Mount Baldy	7,079 (Partial)	Mixed conifers and ponderosa pine to fir and spruce.
Petrified Forest*	50,260	Shortgrass prairie, colorful mesas, buttes and badlands
Strawberrry Crater	10,414	Volcanic cinder cone and lava flow formations

Source: BLM 2006, USFS 2007b
*Wilderness areas within the boundaries of a National Park

Unique Waters

Two "unique waters" occur in the planning area, designated by the Arizona Department of Environmental Quality (ADEQ) pursuant to A.C.C. R18-11-112, as having exceptional recreational or ecological significance and/or providing habitat for threatened or endangered species. Surface water must be of good water quality, free flowing and perennial to be classified as a unique water. In the planning area, a portion of the West Fork of the Little Colorado River above Government Springs (located in the Salt River Basin), and Lee Valley Creek from its headwaters to Lee Valley Reservoir have been classified as unique waters.

2.0.5 Population

Census data for 2000 show a total of almost 250,000 residents in the Eastern Plateau Planning Area. Arizona Department of Commerce population projections forecast a population of more than 378,000 by 2030. The 2000 Census populations for the planning area and Indian reservations are shown in Table 2.0-4. In 2000 about 55% of the planning area population resided in the non-reservation portion. The Navajo Reservation population comprises approximately 42% of the planning area population.

Shown in Table 2.0-5 are incorporated and unincorporated communities in the planning area with 2000 Census populations greater than 1,000 and growth rates for two time periods. Communities are listed from highest to lowest population in 2000. Flagstaff is by far the largest community in the planning area with 38% of the non-tribal population. There are a number of rapidly growing larger communities including Flagstaff, Show Low, Pinetop-Lakeside and Taylor. Some communities grew more rapidly between 2000 and 2006 than during the previous ten year period. There are also rapidly growing communities on the Navajo Reservation, with high growth rates in a number communities including Kaibito, Lukachukai and Pinon.

Table 2.0-4 2000 Census population of the Eastern Plateau and Indian Reservations

Basin/*Reservation*	2000 Census Population
Little Colorado River	249,545
Navajo	*104,565*
Hopi	*6,946*
San Juan Southern Paiute	*265*
Zuni	*NA*

Source: U.S. Census Bureau 2006

Population Growth and Water Use

Arizona has limited mechanisms to address the connections between land use, population growth and water supply. A legislative attempt to link growth and water management planning is the Growing Smarter Plus Act of 2000 (Act) which requires that counties with a population greater than 125,000 (2000 Census) include planning for water resources in their comprehensive plans. In 2000, none of the counties in the planning area had populations greater than 125,000 residents. The Act also requires that twenty-three communities outside AMAs include a water resources element in their general plans. In the Eastern Plateau Planning Area this requirement applies to the communities of Flagstaff, Pinetop-Lakeside, Show Low, Snowflake and Taylor, which have all completed plans. Plans must consider water demand and water resource availability in conjunction with growth, land use and infrastructure. Completed plans are listed in basin references in this volume and may contain useful information for water resources planning.

Beginning in 2007, all community water systems in the state were required to submit Annual Water Use Reports and System Water Plans. The reports and plans are intended to reduce community water systems' vulnerability to

Table 2.0-5 Communities in the Eastern Plateau Planning Area with a 2000 Census population greater than 1,000.

Communities	1990 Census Pop.	2000 Census Pop.	Percent Change 1990-2000	2006 Pop. Estimate[1]	Percent Change 2000-2006	Projected 2030 Pop.
Flagstaff	45,857	52,894	15.3%	62,030	17.3%	83,746
Winslow	9,279	9,520	2.6%	9,945	4.5%	11,706
Tuba City	7,323	8,225	12.3%	8,899	8.2%	10,572
Show Low	5,020	7,695	53.3%	10,555	37.2%	19,625
Window Rock/ Fort Defiance	7,795	7,120	-8.6%	7,120	0.0%	7,120
Page	6,598	6,809	3.2%	7,230	6.2%	8,027
Chinle	5,059	5,366	6.1%	5,524	2.9%	6,086
Kayenta	4,372	4,922	12.6%	5,186	5.4%	6,701
Holbrook	4,686	4,917	4.9%	5,455	10.9%	7,684
Snowflake	3,679	4,460	21.2%	5,180	16.1%	7,048
Eager	4,025	4,033	0.2%	4,530	12.3%	6,252
Pinetop-Lakeside	2,422	3,582	47.9%	4,540	26.7%	6,758
Taylor	2,418	3,176	31.3%	4,270	34.4%	8,210
St. Johns	3,294	3,269	-0.8%	3,925	20.1%	6,559
Heber-Overgaard	1,581	2,722	72.2%	3,596	32.1%	6,642
Springerville	1,802	1,972	9.4%	2,125	7.8%	2,485
Kaibito	641	1,607	150.7%	2,337	45.4%	4,149
LeChee	NA	1,606	--	2,725	69.7%	5,504
Lukachukai	113	1,565	1284.9%	1,669	6.7%	2,041
Many Farms	1,294	1,548	19.6%	1,678	8.4%	2,143
Ganado	1,257	1,505	19.7%	1,633	8.5%	2,087
St. Michaels	1,119	1,295	15.7%	1,386	7.0%	1,708
First Mesa/Polacca	1,108	1,124	1.4%	1,124	0.0%	1,124
Dilkon	NA	1,265	--	1,541	21.8%	2,501
Pinon	468	1,190	154.3%	1,543	29.6%	2,772
Tsaile	1,043	1,078	3.3%	1,096	1.7%	1,161
Total > 1000	**122,253**	**144,465**	**18.2%**	**166,841**	**13.4%**	**230,411**
Remainder of Planning Area	**87,201**	**105,080**	**20.5%**	**112,513**	**7.1%**	**147,981**
Total Planning Area	**209,454**	**249,545**	**19.1%**	**279,354**	**11.9%**	**378,392**

[1] 2006 population shown is the 2006 estimate for incorporated areas and the 2006 projection for unicorporated areas.
Source: Department of Commerce 2006, U.S. Census Bureau 2006

drought, and to promote water resource planning to ensure that water providers are prepared to respond to water shortage conditions. In addition, the information will allow the State to provide regional planning assistance to help communities prepare for, mitigate and respond to drought. An Annual Water Use Report must be submitted each year by the systems that includes information on water pumped, diverted and received, water delivered to customers and effluent used or received. The System Water Plan must be updated and submitted every five years and consist of three components, a Water Supply Plan, a Drought Preparedness Plan and a Water Conservation Plan. By January 1, 2008, all systems were required to submit plans. By the end of 2008, plans have been submitted by 61 community water systems in the planning area. Almost all of the larger systems submitted plans and these plans were used to prepare this document. Annual water report information and a list of water plans is found in Appendix B.

The Department's Water Adequacy Program also connects water supply and demand to growth to some extent, but does not control growth. Developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents. Legislation adopted in June 2007 (SB 1575), authorizes a county board of supervisors to adopt a provision, by unanimous vote, which requires a new subdivision to have an adequate water supply in order for the subdivision to be approved by the platting authority. If the county does not adopt the provision, the legislation allows a city or town to adopt a local ordinance that requires a demonstration of adequacy. By the end of 2008, none of the counties or jurisdictions in the planning area had adopted the new provision.

Subdivision adequacy determinations (Water Adequacy Reports), including the reason for the inadequate determination, are provided in Table 2.1-10 and their location is shown on Figure 2.1-12. Also shown are approved applications for an Analysis of Adequate Water Supply (AAWS). This application is typically associated with large, master planned communities. As of December 2008, two AAWS applications had been approved in the planning area with a total of 1,936 lots.

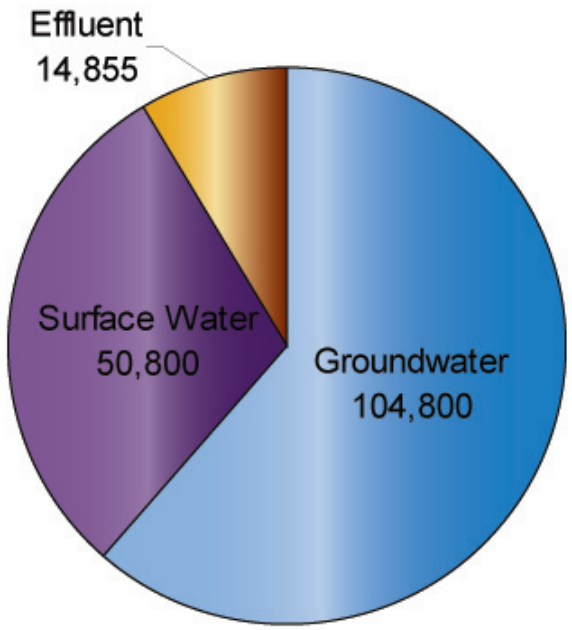
The service areas of 14 water providers in the planning area have been designated as having an adequate water supply. Designation information and the general location of the service area are also shown in Table 2.1-10 and on Figure 2.1-12. If a subdivision is served by one of these designated water providers, a separate adequacy determination is not required. As of December 2008 these included:

- Apache County
    - Town of Springerville
    - City of Saint Johns
- Coconino County
    - City of Flagstaff
    - City of Page
- Navajo County
    - City of Holbrook
    - City of Show Low
    - Town of Taylor
    - City of Winslow
    - Arizona Water Company, Lakeside and Pinetop
    - Town of Snowflake
    - Fools Hollow Water Company (Show Low)
    - Park Valley Water Company (Show Low)
    - Pineview Water Company (Show Low)
    - Voyager at White Mountain Lakes Water Co. (Show Low)

2.0.6 Water Supply

Surface water, groundwater and effluent are important water supplies for municipal, industrial and agricultural uses in the Eastern Plateau Planning Area. As shown in Figure 2.0-15, groundwater is the principal water supply utilized, meeting 61% of the demand on average in 2001-2005. Due to recent drought conditions, some communities that historically used significant amounts of surface water, such as Flagstaff, have turned to more reliable groundwater supplies. Population growth, supply reliability and the desire for economic development is spurring interest in exploring long-term water supply augmentation options such as securing Colorado River water, constructing water conveyance pipelines and acquiring lands with groundwater supplies. Effluent is also utilized by several communities for golf course, landscape irrigation and for industrial and agricultural purposes.

Figure 2.0-15 Water Supply Utilized in the Eastern Plateau Planning Area, 2001-2005 (in acre-feet)



Surface Water

Surface water is a significant water supply in some areas but is geographically limited. On the Navajo reservation, two-thirds of the average annual surface water originates in the Chuska Mountains and the Defiance Plateau and is locally available for agricultural and domestic use. Surface water at higher elevations in the southeastern part of the planning area is used primarily for agricultural use, although the Town of Eagar uses a small amount of surface water from Coon Springs (Town of Eagar, 2008). Colorado River water is the water supply for Page and neighboring LeChee. When there is sufficient rain and snow, surface water is stored in lakes near Flagstaff and used for municipal purposes.

Surface water from the Lake Mary reservoir system is an important municipal supply for the City of Flagstaff. The 30-year median inflow to the system from January to May was 5,000 acre-feet, but due to evaporation and seepage losses, the average availability is approximately 2,250 acre-feet (USBOR, 2006). Because surface water is drought sensitive, it can be unreliable, which has stimulated interest in additional well drilling and development of groundwater supplies in the Flagstaff area. In wet years, Lake Mary has provided 70% of the City's water supply (Pinkham and Davis, 2002); however in 1990, 2000 and 2002, there was very little inflow into Lake Mary. Recently, groundwater use has increased and supplies about 70% of the annual demand (Reed, 2005).

The Salt River Project acquired the rights to the surface water in the C.C. Cragin Reservoir, formerly the Blue Ridge Reservoir, from the Phelps Dodge Corporation in February 2005 as part of the Gila River Indian Water Rights Settlement Act. In addition to satisfying obligations to the Gila River Indian Community, the reservoir will be used to supplement Salt River Project shareholders' water supply and as a water supply for northern Gila County (SRP, 2006). Located near the southwestern boundary of the Eastern Plateau Planning Area on East Clear Creek, this supply is not available to users in the planning area.

The domestic water supply for the City of Page and the neighboring Navajo Nation Chapter of LeChee is obtained from Lake Powell through pumping and conveyance facilities first constructed in 1957. This water is available pursuant to a Colorado River Upper Basin allocation of 2,740 acre-feet of consumptive use.[5] The existing raw water supply facilities marginally meet the current peak demands of the two communities during summer months. A new lake intake to increase capacity, a new pipeline to LeChee and groundwater well development are being considered to provide a more reliable supply (TETRA TECH RMC, 2003). In addition, the City of Page has

[5] Consumption of water brought about by human endeavors….along with the associated losses incidental to these uses." USBOR, 2004, Colorado River System Consumptive Uses and Losses Report 1996-2000.

Lake Powell. The domestic water supply for the City of Page and the neighboring Navajo Nation Chapter of LeChee is obtained from Lake Powell through pumping and conveyance facilities first constructed in 1957.

requested an additional allocation of Colorado River water.

Springs are an important water supply for habitat, wildlife, domestic and cultural/religious purposes in parts of the planning area. On tribal lands, the communities of Tuba City, Moenkopi and Ganado rely on springs for domestic and agricultural uses.

Legal availability of a surface water supply is also an important consideration. As described in detail in Appendix C, the legal framework and process under which surface water right applications and claims are administered and determined is complex. Rights to surface water are subject to the doctrine of prior appropriation which is based on the tenet "first in time, first in right". This means that the person who first put the water to a beneficial use acquires a right that is superior to all other surface water rights with a later priority date. Under the Public Water Code, beneficial use is the basis, measure and limit to the use of water. Each type of surface water right filing is assigned a unique number as explained in Appendix C and shown in Table 2.0-6. The act of filing a statement of claim of rights to use public waters (36) does not in itself create a water right. A Certificate of Water Right (CWR) may be issued if the terms of the permit to appropriate water (3R, 4A, or 33, and in certain cases 38) are met. CWRs retain the original permit application number.

Surface water rights may also be determined through judicial action in state or federal court in which the court process establishes or confirms the validity of the rights and claims and ranks them according to priority. Court decreed rights are considered the most certain surface water right. Major court determinations in the planning area are the Norviel and Concho decrees. The Norviel Decree is comprised of four judicial actions (between 1914 and 1923) determining rights of landowners to divert surface water in and around Saint Johns to the headwaters of the Little Colorado River. The Concho Decree (1927) determined the relative rights to use surface water from Concho Springs and Concho Creek in Apache County.

Arizona has two general stream adjudications in progress to determine the nature, extent and priority of water rights across the entire river systems of the Gila River and the Little Colorado River. Pertinent to the Eastern Plateau Planning Area, the Little Colorado River (LCR) Adjudication is being conducted in the Superior Court of Arizona in Apache County. The LCR Adjudication was initiated by a petition filed by Phelps Dodge Corporation in 1978. It now covers 27,000 square miles and includes three watersheds (Lower Little Colorado River, Upper Little Colorado River and Silver Creek), 5 Indian reservations (Hopi, Navajo, Zuni, Fort Apache and San Juan Southern Paiute) and over 3,000 parties. All parties who claim to have a water right within the river system are required to file a statement of claimant (SOC) (39) or risk loss of their right. This includes reserved water rights for public lands and Indian reservations which for the most part, have not been quantified or prioritized. Results from the Department's investigation of surface water right and adjudication filings are presented in

Hydrographic Survey Reports (HSRs). Within the Eastern Plateau Planning Area, HSRs have been published for the Silver Creek Watershed (1990), Indian Lands in the Little Colorado River System (1994) and the Hopi Indian Reservation (2008).

Table 2.0-6 summarizes the number of surface water right and adjudication filings in the planning area. The methodology used to query the Department's surface water right and SOC registries is described in Appendix C. Of the 19,529 filings that specify surface water diversion points and places of use in the planning area, 797 CWRs have been issued to date. Figure 2.0-16 shows the general location of surface water diversion points listed in the Department's surface water rights registry. The numerous points reflect the large number of stockponds and reservoirs that have been constructed in the planning area as well as diversions from streams and springs. Locations of registered wells, many of which are referenced as the basis of claim in SOCs are also shown in Figure 2.0-16.

Groundwater

Groundwater is withdrawn from both large regional aquifers and from local and perched aquifers. The location of registered exempt and non-exempt wells is shown in Figure 2.0-16.[6] Flagstaff pumps groundwater from perched water bearing zones within the upper 500 feet or in the deeper C-aquifer (Woody Mountain and Lake Mary wellfields and inner city wells) and from shallow volcanic aquifers in the Inner Basin. Depth to water in C-aquifer wells ranges from approximately 1,200 to 1,600 feet bls. In 2005, Flagstaff purchased the Red Gap Ranch east of the city as a potential source of groundwater supplies. The USBOR (2006) reported sustainable or safe yield volumes from the city's various groundwater supplies as follows: Woody Mountain wellfield, 3,500 AFA; Lake Mary wellfield, 2,500 AFA; inner city wells, 1,300 to 2,800 AFA; and inner basin wells, 542 AFA.

Table 2.0-6 Count of surface water right and adjudication filings in the Eastern Plateau Planning Area[1]

Basin	Type of Filing							Total
	BB[2]	3R[3]	4A[3]	33[3]	36[4]	38[5]	39[6]	
Little Colorado River Plateau	134	163	196	373	3,289	3,275	12,099	**19,529**

Notes:

[1] Based on a query of ADWR's surface water right and adjudication registries in February 2009. A file is only counted in this table if it provides sufficient information to allow a Point of Diversion (POD) and/or Place of Use (POU) to be mapped within the basin. If a file lists more than one POD or POU in a given basin, it is only counted once in the table for that basin. Several surface water right and adjudication filings are not counted here due to unsufficient locational information. However, multiple filings for the same POD/POU are counted.

[2] Court decreed rights; not all of these rights have been identified and/or entered into ADWR's surface water rights registry.

[3] Application to construct a reservoir, filed before 1972 (3R); application to appropriate surface water, filed before 1972 (4A); and application for permit to appropriate public water or construct a reservoir, filed after 1972 (33).

[4] Statement of claimant of rights to use public waters of the state, filed pursuant to the Water Rights Registration Act of 1974.

[5] Claim of water right for a stockpond and application for certification, filed pursuant to the Stockpond Registration Act of 1977.

[6] Statement of claimant, filed in the Gila or LCR General Stream Adjudications.

[6] The term "exempt-well" is used to describe any well having a pump with a maxiumum pumpiing capacity of 35 gallons per minute or less. The term "non-exempt well" refers to a well having a pump with a capacity of more than 35 gallons per minute.

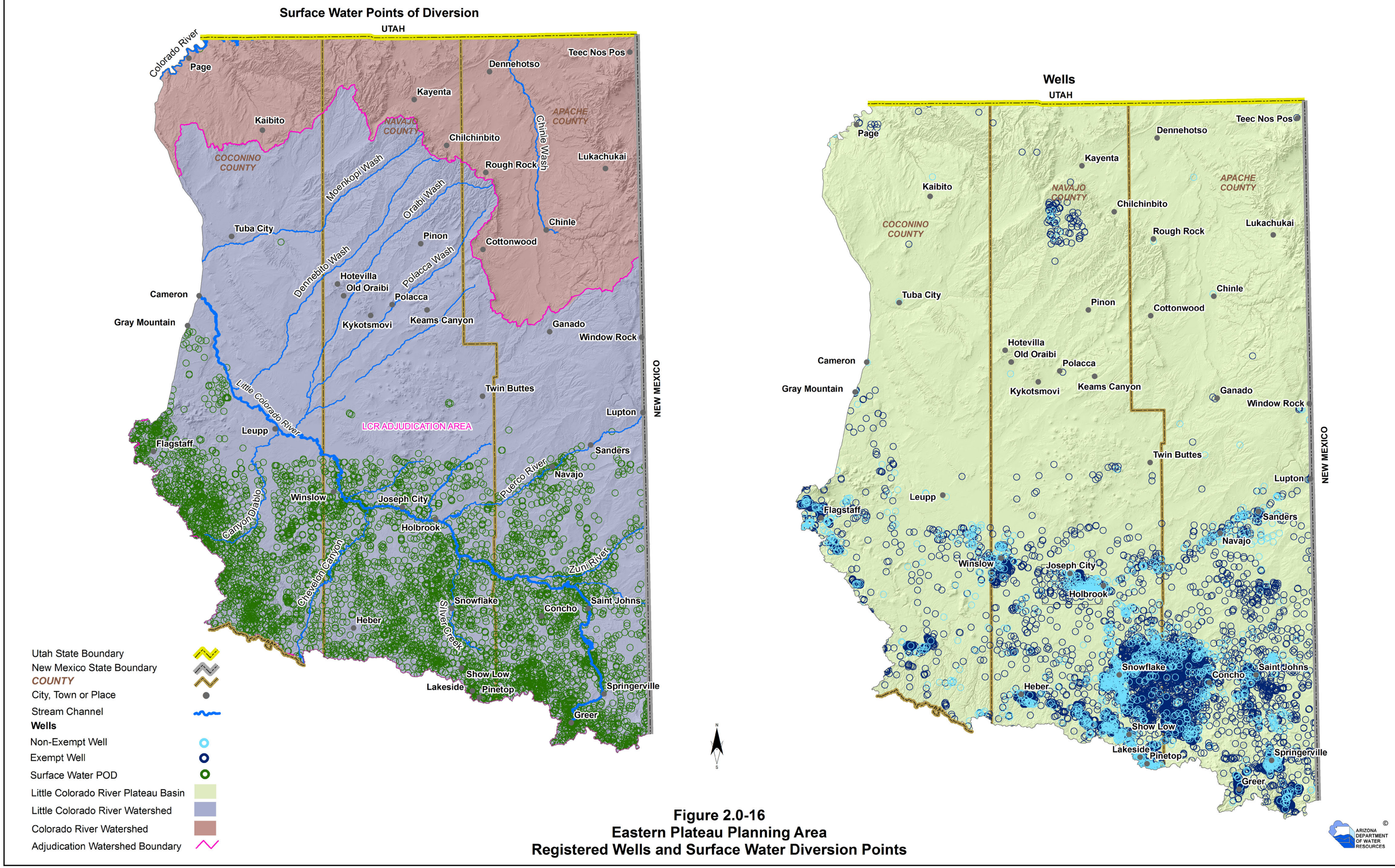


Figure 2.0-16
Eastern Plateau Planning Area
Registered Wells and Surface Water Diversion Points

The cities of Holbrook and Winslow rely entirely on groundwater pumped from the C-aquifer. Groundwater from the C-aquifer and from local aquifers (Bidahochi, Lakeside-Pinetop and White Mountain aquifers) is the principal water supply for municipal use in the Mogollon Rim region, including the communities of Heber, Pinetop-Lakeside, Show Low, Snowflake, Springerville, Eagar, Saint Johns and Greer.

North of the Little Colorado River, including on the Navajo and Hopi reservations, the N-aquifer, which is of good quality, is the primary water supply. In this area the C-aquifer is generally too deep and saline to be used. The D-aquifer underlies much of the Hopi and Navajo reservations and is utilized in some areas; however water quality is marginal due to elevated concentrations of dissolved solids. The community of Cameron pumps highly saline groundwater from wells near the Little Colorado River and treats it for use.

The Department's Groundwater Site Inventory (GWSI) database, the main repository for statewide groundwater well data, is available on the Department's website (www.azwater.gov/). The GWSI database consists of over 42,000 records of wells and over 210,000 groundwater level records statewide. GWSI contains spatial and geographical data, owner information, well construction and well log data and historic groundwater data including water level, water quality, well lift and pumpage records. Included are hydrographs for statewide index wells and automated groundwater monitoring sites, which can be searched and downloaded to access local information for planning, drought mitigation and other purposes. Approximately 1,700 wells are designated as index wells statewide out of over 43,700 GWSI sites. (GWSI sites are primarily well sites but include other types of sites such as springs and drains). Typically, index wells are visited once each year by the Department's field staff to obtain a long-term record of groundwater level fluctuations. Approximately 200 of the GWSI sites are designated as automated wells. These systems measure water levels four times daily and store the data electronically. Automated groundwater monitoring sites are established to better understand the water supply situation in areas of the state where data are lacking. These devices are located based on areas of growth, subsidence, type of land use, proximity to river/stream channels, proximity to water contamination sites or areas affected by drought.

Volume 1 of the Atlas shows the location of index wells and automatic water-level recording sites as of January 2009. At that time there were a total of 94 index wells and four ADWR automatic water-level sites in the Eastern Plateau Planning Area. The automated sites are located at Flagstaff, Joseph City, east of Holbrook and south of Saint Johns. The most updated maps may be viewed at the Department's website.

Information on major aquifers, well yields, estimated natural recharge, estimated water in storage, aquifer flow direction and water level changes are found in groundwater data tables, groundwater conditions maps, hydrographs and well yield maps in Section 2.1.6.

Effluent

More than 36,500 acre-feet of effluent is estimated to be generated annually in the planning area (Table 2.1-9). The communities of Flagstaff, Flagstaff Ranch, Holbrook and Page use effluent for golf course and landscape irrigation. In 2006 and 2007 over 2,300 acre-feet of effluent was used in the Flagstaff area. Reclaimed water is produced by both of the city's wastewater treatment plants. A total of 10 schools, eight parks, two cemeteries, three golf courses and a playing field at Northern Arizona University receive treated effluent. In addition, a large industrial user, SCA Tissues, which had been Flagstaff's second largest potable water user, converted to 100% reclaimed water use

in 2005, resulting in a potable water savings of more than 300 AFA (SCA, 2007). Flagstaff also has a reclaimed water hauling program that makes Class A+ and Class B reclaimed water available for non-potable uses at four sites located throughout the city (City of Flagstaff, 2008). A proposal to use Flagstaff effluent to make snow at the Snowbowl ski area has resulted in a multi-year court battle between a coalition of tribes and environmentalists and the owners of Snowbowl and the Forest Service that remains unresolved.

Other communities in the planning area discharge effluent to fields for agricultural irrigation or to support wetlands (see Table 2.1-9). The Town of Eagar provides treated wastewater at no cost to local hay farmers (Town of Eagar, 2005) and all Snowflake's effluent is applied to a local rancher's hay field.

Approximately 11,900 AFA of industrial wastewater is generated by the Catalyst Paper Mill (formerly Abitibi) near Heber and discharged to a dry lake where it is used to irrigate pasture. Effluent generation location, volumes and disposal method are shown in Table 2.1-9.

View of Northern Arizona University, Flagstaff, Arizona. In 2006 and 2007 over 2,300 acre-feet of effluent was used in the Flagstaff area.

Contamination Sites

Environmental contamination sites may impact the use of some water supplies. An inventory of Department of Defense (DOD), Resource Conservation and Recovery Act (RCRA), Superfund (Environmental Protection Agency designated sites), Water Quality Assurance Revolving Fund (state designated WQARF sites), Voluntary Remediation Program (VRP), Uranium Mill Tailings Remedial Action (UMTRA) and Leaking Underground Storage Tank (LUST) sites was conducted for the planning area. Of these various contamination sites, VRP, UMTRA and LUST sites are found in the planning area. Table 2.0-7 lists the contaminant and affected media at UMTRA and VRP sites. The location of all contamination sites in the planning area is shown on Figure 2.0-17.

There are three active VRP sites with soil and groundwater contamination. PCE, TCE and fuel oil are found in groundwater at the Arizona Public Service (APS) Cholla Power Plant site. At Winslow, soil contamination is found at the La Posada Hotel site, located adjacent to a railroad station and equipment yard. The Georgia-Pacific Corporation site in Flagstaff is also a railroad site; the particular contaminants at this site are not known. The VRP is a state administered and funded voluntary cleanup program. Any site that has soil and/or groundwater contamination, provided that the site is not subject to an enforcement action by another program, is eligible to participate. To encourage participation, ADEQ provides an expedited process and a single point of contact for projects that involve more than one regulatory program (Environmental Law Institute, 2002).

Two UMTRA sites are located on the Navajo Reservation at Tuba City and Monument Valley. The former Monument Valley mill and tailings site covers approximately 83 acres. Surface remediation was completed in 1994. A nitrate

Table 2.0-7 Contamination sites in the Eastern Plateau Planning Area

SITE NAME	MEDIA AFFECTED AND CONTAMINANT
Uranium Mill Tailings Remedial Action (UMTRA) Sites	
Tuba City Disposal Site	Groundwater - Molybdenum, Nitrate, Selenium, Uranium and Sulfate
Monument Valley Processing Site	Groundwater - Uranium, Ammonium, Nitrate and Sulfate
Voluntary Remediation Program (VRP) Sites	
APS Cholla Power Plant	Groundwater - Tetrachloroethylene (PCE), Trichloroethylene (TCE) and Fuel oil Soil - Fuel Oil
La Posada Hotel	Soil - Diesel fuel and Total petroleum hydrocarbons (TPH)
Georgia-Pacific Corp. Flagstaff Facility	Soil and Groundwater - Unknown

Sources: ADEQ 2002, ADEQ 2006a, ADEQ 2006b

plume with concentrations ranging from 44 to 1,030 mg/L extends approximately 4,500 feet north of the site. Uranium concentrations exceed the UMTRA standard of 0.044 mg/L at a site in the alluvial aquifer and in a well completed in the De Chelly formation that was contaminated from the overlying alluvium. Approximately 540 million gallons of groundwater in the alluvial aquifer are contaminated. The Department of Energy (DOE) will conduct pilot studies and continue with remediation, monitoring and enforcement strategies until contaminant concentrations have been reduced to acceptable levels. (DOE, 2007)

The Tuba City site, located five miles east of Tuba City is a former uranium mill that created radioactive mill tailings that were conveyed to evaporation ponds at the site. Surface remediation was completed in 1990. Seepage from the evaporation ponds contaminated groundwater in the N-aquifer. The original volume of contaminated groundwater was between 1.5 and 3 billion gallons. Contaminants include molybdenum, nitrate, selenium, uranium and sulfate. Active groundwater remediation is underway at the site using extraction wells and removal of contaminants (DOE, 2008b).

Widespread mining and milling of uranium ore on the Navajo Reservation beginning in the 1940s also resulted in a large number of abandoned uranium mines (AUMs) and dispersion of radiation and heavy metal contamination in soil and water. In 1993, the Navajo Nation brought concerns about health risks associated with these mining activities to the EPA, DOE and Bureau of Indian Affairs (BIA). In response, EPA initiated a study through the Superfund Program to assess human exposure to radiation and heavy metals from each known AUM on the Navajo Nation. By August 2007, EPA completed a study identifying 520 AUMs. In June 2008, the EPA, in partnership with DOE, BIA, the Indian Health Service and the Nuclear Regulatory Commission, finalized a five-year plan for cleaning up the abandoned uranium mining sites on the Navajo Nation. (EPA, 2008)

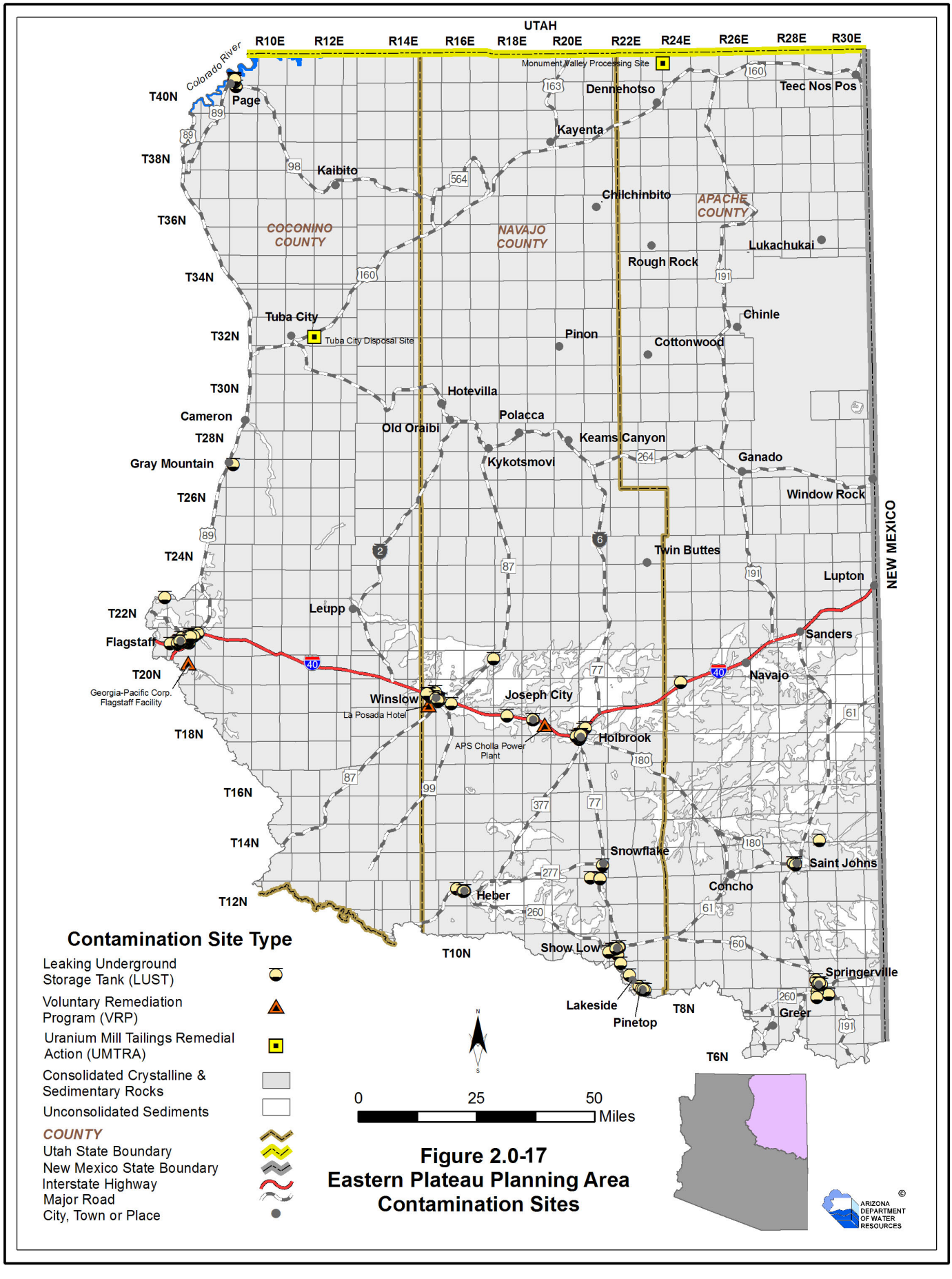


Figure 2.0-17
Eastern Plateau Planning Area
Contamination Sites

There are 260 active LUST sites in the planning area. Fifty-seven sites are located at Flagstaff, 53 at Winslow, 37 at Holbrook, 29 at Show Low/ Pinetop/Lakeside, 28 at Springerville/Eagar, 18 at Page, 11 at Heber and eight at Snowflake.

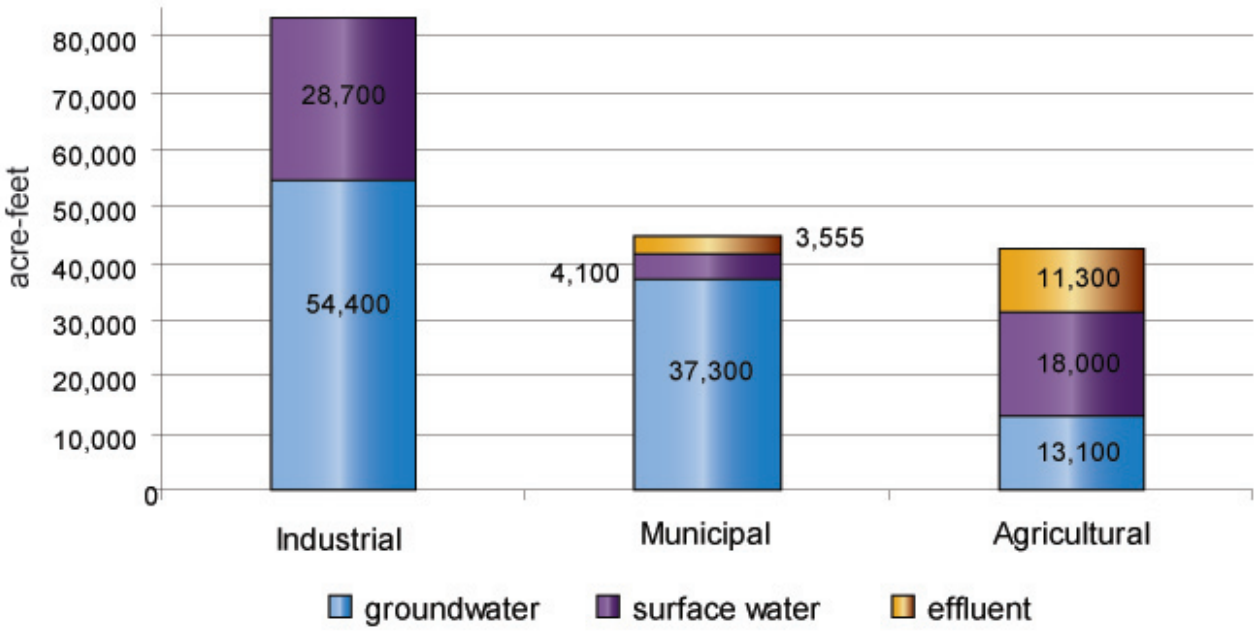
2.0.7 Cultural Water Demand

Cultural water demand in the Eastern Plateau Planning Area averaged approximately 170,400 AFA during the period from 2001 to 2005. Water demand by each sector and water source is shown in Figure 2.0-18. The industrial demand sector is the largest user with 83,100 AFA of water demand, 49% of the total. About two-thirds of the industrial demand is met by groundwater. The municipal sector accounts for about 26% of the cultural demand with almost 45,000 AFA. Most of the municipal demand is met with groundwater. Agricultural demand is approximately 42,400 AFA, 25% of the total. The agricultural sector utilizes comparable volumes of groundwater, surface water and effluent. Most of the agricultural effluent use is at one location and source, the Catalyst Paper Mill northeast of Heber. Surface water is the largest component of agricultural supply, meeting about 42% of the agricultural demand. Tribal water demand is included in these totals.

Tribal Water Demand

Tribal water demand is about a tenth of the overall cultural water demand in the planning area (not including the pumpage by Peabody Western Coal Company at Black Mesa). The Navajo Reservation is the largest and most populated with an estimated annual demand of 11,700 acre-feet and an Arizona population of about 105,000 in 2000. Demand on the Hopi Reservation is approximately 1,000 AFA. With a 2004 on-reservation population of about 8,000, Hopi people have continually occupied the area since 500 A.D. The community of Old Oraibi, established as early as 1100, is considered the oldest continuously inhabited settlement in the United States (ADOC, 2008).

Figure 2.0-18 Cultural Water Demand by Sector in the Eastern Plateau Planning Area, 2001-2005 (in acre-feet)



Navajo Nation

Major municipal demand centers on the Navajo Nation include Chinle, Kayenta, Tuba City and Window Rock/Fort Defiance. Specific amounts used in each community are not known. According to a 2002 Navajo Department of Water Resources (NDWR) report, approximately 40% of the population routinely hauls water for domestic and stock uses. According to the report, the Navajo Nation has the highest percentage of its population lacking potable water systems compared to any other region in the United States. Most municipal water supplies are groundwater (NDWR, USBOR & USIHS, 2002).

The Navajo Tribal Utility Authority (NTUA) is the largest public water provider for the Nation, which extends into New Mexico and Utah. The NTUA operates more than 90 public water systems with approximately 24,000 connections throughout the entire reservation, supplying more than 12,000 acre-feet of residential and 3,300 acre-feet of commercial water per year. It is estimated that smaller operators (NDWR and BIA) serve about 10,000 people and convey about 1,500 acre-feet of water annually. The USGS estimates that approximately 10,500 acre-feet of water was used for municipal purposes in the Arizona portion of the Navajo Reservation in 2006 (USGS, 2008). About 500 acre-feet of wastewater is used for dust abatement and construction. Other major uses are associated with coal mining on Black Mesa and electrical generation (NDWR, USBOR & USIHS, 2002).

Field in Canyon del Muerto, Navajo Reservation. Navajo reservation irrigation consists of Ak Chin (dryland farming) and small irrigation projects.

Navajo reservation irrigation consists of Ak Chin (dryland farming) and small irrigation projects. Between 1910 and the late 1950's the U.S. Government built and expanded dozens of small irrigation projects amounting to about 46,200 acres reservation-wide. Because of inadequate management and funding for operation and maintenance, these small systems have deteriorated and by 1986, a Soil Conservation Service survey found only 16,670 acres still were farmed, a decrease of 64% (NDWR, 2002b).

A field examination by Department staff and Navajo Nation representatives in the Upper Colorado River Basin portion of the planning area found approximately 400 acres of active surface water irrigation in 2005. The total water requirement for the crops grown on these acres was estimated at approximately 600 acre-feet (USBOR, 2007). The report did not include an irrigation efficiency estimate. The survey also found another 500 acres in the Upper Basin that were dryland farmed.

The extent of recent irrigation activity elsewhere on the Arizona portion of the reservation (Little Colorado River) is not well known but appears to be limited. The Hydrographic Survey Report for Indian Lands in the Little Colorado River System (ADWR, 1994b), reported approximately 3,000 irrigated acres in that portion of the reservation. An analysis of recent aerial images show approximately 200 acres irrigated in this area, resulting in total reservation acreage of roughly 600 acres, or 1,200 AFA on the Navajo Reservation (ADWR, 2008b).

An additional 4,400 acre-feet of groundwater was withdrawn annually from tribal lands for the

Black Mesa and Kayenta coal mines and slurry pipeline. With closure of the Mohave Generating Station at Laughlin, Nevada in 2005, the slurry pipeline that deliverd coal from the Black Mesa mine is not operating. As a result withdrawals dropped to 1,500 acre-feet in 2006.

Hopi Tribe

Major municipal demand centers on the Hopi Reservation include Polacca, Kykotsmovi, Shungopavi, Hotevilla and Moenkopi. The N-aquifer is the only aquifer of sufficient quality and accessibility to supply reliable drinking water to the Hopi villages on the three mesas (Hopi Tribe, 2005). The village of Moenkopi uses approximately 160 acre-feet of water from N-aquifer springs.

The Department completed the Preliminary Hydrographic Survey Report for the Hopi Indian Reservation (Hopi HSR) in December 2008, which contains detailed water demand information. The report found that public water systems delivered 445 acre-feet of groundwater in 2006 (ADWR, 2008a). The USGS estimates that an additional 100 acre-feet of groundwater is annually used for domestic purposes (USGS, 2008).

Agriculture on the Hopi Reservation consists primarily of traditional farming activities on small plots of land. The predominant crop grown is corn, with smaller percentages of orchards, beans, melons and squash. The Hopi HSR identified approximately 5,000 traditionally irrigated acres scattered throughout the reservation. These areas are irrigated through a combination of dryland farming, rainwater harvesting or surface water diversions during rainfall events. The survey also found approximately 180 acres of non-traditionally irrigated lands at Pasture Canyon near Moenkopi, 155 acres of which were irrigated in 2005. These acres are irrigated using non-traditional ("modern") irrigation methods at an estimated rate of 2.0 acre-feet per acre or about 310 AFA (ADWR, 2008a).

Dry land farming of corn on the Hopi Reservation.

Zuni Heaven Reservation

The Zuni Heaven Reservation was established by Congress in 1984 through Public Law 98-498 and expanded in 1990 through Public Law 101-486 to further the religious and cultural needs of the Zuni Tribe. Zuni Heaven is a religious pilgrimage site from the main reservation in New Mexico and was a lush riparian habitat with springs, streams and a sacred lake (Hadin Kyaya) as late as the 1930s. Surface water depletions, dams, groundwater pumping and incisement of the Little Colorado River through the Zuni lands resulted in loss of the springs, lake and riparian habitat. The Zuni Indian Tribe Water Rights Settlement Agreement of 2002 provides sufficient water for the reservation including reestablishment and maintenance of the wetland environment. A minimum wetland restoration volume of 5,500 AFA from various sources was identified, including unappropriated surface water flows reaching the reservation, water from Zuni Lands upstream of the reservation, acquired surface water rights and underground water. The agreement allows pumping of up to 1,500 AFA from the Zuni Pumping Lands for restoration of the wetlands and to provide water to the sacred lake. In 2008, the Tribe withdrew approximately 157 acre-feet of water from wells on the Zuni Pumping Lands.

Municipal Demand

The primary municipal water demand centers in the planning area are located at Flagstaff, Winslow/Holbrook, Page and in the White Mountain/Mogollon Rim communities of Eagar, Pinetop-Lakeside, Heber-Overgaard, Show Low, Snowflake, Springerville, Saint Johns and Taylor. Demand centers are discussed briefly below. Estimated water demand served by public and private water providers is shown in Table 2.0-8 for each water demand center. Reported water withdrawals and deliveries for all community water systems in the planning area in 2006 and 2007 are found in Appendix B. Effluent is used for municipal purposes by Flagstaff, Page and Holbrook for golf course, urban irrigation and for industrial purposes.

An estimate of water demand associated with domestic/self-supplied wells is also listed in Table 2.0-8. This demand is difficult to estimate. A population-based estimate rather than an estimate based on the number of domestic wells was used due to uncertainties regarding whether wells drilled are currently functioning. Water hauling is also common in unincorporated areas around Flagstaff and on the Navajo Reservation.

Municipal water demand is primarily residential and commercial. Demand varies seasonally in some communities due to tourism and summer-only landscape watering. Because of the higher elevation, shorter growing season, higher rainfall and rural nature of many parts of the planning area, outdoor landscape watering is typically lower than that in the lower elevation, drier parts of the state. There have been significant conservation efforts in the Flagstaff area. Some of these programs target outdoor water use and landscape design, e.g., rebates for replacement of high water use landscaping. Estimated per capita usage in Flagstaff is 116 gallons per capita per day (GPCD), which is lower than many cities in Arizona (City of Flagstaff, 2009). Public municipal systems serve the majority of water demand in the planning area. Non-Indian large utility systems that served more than 500 acre-feet of water in 2006 are listed in Table 2.0-9.

Estimated demand and water supply for all golf courses in the planning area is shown in Table

Table 2.0-8 Municipal demand in the Eastern Plateau Planning Area in 2006 (in acre-feet)

	Groundwater	Surface Water	Effluent	Total
Municipal Demand Served by a Water Provider				
Flagstaff Area	7,700	1,600	2,300	11,600
Heber-Overgaard/Forest Lakes	900	0	0	900
Page	0	2,250	770	3,020
Saint Johns/Concho	800	0	0	800
Show Low/Pinetop-Lakeside	4,200	0	0	4,200
Snowflake-Taylor	2,400	0	300	2,700
Springerville/Eagar	900	100	0	1,000
Winslow/Holbrook	2,600	0	185	2,785
Total Water Provider	**19,500**	**3,950**	**3,555**	**27,005**
Domestic/Self-supplied	**7,000**	**0**	**0**	**7,000**
Hopi Reservation	**540**	**160**	**0**	**700**
Navajo Nation	**10,500**	**NR**	**0**	**10,500**
Total Municipal	**37,540**	**4,110**	**3,555**	**45,205**

Source: ADWR Community Water Systems 2006 Annual Reports, USGS 2008

Table 2.0-9 Water providers serving 500 acre-feet or more of water per year, excluding effluent, in the Eastern Plateau Planning Area

Water Provider	1991 (AF)	2000 (AF)	2006 (AF)
Arizona Water Company-Lakeside	597	897	792
Arizona Water Company-Overgaard	183	337	503
Doney Park Water	455	737	781
Eager Municipal Water	680	781	700
Flagstaff, City of	8,172	9,927	8,485
Holbrook, City of	1,166	956	790
Page Municipal	2,740	2,740	2,250
Show Low Municipal	830	1,205	1,485
Saint Johns Municipal	558	757	662
Snowflake, Town of	872	1,323	1,416
Taylor, Town of	445	721	871
Winslow Municipal	2,000	1,863	1,744

Source: Community Water System 2006 Annual Reports, USGS 2007

2.0-10. Golf course demand is estimated to be approximately 4,500 acre-feet a year, of which approximately 2,700 acre-feet of groundwater, surface water and effluent is served from the Flagstaff municipal system comprising approximately 6% of the total municipal demand. Four golf courses, Aspen Valley, Continental and Pine Canyon in Flagstaff, and Hidden Cove Country Club in Holbrook use 100% effluent from a municipal source. The remaining 1,800 acre-feet of golf course demand is served from a facility well or surface water diversion and is considered an industrial demand in the Atlas.

Flagstaff Area

A number of water systems serve the Flagstaff area including the City of Flagstaff, Doney Park Water and Flagstaff Ranch. The nearby

Table 2.0-10 Golf course demand in the Eastern Plateau Planning Area (c.2006)

Facility	# of Holes	Demand (acre-feet)	Water Supply
Aspen Valley and Continental Golf Courses (Flagstaff)	36	1078	Effluent
Bison Golf Course - Show Low 1&2*	18	150	Groundwater
Concho Valley Country Club*	18	88/87	Groundwater/Surface Water
Flagstaff Ranch	18	88/22	Groundwater/Effluent
Greer Lakes Golf Resort*	18	150	Groundwater
Hidden Cove (Holbrook)	9	75	Effluent
Juniper Ridge RV Resort* (Show Low)	9	75	Groundwater
Lake Powell National Golf Club (Page)	18	719/46	Effluent/Surface Water
Pine Canyon (Flagstaff)	18	330	Effluent
Pine Meadows Country Club (Overgaard)	9	75	Groundwater
Pinetop Country Club*	18	150	Groundwater
Pinetop Lakes Golf & Country Club*	18	125	Groundwater
River Run Golf Course* (Eagar)	18	150	Groundwater
Silver Creek Golf Club* (Show Low)	18	441	Groundwater
Snowflake Municipal	27	225	Groundwater
Torreon Golf Club* (Show Low)	36	300	Groundwater
White Mountain Country Club* (Pinetop)	18	150	Groundwater

Source: ADWR, 2008c

communities of Kachina Village, Mountainaire, and Forest Highlands are located in the Verde River Basin. The City of Flagstaff is by far the largest provider in the entire planning area, with a potable demand of 8,500 acre-feet in 2006. It also delivered another 2,300 acre-feet of effluent for irrigation and industrial use.

As mentioned previously, the water supply for Flagstaff has become more diversified, with recent investment in additional groundwater development. It also continues to expand its reclaimed water system and recruit new reclaimed water customers. The city offers reduced water rates for reclaimed water use, rebates for the cost of a connection to the reclaimed system and provides reclaimed water hauling locations to users in several areas. Northern Arizona University is the largest water customer in Flagstaff, comprising about 8-10 percent of the annual demand (Pinkham and Davis, 2002).

The other large provider in the Flagstaff area is Doney Park Water, which serves groundwater to unincorporated communities known as Doney Park, Timberline and Fernwood located primarily east of Highway 89, and Cosnino and Winona located southeast of Doney Park along the Townsend-Winona Road. Doney Park Water also provides standpipe services. The Doney Park Water service area is not expected to expand significantly. Water users in the area are not connected to a centralized wastewater system and use on-site wastewater treatment such as septic systems (Pinkham and Davis, 2002). In 2006, Doney Park Water served almost 800 acre-feet of groundwater pumped from six wells to primarily single family residences (97% of deliveries).

Flagstaff Ranch is a growing, 850-acre development west of Flagstaff that includes a residential community, golf course and a business park. Flagstaff Ranch Water Company serves the residential development and provides standpipe services. In 2006 it withdrew about 50 acre-feet of groundwater. Separate wells provide irrigation water to the golf course, which is supplemented with effluent. (Pinkham and Davis, 2002)

Heber-Overgaard/Forest Lakes

The adjacent, unincorporated communities of Heber and Overgaard, with a combined population of approximately 3,600, are located in southern Navajo County along Highway 260. In 2007 Arizona Water Company withdrew about 500 acre-feet of groundwater from five wells to serve Overgaard. In 2007 Heber Domestic Water District withdrew about 140 acre-feet of water from three wells to serve Heber. Neither community has a centralized wastewater treatment system. The Bison Ranch master planned community east of Overgaard is served by a private wastewater treatment plant.

Forest Lakes is a primarily summer/vacation home community located west of Heber-Overgaard. In 2006 the Forest Lakes Water Improvement District pumped 235 acre-feet of water to serve over 800 single-family residences and a small number of commercial customers.

Page

The City of Page began as a housing camp in 1957 for the construction of Lake Powell. Incorporated in 1975, its population is now over 9,000. The city provides all water services to Page and to the adjacent community of

City of Page and the Lake Powell National Golf Course. In 2006, 719 acre-feet of effluent was delivered to this golf course.

LeChee on the Navajo Nation. All water used is from Lake Powell through a contract with the USBOR. Considering return flow credits to the Lake, Page is entitled to about 3,300 AFA. Water is withdrawn via intakes on the dam and pumped 1,200 feet uphill to the city's treatment plant. Some untreated water goes directly to the 27-hole municipal golf course. Page plans to increase its water storage capacity and is looking to improve system reliability since it relies on a single pipeline from the Lake Powell intakes. It is also considering well development to provide backup to the surface water system. Most of Page is served by a centralized wastewater treatment system (Pinkham and Davis, 2002). In 2006, the City of Page received 2,250 acre-feet from the USBOR and delivered 1,898 acre-feet to Page and 97 acre-feet to LeChee. In addition, 719 acre-feet of effluent was delivered to the Lake Powell National Golf Course.

Saint Johns/Concho

Saint Johns is the Apache County seat and home to over 3,800 residents. It is served by the Saint Johns Municipal water system, which withdrew about 660 acre-feet of water from two wells in 2006, and by the Saint Johns WWTP. The nearby Coronado Generating Station, a coal fired power plant operated by the Salt River Project, is a major employer. The unincorporated community of Concho is located about 18 miles west of Saint Johns. It consists of the original town of "Old Concho" and the master planned community of Concho Valley, which includes the Concho Valley Golf Course and Concho Lake. Livco Water and Sewer Company provides water and sewer service in Concho Valley. In 2006 it delivered about 100 acre-feet of groundwater to Concho Valley and 12 acre-feet to Old Concho Water Users, which serves Old Concho.

Show Low/Pinetop-Lakeside

The second largest demand center in the planning area with an annual demand of 6,500 acre-feet, the Show Low/Pinetop-Lakeside area had a combined population of about 15,100 residents in 2006. The area is a popular tourism and recreation destination. The primary water providers in Show Low are the City of Show Low, Pineview Water Company and Fools Hollow-Park Valley Water Company. The City of Show Low water utility serves about 80% of the city's approximately 11,000 residents. It withdraws water from the C-aquifer at depths of between 540 to over 600 feet bls (City of Show Low, 2007). In 2006 it withdrew almost 1,500 acre-feet of groundwater from eight wells and delivered three acre-feet to Pineview Water Company. About 900 acre-feet of effluent was treated at the Show Low Wastewater Treatment Plant and delivered to a series of created wetlands including Pintail Lake, Redhead Marsh and Telephone Lake. In 2006, Pineview Water Compnay withdrew about 335 acre-feet of water from four wells for single family and commercial uses. Fools Hollow-Park Valley Water Company withdrew about 185 acre-feet from two wells to serve primarily single-family customers. It also serves Fools Hollow State Park.

The communities of Pinetop and Lakeside incorporated as one in 1984. The town of about 4,600 residents (2006) is primarily served by four water providers; Arizona Water Company-Lakeside, Ponderosa Domestic Water Improvement District (DWID), Pinetop Water Community Facilities District (CFD) and Arizona Water Company-Pinetop Lakes, that together served almost 2,000 acre-feet of groundwater in 2006. Arizona Water Company-Lakeside withdrew 792 acre-feet from five wells to serve primarily residential customers. The next largest provider, Ponderosa DWID withdrew 484 acre-feet of water from seven wells to serve primarily single family customers and turf. Turf deliveries were 86 acre-feet in 2006 and 176 acre-feet in 2007. Pinetop CFD serves almost equal volumes of water to residential and commercial users. In 2006 it withdrew 468 acre-feet of groundwater from five wells. Arizona Water Company-Pinetop

Lakes serves residential customers from two wells. In 2006 it withdrew 208 acre-feet of water. The communities are also served by a number of small water providers. Area wells tap both the deep Coconino aquifer and the shallower Pinetop-Lakeside aquifer. New water provider wells are generally developed in the Coconino aquifer while the shallower aquifer is a substantial source of domestic water (Pinetop-Lakeside, 2004).

Snowflake/Taylor

Snowflake and Taylor are adjacent, incorporated towns located along Silver Creek in southeastern Navajo County. Each is served by municipal water and sewer systems. The largest industry in the area is the Catalyst Paper Mill located about 15 miles west of Snowflake/Taylor. Other local industries include a large hog feedlot operation, a 20-acre hydroponic tomato greenhouse, cattle grazing and farming. The population of Snowflake was about 5,180 in 2006 when the city utility served 1,416 acre-feet of water from four wells to about 1,640 connections. Wells are located in the C-aquifer with water levels generally between 100-400 ft bls. Reportedly, expansion of both the water and wastewater systems is needed. Treated effluent from the Snowflake WWTP is stored in a pond for irrigating agricultural fields. In 2006 about 300 acre-feet of effluent was delivered to a hay field (Town of Snowflake, 2007). Taylor, with a 2006 population of 4,270, withdrew 871 acre-feet from two active wells. Of this total, 222 acre-feet was delivered to turf and "other" including parks and streetscapes.

Springerville-Eagar

The incorporated communities of Springerville and Eagar are located in Round Valley at the edge of the White Mountains in southern Apache County. They have a combined population of over 6,600 with 4,530 residents in Eagar and 2,125 residents in Springerville in 2006. Both communities are served by municipal water and wastewater utilities. The nearby Tucson

Round Valley, Arizona. In 2006 Springerville served 291 acre-feet of groundwater and Eagar withdrew 595 acre-feet of groundwater and diverted 105 acre-feet of surface water.

Electric Power Springerville Generating Station is a major area employer. Springerville served 291 acre-feet of groundwater to residential and commercial customers from seven wells in 2006. Eagar's water supply comes from seven wells and a spring. Water use averages 150,000 gallons per day in the winter to one mgd in the summer. Peak demand exceeds well pump capacity and the town is planning construction of two new wells. Approximately 60% of the town is connected to a centralized sewer system. Wastewater from the Eagar WWTP is provided for crop irrigation (Town of Eagar, 2002). In 2006, Eagar withdrew 595 acre-feet of groundwater from six wells and diverted 105 acre-feet of surface water. It delivered 98 acre-feet of effluent for agricultural use.

Winslow-Holbrook

These two relatively large communities are located in the Little Colorado River Valley in Navajo County. Holbrook, with a 2006 population of about 5,600, is the county seat. Both communities are served by municipal water systems. The Arizona Public Service Cholla Power Plant is located near Holbrook and is a major area employer. Holbrook withdraws water from the C-aquifer from six wells. In 2006 it withdrew 790 acre-feet of groundwater. Holbrook's sewer system serves

customers in and around the city. The Painted Mesa WWTP treats an average of 0.5 mgd and effluent is reused for agricultural irrigation and for irrigation of the Hidden Cove Golf Course. Located west of Holbrook, Winslow is larger, with a 2006 population of over 10,100. Municipal groundwater is pumped from six wells located southwest of the city. In 2006 it withdrew 1,744 acre-feet of groundwater and diverted 2,000 acre-feet from Clear Creek. Diversions from Clear Creek are for non-municipal uses, primarily recreation. Another approximately 1,000 acre-feet of effluent from the Winslow WWTP was delivered for agricultural irrigation of a farm leased by the city for non-dairy forage crops.

Agricultural Demand

Agricultural demand on non-tribal lands has significantly declined from historic levels. Cessation of some agricultural irrigation has occurred recently in the Hunt Valley area and near Saint Johns due to purchase by the Zuni Tribe to preserve tribal water resources at Zuni Heaven, a historically riparian area sacred to the Zuni.

Areas of greatest non-Indian agricultural irrigation are near the communities of Saint Johns, Springerville, Snowflake/Taylor, Joseph City and Holbrook. In some areas, particularly Snowflake/Taylor, the proportions of surface water and groundwater used varies significantly from year to year with fluctuations in precipitation. Agriculture on the Navajo and Hopi reservations is served primarily by surface water and land is also dryland farmed ("traditional" farming). As mentioned above, "non-traditional" Indian agricultural demand is estimated to be about 1,550 acre-feet. Dryland farming utilizes water harvesting techniques to catch and direct runoff to crops. Because there is no supplemental irrigation, both spring soil moisture and late summer precipitation are needed for success. It is estimated that approximately 8,800 acres in the planning area are actively irrigated with a combination of 42,950 acre-feet of surface water, groundwater and effluent. Agricultural demand is summarized in Table 2.0-11.

Described below is historic agricultural irrigation information from investigations conducted by the Department in 1990 and 1994. In the summer of 2008, staff from the USGS conducted a survey of agricultural lands in the planning area. Preliminary information from this survey is also discussed below and summarized in Table 2.0-12. The survey found approximately 8,000 active (not fallow) acres irrigated during the 2008 growing season on non-tribal lands in the planning area.

Silver Creek Watershed-Pinetop-Lakeside, Show Low, Snowflake, Taylor

Several irrigation companies historically supplied agricultural irrigation water in the Show Low/ Pinetop-Lakeside area. These included the Show Low, Pinetop-Woodlands, Woodlands and Lakeside Irrigation Companies. The irrigation season is limited and irrigated lands were used for pasture, orchards and gardens. The Silver Creek Irrigation District operates in the communities of Shumway, Taylor and Snowflake. Historically, Silver Springs provided the majority

Table 2.0-11 Agricultural demand in the Eastern Plateau Planning Area

	1991-1995 (acre-feet)	1996-2000 (acre-feet)	2001-2005 (acre-feet)
Non-Indian Total	**51,200**	**37,700**	**41,400**
Surface Water	14,700	15,400	17,000
Groundwater	36,500	22,300	13,100
Effluent	UNK	UNK	11,300
Indian Total	**1,550**	**1,550**	**1,550**
Navajo [1]			
Surface Water	1,200	1,200	1,200
Hopi			
Surface Water	350	350	350
TOTAL	**52,750**	**39,250**	**42,950**

Source: ADWR 2008b, USGS 2007

[1] Navajo irrigated acreage estimated based on 2005 aerial data
UNK= Unknown

Table 2.0-12 Active agricultural acres in the Eastern Plateau Planning Area

Area	Source	Acres	Crop Type	Irrigation System
Heber	REUSED WATER (CATALYST CORP)	1,691	ALFALFA	FLOODED
		272	SORGHUM	
		75	TREES	
		60	CORN	
		54	BARLEY	
Subtotal		***2,152***		
Holbrook	GROUNDWATER	41	RYE GRASS	FLOODED
		13	CORN/GRASS MIX	
	HOLBROOK RECLAIM WATER	62	ALFALFA	FLOODED
Subtotal		***115***		
Joseph City INA	GROUNDWATER	153	ALFALFA	FLOODED
		47		SPRINKLER
		22		CENTER PIVOT
		23	CORN	FLOODED
		88	RYE GRASS	FLOODED
		17		SPRINKLER
		32		CENTER PIVOT
		1	VEGETABLES	FLOODED
Subtotal		***383***		
Show Low	SURFACE WATER (SHOW LOW CREEK)	4	CORN	FLOODED
		259	GRASS	FLOODED
Subtotal		***263***		
Snowflake	GROUNDWATER	44	BARLEY	FLOODED
		35	SOD	SPRINKLER
		4		CENTER PIVOT
		289	ALFALFA	FLOODED
	GROUND WATER / SURFACE WATER (SILVER CREEK LAKE)	95	BERMUDA GRASS	FLOODED
		203	CORN	
		45	GREENHOUSE	
		41	OATS	
		1,526	RYE GRASS	
Subtotal		***2,281***		
Springerville/Eager	SURFACE WATER (OTHER)	119	RYE GRASS	FLOODED
		2	VEGETABLES	
	SURFACE WATER FROM GREER RESERVOIR	29	ALFALFA	FLOODED
		1,101	RYE GRASS	
		2	VEGETABLES	
Subtotal		***1,253***		
Saint Johns	GROUNDWATER	101	SOD	SPRINKLER
		94		CENTER PIVOT
		32	OATS	FLOODED
		19	ALFALFA	
		17	RYE GRASS	
	SURFACE WATER (LYMAN LAKE)	257	ALFALFA	FLOODED
		580	RYE GRASS	
		87	SUDAN GRASS	
Subtotal		***1,187***		
Woodruff	GROUNDWATER	243	ALFALFA	FLOODED
	SURFACE AND GROUNDWATER	162	RYE GRASS	FLOODED
Subtotal		***405***		
TOTAL		***8,041***		

Source: USGS 2009

of the surface water supply for the District. White Mountain Lake is the major water storage reservoir for the District. The area is within the Silver Creek Watershed for which a Hydrographic Survey Report was filed with the Adjudication court in 1990. At that time, almost 6,300 acres were irrigated with surface water and groundwater, using a total of almost 29,000 acre-feet per year (ADWR, 1990).

In 2008, the USGS observed 263 acres of primarily grass irrigation with water diverted from Show Low Creek in the Show Low area. In the Snowflake, Taylor, Shumway area, approximately 2,281 acres were irrigated with surface water from White Mountain Reservoir and with groundwater. The primary crop was rye grass.

Joseph City Irrigation Non-Expansion Area (INA)

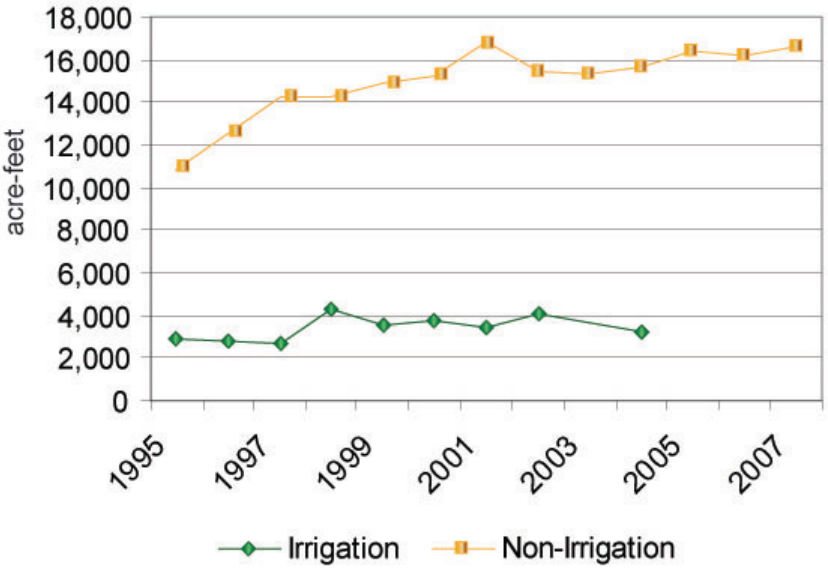
The Joseph City INA was established in 1980 by the Arizona Groundwater Management Act. The area had previously been designated as a Critical Groundwater Area in 1974. Designation of an area as an INA recognizes that there is "insufficient groundwater to provide a reasonably safe supply for the irrigation of the cultivated lands at the current rate of withdrawal" A.R.S. § 45-402(22). Within an INA, irrigation with groundwater is restricted to lands that were irrigated prior to establishment of the area. Groundwater withdrawals by irrigation and large non-irrigation users, such as cities or golf-courses, must be reported annually to the Department. Irrigation and non-irrigation uses (primarily the Cholla Generating Station), are shown in Figure 2.0-19. Irrigation use in the INA had generally been between 2,000 and 4,000 acre-feet a year, served by the Joseph City Irrigation Company. Irrigation use was not reported for 2006 and 2007.

In 2008, the USGS observed about 383 acres of active irrigation, primarily alfalfa, in the Joseph City INA.

Upper Little Colorado River-Springerville, Eagar, Nutrioso, Greer, Vernon, Saint Johns, Concho, Woodruff

The Department conducted an inventory of irrigation use in the Upper Little Colorado River watershed and published a report in 1994 (ADWR, 1994c). The inventory divided the area into ten regions: Nutrioso; Greer; Round Valley, including the Round Valley Water Users Association (Eagar) and Springerville Water Rights and Ditch Company; Vernon; Saint Johns including Lyman Water Company and the Saint Johns Irrigation Company; Concho, including Concho Water Company; Hunt; Hay Hollow; Woodruff, including the Woodruff Irrigation Company and Sanders. At that time, 18,980 acres were irrigated with a total surface water and groundwater use of almost 35,000 acre-feet. The biggest volumes of water use were in the Saint Johns area (6,600 acre-feet) and in the Hunt Valley area, located west of Saint Johns (3,800 acre-feet). The cropped acres were

Figure 2.0-19 Irrigation and Non-irrigation Water Demand in the Joseph City INA



primarily pasture. No use was reported in the Sanders region. As mentioned previously, the Zuni tribe has recently purchased and retired agricultural lands in the Hunt Valley area and near Saint Johns.

By the summer of 2008, the USGS observed irrigation of approximately 2,271 acres in the area. In the Springerville/Eager area 1,252 acres of primarily rye grass was irrigated with surface water. Irrigation water used at Eagar is conveyed via pipeline from the Greer Lakes. That summer, 1,187 acres of primarily rye grass and alfalfa was irrigated in the Saint Johns area with a combination of groundwater and surface water from Lyman Lake. Southeast of Holbrook at Woodruff, another 405 acres of alfalfa and rye grass was observed irrigated with groundwater and surface water.

Lower Little Colorado River-Winslow, Holbrook, Heber, Flagstaff

The Department conducted an inventory of irrigation use in the Lower Little Colorado River watershed and published a report in 1994 (ADWR, 1994d). Similar to the Upper Little Colorado River watershed inventory, the area was divided into four regions: Winslow, Holbrook, Heber and Flagstaff. At the time of the inventory, (excluding the Joseph City Irrigation Company located in the Joseph City INA), about 3,700 acres were actively irrigated with a combination of 10,600 acre-feet of surface water and groundwater. Use was reported in three of the regions: 4,380 AFA at Winslow; 3,300 AFA at Heber; and 2,900 AFA at Holbrook. Pasture and alfalfa were the primary crops grown. No irrigation was reported in the Flagstaff region.

By the summer of 2008, the USGS found that irrigation had ceased at Winslow, although in 2007 the City of Winslow reported that 1,000 acre-feet of effluent was applied to forage crops at a farm leased by the city. At Heber, 1,691 acres of alfalfa, 272 acres of sorghum and 189 acres of trees, corn and barley were irrigated with water discharged from the Catalyst Paper Mill. Irrigation had diminished in the Holbrook area with about 115 acres of rye grass, corn and alfalfa irrigated with a mix of groundwater (53 acres) and effluent (62 acres).

Industrial Demand

Industrial water demand in the planning area includes mining, electrical power generation, paper production, dairies and feedlots and golf course irrigation served by a facility water system. This demand is summarized in Table 2.0-13 for selected time periods. Industrial demand, particularly for power generation is a large cultural demand component in the planning area,

Table 2.0-13 Industrial demand in the Eastern Plateau Planning Area

	1991-1995	1996-2000	2001-2005
Type	**Water Use** (acre-feet)		
Mining Total	**11,144**	**11,445**	**6,241**
Surface water[1]	6,984	7,005	1,441
Groundwater[2]	4,160	4,440	4,800
Power Plant Total	**52,918**	**56,943**	**63,279**
Surface water	23,418	24,843	27,179
Groundwater	29,500	32,100	36,100
Golf course Total	**1,266**	**1,326**	**1,596**
Surface water	87	87	87
Groundwater	1,179	1,239	1,509
Dairy/Feedlot Total	**472**	**524**	**546**
Groundwater	472	524	546
Paper Mill Total	**17,092**	**15,530**	**11,452**
Groundwater	17,092	15,530	11,452
TOTAL	**82,892**	**85,768**	**83,114**

Sources: ADWR 2008c, USGS

[1] Diverted pursuant to an exchange agreement between Phelps Dodge Corporation and the Salt River Valley Water Users Association. Phelps Dodge provided water to SRP from Show Low Lake but this water was accounted for as water used by the Morenci Mine in the Southeastern Arizona Planning Area. This agreement and associated diversions ceased in 2002.

[2] Includes water withdrawn from tribal lands leased by Peabody Coal.

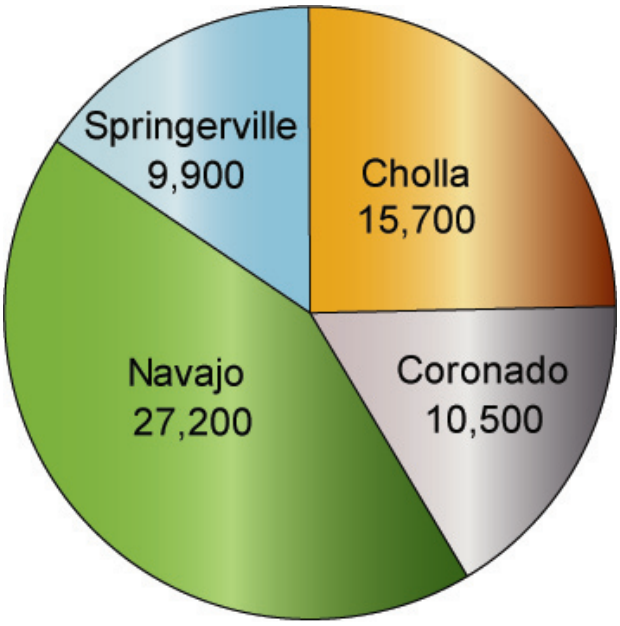
representing about 49% of the total planning area demand during the 2001-2005 time period.

Mine water use includes sand and gravel operations, coal mines on Black Mesa south of Kayenta and historically, surface water diversions from Show Low Lake and Blue Ridge/C.C. Cragin Reservoir for mining use outside the planning area. These diversions ceased in 2002 and Phelps Dodge Corporation relinquished its certificated rights to both water sources in 2005. Peabody Western Coal Company (PWCC) operates two mines on Black Mesa: the Black Mesa Coal Mine and the Kayenta Mine. Until recently, these mines annually shipped approximately 12 million tons per year of low-sulfur subbituminous coal and pumped approximately 4,400 AFA. Over 3.8 million gallons of groundwater per day were required to slurry coal to the Mohave Generating Station (MGS) near Laughlin, Nevada. Coal is also sent to the Navajo Generating Station (NGS) at Page by rail (Grahame and Sisk, 2002). By 2005, the 273-mile slurry pipeline ceased operation, in part because of Southern California Edison's failure to upgrade pollution control devices at the MGS, as required by a lawsuit brought by a consortium of environmental groups. As a result of the closure, PWCC amended its mining permit application to the Office of Surface Mining (OSM) and a final Environmental Impact Statement (EIS) was issued in November 2008. The proposed project would consolidate the operations of the Kayenta Mine and the adjacent Black Mesa Mine, which previously supplied coal to the MGS, under a single permit. Water use at the Black Mesa Complex would be reduced to an average of 1,236 acre-feet of N-aquifer water per year (OSMRE, 2008). In December 2008, OSM approved the project and issued a life-of-mine permit that would allow operations to continue until 2026. This decision is being appealed.

Power plants include the Navajo Generating Station (Page), the Coronado Generating Station located six miles northeast of Saint Johns, the Springerville Station located northeast of Springerville and the Cholla Generating Station near Joseph City. The NGS uses water from Lake Powell pursuant to an Upper Basin Colorado River contract which entitles it to receive up to 34,000 acre-feet of water per year. In recent years about 27,200 AFA has been diverted for use at the NGS. All other facilities pump groundwater. Average annual demand by power plants for the period 2001-2005 is shown in Figure 2.0-20.

In addition to coal-fired power plants, the planning area has a solar system at the Springerville Generating Station, a biomass power plant that began operation in June 2008 at Snowflake and a second proposed biomass facility at Eagar. A previous biomass plant at Eagar was closed in 2008. The Snowflake White Mountain Biomass 24-megawatt power plant uses woody waste and recycled paper fibers from the adjacent Catalyst Paper Co. paper mill (formerly the Abitibi paper mill). Sources of woody waste are from forest thinning projects,

Figure 2.0-20 Average Annual Water Demand by Electrical Generating Stations in the Eastern Plateau Planning Area, 2001-2005 (in acre-feet)



small-diameter trees burned in the Rodeo-Chedeski fire and leftover wood from sawmills. The plant supplies power locally and has long-term power-purchase agreements with Arizona Public Service Co. and Salt River Project. The water demand of the plant is not known.

There are ten industrial golf courses in the planning area, including seven in the Pinetop-Lakeside/Show Low area. An annual average of about 1,600 acre-feet of primarily groundwater was used for industrial golf course irrigation during 2001-2005. Because of cooler temperatures, higher precipitation and short growing season, relatively little water is required for golf course irrigation at most locations.

During 2001-2005, an estimated 124,000 swine were raised annually at four feedlot facilities near Snowflake. These feedlots have been in existence since the early 1980s. In addition, a small dairy is located near Taylor. Combined water demand by the dairy and feedlots is estimated at between 450 to 600 acre-feet of groundwater a year.

Located about 23 miles southwest of Holbrook, the Catalyst Paper Co. purchased the Abitibi paper mill in April 2008. Waste water from the operation is discharged to Dry Lake and is used to irrigate primarily pasture east of SR 377. In 2005, approximately 11,900 acre-feet of effluent was generated while 14,000 acre-feet of groundwater was pumped. This suggests that about 85% of the annual groundwater withdrawal is recovered and used for irrigation.

2.0.8 Water Resource Issues in the Eastern Plateau Planning Area

A number of water resource issues have been identified in the planning area by community groups through the distribution of surveys and from other sources. Primary issues are the accessibility of groundwater supplies in some areas due to hydrologic conditions and water quality problems. There are also infrastructure deficiencies that influence access to water supplies. A number of communities lack financial resources for infrastructure development or repair and drought has impacted surface water supplies. The ability to meet future water demands is a concern for many communities. The North Central Arizona Water Supply Study (which includes Flagstaff and the western portion of the planning area and the Western Plateau Planning Area) concluded that by 2050 the region's groundwater pumping would not be sustainable and that unmet demands will be more than 7,000 acre-feet annually. Many Navajo communities also currently face critical water shortages. Water hauling is commonplace on the reservation, in part because widely scattered housing makes direct water delivery impractical in many areas. Hauling is also common at some locations outside of the reservation.

Planning and Conservation

Many communities in the planning area are rapidly growing and physical and legal availability of water is a challenge in some places. As mentioned previously, the communities of Flagstaff, Pinetop-Lakeside, Show Low, Snowflake, and Taylor are required to include a water resources element in their general plans because of their size and/or rate of growth. Although not required by law to include a water resources element in the county's comprehensive plan, Coconino County has done so. The County Plan emphasizes conservation in tandem with resource development and recognizes the importance of incorporating climatic variability into water resource planning (Coconino County, 2003).

The City of Flagstaff adopted a Regional Plan with a Water Resources Element in 2002. The water resources element includes information on the water and wastewater system and an analysis of future growth and water requirements

(City of Flagstaff, 2001). Flagstaff has an active conservation program that includes an extensive reclaimed water system, education, and a staggered landscape watering schedule.

The Natural Resources Conservation Service (NRCS) has produced rapid watershed assessments (RWA) for the Silver Creek, Chevelon Canyon and Little Colorado River Headwaters Watersheds. A RWA is a concise report containing information on natural resource conditions and concerns at the 8-digit HUC level. They are intended to provide sufficient information and analysis to generate an appraisal of the conservation needs of the watershed as well as serve other uses (NRCS, 2008, 2007a, 2007b).

As mentioned previously, all community water systems in Arizona are required to submit a water system plan as part of the State's Drought Preparedness Plan. The system water plan includes a water supply plan, water conservation plan, and drought preparedness plan. Water providers are required to develop the plan to ensure they reduce their vulnerability to drought and prepare to respond to potential water shortage conditions.

As part of implementation of the State Drought Plan, Local Drought Impact Groups (LDIGs) are being formed, as necessary, at the county level. LDIGs are voluntary groups that will coordinate drought public awareness, provide impact assessment information to local and state leaders and implement and initiate local drought mitigation and response actions. These groups are coordinated by local representatives of Arizona Cooperative Extension and County Emergency Management and supported by ADWR's Statewide Drought program. Information on LDIGs may be found at the department's website. To date, the only LDIG in the Planning area is in Navajo County.

Watershed Groups and Studies

Several watershed groups have formed in the Eastern Plateau Planning Area to address a variety of water resource issues. Some groups encompass areas outside of the planning area. Groups that are currently active in various locations within the planning area are the Coconino Plateau Water Advisory Council, Northern Arizona Municipal Water Users Association, Little Colorado Watershed Coordinating Council (formerly the Little Colorado River Multi-Objective Management Partnership (LCRMOM)), Pinetop-Lakeside Watershed Enhancement Partnership, the Silver Creek Watershed Partnership, the Upper Little Colorado River Watershed Partnership and the Navajo Nation. A complete description of participants, activities, reports and issues is found in Appendix D. Primary issues identified by these groups that apply to the Eastern Plateau Planning area can be summarized as follows:

Growth:

- Excessive growth in some areas
- Proposed development in Greer and impacts on the Little Colorado River
- Unregulated lot splits

Water Supplies and Demand:

- Limited and deep groundwater supplies
- Drought sensitive supplies
- Numerous water haulers and few hauling stations that are sometimes cutoff during drought
- Limited surface water supplies for Page
- Limited groundwater data for entire region
- Potential impacts on groundwater system from power plants
- Seasonal demands impacting ability to meet peak demands
- Competition for supplies

Legal:

- Potential limitation of groundwater usage resulting from Indian reserved groundwater rights
- Uncertainty of Indian water right settlements (Little Colorado River & Colorado River)

- Access to water development activities on public lands
- Competition from Phoenix/Tucson for CAP reallocation water
- Upper Basin/Lower Basin Colorado River issues affecting potential for use
- Unresolved surface water adjudication
- Current definition of an adequate water supply with passage of SB 1575

Water Quality:

- Minor arsenic issues in Woody Mtn. Well field (9-14 ppb)
- Arsenic and TDS in some areas

Environmental:

- Endangered Species Act implications on groundwater usage and impacts on perennial streams
- Potential for groundwater development impact on threatened and endangered species, springs and riparian areas
- Impact of invasive species (tamarisk)

Funding:

- Limited funding resources for planning, projects, infrastructure and studies
- Extremely high cost of water augmentation projects
- Funding for Colorado River water infrastructure
- Funding for water delivery infrastructure

Drought:

- Drought impacts on surface water supplies and springs resulting in impacts on agriculture and cattle ranching
- Potential impacts on tourism due to drought

Other:

- Political differences between some communities
- Perception of no real water supply problem
- Several high hazard unsafe dams

Potential future and current water supply shortfalls have lead to discussions among the Coconino Plateau Advisory Council regarding water supply development/augmentation alternatives (Heffernon and Muro, 2001). A study to identify potential supply alternatives for the area was completed by the Bureau of Reclamation in 2005 and the North Central Arizona Water Supply Study was completed in 2006. All the proposed alternatives to address shortfall included a pipeline to deliver Lake Powell water to various demand centers (USBOR, 2006). A number of other hydrologic and planning studies have been conducted in the planning area, especially in the Flagstaff area. The Department completed a Hydrologic Map Series Report of southern Navajo County in 2007 which covers the area south of the Navajo Nation to the Mogollon Rim. The NEMO Watershed Based Plan for the Little Colorado Watershed was completed in 2006. NEMO (Non-point Education for Municipal Officials) is intended to help communities protect their natural resources while still accommodating growth. Other planning area studies are found in the reference sections of this volume.

Surveys

The Department conducted a rural water resources survey in 2003 to compile information for the public and help identify the needs of communities. This survey was also intended to gather information on drought impacts to incorporate into the Arizona Drought Preparedness Plan, adopted in 2004. Questionnaires were sent to almost 600 water providers, jurisdictions, counties and tribes. A report of the findings from the survey was completed in 2004 (ADWR, 2004).

Thirty-seven water providers and jurisdictions in the Eastern Plateau Planning Area responded to the survey and of these, 23 ranked 18 issues. In the planning area, infrastructure and water supply issues were ranked among the top five issues by a many respondents. In a separate question, a majority of respondents noted at least one drought impact. Primary drought impacts noted were increased demand, increased peak demand and lowered groundwater levels.

The Department conducted another, more concise survey of water providers in 2004.

Table 2.0-14 Water resource issues ranked by survey respondents in the Eastern Plateau Planning Area

Issue	Percent of 2003 respondents that ranked issue as one of the top 5 (of 18)	Percent of 2004 respondents reporting issue was a moderate or major concern
Inadequate storage capacity to meet peak demand	39	31
Inadequate well capacity to meet peak demand	26	28
Inadequate water supplies to meet current demand	17	13
Inadequate water supplies to meet future demand	39	31
Infrastructure in need of replacement	52	49
Inadequate capital to pay for infrastructure improvements	43	56
Drought related water supply problems	35	26

Note: 2003 respondents included 17 water providers and 6 jurisdictions. 2004 respondents included 39 water providers.

This was done to supplement the information gathered in the previous year in support of developing the Arizona Water Atlas, and to reach a wider audience by directly contacting each water provider. Through this effort, 44 water providers in the Eastern Plateau Planning Area, with a total of approximately 46,500 service connections, were willing to participate and provide information on water supply, demand, infrastructure and to rank a list of seven issues.

In the 2004 survey, water providers were asked to rank issues from 0 to 3 with 0 = no concern, 1 = minor concern, 2 = moderate concern and 3 = major concern. Of the 44 water providers that responded to the survey, 39 ranked issues. These respondents include most of the largest water providers in the planning area including City of Flagstaff, City of Holbrook, City of Show Low, Town of Snowflake, Winslow Municipal Water and Doney Park Water Company. Although responses to the 2003 questionnaire are not directly comparable to the 2004 survey due to differences in the form and wording of the surveys, responses to the same issues are similar as shown in Table 2.0-14.

Tribal Issues

Water supply availability is an issue on tribal lands in the planning area. A Navajo Department of Water Resources (NDWR) White Paper identified the need for an increased water supply to help support needed basic services on the reservation (NDWR, 2002). The tribe is investigating the feasibility of transporting water by pipeline to several areas and is conducting groundwater development investigations. This included a plan to investigate the alluvial aquifer in the Bird Springs area located east of Leupp at the southern edge of the Navajo Reservation Boundary northwest of Winslow, to analyze the feasibility of well field development (NDWR, USBOR & USIHS 1999). Subsequently, the USGS issued a report in 2005 evaluating the C-aquifer in this area as a potential supply

for Peabody Coal and the Navajo and Hopi (Hoffman and others, 2005). The Hopi Tribe is also engaged in supply development activities and recently purchased off-reservation ranches near Winslow and Springerville for potential irrigation development or other purposes (HKM Engineering, 2005).

One of the water development challenges on the Navajo Reservation is that resolution of problems requires the coordination of multiple agencies and private resources. In addition, the population has limited economic resources that make large capital investments difficult and the widely dispersed population results in large distances between water sources and water users. Although the Navajo Nation has adopted a Drought Plan and conducts numerous planning activities, additional regional water planning, investigation of a regional conveyance system, improving water service to domestic water haulers and water conservation and reuse were identified as needs. (NDWR, 2002)

In addition to the aforementioned issues, the Hopi and Navajo are concerned about the impact to their water supply by Peabody Western Coal Company (PWCC) extracting N-aquifer water for coal mining activities at the Black Mesa Project. The N-aquifer is the primary source of drinking water for the Hopi. This pumping is believed to be affecting water supplies in some areas (Hopi Tribe, 2005). Approximately 4,400 acre-feet of water per year had been extracted from the aquifer to transport coal through a slurry pipeline from the Black Mesa Coal Mine to the Mohave Generating Station (MGS) at Laughlin, Nevada. The MGS suspended operation in December 2005. As originally proposed in early 2004 and analyzed in a draft EIS in November 2006, the Black Mesa Project included construction of a new water-supply system and a 108-mile long water-supply pipeline from a new well field in the Coconino aquifer near Leupp, Arizona, to the mine complex to replace/reduce N-aquifer pumping (OSMRE, 2008). The draft EIS received over 18,000 comments, largely related to concerns about groundwater use. After the draft EIS was issued, attempts to reopen the MGS were suspended and PWCC amended its Office of Surface Mining (OSM) permit application accordingly (OSMRE, 2008).

In November 2008, the final EIS for the Black Mesa Project was released. The proposed project would consolidate the operations of the Kayenta Mine, which supplies 8.5 million tons of coal per year via a 75-mile railway to the Navajo Generating Station, and the adjacent Black Mesa Mine, which previously supplied coal to the MGS, under a single permit. Water use at the Black Mesa Complex would be reduced to an average of 1,236 acre-feet of N-aquifer water per year for mining-related and domestic purposes (OSMRE, 2008). In December 2008, OSM approved the project and issued a life-of-mine permit that would allow operations to continue until 2026. A coalition of tribal groups and conservationists appealed the decision in January 2009 citing, among other factors, concerns over groundwater depletion (Arizona Republic, 2009).

Reservoir on the Navajo Reservation. Additional regional water planning, investigation of a regional conveyance system, improving water service to domestic water haulers and water conservation and reuse were identified as needs by the Navajo Department of Water Resources.

Resolution of Indian water rights settlements is a critical issue in the planning area. The Navajo Nation, Hopi Tribe, Zuni Tribe and the San Juan Southern Paiute Tribe have been negotiating with non-Indian water users in the Little Colorado River Plateau Basin, the State of Arizona and the federal government for several years in a settlement committee appointed by the LCR Adjudication Court (Court).

The non-Indian parties reached agreement with the Zuni Tribe over protection of its Zuni Heaven lands in Arizona, resulting in congressional approval in 2003. On December 31, 2008 the Department released a preliminary catalog of non-exempt registered wells in the Eastern Little Colorado River Basin for inspection and comment. The catalog was compiled in accordance with the Zuni Indian Tribe Water Rights Settlement, approved by the Court on November 27, 2006.

Talks have continued with the Navajo Nation and Hopi Tribe about possible settlement of their Little Colorado River Basin water right claims. The Department released a preliminary Hydrographic Survey Report (Hopi HSR) for the Hopi Reservation on December 31, 2008, prepared as part of the LCR Adjudication, which is pending before the Superior Court of Arizona in Apache County. The purpose of the Preliminary Hopi HSR is to provide the Hopi, the United States and interested parties with the opportunity to inspect the information that the Department has gathered and to file comments with the Department. The Navajo Nation filed a lawsuit in April 2003 against the Secretary of the Interior over the operation of the Colorado River. A Federal judge has entered a stay in that case to allow negotiations with the State of Arizona and non-Indian water users about possible Navajo Nation claims to the Colorado River.

2.0.9 Groundwater Basin Water Resource Characteristics

Section 2.1 presents data and maps on water resource characteristics of the Little Colorado River Plateau Basin, the only groundwater basin in the Eastern Plateau Planning Area. A description of the data sources and methods used to derive this information is found in Appendix A of Volume 1 of the Atlas. This section briefly describes general information that applies to the basins and the purpose of the information. This information is organized in the order in which the characteristics are discussed in Section 2.1.

Geographic Features

The geographic features map is included to present a general orientation to principal land features, roads, counties and cities, towns and places in the groundwater basin.

Land Ownership

The distribution and type of land ownership has implications for land and water use. Large amounts of private land typically translate into opportunities for land development and associated water demand, whereas federal lands are typically maintained for a purpose with little associated water use. State owned land may be sold or traded, and is often leased for grazing and farming. A key land ownership feature in the basin is the significant amount of private lands interspersed with state trust lands and to a lesser extent federal lands in a checkerboard pattern south of the Navajo Reservation. Prior to 1871, federal land grants of alternating one-square-mile sections of land along the right-of-way were given to railroads to promote railroad expansion. In addition, the State Enabling Act of 1910 and the Act that established the Territory of Arizona in 1863 set aside sections 2, 16, 32 and 36 in each township to be held in trust by the state for educational purposes. Other legislation authorized additional state trust lands. Where the "school" section lands were previously claimed or on federal reservations, national forest, park

or Indian reservations, the state was given the right to select an equal amount of acreage of Federal land. The state is also allowed to trade lands for other federal lands or private lands to block up Trust land holdings (ASLD, 2006). These decisions have resulted in the pattern observed in the basin.

Climate

Climate data including temperature, rainfall, evaporation rates and snow are critical components of water resource planning and management. Averages and variability, seasonality of precipitation and long term climate trends are all important factors in demand and supply planning.

Surface Water Conditions

Depending on physical and legal availability, surface water may be a potential supply in a basin. Stream gage, flood gage, reservoir, stockpond and runoff contour data provide information on physical availability of this supply. Seasonal flow information is relevant to seasonal supply availability. Annual flow volumes provide an indication of potential volumetric availability.

Criteria for including stream gage stations in the basin table are that there is at least one year of record, and annual streamflow statistics are included only if there are at least three years of record. There are different types of stations and those that only serve repeater functions were not included.

Flood gage information is presented to direct the reader to sources of additional precipitation and flow information that can be used in water resource planning. Large reservoir storage information provides data on the amount of water stored in the basin, its uses, and ownership. Because of the large number of small reservoirs, and less reliable data, individual small reservoir data is not provided. The number of stockponds is a general indicator of small scale surface water capture and livestock demand. Runoff contours reflect the average annual runoff in tributary streams. They provide a generalized indication of the amount of runoff that can be expected at a particular geographic location.

Perennial and Intermittent Streams and Major Springs

A map of perennial and intermittent streams is provided utilizing more than one source of information. Stream designations may not accurately reflect current conditions in some cases. Spring data was compiled from a number of sources in an effort to develop as comprehensive a list as possible. Spring data is important to many researchers and to the environmental community due to their importance in maintaining habitat, even from small discharges.

Groundwater Conditions

Several indicators of groundwater conditions are presented for the basin. Aquifer type can be a general indicator of aquifer storage potential, accessibility of the supply, aquifer productivity, water quality and aquifer flux. Well yield information for large diameter wells is provided and is generally measured when the well is drilled and reported on completion reports. It was assumed that large diameter wells were drilled to produce a maximum amount of water and, therefore, their reported pump capacities are indicative of the aquifer's potential to yield water to a well. However, many factors can affect well yields including well design, pump size and condition and the age of the well. Reported well yields are only a general indicator of aquifer productivity and specific information is available from well measurements conducted as part of basin investigations.

Natural recharge is typically the least well known component of a water budget. Many of the estimates in the Atlas are derived from studies of larger geographic areas and all deserve further study. Similarly, estimates of storage are based on rough estimates and

considerably more studies are needed in most basins. Components of storage include aquifer depth and specific yield.

Water level data is from measured wells, usually collected during the period when the wells were not actively being pumped or only minimally pumped. Depth to water measurements are shown on mapped wells if there was a measurement taken during 2003-2004. The basin hydrographs show water-level trends for selected wells over the 30-year period from January 1975 to January 2005.

The flow directions that are shown generally reflect long-term, regional aquifer flow in the basin and are not meant to depict temporary or local-scale conditions.

Water Quality

Water quality conditions impact the availability of water supplies. Water quality data was compiled from a variety of sources as described in Volume 1, Appendix A. The data indicate areas where water quality exceedences have previously occurred, however additional areas of concern may currently exist where water quality samples have not been collected or sample results were not reviewed by the Department (e.g. samples collected in conjunction with the ADEQ Aquifer Protection Permit programs). It is important to note also that the exceedences presented may or may not reflect current aquifer or surface water conditions.

Cultural Water Demand

Cultural water demand is an important component of a water budget. However, without mandatory metering and reporting of water uses, accurate demand data is difficult to acquire. Municipal demand includes water company and domestic (self-supplied) demand estimates. Basin demand information is from several sources in order to prepare as accurate an estimate as possible. Annual demand estimates have been averaged over a specific time period. This provides general trend information without focusing on potentially inaccurate annual demand estimates due to incomplete data.

Locations of major cultural water uses are primarily from a 2004 USGS land cover study using older satellite imagery that may not represent recent changes. The cultural demand maps provide only general information about the location of water users.

Effluent generation data was compiled from several sources to provide an estimate of how much of this renewable resource might be available for use. However, effluent reuse is often difficult both logistically and economically since a potential user may be far from the wastewater treatment plant.

Water Adequacy Determinations

Information on water adequacy and inadequacy determinations for subdivisions, with the reason for the inadequacy determination provides information on the number and status of subdivision lots. Listing the reason for the inadequacy identifies which subdivisions have a demonstrated physical or legal lack of water or may have elected not to provide the necessary information to the Department. Briefly, developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is determined to be inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents.

In addition to these subdivision determinations for which a water adequacy report is issued, water providers may apply for adequacy designations for their entire service area. If a subdivision is to be served water from one of these water providers, then a separate adequacy determination is not required. (See Section 2.0-5)

Developers of large, master-planned communities outside of AMAs may apply for an Analysis of Adequate Water Supply (AAWS). This type of application is generally used to prove that water will be physically available for the master-planned community. AAWS are issued based on the development plan or plat. If an AAWS is issued for groundwater, it reserves a specific volume of water for 10 years (for purposes of further adequacy reviews) only for the specific property that is the subject of the AAWS. (See Appendix A, Volume 1 for more information about the Adequacy Program).

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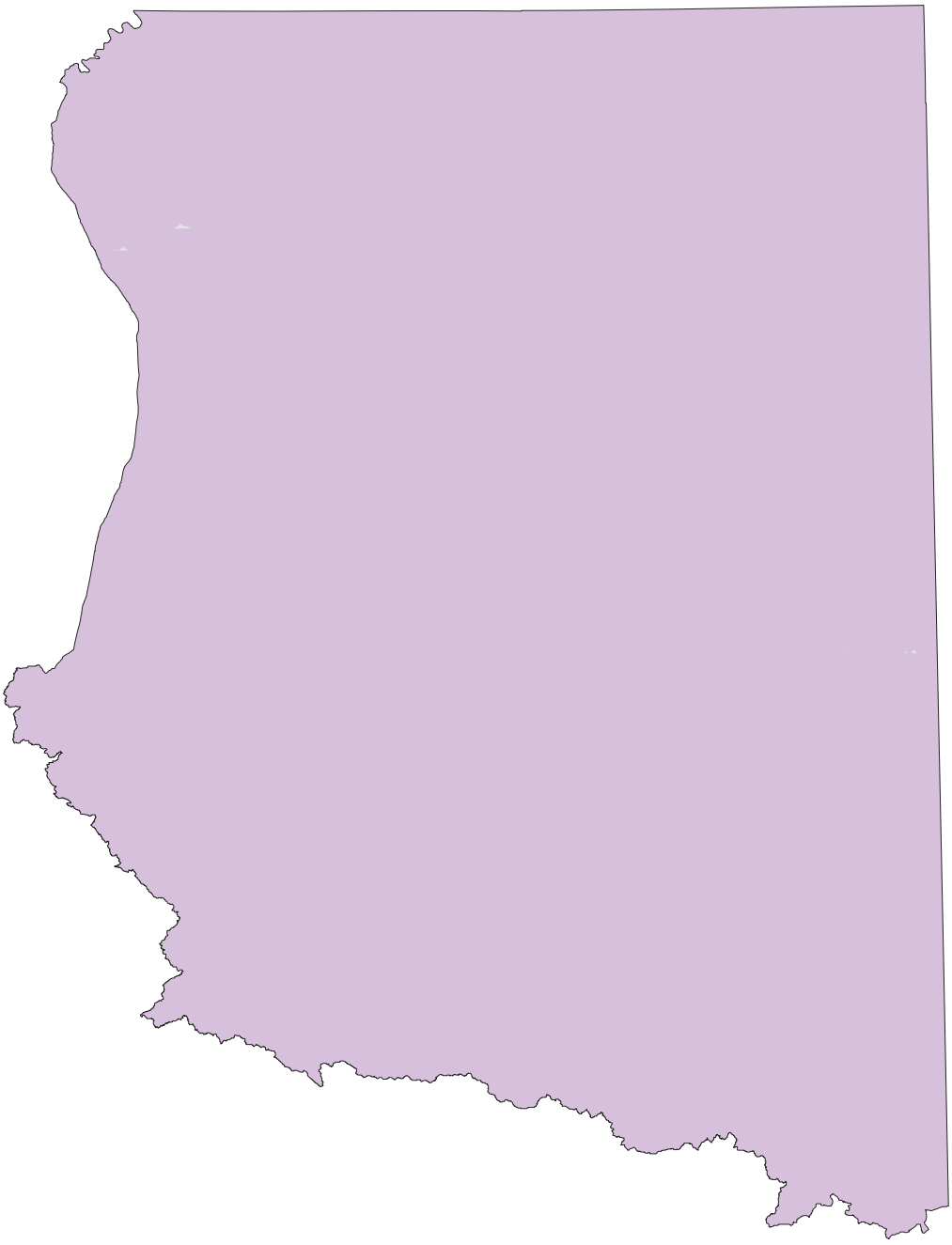
Section 2.1
Little Colorado River Plateau Basin



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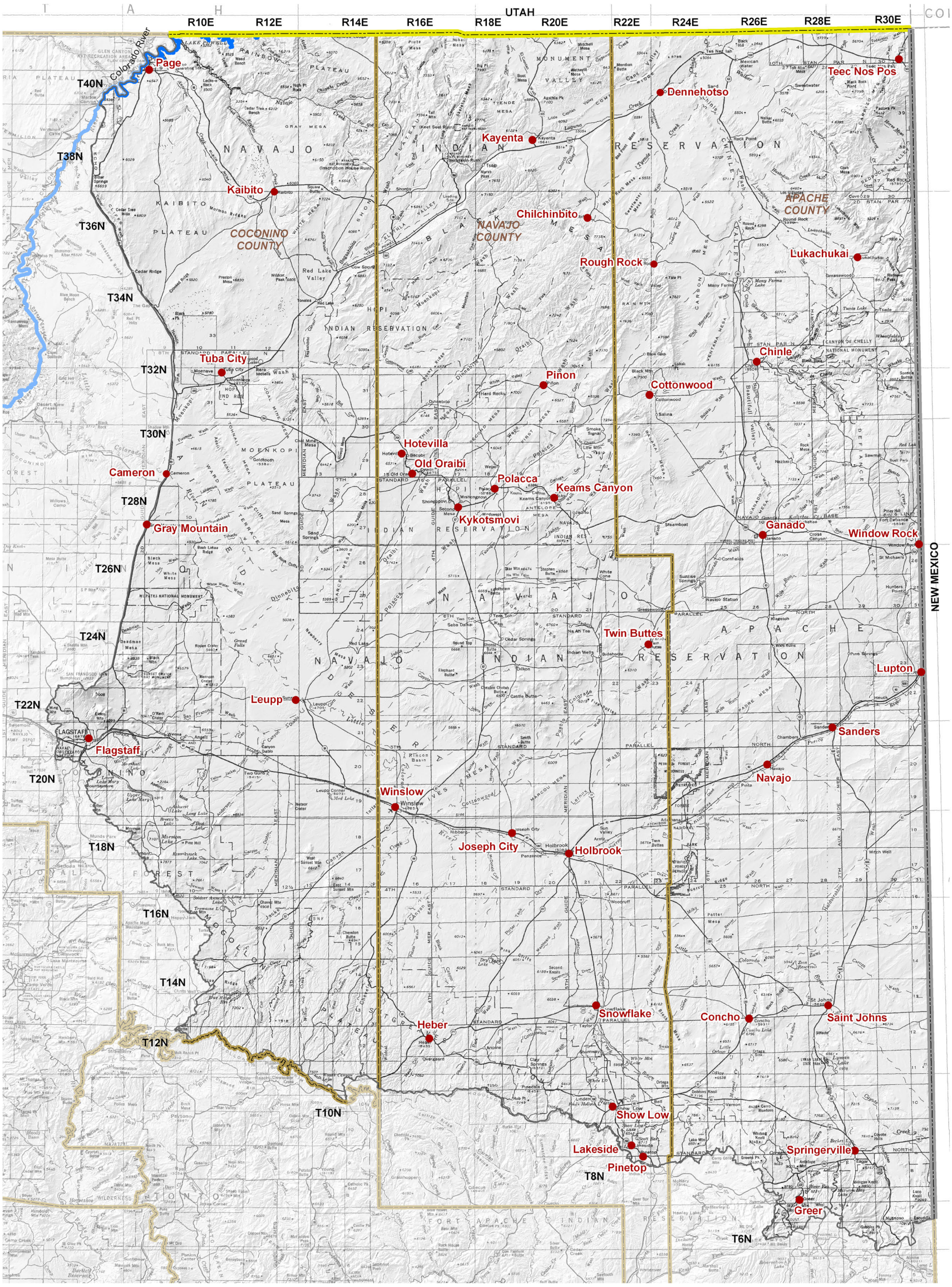
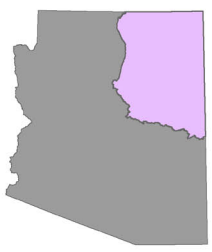
2.1.1 Geography of the Little Colorado River Plateau Basin

The Little Colorado River Plateau Basin, at 26,700 square miles in area, is the largest groundwater basin in the state. Geographic features and principal communities are shown on Figure 2.1-1. Located at the southern end of the Colorado Plateau, it is characterized by relatively high elevation, semi-arid mesas and several high elevation mountain ranges. Elevations generally increase from north to south. Vegetation types are primarily Great Basin conifer woodland, plains and Great Basin grasslands and Great Basin desertscrub. At higher elevations vegetation types include subalpine grassland, Rocky Mountain subalpine conifer forest and Rocky Mountain and madrean montane conifer forests (see Figure 2.0-11). Riparian vegetation is found along streams including: conifer oak, wet meadow, mixed broadleaf, Russian olive and wet meadow along Tsalie Creek, Kinlechee Creek and Canyon de Chelly; tamarisk on Chinle Creek and Silver Creek; and mixed broadleaf, wet meadow and conifer oak on the Little Colorado River east of Springerville.

- Principal geographic features shown on Figure 2.1-1 are:
    - Monument Valley north of Kayenta
    - Kaibito Plateau south of Page
    - Painted Desert, located between Gray Mountain and Winslow
    - Defiance Plateau, running north/south near Window Rock
    - Black Mesa in the vicinity of Chilchinbito
    - Canyon de Chelly, near Chinle
    - First, Second and Third Mesas on the Hopi Reservation
    - Petrified Forest located between Holbrook and Navajo
    - Mogollon Plateau or Mogollon Rim stretching 200 miles from Flagstaff to the White Mountains
    - Lukachukai and Chuska Mountains near Lukachukai
    - Little Colorado River, which flows to the Colorado River from the headwaters near Greer, and exits the basin at Cameron
    - San Francisco Peaks north of Flagstaff with Humphreys Peak, the highest point in Arizona at 12,633 feet
    - White Mountains along the southeastern boundary of the basin, that rise to over 11,000 feet at Mt. Baldy
    - Navajo Mountain, an isolated peak that straddles the Arizona-Utah border east of Page; rising to over 10,400 feet it is a prominent visual feature of the basin
    - The lowest point at 1,300 feet where the Little Colorado River exits the basin





ARIZONA DEPARTMENT OF WATER RESOURCES ©

Base Map:USGS 1:500,000, 1981

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Figure 2.1-1
Little Colorado River Plateau Basin
Geographic Features

COUNTY
New Mexico State Boundary
Utah State Boundary
City, Town or Place

2.1.2 Land Ownership in the Little Colorado River Plateau Basin

Land ownership, including the percentage of ownership by category is shown in Figure 2.1-2. Principal features of land ownership are the large amount of tribal lands, the continuous band of national forest lands along the southern and southwestern boundary of the basin, and the "checkerboard" pattern of land ownership south of the reservation lands. This distribution of land ownership has implications for land management and water development and use. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on National Parks, Monuments and Wilderness Areas is found in Section 2.0.4. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

Indian Reservations

- 63.9% of the land is under tribal ownership.
- Of the 27,000 square miles of Navajo Nation lands in Arizona, New Mexico and Utah, more than 14,600 square miles are in Arizona.
- The Hopi Reservation encompasses about 2,500 square miles (1.5 million acres) in parts of Navajo and Coconino counties.
- The Hopi Reservation is primarily comprised of three mesas and tribal communities at Lower and Upper Moenkopi east of Tuba City. There are areas north of Joseph City under Hopi and Navajo ownership.
- Other tribal lands include those of the Zuni (about 16 square miles) north of Concho and Fort Apache lands (about 4.5 square miles) southwest of Greer. The Zuni tribal lands in Arizona, "Zuni Heaven", were formally recognized in 2004. The Zuni also hold large, non-reservation ranch holdings in and around their reservation.
- The Hopi Tribe holds large, non-reservation ranch holdings in the checkerboard lands area including deeded land, state leased property and Forest Service lands.
- The community of Willow Springs is home to a small community of San Juan Southern Paiute through an agreement with the Navajo.
- Primary land uses are grazing, mining and farming.

Private

- 14.8% of land ownership in the basin is private.
- Private lands are primarily located in areas surrounding non-Indian communities and in the area between Winslow and the New Mexico border south of the Navajo Reservation and north of National Forest lands.
- Private land in-holdings are located within National Forest lands in the Nutrioso area southeast of Springerville and in other areas as shown.
- Primary land uses are domestic, industrial and commercial.

National Forest

- 10.5% of land is federally owned and managed as National Forest.
- Forest lands are part of the Coconino and Apache-Sitgreaves National Forests.
- Forest lands contain the headwaters of most of the major streams and of the only major river in the basin.
- Primary land uses are grazing, recreation and logging.

State Trust Land

- 8.0% of lands are held in trust for public schools and 13 other beneficiaries under the State Trust Land system.
- There is a large amount of contiguous state land ownership between Springerville and Saint Johns and another contiguous area adjacent to national forest lands southeast of Flagstaff.
- Primary land use is livestock grazing.

National Park Service (NPS)

- 1.4% of lands are under federal ownership as parks, monuments and other sites.
- Sites identified on Figure 2.1-2 include a small portion of the Glen Canyon National Recreation Area, Canyon De Chelly National Monument, Wupatki National Monument, Petrified Forest National Park, Sunset Crater National Monument and Walnut Canyon National Monument.
- Primary land use is for recreational purposes.

U.S. Bureau of Land Management (BLM)

- 1.2% of lands are under federal ownership by the Bureau of Land Management.
- All lands are included in the checkerboard pattern of land ownership in Navajo and Apache counties.
- Primary land uses are for livestock grazing.

Other (Arizona Game and Fish, County and Bureau of Reclamation Lands)

- 0.1% is held by other landowners.
- These lands are located in the vicinity of Springerville, southeast of Flagstaff and there are a few sections scattered in the checkerboard lands.
- Primary land uses on Arizona Game and Fish lands is for wildlife conservation.

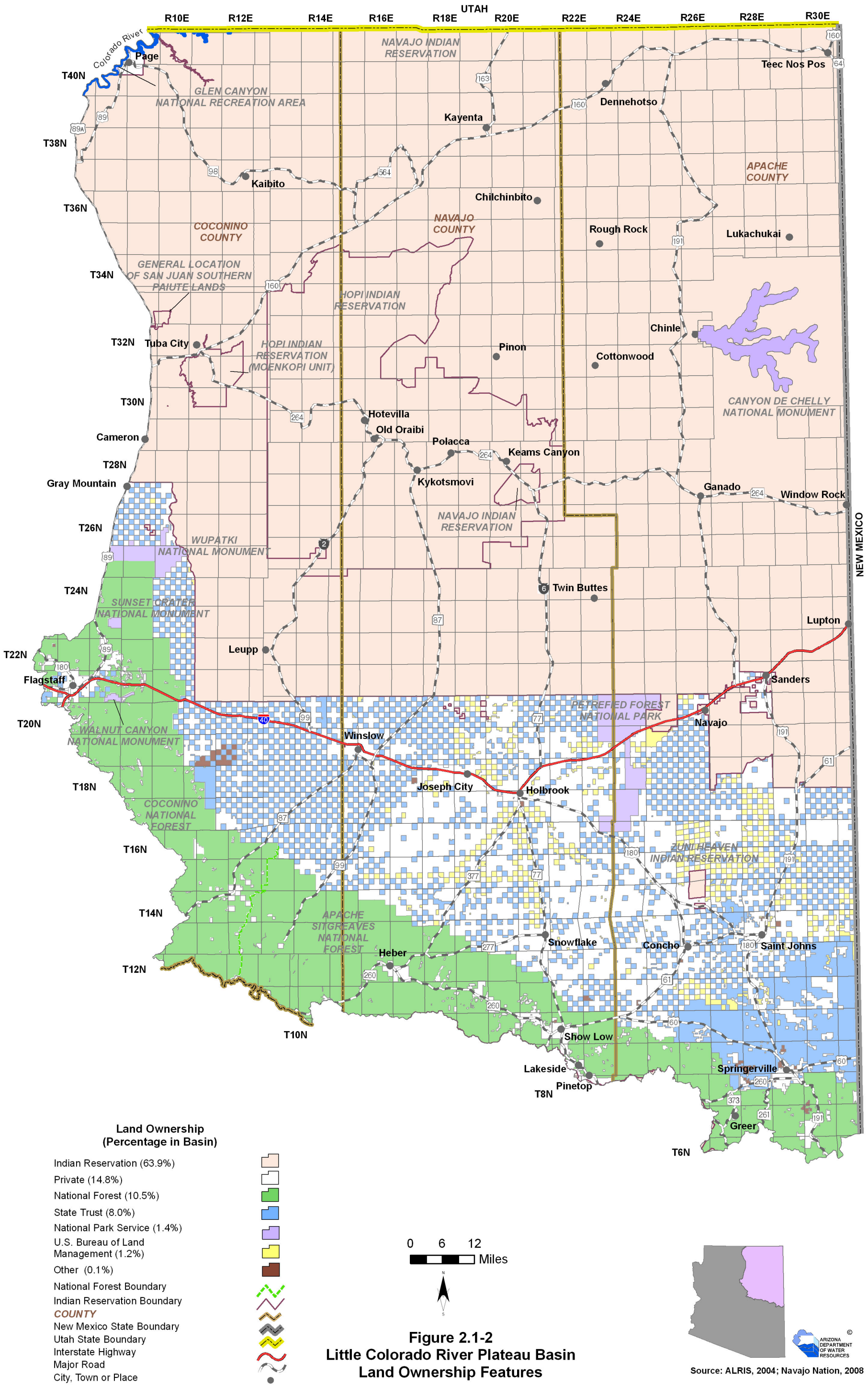

Figure 2.1-2
Little Colorado River Plateau Basin
Land Ownership Features

Source: ALRIS, 2004; Navajo Nation, 2008

2.1.3 Climate of the Little Colorado River Plateau Basin

Climate data from NOAA/NWS Co-op Network, Evaporation Pan, AZMET and SNOTEL/ Snowcourse stations are compiled in Table 2.1-1 and the locations are shown on Figure 2.1-3. Figure 2.1-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate is found in Section 2.0.3. A description of the climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 2.1-1A
- The 46 NOAA/NWS Co-op network climate stations are widely dispersed throughout the basin. The average monthly maximum temperature ranges from 61.5˚F at Greer to 82.2˚F at Cameron and the average monthly minimum temperature ranges from 27.0˚F at Fort Valley to 36.5˚F at Cameron 1 NNE.
- The highest seasonal rainfall occurs at most stations in the summer (July-September). For the period of record used, the highest average annual precipitation is 28.46 inches at McNary 2 N and the lowest is 4.09 inches at Monument Valley.
- On average, the driest season is spring (April-June).
- Altitude is a factor in precipitation, however, the rain shadow effect results in greater precipitation on the windward side as storms move northeastward. Blue Ridge Ranger Station at 6,880 feet received an average of 20.6 inches of rainfall a year while Betatakin, at 7,290 feet received only 12.81 inches.

Evaporation Pan

- Refer to Table 2.1-1B
- There are three sites in the basin at Flagstaff, Page and Winslow. Elevation at the stations range from 4,890 feet to 7,010 feet and the corresponding annual average evaporation ranges from 84.7 inches to 54.0 inches.

AZMET

- Refer to Table 2.1-1C
- There is one AZMET station in the basin, located at Flagstaff at an elevation of 6,747 feet. Average annual reference evaporation is 56.79 inches and is similar to that at the Flagstaff evaporation pan site.

SNOTEL/Snowcourse

- Refer to Table 2.1-1D
- There are data from 20 snow measurement sites in the basin, more than any basin in the state. Four sites have been discontinued.
- Elevations at current sites range from 6,930 feet at Lake Mary to 11,200 feet at Snow Bowl #2.
- High elevation sites (>8,000 feet) in the vicinity of Flagstaff typically continue to accumulate snowpack into April.
- High elevation sites (>8,000 feet) in the Beaver Springs and Tsaile Canyon areas report highest average snowpack in March.

- Sites <8,000 feet generally show highest snowpack in March/February.
- Highest average snowpack is found at three stations near Flagstaff and a station at Mount Baldy (Baldy #2). In general, there is a correlation between elevation and the average snowpack, however the location of the site, even those in close proximity to each other, and the period of record affect snowpack accumulation averages.

SCAS Precipitation Data

- See Figure 2.1-3
- Additional precipitation data shows rainfall as high as 40 inches at sites along the Mogollon Rim and near Flagstaff and as low as 4 inches in the vicinity of Cameron.

Table 2-1.1 Climate Data for the Little Colorado River Plateau Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Betatakin	7290	1971-2000	71.9/Jul	29.8/Jan	3.24	1.71	4.25	3.61	12.81
Blue Ridge Ranger Station	6880	1971-2000	68.0/Jul	30.2/Jan	5.88	2.17	7.31	5.24	20.60
Burrus Ranch	6800	1948-1968	69.4/Jul	29.3/Jan	4.21	2.14	6.63	4.22	17.20
Cameron 1 NNE	4160	1971-2000	82.2/Jul	36.5/Dec	1.34	0.70	2.12	1.40	5.56
Canyon de Chelly	5610	1971-2000	77.2/Jul	32.0/Jan	2.18	1.48	3.34	2.53	9.53
Chevelon Ranger Station	7010	1971-2000	68.4/Jul	30.5/Jan	4.58	2.02	7.95	4.64	19.19
Chinle	5540	1908-1970	75.0/Jul	28.9/Jan	1.70	1.28	4.01	2.17	9.17
Clay Springs	6320	1971-1987[1]	70.4/Jul	32.0/Jan	4.53	2.06	6.47	4.95	18.00
Copper Mine Trading Post	6380	1948-1976[1]	75.4/Jul	30.3/Jan	1.46	0.99	1.84	2.34	6.62
Cottonwood Indian School	6050	NA[2]	Insufficient Data		No Data				
Flagstaff Airport	7000	1971-2000	66.1/Jul	29.7/Jan	7.36	2.52	7.41	5.62	22.91
Fort Valley	7350	1971-2000	62.1/Jul	27.0/Jan	7.18	2.55	7.66	4.71	22.10
Ganado	6340	1971-2000	72.0/Jul	29.2/Jan	2.61	1.57	4.37	3.04	11.59
Greer	8490	1971-2000	61.5/Jul	28.6/Jan	4.44	2.75	10.71	5.29	23.19
Heber Ranger Station	6590	1971-2000	68.3/Jul	32.7/Jan	4.75	1.82	7.94	4.66	19.17
Holbrook	5070	1971-2000	77.6/Jul	35.8/Jan	2.09	0.95	3.86	2.30	9.20
Kayenta	5710	1915-1978[1]	75.7/Jul	29.3/Jan	0.61	0.52	2.30	2.27	5.69
Keams Canyon	6210	1971-2000	72.6/Jul	30.5/Jan	2.77	1.17	3.65	2.57	10.16
Klagetoh 12 WNW	6500	1971-2000	73.7/Jul	32.6/Jan	2.29	1.17	3.27	2.61	9.34
Leupp	4700	1948-1981[1]	77.1/Jul	31.4/Jan	1.57	0.98	2.85	2.00	7.39
Lukachukai	6520	1971-2000	72.5/Jul	28.9/Jan	1.89	1.12	3.84	2.57	9.42
Many Farms School	5320	1951-1975[1]	75.9/Jul	30.4/Dec	0.89	0.48	1.58	1.86	4.80
McNary 2 N	7340	1971-2000	64.7/Jul	31.0/Jan	8.33	3.03	9.75	7.35	28.46
Monument Valley	5560	1971-2000	79.1/Jul	31.2/Jan	0.44	0.70	1.88	1.07	4.09
Navajo	5580	1961-1976[1]	74.1/Jul	28.5/Jan	2.14	0.86	3.43	3.02	9.45
Page	4270	1971-2000	81.7/Jul	34.7/Jan	1.74	1.04	1.93	2.03	6.74
Painted Desert National Park	5760	1973-2005[1]	76.0/Jul	35.5/Jan	2.58	1.32	3.97	2.96	10.83
Petrified Forest National Park	5450	1971-2000	76.0/Jul	34.9/Jan	2.04	1.23	4.40	2.77	10.44
Pinedale	6510	1912-1968	69.4/Jul	29.2/Jan	3.99	2.02	7.52	4.79	18.31
Pinetop	6960	1980-1997[1]	67.2/Jul	32.8/Jan	5.53	2.43	9.13	5.51	22.60
Saint Johns	5790	1971-2000	73.8/Jul	34.0/Dec	2.07	1.40	5.47	2.53	11.47
Sanders	5850	1971-2000	73.4/Jul	32.2/Jan	3.02	1.55	4.39	3.17	12.13
Sanders 11 ESE	6250	1961-1986[1]	71.2/Jul	29.3/Jan	4.20	1.79	4.14	3.59	13.71
Show Low Airport	6410	1971-2000	73.2/Jul	35.1/Jan	4.14	1.86	7.26	4.87	18.13
Snowflake	5640	1971-2000	73.1/Jul	34.1/Jan	2.46	1.34	5.83	3.07	12.70
Snowflake 15 W	6080	1965-1998[1]	72.6/Jul	32.3/Jan	2.22	1.50	5.78	3.03	12.52
Springerville	7060	1971-2000	66.4/Jul	32.3/Dec	1.49	1.25	7.12	2.13	11.99
St. Michaels 6 WNW	7640	1906-1927	69.3/Jul	27.6/Jan	2.85	1.33	6.35	2.89	13.42
Sunset Crater National Monument	6980	1971-2000	65.8/Jul	27.5/Jan	3.87	2.00	7.15	4.04	17.06
Teec Nos Pos	5290	1971-2000	78.4/Jul	31.4/Jan	1.81	1.30	2.80	2.17	8.08
Tonalea	5520	NA[3]	Insufficient Data		No Data				
Tuba City	5030	1971-2000	78.0/Jul	33.8/Jan, Dec	1.66	0.76	2.33	1.60	6.35

Table 2-1.1 Climate Data for the Little Colorado River Plateau Basin (Cont)

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Wallace Ranger Station	7010	1916-1959	67.2/Jul	30.2/Jan	4.37	2.12	8.06	3.73	18.28
Window Rock 4 SW	6900	1971-2000	69.4/Jul	28.5/Jan	2.31	1.49	4.44	3.07	11.31
Winslow Airport	4890	1971-2000	77.5/Jul	34.1/Dec	1.60	0.93	3.51	1.99	8.03
Wupatki National Monument	4910	1971-2000	80.1/Jul	35.6/Dec	1.78	1.10	4.02	2.07	8.97

Source: WRCC, 2005a.

[1] Average temperature for period of record shown; average precipitation from 1971-2000
[2] Not available -Period of Record 1956-1958
[3] Not available -Period of Record 1948-1949

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
Flagstaff WB AP	7,010	1968 - 1978	54.00
Page	4,270	1957 - 2002	80.57
Winslow AP	4,890	1990 - 1999	84.7

Source: WRCC, 2005a.

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evapotranspiration, in inches *(Number of years to calculate average)*
Flagstaff	6,747	2003 - current	56.79 *(4)*

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Snowpack at Beginning of Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
Arbabs Forest	7,680	1985 - current	1.1 *(21)*	2.2 *(22)*	1.8 *(21)*	0.2 *(22)*	0 *(0)*	2.4 *(1)*
Baldy #1	9,125	1950 - 1999 (discontinued)	3.7 *(28)*	5.7 *(49)*	7.3 *(50)*	6.4 *(49)*	*3.3 (2)*	0 *(0)*
Baldy #2	9,750	1963 - 1997	0 *(0)*	12.3 *(2)*	0 *(0)*	19.1 *(9)*	25.2 *(1)*	0 *(0)*
Baldy (SNOTEL)	9,125	1950 - current	3.5 *(35)*	*5.9 (56)*	7.7 *(57)*	6.5 *(57)*	0.3 *(21)*	0 *(19)*
Beaver Spring	9,220	1986 - current	3.7 *(18)*	*6.9 (19)*	*8.7 (18)*	7.4 *(20)*	0 *(0)*	0 *(0)*
Cheese Springs	8,700	1969 - current	2.4 *(28)*	4.1 *(38)*	5.6 *(38)*	*3.9 (38)*	0 *(1)*	0 *(0)*
Fluted Rock	7,800	1985 - current	1.3 *(21)*	2.7 *(22)*	3.1 *(21)*	0.6 *(22)*	0 *(0)*	0 *(0)*
Forestdale Alt.	6,580	1984 - 1989 (discontinued)	0.5 *(6)*	1.0 *(6)*	0.6 *(6)*	0 *(6)*	0 *(0)*	0 *(0)*
Fort Apache	9,160	1951 - current	3.5 *(27)*	6.0 *(54)*	7.7 *(56)*	7.0 *(56)*	0 *(0)*	0 *(0)*
Fort Valley	7,350	1947 - current	1.2 *(32)*	2.2 *(60)*	2.4 *(60)*	1.0 *(59)*	0 *(1)*	0 *(0)*
Heber	7,640	1950 - 1999 (discontinued)	1.8 *(23)*	3.5 *(49)*	3.6 *(49)*	2.1 *(46)*	1.0 *(2)*	0 *(0)*
Heber (SNOTEL)	7,640	1950 - current	2.1 *(31)*	4.4 *(56)*	4.5 *(56)*	2.3 *(52)*	0 *(24)*	0 *(24)*
Lake Mary	6,930	1975 - current	1.2 *(27)*	2.5 *(32)*	*2.9 (32)*	0.4 *(32)*	0 *(0)*	0 *(0)*
Mormon Mountain	7,500	1950 - 1999 (discontinued)	2.8 *(30)*	4.8 *(49)*	5.8 *(50)*	4.2 *(47)*	5.1 *(3)*	0 *(0)*
Mormon Mountain (SNOTEL)	7,500	1950 - current	2.4 *(37)*	4.5 *(56)*	5.7 *(57)*	4.2 *(54)*	1.0 *(27)*	0 *(24)*
Mormon Mountain Summit #2	8,470	1975 - current	3.6 *(16)*	7.5 *(22)*	11.6 *(24)*	13.0 *(29)*	0 *(0)*	0 *(0)*
Snow Bowl #1 Alt.	9,920	1984 - current	5.6 *(22)*	*8.1 (23)*	11.9 *(23)*	12.9 *(22)*	0 *(0)*	0 *(0)*
Snow Bowl #2	11,200	1965 - current	7.6 *(29)*	11.9 *(41)*	16.7 *(41)*	21.4 *(40)*	0 *(0)*	0 *(0)*
Tsaile Canyon #1	8,160	1985 - current	2.5 *(21)*	*4.9 (22)*	5.7 *(21)*	3.4 *(22)*	0 *(0)*	0 *(0)*
Tsaile Canyon #3	8,920	1986 - current	3.5 *(20)*	6.6 *(21)*	8.2 *(20)*	*6.8 (21)*	0 *(0)*	0 *(0)*

Source: Natural Resources Conservation Service, 2005

Notes:
WB = Weather Bureau
AP = Airport
Alt = Alternate
Current = December 2008


UTAH
NEW MEXICO
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R12E
R14E
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Betatkin
Copper Mine T.P.
Kaibito
Chilchinbito
APACHE COUNTY
COCONINO COUNTY
NAVAJO COUNTY
Tsaile Canyon #3
Lukachukai
Lukachukai
Tsaile Canyon #1
Rough Rock
Many Farms S.
Beaver Spring
Tonalea
Tuba City
Tuba City
Chinle
Chinle
Canyon de Chelly
Pinon
Cottonwood
Cottonwood I.S.
Fluted Rock
Cameron 1 NNE
Cameron
Hotevilla
Old Oraibi
Polacca
Keams Canyon
Keams Canyon
Kykotsmovi
Gray Mountain
Ganado
Ganado
Window Rock
Arbabs Forest
St. Michaels 6 WNW
Window Rock 4 SW
Klagetoh 12 WNW
Wupatki N.M.
Twin Buttes
Lupton
Snow Bowl #1 Alt.
Snow Bowl #2
Sunset Crater N.M.
Leupp
Leupp
Fort Valley
Burrus Ranch
Fort Valley
Flagstaff
Flagstaff WB AP
Flagstaff
Sanders
Sanders
Sanders 11 ESE
Navajo
Navajo
Painted Desert N.P.
Flagstaff AP
Winslow AP
Winslow
Winslow AP
Lake Mary
Morman MtnSummit #2
Morman Mountain
Morman Mtn (SNOTEL)
Joseph City
Holbrook
Holbrook
Petrified Forest N.P.
Blue Ridge R.S.
Chevelon R.S.
Wallace R.S.
Snowflake 15 W
Snowflake
Snowflake
Concho
Saint Johns
Saint Johns
Heber
Heber Ranger STN
Clay Springs
Heber
Heber (SNOTEL)
Pinedale
Show Low Airport
Show Low
Forest Dale Alt.
Lakeside
Pinetop
Pinetop
McNary 2N
Springerville
Springerville
Cheese Springs
Greer
Fort Apache
Baldy #1
Baldy #2
Greer
Baldy (SNOTEL)
Average Annual Precipitation (1961-1990) inches per year
4-6
6-8
8-10
10-12
12-14
14-16
16-18
18-20
20-22
22-24
24-26
26-28
28-30
30-32
32-34
34-36
36-38
38-40
Meteorological Stations
NOAA/NWS
AZMet
NRCS Snow
PanET
Precipitation Contour
COUNTY
New Mexico State Boundary
Utah State Boundary
Interstate Highway
Major Road
City, Town or Place
0 6 12
Miles
N
S
Figure 2.1-3
Little Colorado River Plateau Basin
Meteorological Stations
and Annual Precipitation
ARIZONA DEPARTMENT OF WATER RESOURCES
©
Precipitation Data Source: Oregon State University, 1998

2.1.4 Surface Water Conditions of the Little Colorado River Plateau Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 2.1-2. Flood ALERT equipment in the basin is shown in Table 2.1-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 2.1-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 2.1-5. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 2.1-2
- Data from 50 stations, including 28 discontinued stations, are shown in the table and on Figure 2.1-5. All but one of the active stations are real-time stations. Three additional stations were installed in 2008.
- The average seasonal flow is highest in the Spring (April-June) from winter snowmelt and spring rains and in the Summer (July-September) from high intensity monsoon storms.
- High summer season flow was noted at many gages on the Navajo and Hopi reservations. High winter flow (January-March) was recorded at gages near Lakeside, Show Low and Snowflake.
- The largest annual flow recorded in the basin is 20.3 million acre-feet (maf) in 1984 at the Colorado River at Lees Ferry gage, located downstream of Glen Canyon Dam. Mean flow at this gage is 10.8 maf. Maximum flow on the Little Colorado River is 587,869 acre-feet at Grand Falls measured in 1941. (see Figure 2.1-4 for a stream hydrograph for the Little Colorado River)

Flood ALERT Equipment

- Refer to Table 2.1-3
- There were 32 stations in the basin as of October 2005, most located along the Little Colorado River, and in the vicinity of Heber, Snowflake, Show Low and Pinetop-Lakeside.

Reservoirs and Stockponds

- Refer to Table 2.1-4
- The basin contains 94 large reservoirs. The largest, Lake Powell, has a maximum storage of 20.3 maf. Most of this storage is not in the basin.
- Thirty-three large reservoirs are intermittent or dry, particularly those listed in Table 2.1-3B.
- The most common use of large reservoirs is for recreation (46), followed by fire protection, stock or farm use (33) and for irrigation (30). Other reservoir uses include hydroelectric power generation, navigation and water supply.
- Capacity information was available for 416 small reservoirs, which have a combined maximum storage capacity of 13,343 acre-feet.
- There are 269 small reservoirs for which only surface area data are available with a total surface area of 3,907 acres.
- There are 6,113 registered stockponds in the basin.

Runoff Contour

- Refer to Figure 2.1-5.
- Average annual runoff varies from 5 inches per year, or 265 acre-feet per square mile at higher elevations along the Mogollon Rim and near Greer to 0.1 inches, or five acre-feet per square mile, near the Little Colorado River and along a contour stretching from near Sanders, through Polacca to the northwest corner of the basin.

Figure 2.1-4 Annual flows (acre-feet) at Little Colorado River at Holbrook, water years 1930-2008 (Station #9397000)

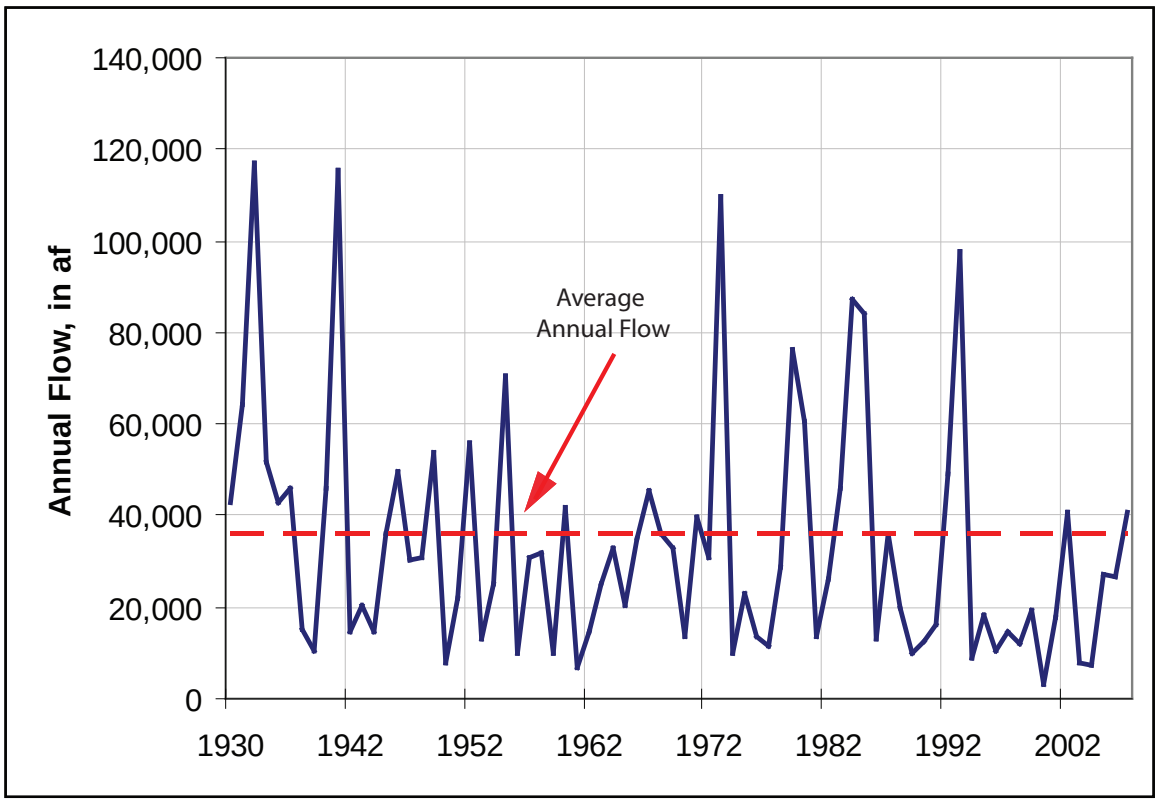


Table 2.1-2 Streamflow Data for the Little Colorado River Plateau Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of Annual Flow)				Annual Flow in Acre-Feet (Year)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9379025	Chinle Creek at Chinle	639	5,500	11/1999-7/2006 (discontinued)	49	42	6	2	905 (2002)	6,624	6,258	10,860 (2004)	5
9379050	Lukachukai Creek near Lukachukai	NA	5,750	8/2000-8/2006 (discontinued)	28	37	22	13	796 (2002)	1,947	1,781	2,172 (2003)	5
9379180	Laguna Creek at Dennehotso	414	4,985	7/1996-12/2005 (discontinued)	13	4	61	22	1,694 (2004)	3,826	4,408	8,760 (1997)	6
9379200	Chinle Creek near Mexican Water	3,650	4,720	10/1964-current (real time)	19	32	36	13	3,062 (1994)	15,457	20,429	67,692 (1982)	40
9379910	Colorado River below Glen Canyon Dam	111,700	3,100	10/1989-8/2004 (discontinued)	23	28	27	22	7,847,916 (2002)	8,166,466	8,382,855	9,252,432 (1971)	9
9380000	Colorado River at Lees Ferry	111,800	3,106	10/1921-current (real time)	16	44	24	16	1,383,521 (1963)	9,375,509	10,885,307	20,322,048 (1984)	83
9383000	Colorado River at Compact Point near Lees Ferry	112,000	NA	10/1980-9/2007	24	25	28	22	7,833,437 (1988)	8,383,659	9,876,067	18,699,615 (1986)	20
9383200	Lee Valley Creek above Lee Valley Reservoir near Greer	1.3	NA	10/1966-9/1972 (discontinued)	7	43	26	24	261 (1970)	398	405	543 (1969)	5
9383220	Lee Valley Creek Tributary near Greer	0.5	NA	10/1966-9/1972 (discontinued)	9	47	30	13	11 (1969)	94	79	130 (1969)	5
9383250	Lee Valley Creek below Lee Valley Reservoir near Greer	1.9	NA	10/1966-9/1972 (discontinued)	17	29	30	24	116 (1967)	188	191	239 (1970)	5
9383400	Little Colorado River at Greer	29.1	8,283	8/1960-9/1982 (reactivated, real time)	12	59	20	9	5,198 (1961)	8,688	11,437	25,267 (1973)	21
9383430	Little Colorado River at Springerville	NA	6,950	new as of 6/2008 (real time)	No statistics run, less than 3 years data								<1
9383500	Nutrioso Creek above Nelson Reservoir near Springerville	83.3	7,421	6/1967-9/1982 (reactivated, real time)	21	63	6	10	485 (1977)	2,729	4,517	16,507 (1973)	14
9383550	Nutrioso Creek below Nelson Reservoir near Springerville	86.8	7,364	7/1967-9/1982 (discontinued)	19	69	4	8	290 (1977)	2,237	4,235	17,013 (1973)	14
9383570	Nutrioso Creek at Springerville	NA	6,965	new as of 10/2008 (real time)	No statistics run, less than 3 years data								<1
9383595	Little Colorado near Wenima	NA	6,740	new as of 10/2008 (real time)	No statistics run, less than 3 years data								<1
9384000	Little Colorado River above Lyman Lake near St. Johns	706	6,010	4/1940-current (real time)	20	52	17	10	2,259 (1996)	11,113	15,588	51,258 (1941)	64

Table 2.1-2 Streamflow Data for the Little Colorado River Plateau Basin (Cont)

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of Annual Flow)				Annual Flow in Acre-Feet (Year)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9385500	Little Colorado River below Lyman Reservoir near St. Johns[1]	790	6,480	4/1941-12/1986 (discontinued)	21	63	6	10	478 (1963)	1,509	2,722	19,547 (1973)	34
9385700	Little Colorado River below Salado Springs	845	5,785	3/1985-current (real time)	No statistics run, less than 3 years data								2
9386000	Little Colorado River at St. Johns	964	NA	4/1906-4/1940 (discontinued)	24	33	27	16	2,013 (1939)	3,895	10,309	45,538 (1909)	8
9386030	Little Colorado River above Zion Reservoir near St. Johns	1,007	5,560	10/1975-current (real time)	29	31	16	24	94 (2004)	3,453	5,149	18,823 (1985)	29
9386250	Carrizo Wash near St. Johns	NA	5,610	8/1998-current (real time)	0	0	99	1	65 (2004)	1,596	2,082	5,169 (2002)	5
9386300	Little Colorado River below Zion Reservoir near St. Johns	NA	5,530	9/1998-current (real time)	1	<1	97	2	80 (2003)	116	2,684	11,798 (2002)	6
9386500	Little Colorado River above Zuni Reservoir near Hunt	3,741	5,399	3/1940-9/1972 (discontinued)	16	10	60	14	8 (1961)	2,266	3,778	22,009 (1955)	31
9388000	Little Colorado River near Hunt	6,383	5,372	5/1929-9/1972 (discontinued)	14	12	64	10	239 (1962)	5,046	10,424	58,424 (1941)	34
9390000	Silver Creek near Shumway	172	5,913	10/1944-6/1955 (discontinued)	12	44	38	6	5,575 (1951)	7,891	8,466	13,683 (1952)	10
9390500	Show Low Creek near Lakeside	69	6,610	5/1953-current (real time)	53	19	9	19	970 (2002)	6,863	9,692	31,493 (1978)	51
9392000	Show Low Creek below Jaques Dam near Show Low	73	6,530	10/1955-2/2006 (discontinued)	47	25	13	14	1,405 (1990)	3,033	6,391	28,090 (1993)	49
9392500	Show Low Creek at Show Low	90.2	6,309	10/1944-6/1955 (discontinued)	65	12	12	11	1,086 (1953)	4,156	6,519	24,832 (1952)	10
9393400	Cottonwood Wash at Snowflake	262	5,580	10/1981-8/1984 (discontinued)	No statistics run, less than 3 years data								2
9393500	Silver Creek near Snowflake	925	5,204	10/1950-9/1995 (discontinued)	45	8	28	19	2,020 (1990)	10,461	13,830	59,583 (1993)	44
9394000	Silver Creek near Woodruff	966	NA	4/1929-9/1952 (discontinued)	51	4	36	9	4,293 (1942)	14,914	17,902	58,642 (1932)	15
9394500	Little Colorado River at Woodruff	8,072	5,130	3/1905-current (real time)	27	12	46	15	5,524 (2000)	26,860	35,839	165,791 (1919)	74
9396500	Puerco River near Adamana	2,654	5,312	4/1940-9/1949 (discontinued)	24	13	47	16	9,557 (1944)	26,642	46,732	167,963 (1941)	8
9397000	Little Colorado River at Holbrook	11,462	5,063	3/1905-current (real time)	19	10	55	16	13,973 (1950)	82,533	91,138	197,646 (1968)	26

Table 2.1-2 Streamflow Data for the Little Colorado River Plateau Basin (Cont)

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of Annual Flow)				Annual Flow in Acre-Feet (Year)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9397500	Chevelon Fork below Wildcat Canyon near Winslow	271	5,905	5/1947-current (real time)	57	28	5	10	0 (1996, 2002)	22,950	30,032	97,737 (1965)	30
9398000	Chevelon Creek near Winslow[1]	785	4,899	1/1906-12/2006 (discontinued)	49	33	6	11	10,715 (1956)	32,651	38,756	99,909 (1952)	44
9398500	Cleak Creek below Willow Creek near Winslow	317	5,957	6/1948-10/1993 (discontinued)	41	45	3	11	4,127 (1990)	36,633	59,275	168,963 (1973)	43
9399000	Clear Creek near Winslow	621	4,861	6/1906-9/2007 (discontinued)	39	49	2	9	3,852 (1967)	46,697	60,719	183,890 (1978)	51
9400350	Little Colorado River near Winslow	16,192	4,863	12/2001-current (real time)	52	9	23	16	54,009 (2003)	69,140	73,870	98,461 (2004)	3
9400562	Oraibi Wash near Tolani Lake	635	5,025	7/1995-current (real time)	1	0	72	19	434 (1996)	1,998	1,980	4,177 (1997)	9
9400568	Polacca Wash near Second Mesa	905	5,240	4/1994-current (real time)	5	1	73	21	195 (1995)	2,125	2,117	3,678 (1997)	8
9400583	Jeddito Wash near Jeddito	147	5,440	9/1993-9/2005 (discontinued)	0	1	88	11	14 (1998)	145	298	1,426 (2003)	11
9401000	Little Colorado River at Grand Falls	21,068	4,439	11/1925-7/1995 (discontinued)	39	24	30	7	18,461 (1956)	162,171	198,406	587,869 (1941)	24
9401110	Dinnebito Wash near Sand Springs	473	5,160	6/1993-current (real time)	5	3	78	14	311 (1994)	2,085	2,680	6,682 (2004)	11
9401226	Coal Mine Wash Tributary near Kayenta	0.6	NA	10/1977-9/1981 (discontinued)	2	4	90	4	0 (1979)	3		70 (1980)	3
9401239	Coal Mine Wash near Mouth near Shonto	NA	NA	5/1978-10/1982 (discontinued)	20	11	48	21	434 (1979)	775	857	1,361 (1980)	3
9401260	Moenkopi Wash at Moenkopi	1,629	4,610	7/1976-current (real time)	13	4	64	18	1,376 (1994)	7,457	7,083	14,769 (2001)	28
9401280	Moenkopi Wash near Tuba City	1,904	NA	7/1926-9/1940 (discontinued)	8	2	81	9	5,408 (1928)	9,774	16,334	45,828 (1930)	13
9401400	Moenkopi Wash near Tuba City	2,492	4,309	10/1940-9/1978 (discontinued)	8	2	58	33	2,179 (1944)	8,833	11,158	44,452 (1972)	25

Source: USGS (NWIS) 2005 & 2008

Notes:
NA = Not available
Statistics based on Calendar Year
Average Seasonal Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of Record may not equal Years of Annual Flow Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retrieved in 2005
[1]Station operated by SRP after 1985 and table statistics do not include the SRP data

Table 2.1-3 Flood ALERT Equipment in the Little Colorado River Plateau Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
1701	Little Colorado River @ Hunt	Precipitation/Stage	NA	Navajo County FCD
1715	Black Canyon Lake	Precipitation/Stage	NA	Navajo County FCD
1720	Oklahoma Flat	Precipitation	NA	Navajo County FCD
1722	Stermer Ridge	Precipitation	NA	Navajo County FCD
1724	Bunger Point	Precipitation	NA	Navajo County FCD
1725	Dreamy Draw	Precipitation/Stage	3/1/2004	Navajo County FCD
1729	Little Colorado River @ Winslow @I-40	Precipitation/Stage	10/27/1995	Navajo County FCD
1739	Cottonwood Wash - Winslow	Stage	NA	Navajo County FCD
1743	Obed Bridge over Little Colorado River @ Joseph City	Precipitation/Stage	9/5/1995	Navajo County FCD
1750	Leroux Wash	Precipitation/Stage	11/2/1995	Navajo County FCD
1764	Little Colorado River @ Holbrook	Precipitation/Stage	NA	Navajo County FCD
1771	Joseph City @ SR 66	Precipitation/Stage	NA	Navajo County FCD
1778	Pinedale Ridge	Precipitation	8/1/2001	Navajo County FCD
1785	Silver Creek at Snowflake	Precipitation/Stage	8/1/2001	Navajo County FCD
1795	Lone Pine Dam	Precipitation/Stage	8/1/2001	Navajo County FCD
1800	Chevelon Butte 20 mi. SW of Winslow	Repeater/Precipitation	7/18/1995	Navajo County FCD
1804	Porter Mountain	Repeater/Precipitation	1/18/1995	Navajo County FCD
1808	Buckskin Wash	Precipitation/Stage	NA	Navajo County FCD
1815	Schoens Dam	Precipitation/Stage	8/1/2001	Navajo County FCD
1822	White Mountain Lake	Precipitation/Stage	NA	Navajo County FCD
1829	Cottonwood Wash - Taylor	Precipitation/Stage	10/6/1995	Navajo County FCD
1843	Dutch Joe	Precipitation	8/1/2001	Navajo County FCD
1850	Morgan Wash	Precipitation/Stage	11/22/1995	Navajo County FCD
1857	Holbrook Base Station	Precipitation	NA	Navajo County FCD
1864	South County Complex	Precipitation	NA	Navajo County FCD
1871	Heber Repeater	Repeater/Precipitation	NA	Navajo County FCD
1881	Black Canyon Wash	Stage	NA	Navajo County FCD
1885	Heber SNOTEL	Precipitation	NA	Navajo County FCD
1892	Show Low Lake	Precipitation	NA	Navajo County FCD
1893	Phoenix Park Wash	Precipitation/Stage	NA	Navajo County FCD
3300	Newman Canyon	Precipitation/Stage	NA	City of Flagstaff
3310	Rio de Flag	Precipitation/Stage	NA	City of Flagstaff

Source: ADWR 2005a

Notes:
FCD = Flood Control District
NA = Not available to ADWR

Table 2.1-4 Reservoirs and Stockponds in the Little Colorado River Plateau Basin

A. Large Reservoirs (500 acre-feet capacity or greater)

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE[1]	JURISDICTION
1	Powell (Glen Canyon Dam)	Bureau of Reclamation	20,325,000	H,I,O,R,S	Federal
2	Schoens	Navajo County	62,000	C	State
3	Lyman	Lyman Water Co	44,500	I,R	State
4	Many Farms	Navajo Nation	32,500	I,R	Tribal
5	Upper Lake Mary	City of Flagstaff	21,041	S,R	State
6	Red[2]	Navajo Nation	15,517	F,I,R	Tribal
7	Blue Ridge/C.C. Cragin	Bureau of Reclamation/Salt River Project	15,000	H,S,R	State
8	Mormon	Coconino NF	15,000	F,R	Federal
9	Lone Pine[3]	Navajo County	14,700	C	State
10	White Mountain (Daggs Dam)	Silver Creek Irrigation District	13,750	I,R	State
11	Tremaine (Hay Lake Dam)	Bar T Bar Ranch	9,000	I	State
12	Chevelon Canyon	AZ Game & Fish	8,542	R	State
13	Show Low (Jacques Dam)	City of Show Low	8,160	O,R	State
14	Tsaile	Navajo Nation	8,100	I,R	Tribal
15	Wheatfields	Navajo Nation	5,700	I,R	Tribal
16	Fool's Hollow	AZ Game & Fish	5,617	R	State
17	Canyon Diablo Reservoir	Navajo Nation	4,700	I,R	Tribal
18	Mill Pond	Abitibi	4,400	I	State
19	Willow Springs	AZ Game & Fish	4,230	R	State
20	Ashurst	AZ Game & Fish	4,164	R	State
21	Alejandro	Private	4,111	U	State
22	Ganado Reservoir	Navajo Nation	3,750	I,R	Tribal
23	Twin Lakes	Abitibi	3,700[4]	O	State
24	Hay[3]	Bar T Bar Ranch	3,530	U	State
25	River Reservoir	Round Valley Water Users	3,195	I,R	State
26	Kinnikinick	AZ Game & Fish	3,124	R	State
27	Ortega + Little Ortega (Ortega Lake Retention)	Silver Creek Flood Control	2,500	C,R	State
28	White Mountain	Round Valley Water Users	2,391[4]	I,R	State
29	Lower Lake Mary	Coconino NF	2,240	R,S	Federal
30	Rainbow (Lakeside Dam)	Show Low Irrigation	2,226	I,R	State
31	Cholla	Arizona Public Service	2,200[4]	F,O,R	State
32	Millett Swale	Silver Creek Flood Control	2,104	C	State
33	Black Canyon	AZ Game & Fish	1,900	R	State
34	Blue Canyon	Navajo Nation	1,900	S	Tribal
35	Soldier Annex	Coconino NF	1,886	F,I,P,R	Federal
36	Knoll	AZ Game & Fish	1,774	R	State
37	Scott Reservoir	Show Low Irrigation	1,740	I,R	State
38	Bear Canyon	AZ Game & Fish	1,638	R	State
39	Concho	Concho Water Co	1,560	I,R	State
40	Unnamed (Twin Dams)	Hopi Tribe	1,500	C	Tribal
41	Little Mormon	Apache Sitgreaves NF	1,400	F,R	Federal
42	Becker	Apache Sitgreaves NF	1,338	I,F,R	Federal
43	Woods Canyon	AZ Game & Fish	1,232	R	State
44	Little	St. John's Irrigation	1,200[4]	I,R	State
45	Long[3]	Apache Sitgreaves NF	1,200	F,R	Federal
46	Mexican[3]	Apache Sitgreaves NF	1,100	C,F,I	Federal
47	Round Rock	Navajo Nation	1,070	I,R	Tribal
48	Hog Wallow	Lyman Water Co	1,000	I	State
49	Pool Corral	Lyman Water Co	993	I	State
50	Nelson	AZ Game & Fish	900	R	State
51	Slade	Private	898	I	State
52	Broken Tank	AZ State Land Dept.	851[4]	P	State
53	Mexican Hay	Lyman Water Co	821	I,R	State
54	Clear Creek (Clear Creek #2)	City of Winslow	750	I,R	State
55	Colter	Lyman Water Co	732	I	State
56	Tunnel	Apache Sitgreaves NF	694	I,R	Federal
57	Norton[3]	Town of Springerville	680	I	State
58	Haumont Tank[3]	AZ State Land Dept./Rancho Allegra	674	I	State
59	Lee Valley	AZ Game & Fish	640	I,R	State
60	Soldiers	Coconino NF	550	R	Federal
61	Patterson	AZ Land Dept	534[4]	P	State
62	Bunch	Round Valley Water Users	512	I,R	State

Table 2.1-4 Reservoirs and Stockponds in the Little Colorado River Plateau Basin (Cont)

B. Other Large Reservoirs (50 acre surface area or greater)

MAP KEY	RESERVOIR/LAKE NAME	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[1]	JURISDICTION
63	Unnamed[6]	Navajo Nation	2,642	P	Tribal
64	Dry[6]	AZ State Land Dept./Private	1,817	P	Landowner
65	Dry	Private	1,674	P	Landowner
66	Red[6]	Navajo Nation	502	P	Tribal
67	Ortega Sink[6]	Bureau of Land Management/Private	405	P	Federal
68	Long[3]	Coconino NF	323	F,P,R	Federal
69	Long	Coconino NF	271	F,P	Federal
70	Greasewood [6]	Navajo Nation	269	P	Tribal
71	Unnamed [6]	AZ State Land Dept./Private	215	P	Landowner
72	Marshall	Coconino NF	213	F	Federal
73	Tolani[3]	Navajo Nation	129	P	Tribal
74	Toh De Niihe[3]	Navajo Nation	121	P	Tribal
75	Unnamed [6]	Navajo Nation	112	P	Landowner
76	Mud Flats [6]	Navajo Nation	110	P	Landowner
77	Mud Lake & Tank[3]	Coconino NF	106	F,P	Landowner
78	Breezy [3]	Coconino NF	101	P,R	Landowner
79	Yaeger Lake & Tank[3]	Coconino NF	96	P	Landowner
80	Unnamed [6]	Navajo Nation	95	P	Landowner
81	Unnamed Lake & Windy Tank[6]	Navajo Nation	92	P	Landowner
82	Unnamed[6]	Bureau of Land Management	90	P	Landowner
83	Vail	Coconino NF	88	P	Federal
84	Grass Flat Tank[3]	Coconino NF	88	P	Federal
85	Unnamed	Navajo Nation	87	P	Tribal
86	Horse Lake & Tank[3]	Coconino NF	84	P	Federal
87	Unnamed[3]	Private	81	P	Landowner
88	Whipple[3]	Apache Sitgreaves NF	75	F,P,R	Federal
89	McDermit[3]	Private	72	P	Landowner
90	Pine Lake & Tank[3]	Coconino NF	70	P	Federal
91	Tobenayoli Pond[3]	Navajo Nation	65	P	Tribal
92	Deep[3]	Coconino NF	62	F	Federal
93	Indian[3]	Coconino NF	60	P	Federal
94	To Kla Dua Aakee	Navajo Nation	54	P	Tribal

Source: Compilation of databases from ADWR & others

C.Small Reservoirs (greater than 15 acre-feet and less than 500 acre-feet)

Total number: 416

Total maximum storage: 13,343 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[5]

Total number: 269

Total surface area: 3,907 acres

E. Stockponds (up to 15 acre-feet)

Total number: 6,113 (estimate based on water right filings)

Notes:

NF = National Forest

[1]C=flood control; F=fish & wildlife pond; H=hydroelectric; I=irrigation; N= navigation; O=other; P=fire protection, stock or farm pond; R=recreation; S=water supply; U=unknown

[2]Dam is in New Mexico as is most of the lake

[3]Intermittent Lake

[4]Normal capacity < 500 acre-feet

[5]Capacity data not available to ADWR

[6]Dry Lake

Figure 2.1-5
Little Colorado River Plateau Basin
Surface Water Conditions

2.1.5 Perennial/Intermittent Streams and Major Springs in the Little Colorado River Plateau Basin

Major and minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 2.1-5. The location of major springs is shown on Figure 2.1-6, keyed to Table 2.1-5A. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- Perennial streams are found at higher elevations in the basin. The Little Colorado River, the major drainage in the basin, flows perennially only in areas near the headwaters and below Silver Creek.
- On tribal lands data were insufficient to determine if streams are intermittent or perennial.
- There are 70 major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time.
- Listed discharge rates may not be indicative of current conditions. Many of the measurements were taken prior to 1990. Only 14 major and 13 minor spring measurements post-date 1990.
- Greatest discharge rates were measured in the far southeastern corner of the basin at the headwaters of Silver Creek (Silver Springs, 3,648 gpm), south of Saint Johns (Salado, 1,730 gpm), east of Pinetop (Big, 1,211 gpm) and near Concho (Concho, 1,120 gpm). Most of the other major springs are located in this area. A cluster of major springs is also located in the vicinity of Tuba City and the Hopi community of Moenkopi.
- More than three quarters of the major springs discharge less than 100 gpm.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 2.1-5B. 160 minor springs have been identified in the basin.
- The total number of springs identified by the USGS varies between 1,222 to 1,305, depending on the database reference.

Table 2.1-5 Springs in the Little Colorado River Plateau Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Lattitude	Longitude		
1	Silver (multiple)	341951	1095527	3648	6/1990
2	Salado	342604	1092352	1730	6/12/1990
3	Big (multiple)	340814	1095804	1211	11/30/1990
4	Concho	342551	1093745	1120	12/6/1951
5	Unnamed[2]	364025	1104828	700	7/27/1954
6	Pinetop	340724	1095454	673	11/20/1990
7	Coal Canyon Mine Wash	360631	1110031	450	2/16/1955
8	Carnero	340609	1093212	400	9/24/1974
9	Adair	340825	1095727	276	11/30/1990
10	Walnut	340749	1095723	225	6/23/1952
11	Unnamed	342240	1092318	200	8/15/1985
12	Porter/Paige	341047	1095622	145	7/1/1971
13	Moenave	360840	1112005	118	2/25/1948
14	Unnamed	360845	1112003	118	8/9/1954
15	Bourdon Ranch[2]	342039	1095612	100	6/25/1952
16	Wiltbank	341629	1092359	100	1/6/1975
17	Unnamed	362712	1102307	89[3]	10/19/1983
18	Coon	340346	1092212	70	NA
19	Big Hollow Wash (multiple)	343215	1092520	67	9/17/1975
20	Dodson Upper	360830	1111441	66	7/26/1954
21	Sheep	340316	1093358	60	5/22/1952
22	Unnamed	362952	1101836	60[3]	11/14/2003
23	Eagle Nest, Talakwava	361056	1111147	50	NA
24	Shonto-2	363536	1103834	50	3/20/1951
25	Unnamed (multiple)2	343135	1092553	50	2/12/1975
26	Unnamed	354919	1100851	50	NA
27	Sawmill	345014	1112234	40	7/12/1975
28	Whitcom	340845	1095217	40	6/11/1952
29	Unnamed	363237	1102318	40[3]	11/13/2003
30	Danstone	340921	1094749	38	6/13/1952
31	Unnamed	360813	1111908	38	8/10/1954
32	Unnamed	342251	1092251	37	8/15/1985
33	Willow	361049	1112242	35	4/5/1952
34	Unnamed	342247	1092254	31	8/15/1985
35	Pasture Canyon[4]	361021	1111159	31	4/26/2004
36	Unnamed (multiple)[2]	364851	1103221	30	NA
37	Davis[2]	342932	1091634	29	1/1/1957
38	Unnamed	362539	1102412	27[3]	4/3/2007
39	Big Leroux	351736	1114327	25	9/26/1949
40	Los Burros[2]	340829	1094634	25	6/11/1952
41	24 Ranch	341723	1092445	20	1/6/1975
42	Bitter	361411	1105403	20	NA
43	Oak	351438	1113521	20	9/20/1962
44	Thompson	340752	1095358	20	6/11/1952
45	Unnamed	365113	1105546	20	NA
46	Unnamed[2]	363747	1103749	20	6/11/1966
47	Dodson Lower	360828	1111441	19	7/26/1954
48	Stinking	343729	1093435	18[5]	NA
49	Charlie Day	360833	1111412	16	6/10/1988
50	Coyote, Isva	353905	1103349	15	During or prior to 2005

Table 2.1-5 Springs in the Little Colorado River Plateau Basin (Cont)

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
51	Hoxworth	350225	1113427	15	4/1/1996
52	Muddy Water	360651	1105709	15	2/16/1955
53	Unnamed	360625	1111311	15	During or prior to 2005
54	Unnamed	365215	1094857	15	2/16/1955
55	Wide Reeds Ruins - Right	354237	1093312	15	11/9/2004
56	Unnamed Near Dennehotso	364656	1094254	13	4/1/2004
57	Moenkopi School Spring	360632	1111311	12	3/29/2004
58	Wide Reed Ruins - Left	354237	1093312	11	11/9/2004
59	2 Sheep, Many Fast Drips	361204	1104335	10	During or prior to 2005
60	Cliff Dwelling	364736	1094232	10	10/6/1954
61	Jack Homer	361056	1112244	10	7/16/1954
62	Mineral	340939	1093645	10	11/20/1974
63	Schuster	342859	1093002	10	2/6/1975
64	Sweet Water	361403	1103521	10	During or prior to 2005
65	Unnamed	354812	1101046	10	During or prior to 2005
66	Unnamed	360636	1111321	10	During or prior to 2005
67	Unnamed	365539	1094419	10	2/16/1955
68	Unnamed[2]	364545	1104327	10	NA
69	Unnamed	365221	1103835	10	NA
70	Unnamed	365144	1103838	10	NA

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed	354860	1100939	8.5	10/30/1951
Atascacita	341007	1093100	8	9/24/1974
Little Giant	341027	1093417	8	9/24/1974
Neilson	341753	1092124	8	1/17/1975
Unnamed	360631	1111315	8	NA
Unnamed	364226	1103004	8	9/25/1965
Huse	354218	1144836	7	2/10/1976
Tse Chizzi	355434	1100117	7	6/18/1954
Unnamed	361554	1103613	7	4/301952
Cc Hall	340715	1093737	6	6/23/1952
Government	361110	1115225	6	6/24/1954
Unnamed	362022	1100501	6	10/7/1954
Willow	360645	1104703	6	NA
Unnamed	360824	1111912	6	4/4/1952
Keams Canyon	354847	1101003	5.5[6]	10/31/1950
Cow	355734	1095504	5	6/18/1954
Halleck	340730	1095513	5	6/1/1952
Kalbito #1	353113	1102538	5	NA
Mcintosh	343048	1091740	5	7/1/1946
Mud	342154	1092847	5	1/7/1975
Navajo	350605	1092938	5	11/18/1975
Nee De Miso Bito	361409	1105926	5	6/24/1954
Ortega	342657	1093555	5	1/15/1975
Unnamed	351823	1114243	5	8/23/1979
Unnamed	354835	1101001	5	NA
Unnamed	364225	1103004	5	8/25/1965
Unnamed	360821	1101333	5	4/5/1952

Table 2.1-5 Springs in the Little Colorado River Plateau Basin (Cont)

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed	364221	1093352	5	12/2/1954
Walker Wash	361056	1141732	5	3/12/1980
Kydestea	361947	1104019	4.5	4/21/1987
Heiser	353021	1112114	4[6]	6/25/1925
Chipmunk	340830	1095218	4	6/11/1952
Kai Si Kato	361811	1104805	4	NA
Sueiva	354846	1103143	4	NA
Unnamed	354728	1101601	4	NA
Unnamed	354632	1101637	4	4/21/1955
Unnamed	361953	1094052	4	2/27/1950
Unnamed	362601	1101812	4[6]	3/3/2004
Unnamed	365149	1103127	4	NA
Unnamed	362629	1102419	4[6]	9/26/1995
Malpais	342428	1093325	4	1/15/1975
Oak	355524	1095730	4	6/17/1954
Ashurst	350131	1112949	3	7/26/1978
Bitter, Toh De Koinish	363930	1113845	3	4/30/1952
Chili, Tsilvasa	354822	1101119	3	NA
Coal Slurry	361736	1104016	3	8/11/1954
Hall	341624	1092055	3	1/16/1975
Hoecevi	354944	1102948	3	7/10/1952
Little Burro, Matovia	354036	1103413	3	NA
Red Bluff, South	362740	1141512	3	3/11/1980
Sand	354306	1105546	3	5/13/1954
Sand 2	354259	1105545	3	NA
Siwukva	355405	1104050	3	NA
Tonali	360002	1111434	3	7/7/1954
Unnamed	340913	1092742	3	12/24/1974
Unnamed	360642	1111325	3	NA
Unnamed	355358	1104028	3	4/21/1955
Unnamed	355812	1103306	3	4/15/1955
Unnamed	364813	1101039	3	10/1/1954
Unnamed	360651	1111551	3	6/25/1954
Betakin	364049	1103218	3	8/28/2002
Wepo South	355325	1102203	3	8/17/1993
Bluebird	354714	1101430	3	4/21/1955
Hotevilla	355544	1104024	3	8/16/1993
Laguna Salada	342018	1094324	3	1/15/1975
Awat ovi	354325	1101645	2	NA
Babbit	350401	1113216	2	3/27/2004
CC Fireman Cabin	340653	1093737	2	9/24/1974
Hock	355103	1105424	2	NA
Lemova	354818	1102900	2	NA
Maynard	361544	1141818	2	3/11/1980
Nee De Miso Bito	361358	1105925	2	6/24/1954
Onion	355946	1102908	2	NA
Red Willow	361952	1103249	2	NA
Rock Ledge, Phillips Farm	354011	1103315	2	NA
Sand	361004	1105546	2	NA
Shonto	354032	1104439	2	8/6/1954
Sweetwater	354538	1105635	2	4/13/1954
Talahogan	354406	1101635	2	NA
Telephone	340842	1094837	2	6/13/1952
Unnamed	350659	1103153	2	7/2/1972

Table 2.1-5 Springs in the Little Colorado River Plateau Basin (Cont)

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed	354434	1105616	2	NA
Unnamed	355141	1100909	2	NA
Unnamed	360936	1105330	2	6/25/1954
Unnamed	360534	1111021	2	7/7/1954
Unnamed	362412	1102318	2	10/8/1954
Unnamed	354519	1102402	2	NA
Unnamed	355905	1102945	2	4/14/1955
Unnamed	362812	1105902	2	7/8/1954
Unnamed	360644	1111447	2	8/10/1954
Unnamed	364856	1102149	2	10/14/1954
Unnamed	354851	1101214	2	NA
Wolf Pass	353125	1101952	2	NA
Salt Water	361301	1100153	2	10/6/1954
Unnamed	363153	1101837	2[5]	12/8/1987
Unnamed	364128	1103606	2	8/7/1954
Big Willow	354804	1095611	2	6/16/1954
Chief, Monwisva	354533	1101638	2	NA
Franey	340718	1093744	2	9/24/1974
Hawk Nest	365002	1103611	2	7/28/1954
Shonto	363625	1103822	2	8/6/1954
Trickle, Yatcakpa	354347	1101653	2	NA
Unnamed	342448	1093109	2	1/15/1975
Unnamed	354902	1100936	2	NA
Unnamed	363632	1103822	2	8/6/1954
Unnamed	361633	1094330	2	2/27/1950
Wepo North, Wipho, Cattail, Reed	355330	1102159	2	8/17/1993
Youngs	350517	1112838	2	7/24/1978
Unnamed	362208	1094113	1.5[6]	11/1/1929
Unnamed	363238	1102241	1	4/18/2007
Unnamed	362537	1102407	1	6/25/2007
Unnamed	362537	1102406	1	6/25/2007
Bell Butte	353338	1102045	1	NA
Scott	361542	1094119	1	8/4/1954
Aqwpa	354917	1102941	1	NA
Beehive	340404	1093239	1	9/23/1974
Bryan Adams, Fadairs	355123	1100849	1	NA
Buhu Va	354720	1101802	1	NA
Campbell	344453	1112947	1	8/6/2002
Cane	363346	1100706	1	10/13/1954
Clark	350402	1113444	1	3/27/2004
Cottonwood, White cave	360216	1103902	1	NA
Coyote	351358	1113934	1	8/27/1979
Flower, Wuko'kwan tu kwi, Siipa	355039	1102238	1	NA
Gopher	362103	1110326	1	7/7/1954
Grooming, Naftakinva	354821	1103128	1	NA
Hard Rocks	360134	1103008	1	NA
Horse	361106	1103437	1	NA
Hummingbird	364941	1094155	1	11/10/1954
Lee	353947	1111811	1	2/3/1954
Lukai	353113	1102050	1	NA

Table 2.1-5 Springs in the Little Colorado River Plateau Basin (Cont)

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Many Fast Drip	361153	1104406	1	6/25/1954
Mccormick	340853	1094623	1	6/13/1952
Red Bluff, North	362744	1141505	1	3/11/1980
Salt Seeps	350625	1092706	1	11/18/1975
Sand	365025	1094206	1	11/10/1954
Seba Delkai	353453	1102414	1	NA
Setsiltso	364323	1094014	1	112/1/1954
Sherwood	341715	1092115	1	1/16/1975
Shonto-hi, Shontah	353250	1101732	1	NA
Spring on a Rock	355740	1111425	1	7/7/1954
Tis Ya Toh	360428	1104325	1	10/8/1954
Tonahakaad	354643	1111259	1	7/14/1954
Trough	341937	1102448	1	11/7/1952
Unnamed[2,7]	351521	1113544	1	8/27/1949
Unnamed	354840	1104004	1	NA
Unnamed	361556	1105911	1	6/24/1954
Unnamed	361121	1103742	1	10/28/1954
Unnamed	354120	1105301	1	5/13/1954
Unnamed	354848	1101024	1	7/9/1950
Unnamed	353755	1102650	1	NA
Unnamed	361603	1105911	1	6/24/1954
Unnamed	364618	1102142	1	10/14/1954
Unnamed	364626	1093645	1	12/1/1954
Unnamed (multiple)	364632	1094136	1	10/6/1954
Unnamed (multiple)	364449	1094036	1	10/6/1954
Unnamed	362422	1095214	1[6]	8/4/1994
Unnamed	363212	1102339	1[6]	2/3/2005
Nasjo Toh	363504	1100937	1[6]	10/13/1954
Wupatki	353118	1112231	1[6]	8/23/1950

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 1,222 to 1,305

Notes:
[1]Most current discharge measurement
[2]Spring not on current topographic map
[3]Most current discharge <10gpm
[4]One of 21 springs in a 1 mile section of the canyon.
This representative spring is the is only one measured.
[5]Spring is now dry
[6]Most current discharge <1gpm
[7]Location approximated by ADWR

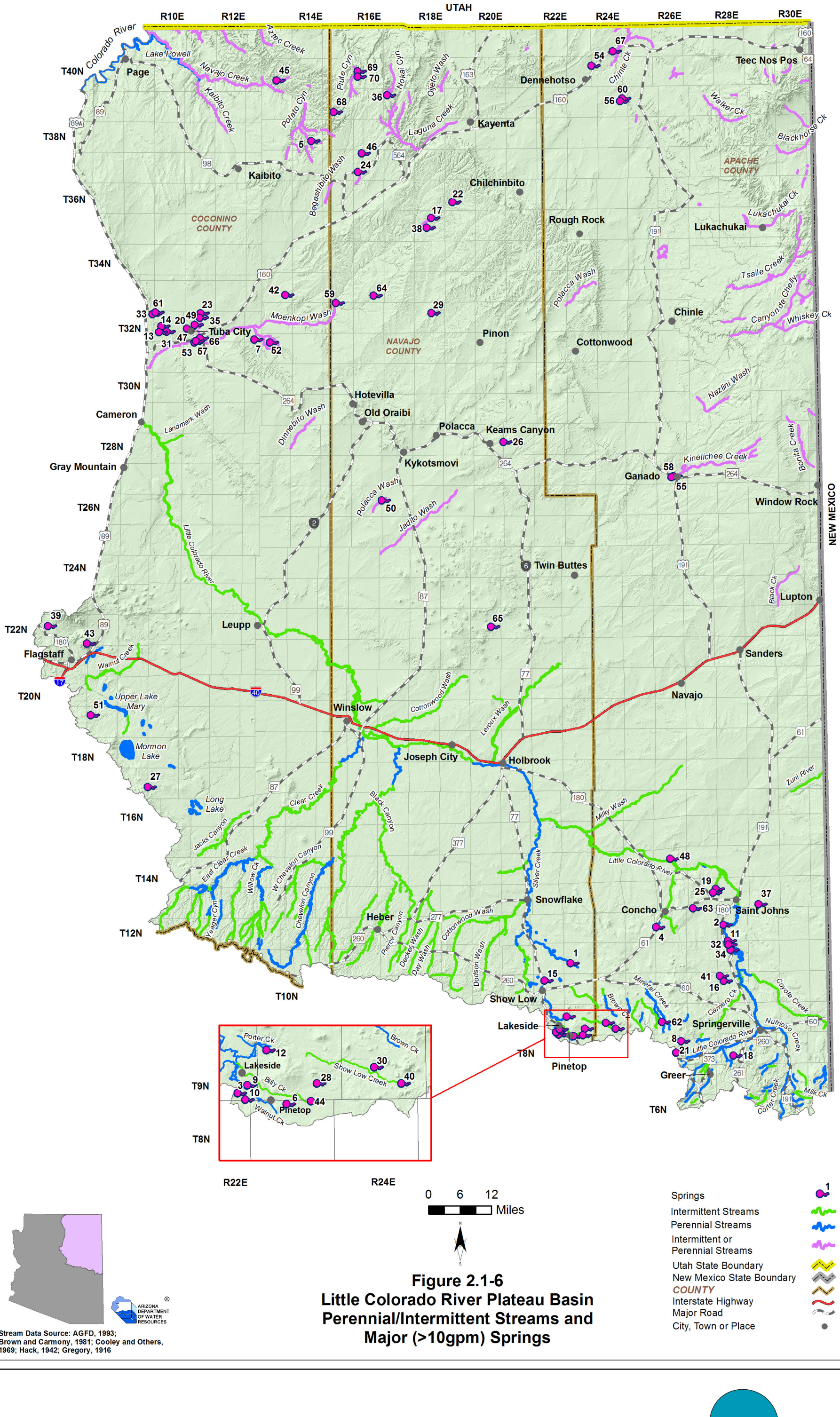


Figure 2.1-6
Little Colorado River Plateau Basin
Perennial/Intermittent Streams and Major (>10gpm) Springs

Stream Data Source: AGFD, 1993; Brown and Carmony, 1981; Cooley and Others, 1969; Hack, 1942; Gregory, 1916

2.1.6 Groundwater Conditions of the Little Colorado River Plateau Basin

Major aquifers, well yields, estimated natural recharge, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 2.1-6. Figure 2.1-7 shows aquifer boundaries, aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 2.1-8 contains hydrographs for selected wells shown on Figure 2.1-7. Figure 2.1-9 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 2.1-6 and Figure 2.1-7.
- Recent stream alluvium aquifers include alluvial deposits along washes and stream channels, including along the Little Colorado River and its tributaries.
- Volcanic aquifers include the Lakeside-Pinetop aquifer and a smaller aquifer inside the caldera of the San Francisco Peaks, known as the “Inner Basin”.
- The large regional aquifers are located in sedimentary formations of sandstone and limestone that are stacked on top of one another and are generally separated by impermeable shales and siltsones. In descending order, the regional aquifers are the D-, N-, and C-aquifers.
- The Bidahochi formation forms a local aquifer in the central part of Apache and Navajo counties and near Saint Johns.
- Undifferentiated sandstones west of Show Low along the Mogollon Rim and in the Springerville-Eagar area form local aquifers, known as the White Mountain and Springerville aquifers, respectively.
- Flow directions are shown in Figure 2.1-7. Flow directions in the D-aquifer are generally from east to west. Flow in the N-aquifer varies as shown on the map. Flow direction in the C-aquifer is south to north in the southern part of the basin and generally from east to west in the northern part of the basin. The Bidahochi aquifer flows are not mapped in the area south of Keams Canyon. Flows in the Volcanic aquifer are generally toward the north.

Well Yields

- Refer to Table 2.1-6 and Figure 2.1-9.
- Well yields vary greatly in the basin. In general, well yields are greatest along the Little Colorado River and in alluvial areas north of Springerville and in the vicinity of Concho, Saint Johns and Snowflake. Areas of lower yield are found in the northern part of the basin and in the volcanic aquifers around Flagstaff and Greer.
- One source of well yield information, based on 386 reported wells, indicates that the median yield from is 500 gpm. An estimate that includes USGS and Navajo Tribal Utility Authority data found a median well yield of 95 gpm.

Natural Recharge

- Refer to Table 2.1-6
- Estimated natural recharge to the major regional aquifers is 319,000 AFA to the C-aquifer (areal extent 21,655 square miles), 5,392 AFA to the D-aquifer (areal extent 3,125 square miles) and between 2,600 acre-feet to 20,248 acre-feet with a median of 13,000 AFA to the

N-aquifer (areal extent 6,250 square miles). Main recharge areas are along the southern and eastern periphery of the basin.
- Recharge rates to other basin aquifers is unknown.

Water in Storage
- Refer to Table 2.1-6
- Storage volumes are based on rough estimates and additional aquifer studies are needed.
- The only storage estimate for the entire basin is 508 maf from a 1989 ADWR study.

Water Level
- Refer to Figure 2.1-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 57 index wells in the basin. Hydrographs for 10 index wells, including one automated telemetry site, and other wells (Hydrograph #AZ), are shown in Figure 2.1-8.
- Deep water levels are found in areas near Flagstaff where water levels as deep as 1,572 feet below land surface (bls) were measured, and near Cottonwood and Piñon where water levels were between 1,000 and 1,272 bls. Shallow water levels (<50 feet bls) are found along the Little Colorado River, in the Tuba City area, near Window Rock and near Dennehotso.
- Areas of most significant groundwater level decline were found in the vicinity of St. Johns, Pinon, Flagstaff and Kayenta. Water level rises were noted in individual wells near Springerville, Concho, Chilchinbito and Flagstaff.

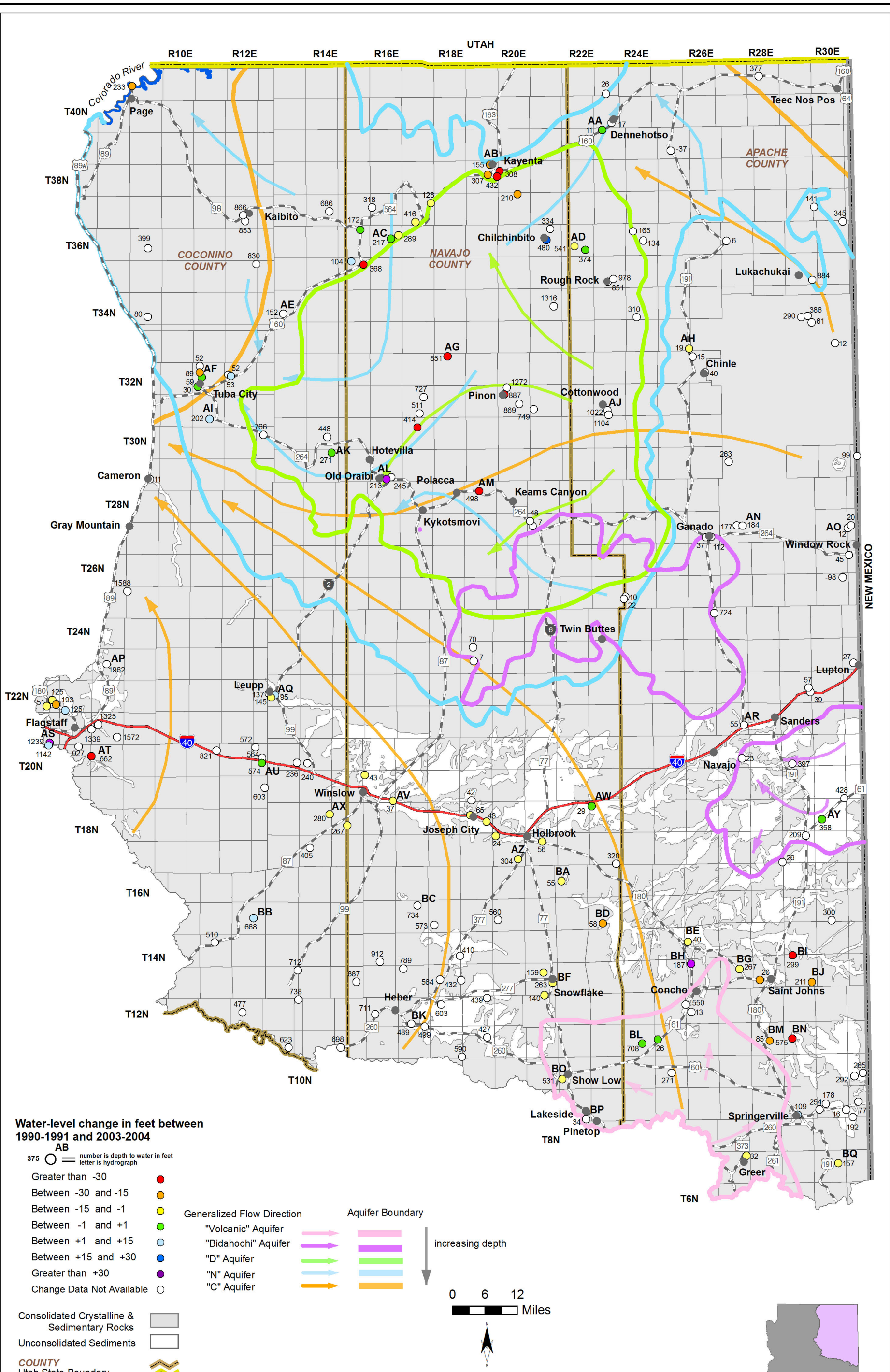
Table 2.1-6 Groundwater Data for the Little Colorado River Plateau Basin

Basin Area, in square miles:	26,700	
Major Aquifer(s):	**Geologic Units and/or Name**	
	Recent Stream Alluvium	
	Volcanic Rock (Lakeside-Pinetop Aquifer)	
	Sedimentary Rock (Bidahochi Formation, C, D, N, Springerville, and White Mountain Aquifers)	
Well Yields, in gal/min:	Range 8-1,602 Median 95 (85 wells measured)	Measured by ADWR and/or USGS or NTUA
	Range 1-3,000 Median 500 (386 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 30-300	ADWR (1990b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	319,000[1] (C Aquifer)	Hart et. al (2002)
	5,392 (D Aquifer)	GeoTrans and Waterstone (1999)
	2,600 - 20,248, median 13,000 (N Aquifer)	OSM (2008)
Estimated Water Currently in Storage, in acre-feet:	508,000,000 (total)	ADWR (1990b)
	413,000,000 (C Aquifer)	ADWR (1989)
	15,000,000 (D Aquifer)	ADWR (1989)
	526,000,000 (N Aquifer)	ADWR (2008d)
Current Number of Index Wells:	94	
Date of Last Water-level Sweep:	2001 (932 wells measured)	

Notes:

[1] Assumes stready state conditions and may include parts of the Verde and Salt River Basins.

NTUA = Navajo Tribal Utility Authority



Water-level change in feet between 1990-1991 and 2003-2004

AB
375 ○ = number is depth to water in feet, letter is hydrograph

- Greater than -30
- Between -30 and -15
- Between -15 and -1
- Between -1 and +1
- Between +1 and +15
- Between +15 and +30
- Greater than +30
- Change Data Not Available

Generalized Flow Direction
- "Volcanic" Aquifer
- "Bidahochi" Aquifer
- "D" Aquifer
- "N" Aquifer
- "C" Aquifer

Aquifer Boundary

increasing depth

Consolidated Crystalline & Sedimentary Rocks

Unconsolidated Sediments

COUNTY
Utah State Boundary
New Mexico State Boundary
Interstate Highway
Major Road
City, Town or Place

0 6 12 Miles

Figure 2.1-7
Little Colorado River Plateau Basin
Groundwater Conditions

Figure 2.1-8
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

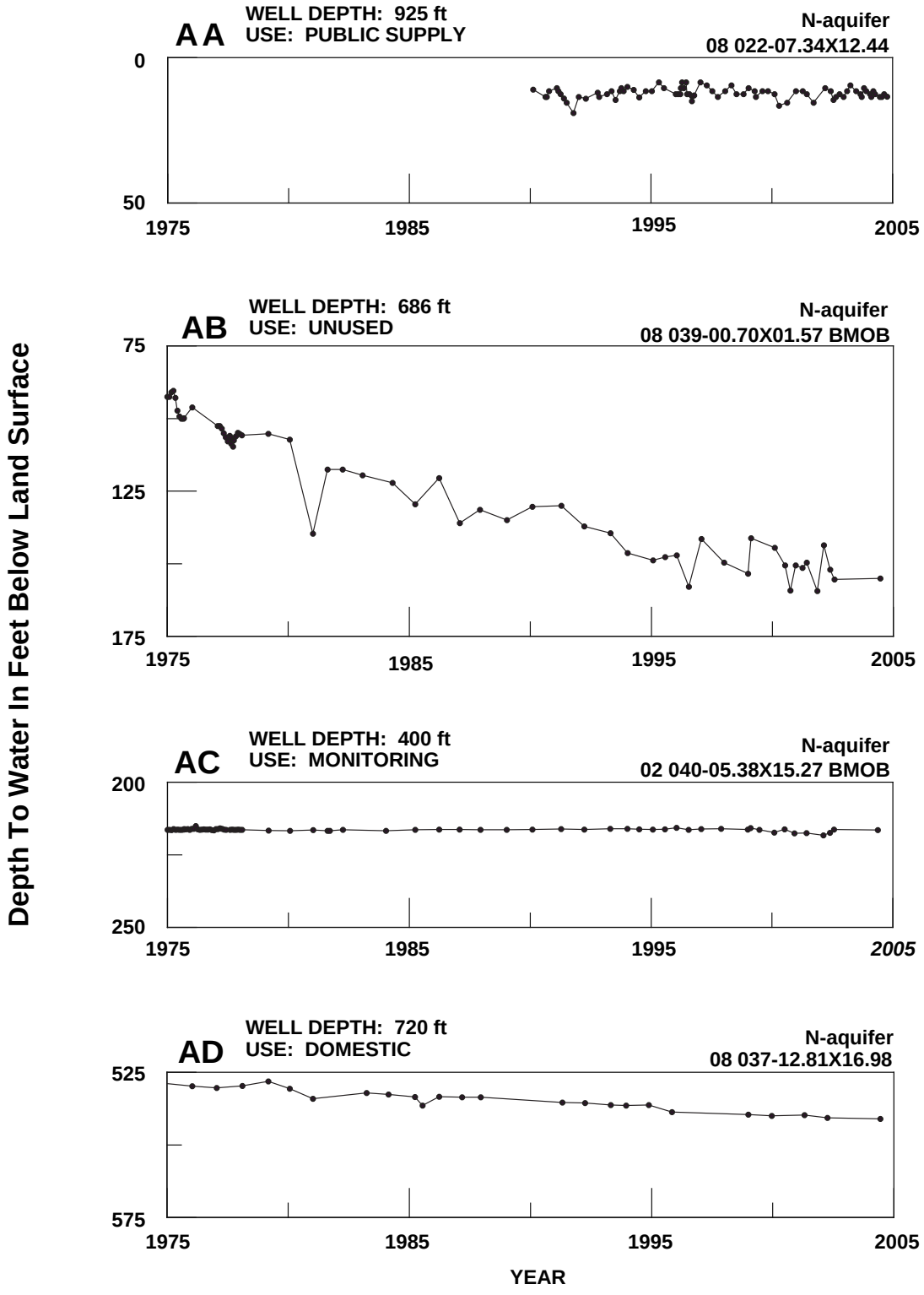


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

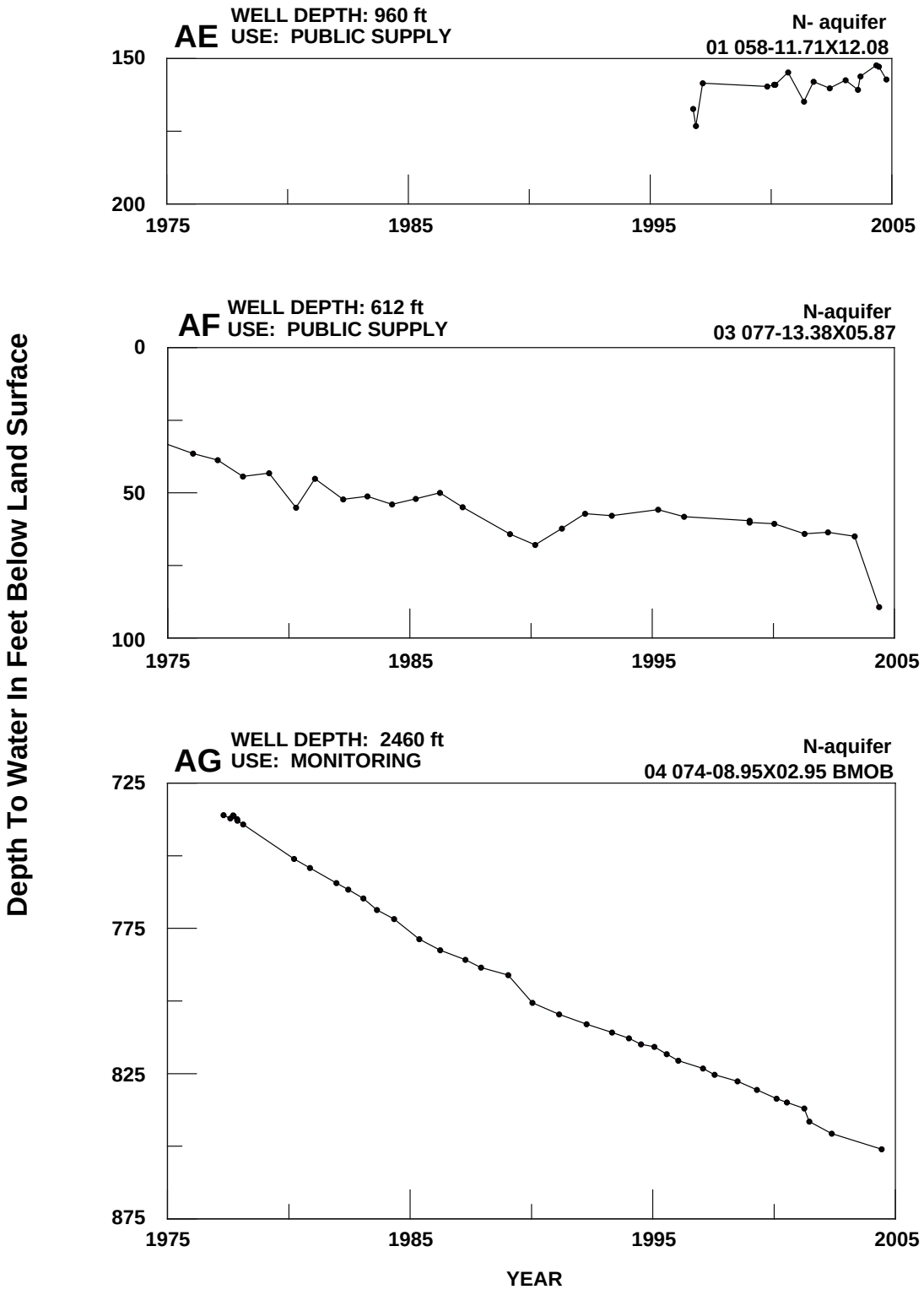


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

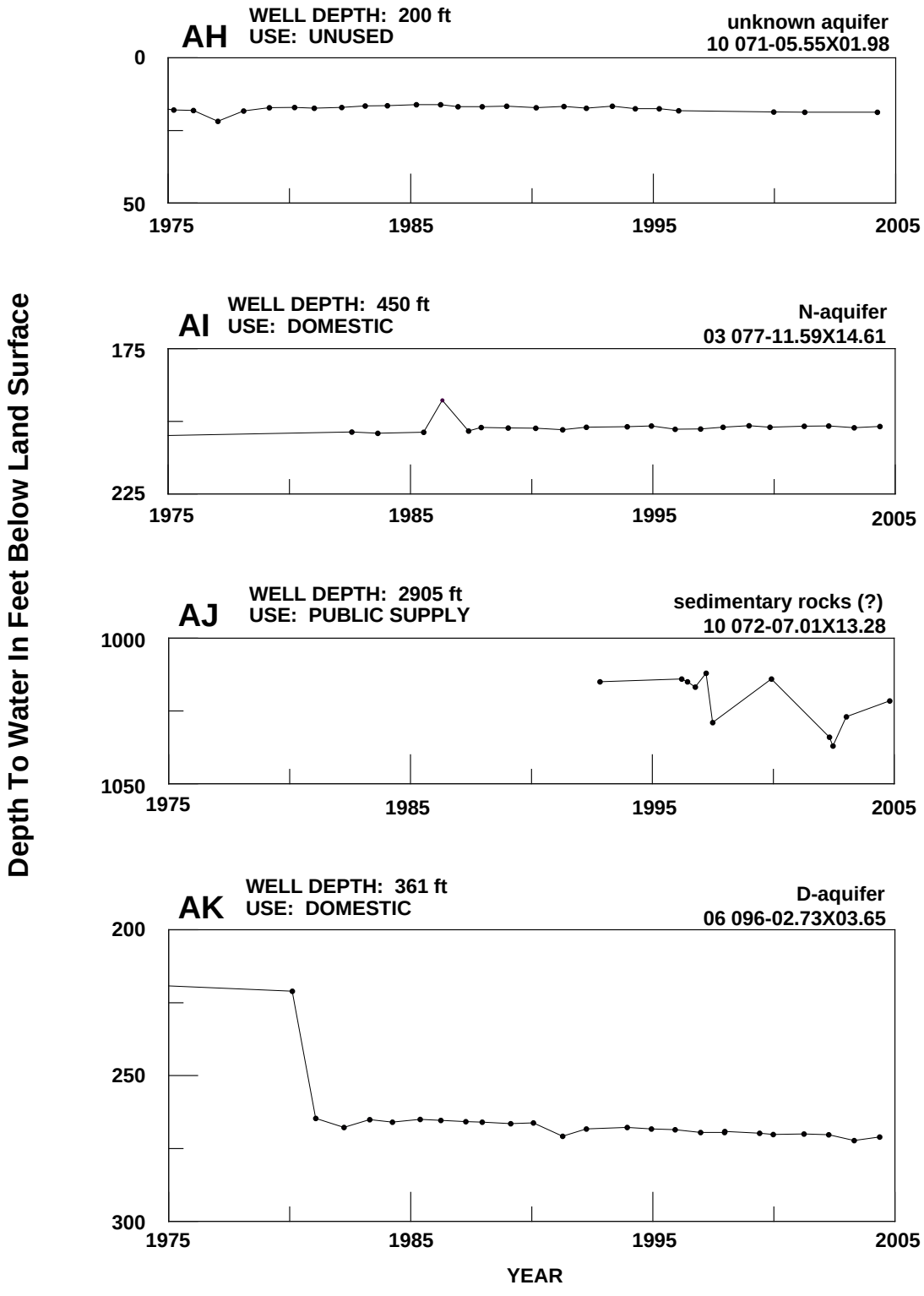


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

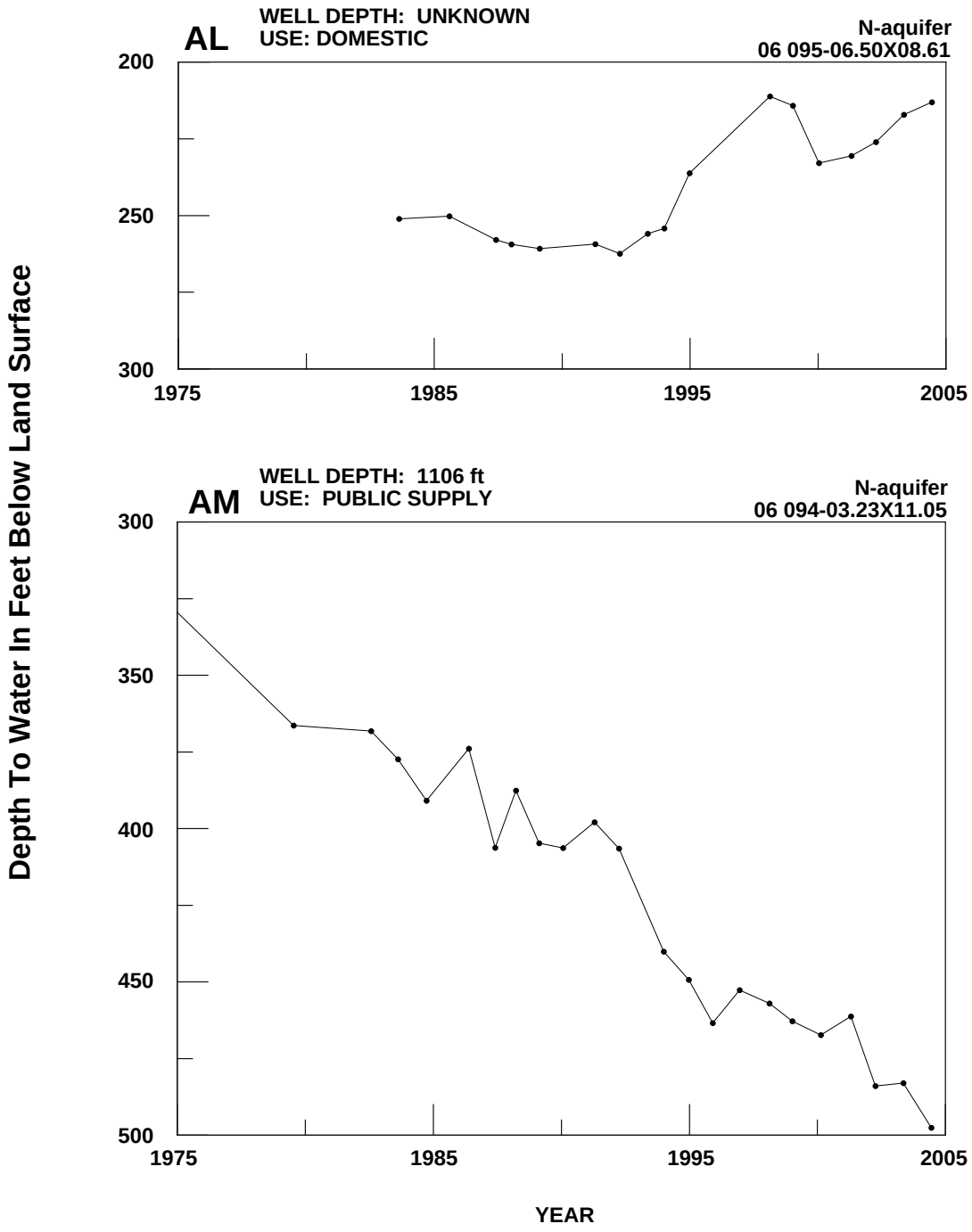


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

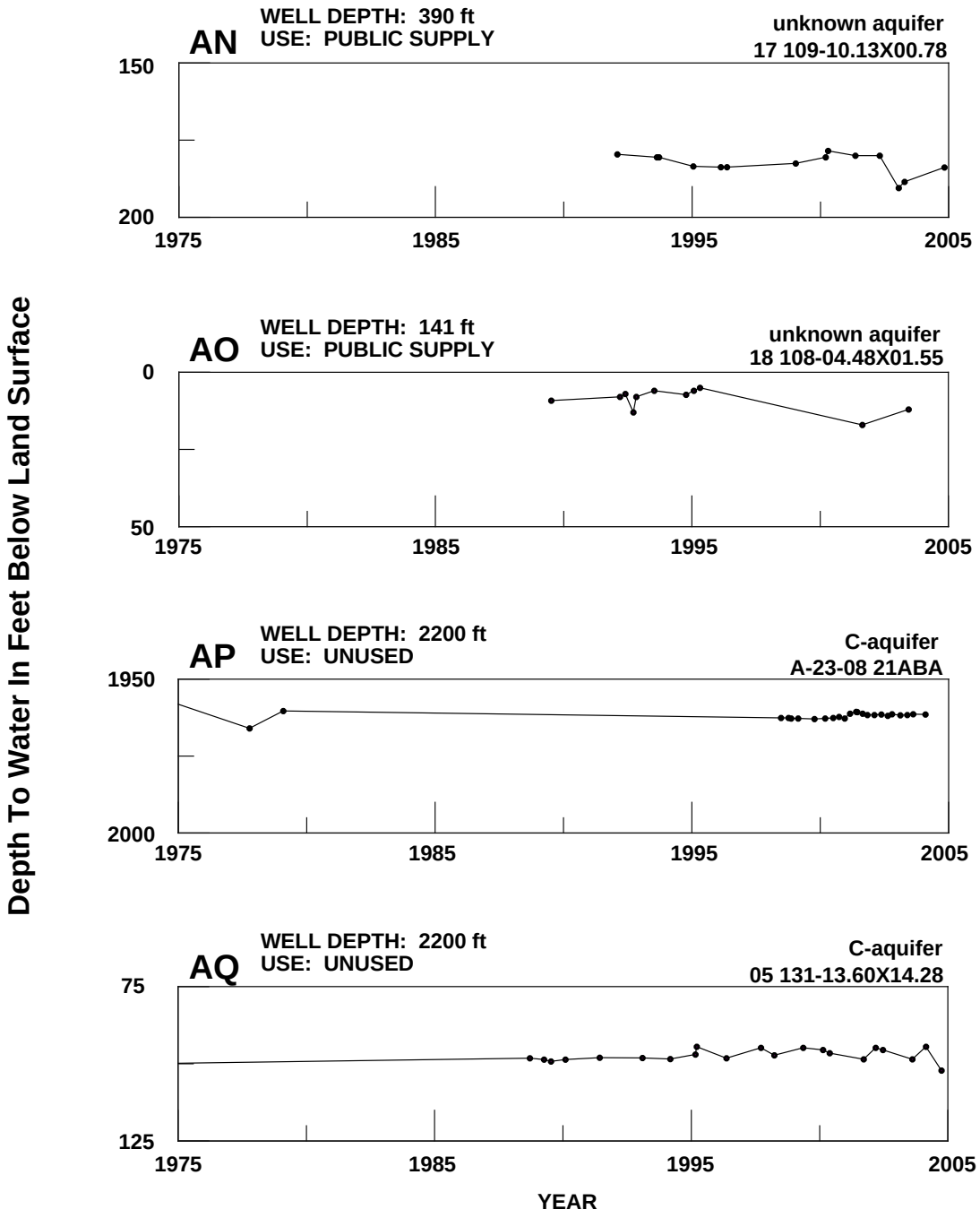


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

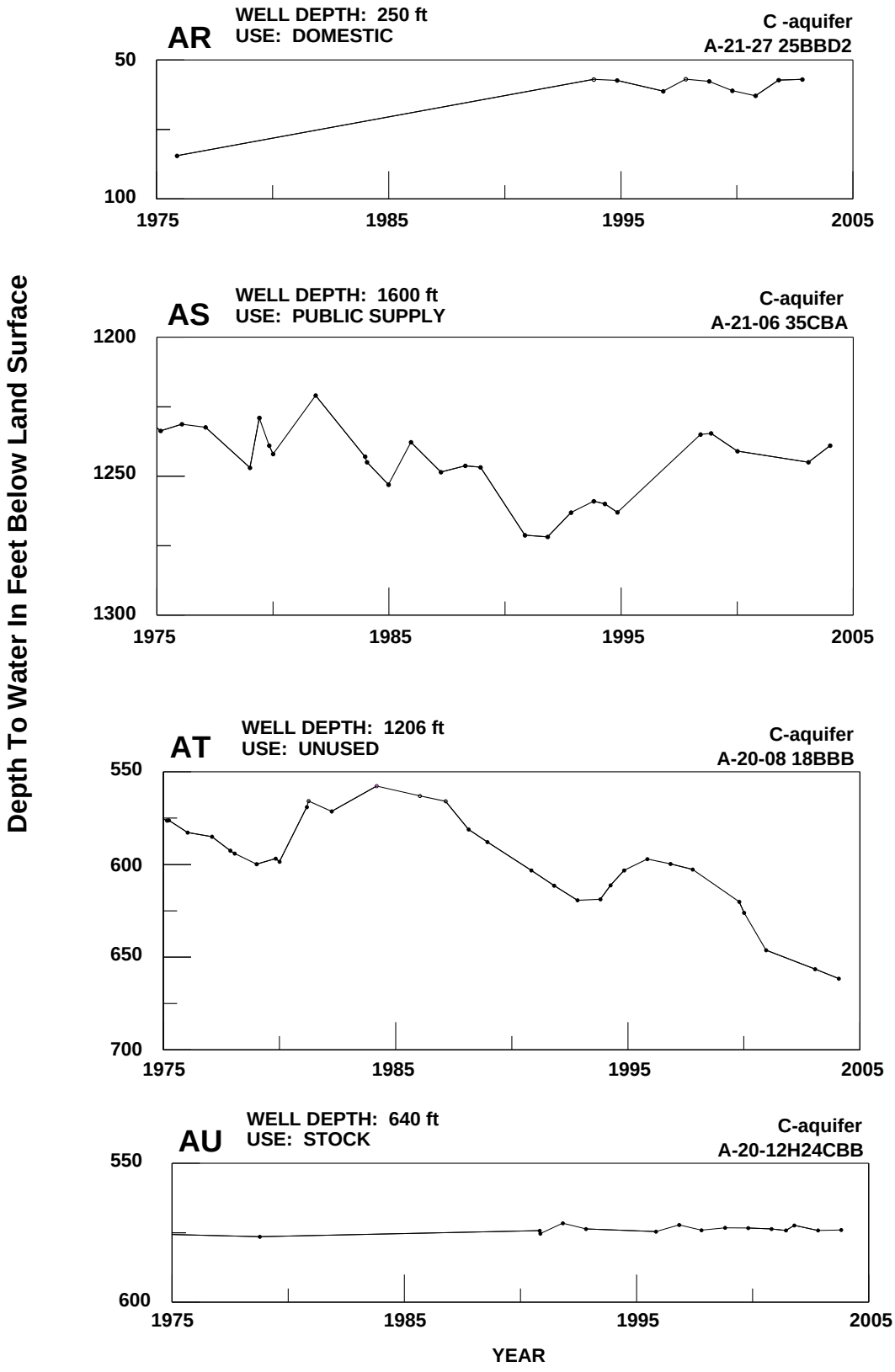


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

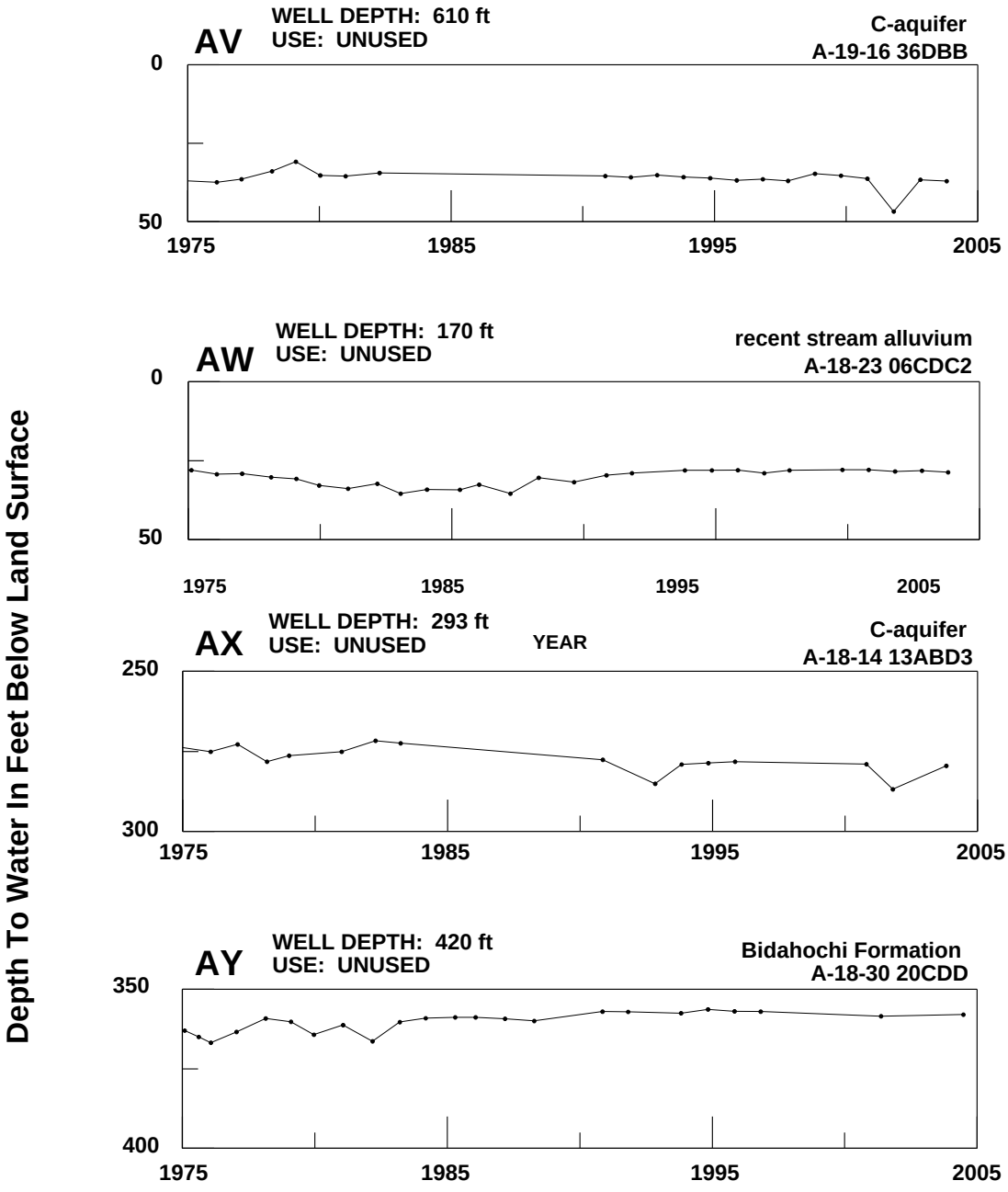


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

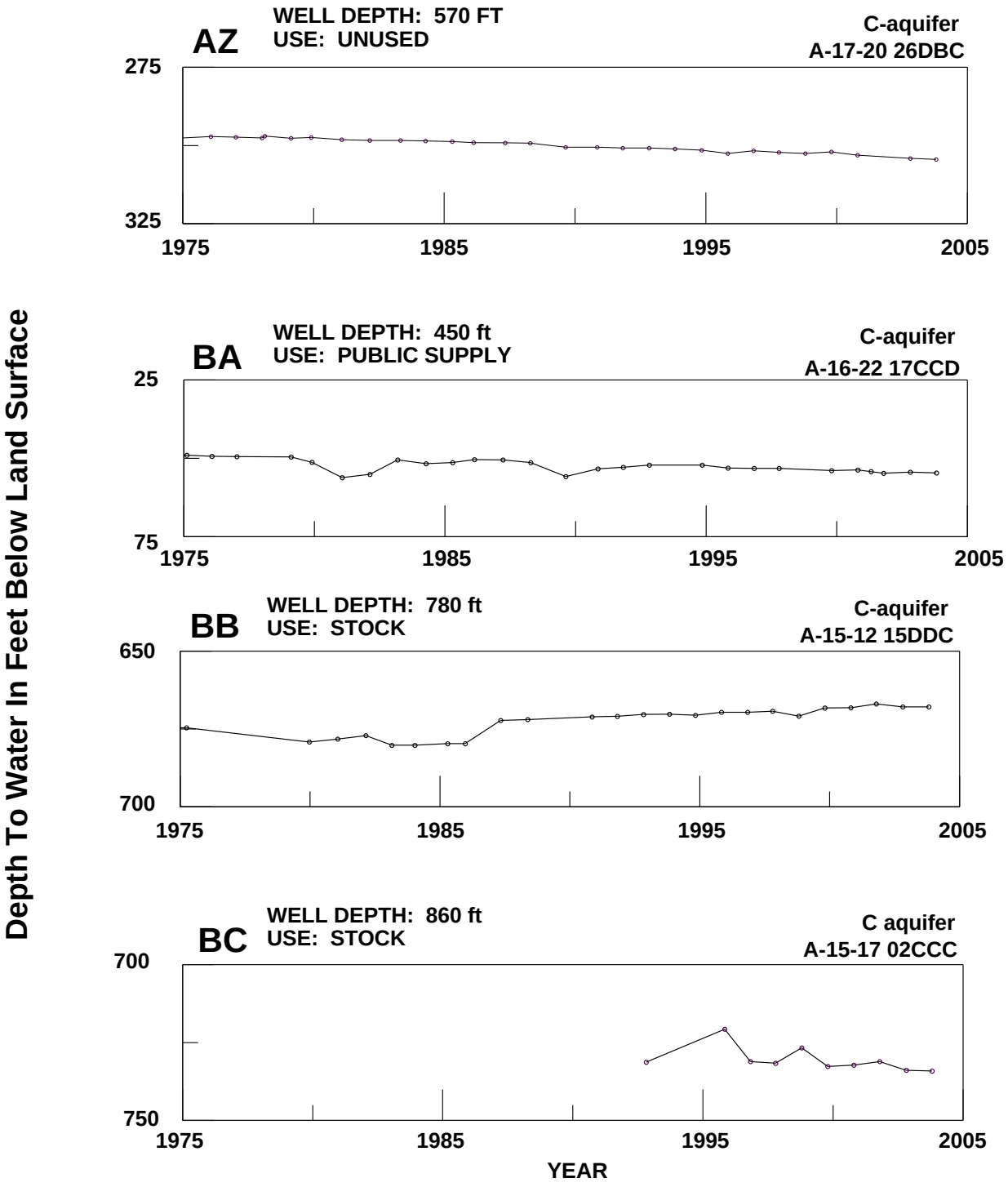


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

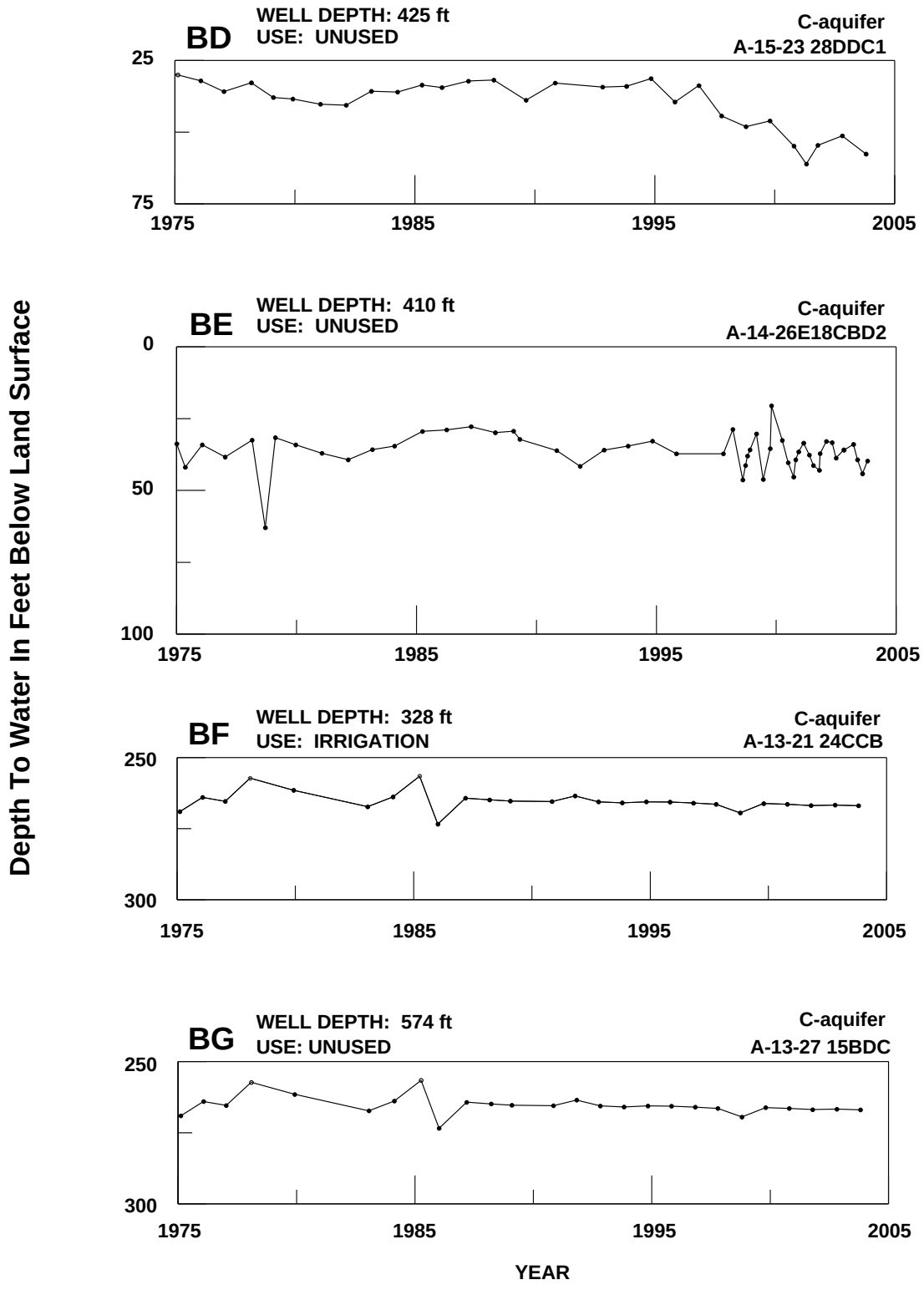


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells

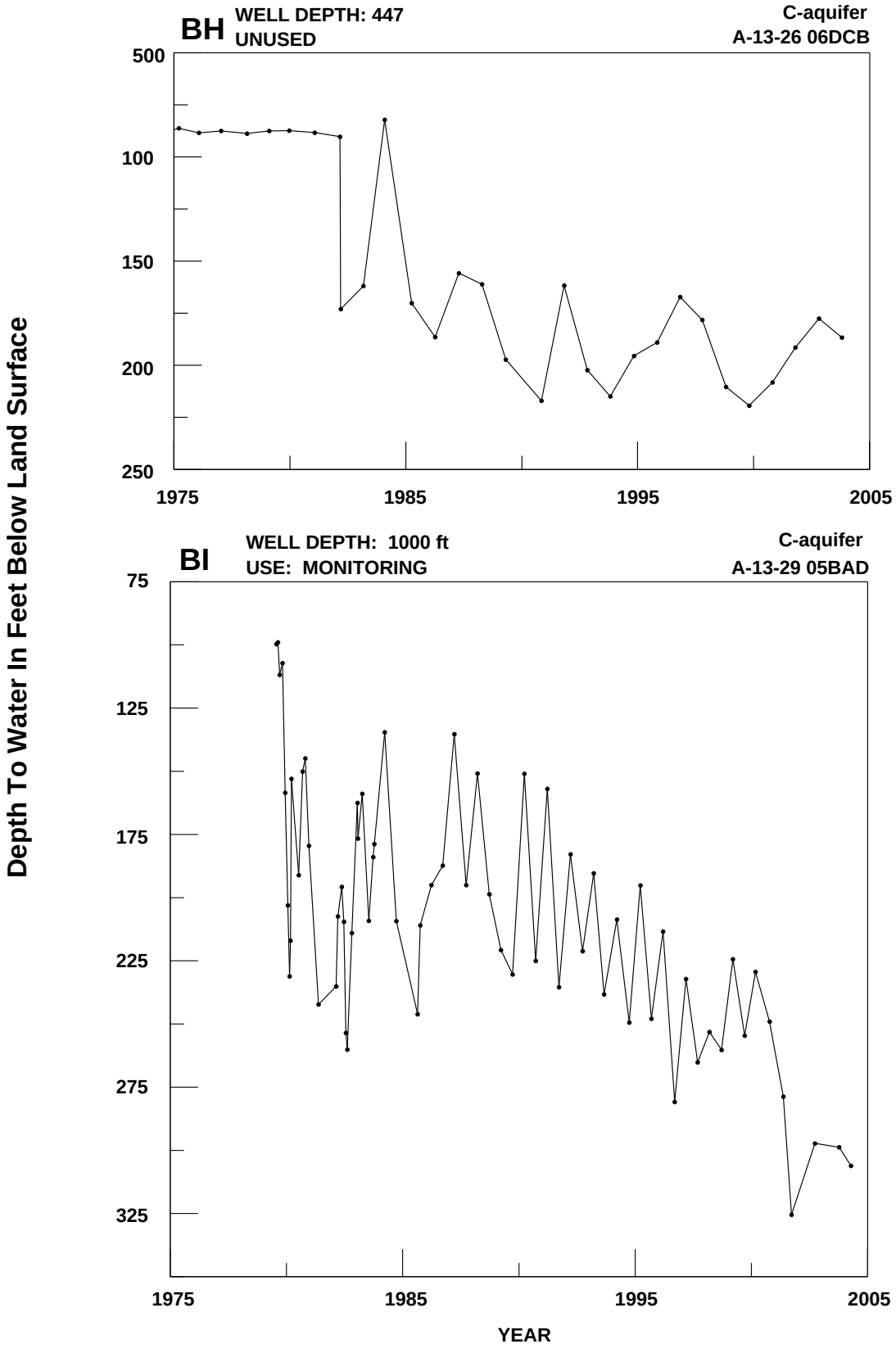


Figure 2.1-8 (Cont)
Little Colorado River Basin
Hydrographs Showing Depth to Water in Selected Wells

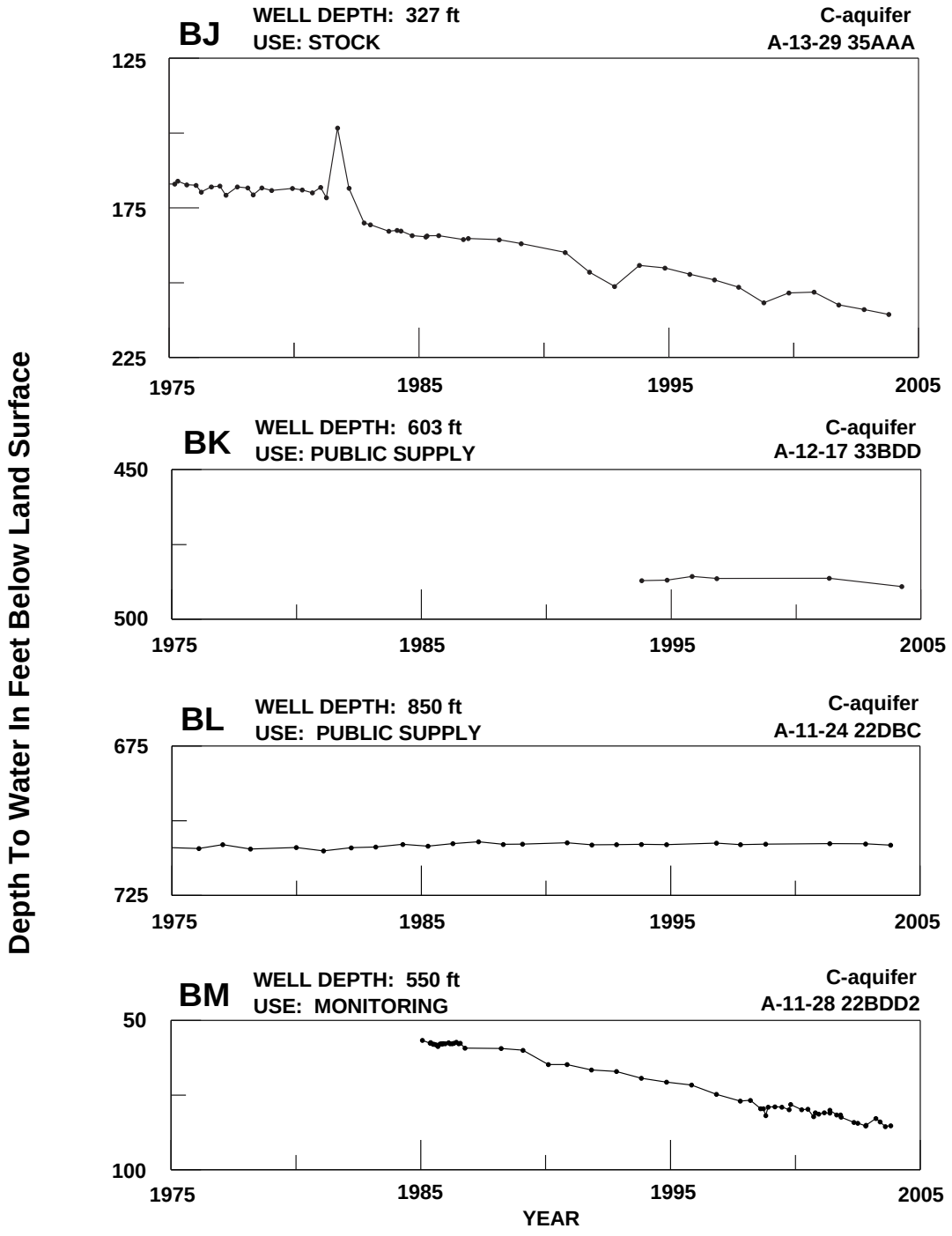
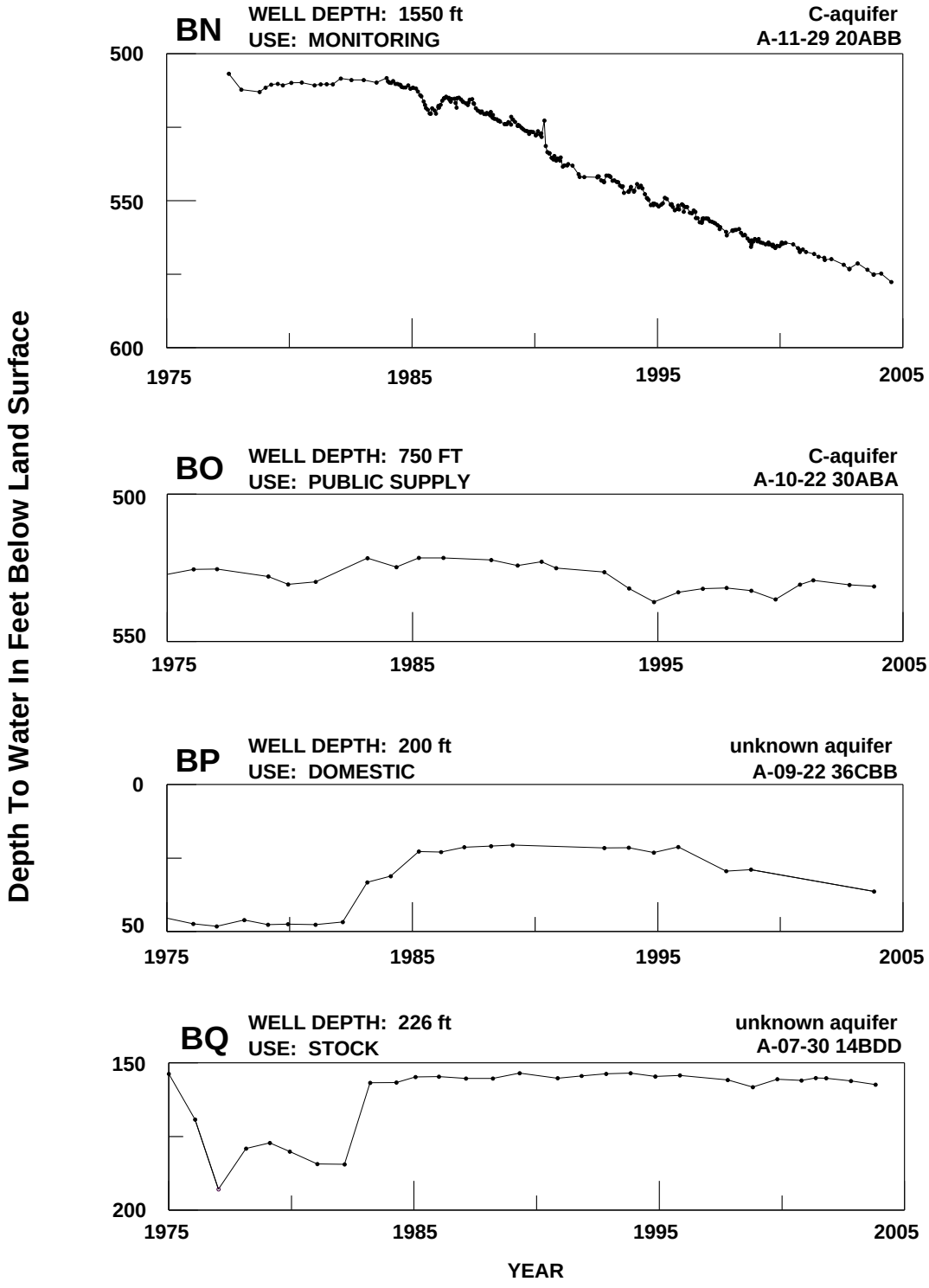


Figure 2.1-8 (Cont)
Little Colorado River Plateau Basin
Hydrographs Showing Depth to Water in Selected Wells



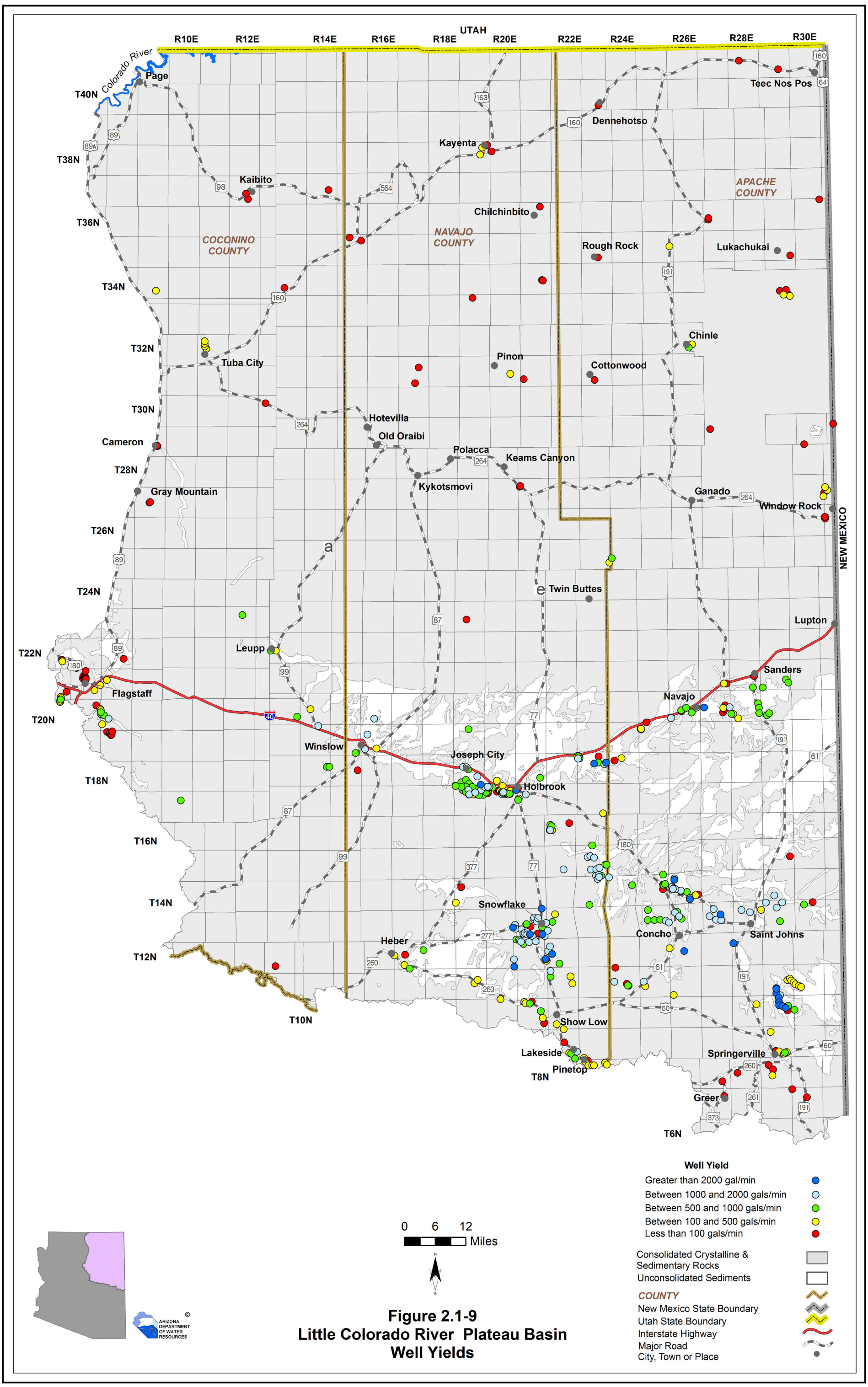


Figure 2.1-9
Little Colorado River Plateau Basin
Well Yields

2.1.7 Water Quality of the Little Colorado River Plateau Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeding drinking water standard(s), including location and parameter(s) are shown in Table 2.1-7A. Impaired lakes and streams with site type, name, length of impaired stream reach, area of impaired lake, designated use standard and parameter(s) exceeded is shown in Table 2.1-7B. Figure 2.1-10 shows the location of water quality occurrences keyed to Table 2.1-7. A description of water quality data sources and methods is found in Volume 1, Appendix A. All community water systems are regulated under the Safe Drinking Water Act and treat water supplies to meet drinking water standards. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mine Sites

- Refer to Table 2.1-7A
- 237 wells, springs and mine sites have parameter concentrations that have equaled or exceeded drinking water standards.
- North of Highway 264, the parameters most frequently exceeded in the sites measured were thallium and radionuclides in both wells and springs.
- Between Highway 264 and Interstate 40, the parameter most frequently exceeded in the sites measured was arsenic. There is a notable arsenic cluster in the vicinity of the Hopi communities of Polacca, Kykotsmovi and Keams Canyon.
- South of Interstate 40 the parameters most frequently exceeded in the sites measured were arsenic and cadmium.
- For the entire basin, the most frequently exceeded constituents measured, in order of greatest occurrence were arsenic, radionuclides, thallium, lead and TDS.

Lakes and Streams

- Refer to Table 2.1-7B
- Water quality standards were equaled or exceeded in eight lakes; mercury was the most common contaminant.
- Water quality standards were equaled or exceed in two reaches of Nutrioso Creek and six reaches of the Little Colorado River; turbidity was the most common contaminant.
- At this time, 12 of the 16 sites are part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) Program. These include sites b, c, f,and h-p in Table 2.1-7B.
- Final TMDL reports have been completed for the Little Colorado River (Nutrioso Creek to Camero Wash), Little Colorado River (Water Canyon Creek to Nutrioso Creek), Rainbow Lake and Nutrioso Creek from its headwaters to the Little Colorado River where Clean Water Act 319 projects are ongoing.

Effluent Dependent Reaches

- See Figure 2.1-10
- There is one effluent dependent reach, the Rio de Flag, at Flagstaff. Effluent is discharged to the Rio de Flag from the Rio de Flag and Wildcat Hill wastewater treatment plants.

Table 2.1-7 Water Quality Exceedences in the Little Colorado River Plateau Basin

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	41 North	19 East	21	As, Rad
2	Spring	41 North	23 East	28	Pb
3	Well	41 North	29 East	14	Tl
4	Well	41 North	30 East	34	Tl
5	Well	40 North	27 East	14	Rad
6	Well	40 North	27 East	21	As
7	Well	40 North	27 East	26	As
8	Well	40 North	28 East	1	As
9	Spring	40 North	28 East	13	Rad
10	Well	40 North	28 East	18	Rad
11	Well	40 North	28 East	29	Rad
12	Spring	39 North	21 East	35	Rad, Se, Tl
13	Spring	39 North	39 East	31	Sb
14	Spring	39 North	39 East	31	Tl
15	Spring	38 North	7 East	28	Rad, Tl
16	Well	38 North	20 East	23	Tl
17	Spring	38 North	28 East	2	Rad
18	Spring	38 North	29 East	33	Tl
19	Spring	37 North	29 East	2	Tl
20	Well	37 North	29 East	26	Sb, Rad
21	Well	37 North	29 East	27	Rad, Tl
22	Well	37 North	31 East	19	Sb, Tl
23	Well	36 North	22 East	9	Pb
24	Well	36 North	23 East	18	As, Tl
25	Spring	36 North	23 East	33	Rad, Se
26	Spring	36 North	28 East	1	Tl
27	Well	36 North	29 East	4	Rad, Tl
28	Spring	36 North	29 East	14	Pb
29	Spring	36 North	29 East	15	Tl
30	Mine	36 North	29 East	17	As, Rad, Se, Tl
31	Spring	36 North	29 East	18	Tl
32	Mine	36 North	29 East	21	As, Rad, Se, Tl
33	Mine	36 North	29 East	33	Rad
34	Spring	36 North	30 East	6	Tl
35	Spring	36 North	31 East	18	Rad
36	Spring	35 North	22 East	17	Tl
37	Spring	35 North	23 East	7	Rad, Tl
38	Spring	35 North	23 East	8	Rad, Tl
39	Spring	35 North	23 East	18	Rad
40	Well	35 North	23 East	27	As
41	Well	35 North	23 East	27	As
42	Well	35 North	23 East	27	As
43	Mine	35 North	30 East	2	Rad
44	Well	34 North	9 East	31	Tl
45	Well	34 North	21 East	22	As, Tl
46	Well	34 North	21 East	23	As
47	Well	34 North	22 East	8	Tl
48	Well	34 North	23 East	20	Tl
49	Well	33 North	11 East	27	Rad, Tl
50	Spring	33 North	23 East	2	Rad
51	Well	33 North	23 East	32	Tl
52	Spring	33 North	23 East	32	Rad
53	Spring	33 North	24 East	7	Se
54	Spring	32 North	9 East	2	As, Tl
56	Spring	32 North	11 East	33	Tl
55	Well	32 North	11 East	29	Tl
57	Spring	32 North	12 East	14	Tl
58	Well	32 North	12 East	21	As, Pb, Rad
59	Well	32 North	20 East	6	Tl
60	Well	32 North	23 East	21	Rad
61	Spring	32 North	23 East	33	Tl
62	Well	31 North	23 East	21	Rad
63	Spring	31 North	24 East	5	Tl
64	Spring	30 North	10 East	16	Rad
65	Spring	30 North	19 East	25	Pb
66	Mine	29 North	9 East	11	As, Ba, Be, Cd, Pb, Rad
67	Well	29 North	9 East	15	NO3

Table 2.1-7 Water Quality Exceedences in the Little Colorado River Plateau Basin (Cont)

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
68	Well	29 North	9 East	22	TDS
69	Mine	29 North	9 East	25	As, Ba, Pb, Rad
70	Well	29 North	9 East	33	TDS
71	Well	29 North	12 East	7	Tl
72	Spring	29 North	15 East	12	NO3
73	Spring	29 North	18 East	26	Se
74	Well	29 North	19 East	33	Fl
75	Well	29 North	21 East	5	AS, TDS
76	Well	28 North	10 East	5	Pb
77	Well	28 North	17 East	9	As
78	Well	28 North	17 East	9	As
79	Well	28 North	17 East	26	As
80	Well	28 North	17 East	26	As
81	Well	28 North	17 East	26	As
82	Well	28 North	17 East	27	As
83	Well	28 North	17 East	27	As
84	Well	28 North	17 East	28	As
85	Well	28 North	18 East	14	As
86	Well	28 North	18 East	14	As
87	Well	28 North	18 East	22	As, Pb
88	Well	28 North	19 East	9	As
89	Well	28 North	19 East	9	As
90	Well	28 North	19 East	21	As
91	Well	28 North	19 East	21	As
92	Well	27 North	9 East	11	TDS
93	Well	27 North	10 East	6	Pb
94	Well	27 North	11 East	19	As, Rad
95	Spring	27 North	11 East	26	As, Rad, Tl
96	Spring	27 North	12 East	27	As, Rad
97	Well	27 North	15 East	16	NO3
98	Spring	26 North	10 East	2	Tl
99	Well	26 North	10 East	9	TDS
100	Well	26 North	10 East	16	TDS
101	Spring	26 North	11 East	14	As, Rad, Tl
102	Spring	26 North	17 East	7	TDS
103	Spring	26 North	22 East	31	As
104	Well	26 North	22 East	35	As
105	Well	26 North	23 East	35	As, Rad
106	Well	25 North	10 East	30	Pb
107	Well	25 North	20 East	22	As
108	Well	25 North	20 East	34	As
109	Well	25 North	21 East	22	Ba, Tl
110	Spring	25 North	22 East	6	As Tl
111	Well	25 North	22 East	17	Tl
112	Well	25 North	22 East	35	As
113	Well	25 North	22 East	35	Ba
114	Well	25 North	23 East	19	As, Rad
115	Well	24 North	18 East	11	Ba
116	Spring	24 North	23 East	1	As, Rad, Se, Tl
117	Well	24 North	24 East	24	As
118	Spring	23 North	17 East	24	As
119	Well	23 North	19 East	21	Ba
120	Well	23 North	21 East	14	Ba
121	Spring	23 North	22 East	8	As
122	Spring	23 North	23 East	4	As, Rad
123	Well	22 North	6 East	26	NO3
124	Well	22 North	6 East	26	NO3
125	Well	22 North	8 East	27	Ba
126	Spring	22 North	18 East	10	As
127	Spring	22 North	19 East	9	As
128	Spring	22 North	21 East	4	Tl
129	Well	22 North	30 East	22	Cd, Rad
130	Well	22 North	30 East	27	Cd
131	Well	22 North	31 East	5	Rad
132	Well	22 North	31 East	8	Rad
133	Well	22 North	31 East	8	Cd
134	Well	22 North	31 East	8	Pb

Table 2.1-7 Water Quality Exceedences in the Little Colorado River Plateau Basin (Cont)

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
135	Well	22 North	31 East	9	Rad
136	Well	21 North	6 East	23	As
137	Well	21 North	6 East	25	As, Sb
138	Well	21 North	7 East	9	As
139	Well	21 North	7 East	19	As
140	Well	21 North	7 East	20	As
141	Well	21 North	7 East	20	TDS
142	Well	21 North	7 East	25	Pb, NO3
143	Well	21 North	27 East	25	Be
144	Well	21 North	27 East	25	F
145	Well	21 North	27 East	25	As, Cd
146	Well	21 North	27 East	35	Be
147	Well	21 North	28 East	10	As, Cd, Rad
148	Well	21 North	28 East	13	Cd
149	Well	21 North	28 East	20	As
150	Well	21 North	28 East	23	Rad
151	Well	21 North	28 East	24	Cd
152	Well	21 North	28 East	24	As
153	Well	21 North	28 East	28	Cd
154	Well	21 North	28 East	30	Rad
155	Well	21 North	28 East	30	Rad
156	Well	20 North	19 East	15	TDS
157	Well	20 North	25 East	15	F
158	Well	20 North	25 East	28	F
159	Well	20 North	27 East	4	As
160	Spring	20 North	27 East	26	Rad
161	Spring	20 North	27 East	28	As
162	Spring	20 North	28 East	32	As
163	Well	20 North	29 East	20	As
164	Well	19 North	9 East	17	Ba
165	Well	19 North	16 East	20	TDS
166	Well	19 North	16 East	28	TDS
167	Well	19 North	23 East	3	Rad
168	Well	19 North	23 East	19	TDS
169	Well	19 North	25 East	11	Cd, Rad
170	Well	19 North	26 East	32	As
171	Well	19 North	28 East	4	As
172	Well	18 North	24 East	8	Be, F, TDS
173	Well	18 North	24 East	16	As, Rad
174	Well	18 North	24 East	16	As, Rad
175	Well	17 North	19 East	28	Cd, Pb
176	Well	17 North	22 East	17	TDS
177	Well	17 North	26 East	13	F
178	Well	16 North	18 East	9	TDS
179	Well	16 North	22 East	14	F
180	Well	16 North	25 East	6	F
181	Well	16 North	28 East	18	NO3
182	Well	16 North	28 East	35	TDS
183	Well	16 North	30 East	14	TDS
184	Well	14 North	16 East	9	As
185	Well	14 North	25 East	4	As
186	Well	14 North	27 East	1	TDS
187	Well	14 North	27 East	15	TDS
188	Well	14 North	30 East	7	F
189	Well	14 North	30 East	21	F
190	Well	13 North	21 East	26	NO3
191	Well	13 North	21 East	26	NO3
192	Well	13 North	27 East	31	NO3
193	Well	13 North	28 East	20	F
194	Well	13 North	28 East	28	TDS
195	Well	13 North	28 East	29	F
196	Well	12 North	16 East	15	Pb
197	Well	12 North	17 East	21	Cd, Se
198	Well	12 North	17 East	30	Cd, Se
199	Well	12 North	17 East	32	As, Cd, Se
200	Well	12 North	17 East	33	Cd, Se
201	Well	12 North	18 East	28	As

Table 2.1-7 Water Quality Exceedences in the Little Colorado River Plateau Basin (Cont)

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
202	Well	12 North	26 East	13	Be
203	Spring	12 North	28 East	17	As
204	Well	12 North	28 East	17	F
205	Well	12 North	28 East	18	F
206	Well	11 North	14 East	11	As
207	Well	11 North	19 East	18	Cd
208	Well	11 North	20 East	29	As, Cd
209	Well	11 North	21 East	34	As, Cd
210	Well	11 North	22 East	23	As
211	Well	11 North	28 East	9	As
212	Well	11 North	29 East	7	As
213	Well	11 North	29 East	28	As
214	Well	10 North	20 East	13	Be, Cd
215	Well	10 North	20 East	20	Cd, Pb, Se
216	Well	10 North	21 East	3	As
217	Well	10 North	21 East	3	As, Cd
218	Well	10 North	21 East	13	Pb
219	Well	10 North	22 East	14	As
220	Well	10 North	22 East	32	Cd
221	Well[3]	10 North	23 East	22	Cd
222	Well	10 North	25 East	22	Cd
223	Well	10 North	25 East	22	Cd
224	Well	9 North	22 East	25	Cd
225	Well	9 North	22 East	26	Pb, Cd
226	Well	9 North	23 East	22	Cd
227	Well	8 North	23 East	10	Cu, Pb
228	Well	8 North	29 East	9	Pb
233	Well	7 North	26 East	14	NO3
234	Well	UNSRV	UNSRV	UNSRV	Pb, Tl
235	Spring	UNSRV	UNSRV	UNSRV	As, Pb, Rad
236	Spring	UNSRV	UNSRV	UNSRV	Tl
237	Well	UNSRV	UNSRV	UNSRV	Tl

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard[4]	Parameter(s) Exceeding Use Standard[2]
a	Lake	Bear Canyon	NA	55	A&W, AgI, AgL, FBC	pH
b	River	Little Colorado River (Nutrioso Creek to Carnero Wash)	12	NA	A&W	Turbidity/Suspended sediment concentration
c	River	Little Colorado River (Porter Tank to McDonalds Wash)	17	NA	A&W	Cu, Ag, Sediment
d	River	Little Colorado River (Silver Creek to Carr Wash)	6	NA	A&W	E. coli, sediment
e	River	Little Colorado River (unnamed tributary to Lyman Lake)	3	NA	A&W	Turbidity/Suspended sediment concentration
f	River	Little Colorado River (Water Canyon Creek to Nutrioso Creek)	4	NA	A&W	Turbidity/Suspended sediment concentration

Table 2.1-7 Water Quality Exceedences in the Little Colorado River Plateau Basin (Cont)

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]	
g	River	Little Colorado River (West Fork to Water Canyon Creek)	20	NA	A&W	Turbidity/Suspended sediment concentration
h	Lake	Long Lake	NA	323	FC	Hg
i	Lake	Lower Lake Mary	NA	865	FC	Hg
j	Lake	Lyman	NA	1,308	FC	Hg
k	Stream	Nutrioso Creek (headwaters to Picnic Creek)	27	NA	A&W	Turbidity
l	Stream	Nutrioso Creek (Picnic Creek to Little Colorado River)	4	NA	A&W	Turbidity
m	Lake	Rainbow	NA	111	A&W, AgI, AgL, FBC	DO, NO3, P, pH
n	Lake	Soldiers	NA	28	FC	Hg
o	Lake	Soldiers Annex	NA	122	FC	Hg
p	Lake	Upper Lake Mary	NA	760	FC	Hg

Source: ADEQ 2005f

Notes:
NA = Not applicable
UNSRV = Unsurveyed
[1]Most water quality samples collected between 1975 and 2003. One sample was collected in 1951.
[2] Sb = Antimony
As = Arsenic
Ba = Barium
Be = Beryllium
Cd = Cadmium
Cu = Copper
DO = Dissolved oxygen
F= Fluoride
Pb = Lead
Hg = Mercury
NO3 = Nitrate
P = Phosphorous
Se = Selenium
Ag = Silver
TDS = Total Dissolved Solids
Tl = Thallium
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
[3] Conflicting locational information
[4] A&W = Aquatic and Wildlife
AgI = Agricultural Irrigation
AgL = Agricultural Livestock Watering
FBC = Full Body Contact
FC = Fish Consumption

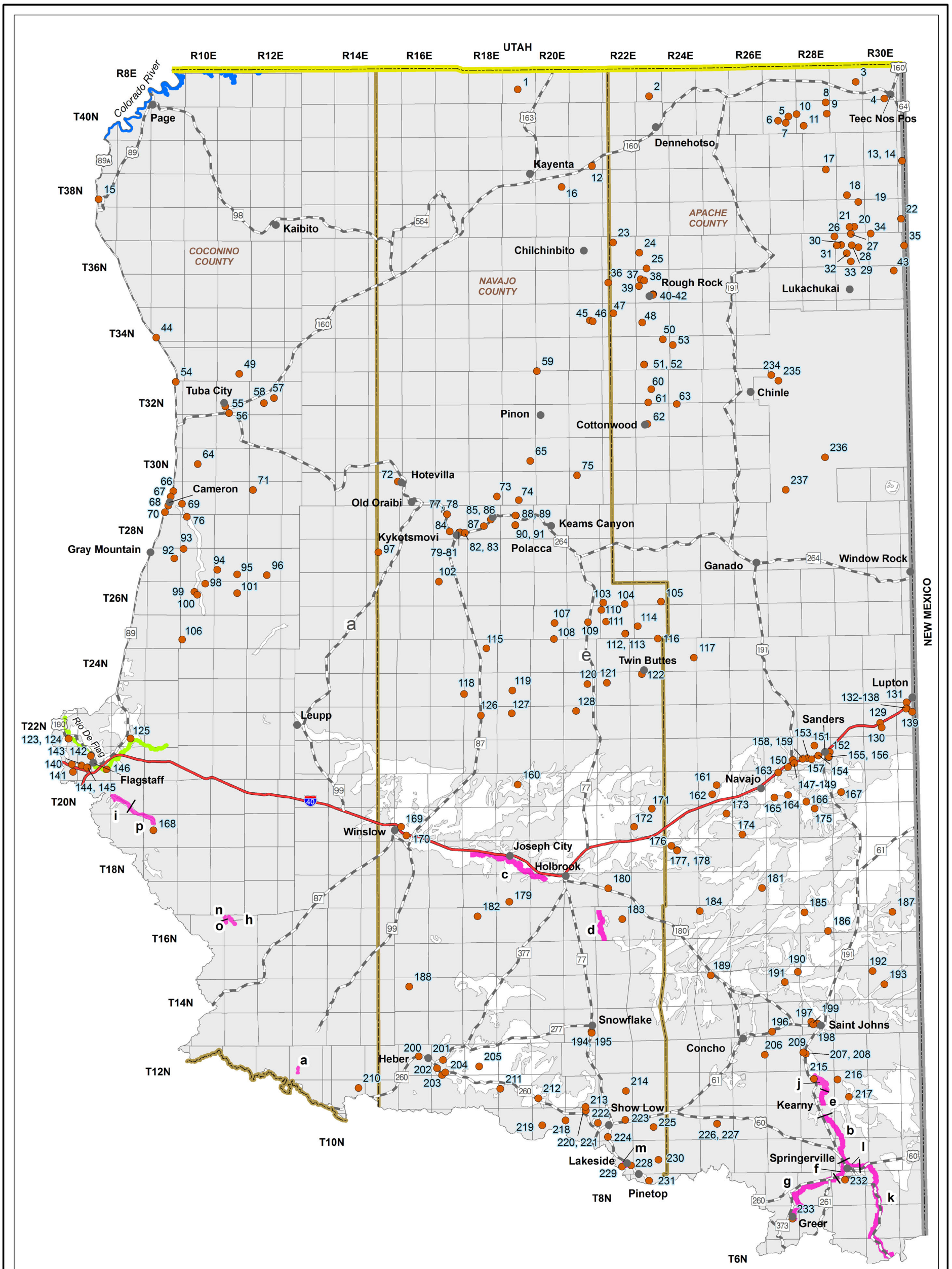


Figure 2.1-10
Little Colorado River Plateau Basin
Water Quality Conditions

2.1.8 Cultural Water Demand in the Little Colorado River Plateau Basin

Cultural water demand data including population, number of wells, and the average well pumpage and surface water diversions by the municipal, industrial and agricultural sectors are shown in Table 2.1-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 2.1-9. Figure 2.1-11 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demand is found in Section 2.0.7.

Cultural Water Demand

- Refer to Table 2.1-8 and Figure 2.1-11.
- Population increased by an average of 3,700 people per year between 1980 and 2000.
- Total groundwater pumping is increasing with an average of 104,800 acre-feet pumped per year in 2001-2005.
- Total surface water diversions are estimated to be comparable to historic diversion volumes with 50,800 acre-feet diverted per year in 2001-2005. Municipal surface water diversions, however, appear to be declining with 4,100 acre-feet of surface water diverted per year between 2001-2005.
- Most high intensity municipal and industrial (M&I) use is found in the population centers of Flagstaff, Page, Show Low/Pinetop-Lakeside, Taylor/Snowflake and Winslow/Holbrook.
- Industrial use has remained relatively constant with an average of 83,100 acre-feet of surface water and groundwater used per year during 2001-2005.
- Approximately two-thirds of the industrial water supply is groundwater.
- Location of power plants and mines are shown on Figure 2.1-11 including the extent of the large Black Mesa and Kayenta coal mines south of Kayenta. Power plants/electrical generating stations include Cholla near Joseph City, Coronado near Saint Johns, Navajo at Page and the Springerville power plant located northeast of Springerville.
- Agricultural use is estimated to have declined since 1991, for agricultural acreage in 2008 see Table 2.0-12.

Effluent Generation

- Refer to Table 2.1-9.
- There are 60 known wastewater treatment facilities in the basin.
- The population served appears to be overestimated for the basin as a whole. Multiple databases were used to compile the effluent generation information and may contain flawed population estimates and outdated information.
- More than 36,000 acre-feet of effluent per year are generated in the basin. Almost a third of this volume is generated by a single facility, the Catalyst paper mill.
- Eight facilities discharge waste water for irrigation.
- Effluent is used to irrigate five golf courses. More than 20 schools, parks, and other locations use effluent in Flagstaff.
- Thirteen facilities discharge effluent to unlined impoundments that recharge the aquifer and three discharge to created wetlands (wildlife areas).

Table 2.1-8 Cultural Demand in the Little Colorado River Plateau Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971		2,581[2]	947[2]	60,000			85,000			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				77,000			85,000			
1977										
1978										
1979										
1980	175,451									
1981	178,851	905	190	90,000			85,000			
1982	182,252									
1983	185,652									
1984	189,052									
1985	192,452									
1986	195,853	717	119	93,000			85,000			
1987	199,253									
1988	202,653									
1989	206,053									
1990	209,454									
1991	213,463	819	117	29,600	52,400	36,500	7,100	30,500	15,600	ADWR (2008b) ADWR (2008c) ADWR (2008d) USGS (2007)
1992	217,472									
1993	221,481									
1994	225,490									
1995	229,649									
1996	233,508	1,428	128	34,700	53,800	22,300	5,500	31,900	16,300	
1997	237,518									
1998	241,527									
1999	245,536									
2000	249,545									
2001	254,513	1,542	155	37,300	54,400	13,100	4,100	28,700	18,000	
2002	259,481									
2003	264,450									
2004	269,418									
2005	274,386									
2010	299,227									
2020	343,049									
2030	378,392									
	WELL TOTALS:	**7,990**	**1,657**							

[1] Does not include evaporation losses from stockponds and reservoirs or effluent.

[2] Includes all wells through 1980.

Table 2.1-9 Effluent Generation in the Little Colorado River Plateau Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method								Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Wildlife Area	Golf Course/ Turf/ Landscape	Discharge to Another Facility	Industrial Use	Infiltration Basins			
Catalyst Paper	Private	Industrial	NA	11,862			X						Primary	NA	2005
Bacobi WWTP	Hopi Tribe	Bacobi	550	62								X	NA	70	2000
Bison Ranch WWTP	Private	Overgaard	NA												
Black Mesa Ranger District	Apache Sitgreaves National Forest	Forest Service Facilities	NA												
Black Mesa Sewer System	Navajo Nation	Black Mesa	305	34								X	Secondary	100	2000
Chilchinbito Sewer System	Navajo Nation	Chilchinbeto	150	17		X							Secondary	600	1999
Chinle WWTP	Navajo Nation	Chinle	7,775	493		X							Secondary	750	1998
Cottonwood Sewer System	Navajo Nation	Cottonwood	1,000	112		X							Secondary	645	2000
Dennehotso	Navajo Nation	Dennehotso	1,000	112	X								Secondary	1,115	2000
Dilkon WWTF	Navajo Nation	Dilkon	1,408	134	X								Secondary	850	2000
Eager WWTP	Town of Eagar	Eagar	4,500	269		X	X						Adv. Trt.II	1,400	2001
Flagstaff Ranch Development WWTP	Private	Flagstaff	NA						Flagstaff Ranch				NA		
Fort Valley Meadow Subdivision	Private	Flagstaff	NA												
Ganado Burnwater Phase IX	Navajo Nation	Ganado	3,000	336								X	Secondary	500	1998
Ganado WWTP	Navajo Nation	Ganado	851	157								X	Secondary	51	1996
Ganado Wood Springs II	Navajo Nation	Ganado	NA	45								X	NA		2000
Glen Canyon NRA WWTF	National Park Service	Recreation Area	NA												
Greenhaven WWTP	Private	Page	226	13		X							NA		2003
Greer WWTP	Little Colorado SD	Greer	600	56								X	Secondary	300	2000
Hon-Dah Resort WWTP	White Mountain Apache Tribe	Resort	NA												
Houck Burnwater Phase I	Navajo Nation	Houck	300	34								X	Secondary	300	2001
Inscription House Septics	Navajo Nation	Inscription House	1,000	112		X							Secondary	250	2000
Joseph City WWTF	Town of Joseph City	Joseph City	1,300	314		X							Secondary	60	2000
Kayenta WWTP	Navajo Nation	Kayenta	3,270	627	Laguna & Chinle Washes								Secondary	750	2000
Le Chee Sewer System	Navajo Nation	Le Chee	150	17		X							Secondary	165	2000
Leupp WWTF	Navajo Nation	Leupp	400	45		X							Secondary	NA	1999
Linden Trails WWTP	NA	Show Low	NA												
Livco Sewer Co.	Private	Concho	NA	3		X							NA		2003
Lukachukai	Navajo Nation	Lukachukai	200	22		X							Secondary	1,540	2000
Many Farms	Navajo Nation	Many Farms	685	34	X								Secondary	620	2000
Moenkopi WWTF	Hopi Tribe	Moenkopi	1,385	NA		X							NA		
Navajo Govt. Complex	Navajo County	Holbrook	700	45		X							Secondary	NA	2004
Nazali WWTF	Navajo Nation	Ganado	1,493	157		X							Secondary	NA	2000
Oraibi	Hopi Tribe	Oraibi	500	56		X							Secondary	NA	2000

Table 2.1-9 Effluent Generation in the Little Colorado River Plateau Basin (Cont)

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method								Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Wildlife Area	Golf Course/ Turf/ Landscape	Discharge to Another Facility	Industrial Use	Infiltration Basins			
Page WWTF	City of Page	Page	7,500	1,120					Lake Powell	X			Adv. Trt. I	NA	2000
Painted Mesa WWTF	City of Holbrook	Holbrook	6,000	728		X	X		Hidden Cove				Adv. Trt.I	NA	2004
Pinetop Lakeside WWTF	Pinetop-Lakeside SD	Pinetop-Lakeside	20,000	1,792				X				X	Adv. Trt. II	2,200	2004
Pinon WWTP	Navajo Nation	Pinon	2,050	213	NA								Secondary	700	2000
Rio De Flag WWTP	City of Flagstaff	Flagstaff	20,000	2,467	Rio De Flag		X	X	Pine Canyon		X		Adv. Trt. II	NA	2008
Rough Rock WWTF	Navajo Nation	Rough Rock	839	11	NA								Secondary	635	2000
Sanders Unifed School District	NA	Sanders	NA												
Show Low WWTF	City of Show Low	Show Low	8,800	896	X	X		X					Secondary	1,500	2004
Shungopavi WWTF	Hopi Tribe	Shungopavi	400	45		X							Secondary	NA	2000
Sipaulovi WWTF	Hopi Tribe	Sipaulovi	500	56		X							Secondary	200	2000
Snowflake WWTF	Town of Snowflake	Snowflake	3,600	282			X						Adv.Trt.I	600	2000
Springerville WWTF	Town of Springerville	Springerville	1,400	224	NA								Secondary	NA	2000
St. Johns WWTP	Town of St. John's	St.Johns	3,340	446			X						Secondary	159	2000
St. Micheals WWTF	Hopi Tribe	St.Micheals	500	50		X							Secondary	450	1999
Sweetwater Sewer System	Navajo Nation	Sweetwater	200	22								X	Secondary	200	2001
Sunrise Resort	White Mountain Apache Tribe	Resort	7,677	45	NA								Secondary	NA	2000
Taylor WWTF	Town of Taylor	Taylor	2,400	202		X							Secondary	1,200	2004
Tec Nos Pos WWTF	Navajo Nation	Tec Nos Pos	400	22								X	Secondary	1,399	2000
Tolani-Red Lake Sewer System	Navajo Nation	Tolani-Red Lake	100	11								X	Secondary	100	2000
Tsaile WWTF	Navajo Nation	Tsaile	4,861	448								X	Secondary	500	2000
Tuba City WWTF	Navajo Nation	Tuba City	12,443	448	Moenkopi Wash								Secondary	350	2000
Waweep WWTF	National Park Service	Park	NA												
Wide Ruins Sewer System	Navajo Nation	Wide Ruin	245	11								X	Secondary	245	1999
Wildcat Hill WWTP	City of Flagstaff	Flagstaff	64,693	3,939	Rio De Flag		X		Continental & Aspen				Adv. Trt II	NA	2008
Window Rock WWTP	Navajo Nation	Window Rock	10,650	986	Black Creek								Secondary	2,215	2000
Winslow WWTF	City of Winslow	Winslow	9,800	2,016	Ruby Wash		X						Adv. Tr. I	NA	2004
Total			**221,146**	**31,647**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
NRA: National Recreation Area
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
WRP: Water Reclamation Plant
SD: Sanitation District
ID: Improvement District
Adv. Tr. I: Advanced treatment level I
Adv. Tr. II: Advanced treatment level II
[1]SCA Tissues began using reclaimed water for industrial processes in 2004

Demand Centers

- Agriculture
- M&I - High Intensity
- M&I - Low Intensity
- Large Mine
- Small Mine/Quarry
- Power Plant
- Indian Reservation
- Indian Reservation Boundary
- *COUNTY*
- New Mexico State Boundary
- Utah State Boundary
- Interstate Highway
- Major Road
- City, Town or Place

0 6 12 Miles

Figure 2.1-11
Little Colorado River Plateau Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

2.1.9 Water Adequacy Determinations in the Little Colorado River Plateau Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for the inadequacy determination, date of determination and subdivision water provider are shown in Table 2.1-10A and B for water adequacy reports and analysis of adequate water supply. Water adequacy designations are shown in Table 2.1-10C. Figure 2.1-12 shows the general location of subdivisions (to the section level) and designated providers keyed to the table. A description of the Water Adequacy Program is found in Volume 1. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- Three hundred and six determinations of water adequacy for over 18,800 lots have been made through December 2008.
- One hundred and forty-nine determinations of inadequacy have been made, primarily in the vicinity of Flagstaff, Show Low and Pinetop-Lakeside.
- The most common reason for a determination of inadequacy was because the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination.
- There are two analyses of adequate water supply for a total of 1,936 lots.
- There are 13 designated water providers. Six designated water providers have total projected or estimated annual demand of 10,450.22 acre feet. The remaining seven designated water providers do not have a projected or estimated annual demand.
- The number of lots receiving an adequacy determination, by county, are:

County	Number of Subdivision Lots	Number of Lots Determined to be Adequate	Percent Adequate
Apache	5,597	2,731	48
Coconino	4,139	2,330	56
Navajo	9,054	5,042	56

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	A-1 Ranch	Coconino	21 North	6 East	15	33	53-401052	Inadequate	A1,A2	5/7/2004	A-1 Ranch Owners
2	Amity Estates	Apache	8 North	29 East	7	23	53-500268	Adequate		12/2/1976	Town of Eagar
3	Anasazi Trails	Coconino	22 North	8 East	10, 15	17	53-401071	Inadequate	A1,A2	10/14/2003	Doney Park Water Company
4	Apache Trails Unit One - Amended	Apache	10 North	24 East	11	94	53-400112	Inadequate	C	7/30/1999	Cedar Grove WC
5	Arizona Park Estates Unit One	Apache	21 North	28 East	24, 26, 35	19	53-700259	Inadequate	A1	4/4/2007	Dry Lot Subdivsion
6	Arizona Rancheros, Rancho 36	Navajo	18 North	22 East	9	21	53-400335	Inadequate	C	7/28/2000	Sun Valley Utilities
7	Arrowhead Estates	Coconino	21 North	7 East	9	8	53-500298	Inadequate	A2,A3	8/8/1988	Dry Lot Subdivsion
8	Aspen Glen	Coconino	22 North	8 East	27	28	53-300069	Inadequate	A1	12/5/1995	Doney Park Water Company
9	Aspen Meadow Estates and Aspen Meadow Condominiums	Navajo	8 North	23 East	5	214	53-402263	Inadequate	A1	8/21/2006	Pinetop Water Community Facilities District
10	Aspen Meadows Phase 1	Navajo	8 North	23 East	5	14	53-700381	Inadequate	A1	8/13/2007	Pinetop Water Community Facilities District
11	Aspen Shadows	Coconino	21 North	6 East	25	390	53-300242	Adequate		8/11/1997	Flagstaff Ranch Water Company
12	Bar D Ranches	Coconino	21 North	8 East	3	15	53-400979	Inadequate	A1,A2	7/30/2003	Doney Park Water Company
13	Bear Country Estates	Navajo	12 North	17 East	33	22	53-400036	Adequate		3/24/1999	Arizona Water Company - Overgaard
14	Belair Estates	Apache	10 North	24 East	9	8	53-500314	Inadequate	D	3/2/1987	Belair Estates HOA
15	Benny Jay Heights	Apache	8 North	29 East	17	9	53-400431	Inadequate	A1	12/1/2000	Town of Eagar
16	Bent Oak	Navajo	8 North	23 East	2, 11	71	53-500318	Adequate		6/21/1989	Ponderosa DWID
17	Bison Cabin Resort II	Navajo	12 North	17 East	34	33	53-400516	Adequate		4/2/2002	Arizona Water Company - Overgaard
18	Bison Ranch	Navajo	12 North	17 East	33	39	53-400080	Adequate		6/2/1999	Arizona Water Company - Overgaard
19	Bison Ranch Parcel C3 Bison Lodge Cabins	Navajo	12 North	17 East	34	22	53-400572	Adequate		9/21/2001	Arizona Water Company - Overgaard
20	Bison Ranch Resort Suites	Navajo	12 North	17 East	34	88	53-401659	Adequate		5/25/2005	Arizona Water Company - Overgaard
21	Bison Resort Cabins	Navajo	11 North	17 East	3	57	53-400257	Adequate		3/6/2000	Arizona Water Company - Overgaard
22	Bison Resort Cabins III	Navajo	12 North	17 East	34	57	53-400691	Adequate		4/2/2002	Arizona Water Company - Overgaard
23	Bison Town I, Parcels B1 and B2 of Bison	Navajo	12 North	17 East	33, 34	34	53-400447	Adequate		1/19/2001	Arizona Water Company - Overgaard
24	Bison Town II, Parcels B3 and B4 of Biso	Navajo	12 North	17 East	33, 34	25	53-400446	Adequate		1/19/2001	Arizona Water Company - Overgaard
25	Blue Ridge Estates	Coconino	15 North	12 East	32	193	53-300463	Adequate		6/12/1997	Starlight Water Company

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
26	Blue Valley	Apache	8 North	29 East	16	8	53-500345	Adequate		5/14/1976	Town of Eagar
27	Brewer Acres	Navajo	13 North	21 East	23	20	53-500359	Adequate		11/3/1975	Town of Snowflake
28	Burdon Ranch Estates	Navajo	11 North	22 East	25	131	53-500370	Inadequate	A1	12/6/1984	Dry Lot Subdivsion
29	Bushman Acres	Navajo	13 North	21 East	26	48	53-500371	Adequate		8/11/1976	Town of Snowflake
30	Canyon Vista Estates	Navajo	12 North	22 East	31	56	53-402027	Adequate		5/24/2006	Watco Inc.
31	Casitas of Pinetop, The	Navajo	9 North	23 East	32	0	53-500420	Inadequate	A1	10/31/1980	Pinetop Water Company
32	Cedar Mesa Ridge	Navajo	12 North	22 East	31	56	53-402026	Adequate		8/18/2006	Watco Inc.
33	Cedar Ridge	Apache	8 North	29 East	11	49	53-500427	Adequate		8/22/1983	Town of Eagar
34	Cedar Ridge #1	Apache	10 North	24 East	10	13	53-500429	Inadequate	A1	11/6/1991	Dry Lot Subdivsion
35	Cedar Ridge #2	Apache	10 North	24 East	4	5		Inadequate	A1	7/9/1987	Dry Lot Subdivsion
36	Central Center	Navajo	10 North	22 East	20	10	53-500430	Inadequate	A1	6/21/1984	City of Show Low
37	Cheney Ranch	Navajo	10 North	21 East	8	168	53-500449	Adequate		4/17/1986	White Mountain Water Co.
38	Cholla Subdivision	Navajo	13 North	21 East	36	12	53-500453	Adequate		3/4/1981	Town of Taylor
39	Chu-Vista Estates	Navajo	12 North	22 East	30	23	53-500455	Inadequate	D	5/12/1987	Dry Lot Subdivsion
40	Cinder Forest Estates	Coconino	22 North	8 East	26, 27, 35	82	53-500457	Inadequate	A2	1/16/1974	Dry Lot Subdivsion
41	Cinder Mountain	Navajo	8 North	23 East	11	65	53-500458	Adequate		9/17/1973	Ponderosa Water Company
42	Circle G at Temple Hill Estates	Navajo	13 North	21 East	22	23	53-400715	Adequate		5/22/2002	Town of Snowflake
43	Clearview Estates	Apache	10 North	24 East	12	8	53-700423	Inadequate	A1	10/26/2007	Lord AZ Water Co.
44	Cobblecreek Development	Navajo	11 North	20 East	32	0	53-500475	Adequate		5/12/1987	Pinedale DWID
45	Concho Lake Land Unit 1 Amended	Apache	11 North	26 East	7	8	53-700256	Inadequate	A1	3/30/2007	Dry Lot Subdivsion
46	Concho Lakeland Unit 1 Amended	Apache	11 North	26 East	7	4	53-700306	Inadequate	A1	5/22/2007	Dry Lot Subdivsion
47	Concho Lakeland Unit 3, lots 580-582 & 538	Apache	11 North	26 East	19	4	53-402274	Inadequate	A1	8/31/2006	Dry Lot Subdivsion
48	Concho Valley #01B	Apache	12 North	26 East	18	21	53-500489	Adequate		5/11/1982	Livco Water & Sewer Co.
49	Concho Valley #05A	Apache	12 North	26 East	19	108	53-500490	Adequate		7/16/1979	Livco Water & Sewer Co.
50	Concho Valley #05B	Apache	12 North	26 East	19	0	53-500491	Adequate		6/23/1980	Livco Water & Sewer Co.
51	Concho Valley #09	Apache	12 North	26 East	29	181	53-500492	Adequate		8/23/1989	Livco Water & Sewer Co.
52	Concho Valley #09A	Apache	12 North	26 East	19	117	53-500493	Adequate		5/23/1991	Livco Water & Sewer Co.
53	Concho Valley #10	Apache	12 North	26 East	7, 8	193	53-500494	Adequate		5/23/1991	Livco Water & Sewer Co.
54	Concho Valley #12	Apache	12 North	26 East	8	303	53-500495	Adequate		7/30/1992	Livco Water & Sewer Co.
55	Concho Valley #18	Apache	12 North	26 East	8, 9	203	53-500496	Adequate		3/5/1993	Livco Water & Sewer Co.
56	Concho Valley #33	Apache	12 North	26 East	33	82	53-500497	Adequate		1/15/1985	Livco Water & Sewer Co.

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
57	Concho Valley Unit 3	Apache	12 North	26 East	29, 31	7	53-700262	Inadequate	A1	6/11/2007	Dry Lot Subdivsion
58	Concho Valley Unit 3, Lot 1/85; Lot 3/50; Lot 2/73;Lot 3/276; Parcel 2,Lot 2/134	Apache	12 North	26 East	29	5	53-402273	Inadequate	A1	8/30/2006	Dry Lot Subdivsion
59	Concho Valley Unit 4	Apache	South	East		13	53-500034	Inadequate	A1	11/21/2006	Livco Water & Sewer Co.
60	Concho Valley Unit Eight	Apache	12 North	26 East	22	7	53-402248	Inadequate	A1	8/23/2006	Dry Lot Subdivsion
61	Concho Valley Unit Three	Apache	12 North	26 East	31	6	53-700258	Inadequate	A1	4/2/2007	Dry Lot Subdivsion
62	Concho Valley, Unit 4A	Apache	12 North	26 East	18	14	53-500033	Inadequate	A1	11/21/2006	Livco Water & Sewer Co.
63	Concho Valley, Unit 5	Apache	13 North	27 East	18	26	53-500032	Inadequate	A1	10/24/2006	Livco Water & Sewer Co.
64	Concho West Shore Subdivision	Apache	12 North	26 East	7, 18	47	53-402047	Inadequate	A1	3/17/2006	Livco Water & Sewer Co.
65	Condominium at Pine Creek, The	Navajo	9 North	23 East	31	101	53-500498	Inadequate	A1	10/3/1986	Pinetop Water Community Facilities District
66	Cool Water Acres	Navajo	17 North	19 East	12	25	53-500503	Adequate		5/23/1984	Dry Lot Subdivsion
67	Cosnino Equestrian Estates	Coconino	21 North	9 East	7, 8	30	53-500512	Adequate		8/28/1973	Black Bill and Doney Park WUA
68	Cosnino Equestrian Sub. #2	Coconino	21 North	9 East	8, 9	77	53-500514	Adequate		3/21/1979	Black Bill and Doney Park WUA
69	Cottonwood Ranch	Navajo	19 North	16 East	7	47	53-500518	Inadequate	A1	6/19/1985	Dry Lot Subdivsion
70	Country Club Estates #1	Navajo	13 North	21 East	21	18	53-500522	Adequate		10/31/1983	Town of Snowflake
71	Country Club Manor #1	Navajo	10 North	21 East	14	0	53-500523	Adequate		9/13/1978	City of Show Low
72	Country Club Villas, Unit I, Lots 2-15	Apache	12 North	26 East	18	14	53-700387	Inadequate	A1	8/8/2007	Livco Water & Sewer Co.
73	Country Estates	Apache	8 North	29 East	10	20	53-500524	Adequate		9/11/1980	Town of Eagar
74	Dutch Joe Ranch	Coconino	13 North	13 East	27	400	53-500045	Inadequate	A1	3/12/2007	Dutch Joe Ranch HOA
75	E C Bar Ranch Estates	Apache	7 North	30 East	20, 29	81	53-700503	Inadequate	A1	3/14/2008	Dry Lot Subdivsion
76	Eagle Ridge	Apache	11 North	24 East	34	54	53-300464	Adequate		12/28/1998	Cedar Grove WC
77	Eagle View Park	Coconino	22 North	8 East	10	11	53-401404	Inadequate	A1	9/2/2004	Doney Park Water Company
78	East Highland Estates	Navajo	13 North	21 East	23	11	53-500597	Adequate		5/23/1979	Town of Snowflake
79	East Valley Acres	Apache	8 North	29 East	33	12	53-500598	Inadequate	A1	8/21/1986	Town of Eagar
80	El Rancho Grande	Navajo	12 North	21 East	6	46	53-500609	Inadequate	A1	3/14/1984	Dry Lot Subdivsion
81	Elk Crest Estates	Apache	8 North	29 East	18	72	53-400164	Inadequate	A1	11/30/1999	Town of Eagar
82	Elk Meadow	Apache	6 North	29 East	1	8	53-500610	Adequate		5/30/1989	Elk Meadow HOA
83	Elk Springs	Navajo	9 North	22 East	9	43	53-500063	Inadequate	A1	11/14/2006	Pineview Water Company
84	Elk Springs Subdivision	Navajo	20 North	11 East	30	6	53-700441	Inadequate	A1	1/28/2008	Dry Lot Subdivsion

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
85	Ellkins Acres	Navajo	10 North	21 East	24	51	53-400991	Inadequate	A1	8/18/2003	Park Valley Water Company
86	Escondido	Apache	8 North	29 East	7, 8	48	53-500616	Adequate		8/22/1979	Town of Eagar
87	Escondido #2 amended	Apache	8 North	29 East	18	57	53-500617	Adequate		5/21/1982	Town of Eagar
88	Escudilla Mountain Estates, Units 1,2 &3	Apache	7 North	30 East	31	74	53-300583	Inadequate	A1	12/15/1998	Dry Lot Subdivsion
89	Evergreen Estates Unit I	Navajo	9 North	22 East	4	24	53-400725	Inadequate	A1	5/22/2002	Pineview Water Company
90	Evergreen Estates Unit II	Navajo	9 North	22 East	4	19	53-401857	Inadequate		9/8/2005	Pineview Water Company
91	Fairway Park Center	Navajo	10 North	21 East	23	26	53-500636	Adequate		9/24/1976	Fairway Park
92	Foothills #02	Apache	8 North	29 East	9	36	53-500639	Adequate		12/21/1979	Town of Eagar
93	Forest Trails #1	Navajo	12 North	17 East	28	170	53-500673	Adequate		7/20/1984	Arizona Water Company - Overgaard
94	Forest Trails #2	Navajo	12 North	17 East	28	207	53-500674	Adequate		5/13/1985	Arizona Water Company - Overgaard
95	Forest Trails #3B	Navajo	12 North	17 East	28	49	53-300004	Adequate		4/3/1995	Arizona Water Company - Overgaard
96	Fort Valley Meadows, lots 56-65	Coconino	22 North	6 East	26	10	53-400139	Inadequate	A2	7/30/1999	Community well
97	Fort Valley Pines	Coconino	22 North	6 East	34	11	53-400898	Inadequate	A1	3/12/2003	Dry Lot Subdivsion
98	Frontier Estates	Navajo	13 North	21 East	22	202	53-400564	Adequate		8/30/2001	Town of Snowflake
99	Frontier Hills	Coconino	22 North	8 East	24	33	53-500689	Inadequate	A1,A2	5/4/1994	Doney Park Water Company
100	G Flake Subdivision	Navajo	13 North	21 East	22	11	53-400583	Adequate		9/28/2001	Town of Snowflake
101	Gobbler Peak Estates	Apache	6 North	29 East	1	28	53-500706	Adequate		10/24/1991	Dry Lot Subdivsion
102	Golden Lockett	Coconino	21 North	7 East	3	14	53-400951	Inadequate	A1,A2	5/23/2003	NA
103	Grand View Estates #1	Apache	8 North	29 East	18	58	53-500723	Adequate		7/26/1982	Town of Eagar
104	Green Acre Estates	Navajo	10 North	21 East	13	7	53-700400	Inadequate	A1	8/23/2007	Park Valley / Fool Hollow Water co.
105	Green Valley Acres	Apache	8 North	29 East	16	198	53-500730	Adequate		2/26/1975	Town of Eagar
106	Green Valley Ranches	Navajo	11 North	22 East	6	22	53-500750	Adequate		9/1/1976	Subdivision wells
107	Greer Acres	Apache	7 North	27 East	2	20	53-400209	Inadequate	A1	12/12/2000	Dry Lot Subdivsion
108	Greer Lodge Estates	Apache	7 North	27 East	14	16	53-500764	Adequate		9/13/1994	Greer Meadows HOA
109	Greer Mountain Subdivision	Apache	7 North	27 East	14	24	53-500765	Adequate		7/11/1995	Greer Mountain Subdivision Joint Venture
110	Greer View Estates	Apache	7 North	27 East	12	22	53-400001	Adequate		3/4/1999	Dry Lot Subdivsion
111	Hacienda Pines-Unit 1	Navajo	10 North	21 East	25	68	53-300448	Adequate		4/23/1998	City of Show Low
112	Harvest Valley	Navajo	12 North	21 East	5	10	53-500776	Adequate		2/24/1976	Dry Lot Subdivsion
113	Hidden Meadow Ranch	Apache	9 North	27 East	30	52	53-400654	Inadequate	B	5/13/2002	Club at Hidden Ranch HOA
114	Hidden Oak	Navajo	8 North	23 East	2	21	53-401931	Inadequate	A1	11/7/2005	Ponderosa Water Company

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
115	High Country Pines II - Unit 2	Navajo	12 North	16 East	15	74	53-400127	Adequate		7/21/1999	High Country Pines WC
116	High Country Pines II - Unit I	Navajo	12 North	16 East	15	104	53-300405	Adequate		1/8/1998	High Country Pines WC
117	High Country Pines Inc.	Navajo	12 North	16 East	15	0	53-500787	Adequate		4/26/1985	High Country Pines WC
118	High Pines Estates	Navajo	11 North	18 East	3, 4, 9	63	53-700437	Inadequate	A1	3/31/2008	Mountain Glen Water Co
119	Highland Park Unit 5, Phase 1	Navajo	13 North	21 East	36	12	53-300161	Adequate		6/24/1996	Town of Snowflake
120	Hillcrest	Apache	8 North	29 East	3, 4	36	53-500793	Adequate		1/29/1976	Town of Eagar
121	Homestead Unit One at Torreon	Navajo	10 North	21 East	25, 26	109	53-300437	Adequate		3/31/1998	City of Show Low
122	Hutchinson Acres	Coconino	22 North	8 East	9, 16	95	53-400459	Inadequate	A1	3/21/2001	Doney Park Water Company
123	J. L. Subdivision	Apache	8 North	29 East	4	11	53-500817	Adequate		7/23/1976	Town of Eagar
124	Koch Field East	Coconino	22 North	8 East	25	10	53-500847	Inadequate	A2	4/26/1993	Doney Park Water Company
125	Laguna Estates #1	Navajo	11 North	22 East	25	151	53-500871	Inadequate	A1	7/7/1986	High Country Water
126	Lake View Estates Phase I	Navajo	11 North	22 East	11	25	53-700328	Inadequate	A1	6/13/2007	Dry Lot Subdivsion
127	Linden Trails	Navajo	10 North	21 East	3, 4	96	53-401605	Adequate		3/16/2005	Mountain Glen Water Co
128	Lockett Estates	Coconino	21 North	7 East	4	16	53-400415	Inadequate	A1,A3	11/13/2000	Community well
129	Mahogany Run Subdivision	Coconino	21 North	7 East	3, 4	7	53-400716	Inadequate	A3	5/21/2002	Dry Lot Subdivsion
130	Majestic Views Estates	Coconino	22 North	6 East	26	28	53-401616	Inadequate	A1	1/12/2005	Majestic Views Domestic Water Improvement District
131	Mogollon Airpark	Navajo	12 North	17 East	33	27	53-500994	Adequate		1/3/1986	Arizona Water Company - Overgaard
132	Mogollon Airpark #03	Navajo	12 North	17 East	33	59	53-500995	Adequate		5/15/1987	Arizona Water Company - Overgaard
133	Mogollon Airpark #04A	Navajo	12 North	17 East	34	37	53-500997	Adequate		10/6/1993	Arizona Water Company - Overgaard
134	Mogollon Air Park #04B	Navajo	12 North	17 East	27, 34	36	53-500993	Adequate		4/6/1994	Arizona Water Company - Overgaard
135	Mogollon Airpark #06	Navajo	12 North	17 East	27, 34	52	53-300042	Adequate		7/25/1995	Arizona Water Company - Overgaard
136	Mogollon Airpark Properties	Navajo	12 North	17 East		54	53-500998	Adequate		3/6/1985	Arizona Water Company - Overgaard
137	Mogollon Estates	Navajo	12 North	17 East	27, 34	70	53-300167	Adequate		7/15/1996	Arizona Water Company - Overgaard
138	Mountain Pine Ranch #1	Apache	10 North	24 East	5	57	53-501019	Inadequate	A1	4/13/1993	Dry Lot Subdivsion
139	Mountain Pine Ranch Unit II	Apache	10 North	24 East	5	57	53-400107	Inadequate	A1	6/26/1999	Dry Lot Subdivsion
140	Mountain Pines Estates	Navajo	8 North	23 East	2	86	53-501020	Adequate		9/1/1983	Ponderosa Water Company

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
142	Mountain View #2	Apache	12 North	28 East	4	32	53-501027	Adequate		8/18/1978	Mountain View Water Company
143	Mountain View Ranchos	Coconino	21 North	9 East	11	28	53-501035	Adequate		7/19/1973	Subdivision wells
144	Mountains Meadow	Navajo	9 North	22 East	4	142	53-402238	Inadequate	A1	9/11/2006	Pineview Water Company
145	Needles Creek Subdivision	Navajo	10 North	21 East	13	57	53-400451	Inadequate	A1	1/19/2001	Fools Hollow Water Company
146	Nicoll Subdivision	Apache	8 North	29 East	9	20	53-501048	Adequate		2/6/1980	Town of Eagar
147	Noble Mountain Estates Amended	Apache	6 North	30 East	7	65	53-501050	Inadequate	A1	7/26/1994	Doney Park Water Company
148	North Peak	Coconino	22 North	8 East	28, 29	18	53-501051	Inadequate	A2	1/24/1992	Doney Park Water Company
149	North Peak #2	Coconino	22 North	8 East	28	11	53-501052	Inadequate	A2	2/23/1993	Doney Park Water Company
150	Northern Taylor	Navajo	13 North	21 East	36	14	53-501055	Adequate		8/15/1977	Town of Taylor
151	Northfork Ranches #1	Apache	10 North	24 East	7	93	53-501056	Inadequate	A1	4/10/1985	Dry Lot Subdivsion
152	Nutrioso Pines	Apache	6 North	30 East	4, 5	83	53-700223	Inadequate	A1	3/15/2007	Dry Lot Subdivsion
153	Ojo Bonito Estates	Apache	10 North	25 East	19	63	53-501074	Adequate		9/10/1981	Ojo Bonito HOA
154	Overgaard Springs Ranch Unit I	Navajo	12 North	17 East	33	32	53-500047	Inadequate		11/14/2006	Arizona Water Company - Overgaard
155	Overgaard Springs Ranch Unit II	Navajo	12 North	17 East	33	39	53-500048	Inadequate		11/14/2006	Arizona Water Company - Overgaard
157	Park Place	Navajo	10 North	21 East	24	78	53-300341	Inadequate	A1	8/15/1997	Park Valley / Fool Hollow Water co.
158	Park Place III	Navajo	10 North	21 East	24	35	53-400331	Inadequate	A1	7/17/2000	Park Valley / Fool Hollow Water co.
159	Park Place IV	Navajo	10 North	21 East	24	16	53-401172	Inadequate	A1	1/12/2004	Park Valley / Fool Hollow Water co.
160	Park Plaza #1	Navajo	13 North	21 East	21	31	53-501113	Adequate		5/23/1986	Town of Snowflake
161	Park Show Low #1	Apache	10 North	24 East	1	14	53-501114	Inadequate	A1	9/8/1989	Dry Lot Subdivsion
162	Park Show Low #1-4	Apache	10 North	24 East	1, 11, 25	140	53-501117	Inadequate	A1	11/6/1991	Dry Lot Subdivsion
163	Park Show Low #3, 4	Apache	11 North	24 East	1, 11	47	53-501119	Inadequate	A1	6/22/1994	Dry Lot Subdivsion
164	Park Show Low #4,5,6	Apache	11 North	24 East	1, 13, 15	62	53-501120	Inadequate	A1	12/22/1986	Dry Lot Subdivsion
165	Park Valley #3	Navajo	10 North	21 East	24	86	53-501121	Inadequate	A1	10/5/1983	Park Valley / Fool Hollow Water co.
166	Park Valley #4	Navajo	10 North	21 East	25	189	53-501122	Inadequate	A1	10/8/1986	City of Show Low
167	Petrified Forest Estates #2	Apache	18 North	24 East	5	133	53-501144	Inadequate	C	1/14/1987	Dry Lot Subdivsion
168	Pine Canyon Estates	Coconino	14 North	12 East	6	385	53-300466	Adequate		6/24/1998	Starlight Water Company
169	Pine Creek	Navajo	9 North	23 East	31	45	53-402114	Inadequate	A1	4/25/2006	Pinetop Water Community Facilities District
170	Pine Meadows Country Club Est	Navajo	12 North	17 East	33	116	53-501150	Adequate		5/30/1986	Arizona Water Company - Overgaard

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
172	Pine Mountain Estates	Coconino	22 North	8 East	9	36	53-300065	Inadequate	A1	12/5/1995	Doney Park Water Company
173	Pine Oaks	Navajo	10 North	22 East	29	78	53-300200	Inadequate	A1	10/17/1996	City of Show Low
174	Pine Ridge #1	Navajo	8 North	23 East	4, 5	0	53-501152	Inadequate	A1	1/8/1986	Pinetop Water Company
175	Pine Rim Forest	Navajo	12 North	17 East	30	56	53-501154	Adequate		9/1/1983	Arizona Water Company - Overgaard
176	Pineaire	Navajo	10 North	22 East	32	160	53-501156	Adequate		10/25/1973	Pineview Water Company
177	Pinecrest Lake	Navajo	12 North	17 East	33	3	53-501158	Adequate		8/5/1986	Arizona Water Company - Overgaard
178	Pineglen Park	Navajo	9 North	22 East	4	84	53-501159	Inadequate	A1	12/5/1983	Pineview Water Company
179	Pineglen Village #1	Navajo	9 North	22 East	4	94	53-501160	Inadequate	A1	12/5/1983	Pineview Water Company
180	Pinegrove Park	Navajo	10 North	21 East	24	37	53-501161	Inadequate	A1	8/10/1983	Park Valley / Fool Hollow Water co.
181	Pines at Show Low Condominiums	Navajo	10 North	22 East	32	0	53-501163	Adequate		2/18/1987	Pineview Water Company
182	Pinetop Country Club Village	Navajo	8 North	23 East	11	65	53-501164	Adequate		9/17/1973	Ponderosa Water Company
183	Pinetop Lakes Plaza #2,3	Navajo	8 North	23 East	2	53	53-501166	Adequate		10/6/1983	Ponderosa Water Company
184	Pinetop Lakes, Mountain Homes	Navajo	8 North	23 East	11	0	53-501167	Adequate		2/6/1974	Ponderosa Water Company
185	Pioneer Subdivision	Apache	8 North	29 East	4	0	53-501196	Adequate		6/8/1981	Town of Eagar
186	Pioneer Valley #1	Coconino	22 North	8 East	14, 23	35	53-501197	Inadequate	A2	12/4/1992	Doney Park Water Company
187	Pioneer Valley #3, 2B	Coconino	22 North	8 East	23	83	53-501198	Inadequate	A2	10/3/1994	Doney Park Water Company
188	Randall	Navajo	18 North	19 East	15	36	53-501286	Adequate		9/6/1973	Joseph City Water Company
189	Red Cabin Ranch Estates	Apache	9 North	26 East	5, 8	44	53-402231	Inadequate	A1	8/22/2006	Dry Lot Subdivsion
190	Rendezvous Unit One at Torreon	Navajo	10 North	21 East	23	113	53-300436	Adequate		3/31/1998	City of Show Low
191	Rim Rock View Estates, Unit 1	Navajo	13 North	21 East	22	8	53-400642	Adequate		1/3/2002	Subdivision wells
192	Rim Spur	Navajo	9 North	22 East	27	11	53-400368	Inadequate	C	8/30/2000	Dry Lot Subdivsion
193	Rim Top Ranch	Coconino	15 North	12 East	21, 27, 35	233	53-300542	Inadequate	D	9/21/1999	HOA Wells
194	Rio Rancho Estates	Coconino	22 North	8 East	35, 36	37	53-400499	Inadequate	A1	3/2/2001	Doney Park Water Company
195	Rio Vista Estates	Apache	21 North	28 East	13	34	53-401474	Inadequate	A1	11/3/2004	Navajo Tribal Utility
196	River Run Estates	Apache	8 North	29 East	5	214	53-400290	Inadequate	A1	4/13/2000	Town of Eagar
197	Rolling Hills #2	Navajo	12 North	21 East	3	49	53-501341	Adequate		3/12/1974	Town of Taylor
198	Roundhouse Square #2	Navajo	8 North	23 East	2	0	53-501345	Adequate		3/31/1976	Ponderosa Water Company

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
199	Sacred Circle Ranchos, lots 1-7,17-23, 46,47	Apache	10 North	24 East	10	16	53-402183	Inadequate	A1	6/14/2006	Cedar Grove WC
200	San Juan Meadows	Apache	13 North	27 East	25, 26	15	53-300370	Adequate		10/31/1997	Dry Lot Subdivsion
201	Saskan Ranch	Coconino	21 North	6 East	23, 24	14	53-501372	Inadequate	D	8/31/1994	HOA Wells
202	Satellite Homestead	Navajo	11 North	22 East	25	131	53-501373	Adequate		5/13/1975	Silver Well Service Corporation
203	Sawmill Point	Navajo	12 North	16 East	13	30	53-700299	Inadequate	A1	5/2/2007	Heber Domestic Water Improvement District
204	Scotts Pine Meadows	Navajo	9 North	22 East	9	27	53-501378	Inadequate	A1	2/11/1986	Pineview Water Company
205	Shadowing Pines	Navajo	8 North	23 East	5	112	53-501388	Adequate		12/16/1974	Pinetop Water Company
206	Show Low East Unit 1	Apache	10 North	24 East	9	41	53-700233	Inadequate	A1	4/12/2007	Cedar Grove WC
207	Show Low Golf & Country Club	Navajo	10 North	21 East	23	124	53-501391	Adequate		7/1/1975	City of Show Low
208	Show Low Mountain Ranch	Navajo	11 North	22 East	25	147	53-700567	Inadequate	A1	10/2/2008	Watco Inc.
209	Show Low Pines Unit 5	Apache	11 North	25 East	7, 18, 19	6	53-700257	Inadequate	A1	4/4/2007	Dry Lot Subdivsion
210	Show Low Vista Community - Unit 1A	Navajo	10 North	22 East	18	20	53-300490	Adequate		7/8/1998	City of Show Low
211	Sierra Pines	Navajo	10 North	22 East	30	57	53-300054	Adequate		10/19/1995	City of Show Low
212	Sierra Pines Unit Two	Navajo	10 North	22 East	30	30	53-300198	Inadequate	A1	9/19/1996	City of Show Low
213	Sierra Pines Unit Three	Navajo	10 North	22 East	29, 30	39	53-300379	Adequate		10/15/1997	City of Show Low
214	Sierra Pines Unit Four	Navajo	10 North	22 East	30	49	53-300501	Adequate		7/21/1998	Dry Lot Subdivsion
215	Sierra Springs Ranch	Navajo	9 North	23 East	27, 34	51	53-401740	Adequate		3/29/2006	Sierra Springs Ranch HOA
216	Sierra Vista Ranchettes	Navajo	19 North	15 East	1	20	53-501407	Adequate		6/5/1986	Dry Lot Subdivsion
217	Silver Creek Golf Heights, Unit 1	Navajo	11 North	22 East	11	50	53-700343	Inadequate	A1	6/14/2007	White Mountain Lake Estates, Inc.
218	Silver Creek Village	Navajo	11 North	22 East	15	0	53-501409	Inadequate	A1	2/4/1985	White Mountain Lake Water Company
219	Silver Creek Waterfront Estates	Navajo	11 North	22 East	10, 11	99	53-400262	Adequate		2/3/2000	White Mountain Lake Estates, Inc.
220	Silver Lake Estates No. 1 & 2	Navajo	11 North	22 East	35	12	53-300146	Inadequate	C	7/25/1996	Silver Well Service Corporation
221	Skyline Estates	Coconino	22 North	9 East	19	9	53-401403	Inadequate	D	9/2/2004	Doney Park Water Company
222	Skyline Ranch	Apache	10 North	24 East	11, 12	71	53-700340	Inadequate	A1	6/12/2007	The Wilderness
223	Slayton Ranch Estates	Coconino	22 North	8 East	13, 19, 24	117	53-401149	Inadequate	A1,A2	12/22/2003	Doney Park Water Company
224	Snowbase	Coconino	22 North	6 East	26	55	53-300287	Inadequate	A1	6/4/1997	Dry Lot Subdivsion
225	Snowbowl Ranch	Coconino	22 North	6 East	23	15	53-501421	Inadequate	A1,A2	8/24/1994	Dry Lot Subdivsion
226	Snowbowl Ranch Unit 2	Coconino	22 North	6 East	23	10	53-700545	Inadequate	A1	7/7/2008	Dry Lot Subdivsion
227	Snowbowl Ranch Unit 3	Coconino	22 North	6 East	23	14	53-700547	Inadequate	A1	7/10/2008	Dry Lot Subdivsion

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
228	Snowflake Cntry Club Properties	Navajo	13 North	21 East	21	80	53-400563	Adequate		8/20/2001	Town of Snowflake
229	Snowflake Country Club	Navajo	13 North	21 East	21	57	53-501422	Adequate		6/4/1980	Town of Snowflake
230	Snowflake East #1	Navajo	13 North	22 East	3	25	53-501425	Inadequate	A1	8/9/1985	Dry Lot Subdivsion
231	Snowflake Garden Estates	Navajo	13 North	21 East	14	47	53-501426	Adequate		7/8/1974	Town of Snowflake
232	Snowflake Heights	Navajo	13 North	22 East	17	90	53-501427	Adequate		1/27/1984	Town of Snowflake
233	Snowflake Heights #2	Navajo	13 North	22 East	17	131	53-501428	Adequate		6/6/1984	Town of Snowflake
234	Solomon's Lakes	Navajo	11 North	22 East	6	56	53-700513	Inadequate	A1	4/11/2008	Dry Lot Subdivsion
235	Stardust Meadows	Coconino	22 North	8 East	24	9	53-300002	Inadequate	A1	4/10/1995	Doney Park Water Company
236	Stardust Trails Subdivision	Coconino	22 North	8 East	23, 24	5	53-700305	Inadequate	A1	5/3/2007	Doney Park Water Company
237	Starlight Pines #1	Coconino	15 North	12 East	31	54	53-501451	Adequate		5/23/1983	Mogollon Water Company
238	Starlight Pines #2	Coconino	15 North	12 East	31	176	53-501452	Adequate		4/24/1986	Mogollon Water Company
239	Starlight Pines #3	Coconino	15 North	12 East	31	118	53-501453	Adequate		10/24/1986	Mogollon Water Company
240	Starlight Pines #4	Coconino	15 North	12 East	31	248	53-501454	Adequate		11/9/1988	Mogollon Water Company
241	Starlight Pines #5	Coconino	15 North	12 East	31	17	53-501455	Adequate		2/9/1995	Starlight Water Company
242	Starlight Pines Ranchettes	Coconino	14 North	12 East	7	125	53-300093	Adequate		7/30/1996	Starlight Water Company
243	Starlight Ridge Estates Townhouses unit 1	Navajo	9 North	22 East	8	72	53-401754	Inadequate	D	5/25/2005	Pineview Water Company
244	Starlight Ridge Estates Townhouses Unit 2	Navajo	9 North	22 East	8	72	53-700333	Inadequate	A1	6/22/2007	Pineview Water Company
245	Starlight Ridge Estates Unit 1	Navajo	9 North	22 East	8	48	53-401400	Inadequate	D	7/20/2004	Pineview Water Company
246	Starlight Ridge Estates Unit II	Navajo	9 North	22 East	8	95	53-402147	Inadequate	A1	5/23/2006	Pineview Water Company
247	Starwood Estates	Navajo	8 North	23 East	1	65	53-400300	Inadequate	D	5/3/2000	Ponderosa Water Company
248	Summer Meadows	Apache	8 North	29 East	4	17	53-501473	Adequate		6/8/1981	Town of Eagar
249	Summer Meadows #3	Apache	8 North	29 East	4	7	53-501474	Inadequate	A1	8/21/1986	Town of Eagar
250	Summer Place	Navajo	12 North	16 East	24	58	53-501475	Adequate		10/8/1985	Arizona Water Company - Overgaard
251	Summer Place North	Navajo	12 North	16 East	24	45	53-300369	Adequate		11/17/1997	Arizona Water Company - Overgaard
252	Summer Place North Unit 2	Navajo	12 North	16 East	24	40	53-400412	Adequate		9/28/2000	Arizona Water Company - Overgaard
253	Summer Place North Unit 3A & 3B	Navajo	12 North	16 East	24	68	53-700323	Adequate		8/7/2007	Heber Domestic Water Improvement District
254	Summer Place North, Unit 3C	Navajo	12 North	16 East	24	43	53-700515	Adequate		6/23/2008	Arizona Water Company - Overgaard

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
255	Sun Valley Highlands No. 2	Navajo	18 North	22 East	5	58	53-300308	Inadequate	A1	6/3/1997	Dry Lot Subdivsion
257	Sundance Springs Community	Navajo	13 North	21 East	13	257	53-401743	Adequate		8/4/2005	Snowflake Municipal Water Company
258	Sunrise Vista Estates	Apache	10 North	24 East	9	24	53-501514	Adequate		10/26/1993	Cedar Grove WC
259	Sunset Vista Estates	Coconino	22 North	8 East	31	24	53-300390	Inadequate	A1	11/19/1997	Doney Park Water Company
260	Tall Pine Estates #2	Coconino	18 North	9 East	28	44	53-501534	Inadequate	A1	8/10/1989	Tall Pines Estates Water & Improvement
261	Tamarron Pines	Coconino	15 North	12 East	32	411	53-400100	Adequate		7/8/1999	Starlight Water Company
262	The Commons at White Mountain Lodge	Apache	7 North	27 East	11	7	53-402010	Inadequate	A1	2/9/2006	White Mountain Lodge
263	The Ranch At The Peaks	Coconino	22 North	6 East	23	74	53-700246	Inadequate	A1	3/29/2007	Majestic Views Domestic Water Improvement District
264	The Retreat Villas at Bison Crossing	Navajo	10 North	21 East	13, 24	66	53-700337	Inadequate	A1	5/22/2007	Park Valley / Fool Hollow Water Co.
265	The Retreat at Bison Crossing	Navajo	10 North	21 East	13, 24	90	53-700336	Inadequate	A1	5/22/2007	Park Valley / Fool Hollow Water Co.
266	The Village	Navajo	10 North	21 East	24	17	53-401373	Inadequate	D	8/4/2004	Park Valley / Fool Hollow Water Co.
267	Thunder Run Estates	Navajo	12 North	17 East	30	41	53-400132	Adequate		7/28/1999	Arizona Water Company - Overgaard
268	Timberline Estates #3	Coconino	22 North	8 East	9	10	53-501560	Inadequate	A2	10/3/1989	Doney Park Water Company
269	Timberline Estates Unit 4	Coconino	22 North	8 East	9	25	53-400187	Inadequate	A1,A2	10/20/1999	Doney Park Water Company
270	Town and Country #1	Navajo	18 North	19 East	15	33	53-501574	Adequate		5/7/1979	Joseph City Water Company
271	Udall Estates	Apache	8 North	29 East	7, 18	37	53-501589	Adequate		12/5/1983	Town of Eagar
272	United Estates #1	Navajo	12 North	17 East	30	35	53-501591	Adequate		5/23/1979	Arizona Water Company - Overgaard
273	Valley View Estates	Apache	8 North	29 East	26	11	53-501601	Adequate		9/1/1976	Town of Eagar
274	Valley View Estates	Navajo	13 North	21 East	26	49	53-501602	Adequate		9/26/1977	Town of Snowflake
275	Valley View Estates #2	Apache	8 North	29 East	8	21	53-501603	Adequate		7/26/1982	Town of Eagar
276	Vein of Gold Unit IV	Navajo	18 North	22 East	5, 8	322	53-300309	Inadequate	A1	6/3/1997	Dry Lot Subdivsion
277	Vernon Valley II	Apache	10 North	25 East	22	28	53-501616	Adequate		10/15/1986	Serviceberry Water Company
278	Vista San Juan #1	Apache	13 North	28 East	31	45	53-501656	Adequate		12/6/1976	Developer Water Company
279	Wagon Wheel Meadows	Navajo	9 North	22 East	9	17	53-700240	Inadequate	A1	2/13/2007	Pineview Water Company
280	Wenima Village Project	Apache	9 North	29 East	8, 17, 18	221	53-501665	Adequate		5/17/1989	Town of Springerville
281	West Gardens	Navajo	13 North	21 East	16	0	53-501666	Adequate		12/9/1976	Town of Snowflake
282	West Peak	Coconino	21 North	6 East	23, 24	12	53-501667	Inadequate	A2,A3	8/11/1994	Dry Lot Subdivsion

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
283	West View Subdivision	Navajo	13 North	21 East	23	12	53-401498	Adequate		1/18/2005	Snowflake Municipal Water Company
284	Westbrook Additn to the Vernon Townsite	Apache	10 North	25 East	21	8	53-400056	Adequate		4/18/2001	Vernon DWID
285	Westwood Estates	Coconino	21 North	6 East	23	78	53-300012	Adequate		6/21/1995	Flagstaff Ranch Water Company
286	Whispering Pines Townhouses	Navajo	9 North	23 East	31	89	53-501675	Inadequate	A1	7/3/1984	Pinetop Water Company
287	White Mountain Lake Vistas, Unit I	Navajo	11 North	22 East	15	84	53-401733	Inadequate		10/4/2005	White Mountain Lake Estates, Inc.
288	White Mountain Lakes #18	Navajo	11 North	22 East	10, 14, 15	132	53-501678	Inadequate	A1	9/27/1984	White Mountain Lake Estates, Inc.
289	White Mountain Lakes Airpark Voyager Unit I	Navajo	11 North	22 East	13, 24	61	53-402149	Inadequate	A1	6/15/2006	White Mountain Lake Estates, Inc.
290	White Mountain Lakes Estates	Navajo	11 North	22 East	3, 4, 10, 11, 12, 13, 14, 23, 24	0	53-501679	Adequate		6/27/1985	White Mountain Lake Estates, Inc.
291	White Mountain Vacation Village, LLC	Navajo	9 North	22 East	4, 5	117	53-400626	Inadequate	A1	11/8/2001	Pineview Water Company
			10 North	22 East	32, 33						
292	White Mountain Vacation Village, Unit 2 Phase 3	Navajo	9 North	22 East	4	7	53-401415	Inadequate	A1	38214	Pineview Water Company
			10 North	22 East	33						
293	Wilderness, The	Apache	10 North	24 East	12	115	53-501686	Adequate		7/10/1991	Lord Arizona Water Systems
294	Winchester Trails Ranches	Apache	10 North	25 East	17	125	53-501692	Adequate		3/3/1987	Lord Arizona Water Systems
295	Winchester Trails Ranches #2	Apache	10 North	25 East	17	68	53-501693	Inadequate	C	1/28/1985	Dry Lot Subdivsion
296	Windsor Valley Ranch Phase 2	Apache	11 North	25 East	3	332	53-700551	Inadequate	A1	9/29/2008	Dry Lot Subdivsion
			12 North	25 East	25, 26, 27, 28, 33, 34						
297	Windsor Valley Subdivision	Apache	12 North	25 East	25, 26, 27, 28	321	53-402094	Inadequate	A1	9/1/2006	Dry Lot Subdivsion
298	Wing Mountain Ranch, Unit 1	Coconino	22 North	6 East	27	15	53-501697	Inadequate	A1	4/11/1990	Dry Lot Subdivsion
299	Wing Mountain Ranch, Unit 2	Coconino	22 North	6 East	27	15	53-501698	Inadequate	A1	7/7/1992	Dry Lot Subdivsion
300	Wing Mountain Ranch, Unit 3	Coconino	22 North	6 East	27	15	53-300534	Inadequate	A1,A2	9/22/1998	Dry Lot Subdivsion
301	Wing Mountain Ranch, Unit 3, Phase 2	Coconino	22 North	6 East	27	15	53-401217	Inadequate	A1	3/2/2004	Dry Lot Subdivsion
302	Wolf Pines Unit I	Navajo	9 North	22 East	9	26	53-400565	Inadequate	A1	10/2/2001	Pineview Water Company
303	Woodland Acres	Navajo	12 North	17 East	6	19	53-400043	Adequate		3/24/1999	Arizona Water Company - Overgaard
304	Woodland Hills Subdivision	Navajo	8 North	23 East	6	152	53-300514	Inadequate	A1,C	8/27/1998	Pinetop Water Company
305	Wupatki Trails	Coconino	23 North	8 East	29, 32	41	53-400517	Inadequate	A1	5/14/2001	Doney Park Water Company
306	Wye Subdivision	Apache	8 North	29 East	11	18	53-501708	Adequate		8/22/1983	Town of Eagar

Table 2.1-10 Adequacy Determinations in the Little Colorado River Plateau Basin (Cont)[1]

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
156	Padre Canyon Trails Planned Residential Development	Coconino	21 North	11 East	19, 29, 31	1200	43-402073	6/23/2006	Undetermined
256	Sundance Springs Community	Navajo	13 North	21 East	13	736	43-401744	7/21/2005	Snowflake Municipal Water Company

C. Designated Adequate Water Supply

Map Key	Basin	County	Designation No.	Projected or Annual Estimated Demand *(af/yr)*	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	Arizona Water Company - Lakeside & Pinetop	Navajo	40-900000	No amount designated	NA	10/25/1973	No data, hydrologic study needed
b	City of Flagstaff	Coconino	40-900002	No amount designated	NA	5/17/1973	No data, hydrologic study needed
c	City of Holbrook	Navajo	40-900005	No amount designated	NA	5/17/1973	No data, hydrologic study needed
Not Shown	City of Page	Coconino	40-900009	No amount designated	NA	5/17/1973	No data, hydrologic study needed
d	Park Valley/Fools Hollow Water Company	Navajo	40-402065	611.74	3/16/2006	10/16/2007	2016
e	Pineview Water Company	Navajo	40-402066	919.48	3/16/2006	8/20/2007	2016
f	City of Show Low	Navajo	40-300412	2,246	1/1/1998	4/15/1999	2010
g	Town of Snowflake	Navajo	40-401841	3,333	8/10/2005	1/17/2006	2025
h	Town of Springerville	Apache	40-900013	No amount designated	NA	5/17/1973	No data, hydrologic study needed
i	City of St. Johns	Apache	40-900012	No amount designated	NA	5/16/1973	No data, hydrologic study needed
j	Town of Taylor	Navajo	40-900014	1,800	NA	12/21/1982	NA
k	Voyager at White Mountain Lakes Water Co.	Navajo	40-700359	1,540	6/12/2007	2/19/2008	2017
l	City of Winslow	Navajo	40-900018	No amount designated	NA	5/17/1973	No data, hydrologic study needed

Source: ADWR 2008a

Notes:

[1] Each determination of the adequacy of water supplies available to a subdivision is based on the information available to ADWR and the standards of review and policies in effect at the time the determination was made. In some cases, ADWR might make a different determination if a similar application were submitted today, based on the hydrologic data and other information currently available, as well as current rules and policies.

[2] Prior to February 1995, ADWR did not assign file numbers to applications for adequacy. Between 1995-2006 all applications for adequacy were given a file number with a 22 prefix. In 2006 a 53 prefix was assigned to all water adequacy reports and applications regardless of their issue date.

[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically unavaible; for groundwater, depth-to-water exceeds criteria)
3) Insufficient Infrastructure (distribution system is insufficient to meet demands or applicant proposed water hauling)
B. Legal (applicant failed to demonstrate a legal right to use the water or failed to demonstrate the provider's legal authority to serve the subdivision)
C. Water Quality
D. Unable to locate records
NA=:a not currently available to ADWR

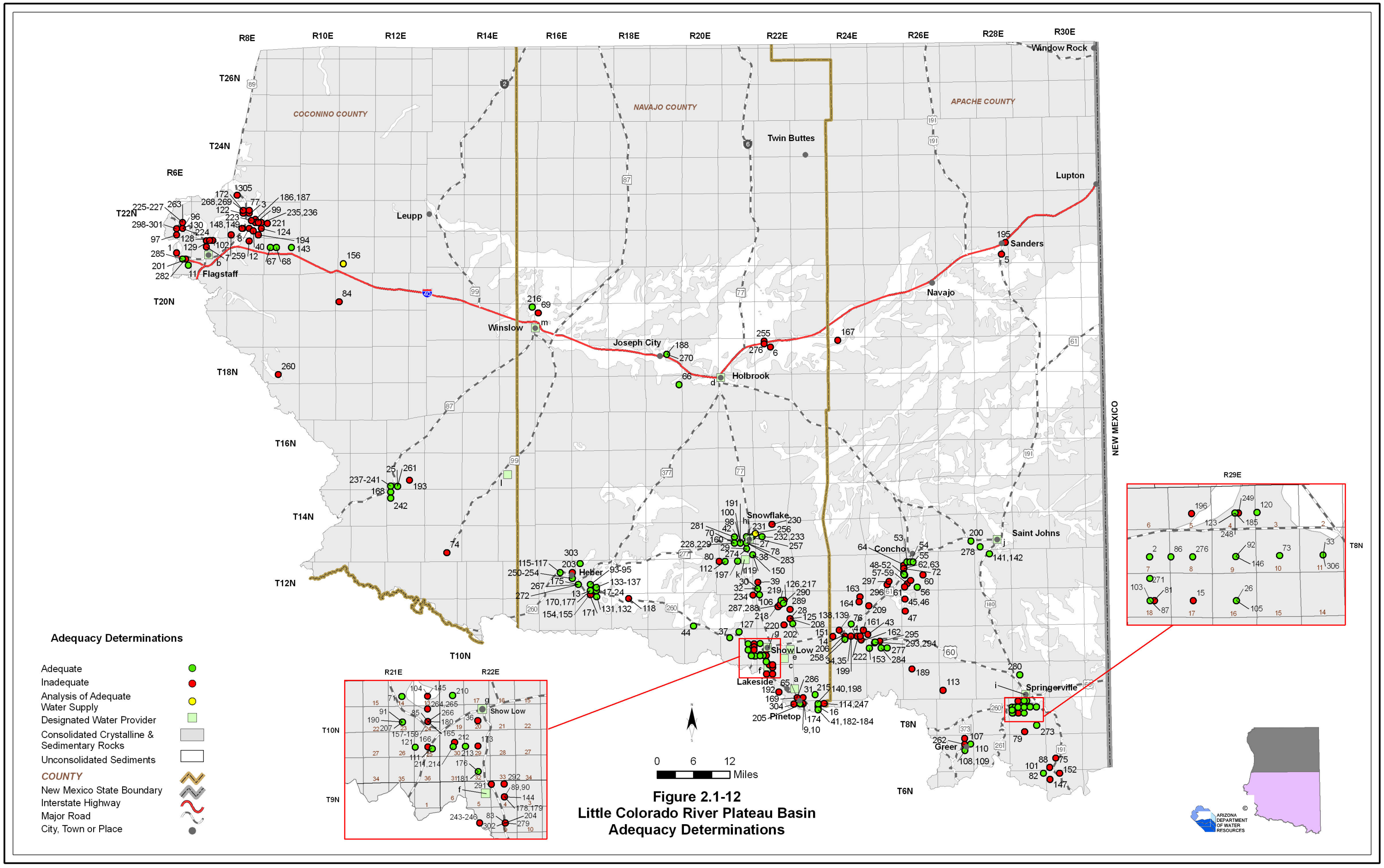


Figure 2.1-12
Little Colorado River Plateau Basin
Adequacy Determinations

LITTLE COLORADO RIVER PLATEAU BASIN

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ACRONYMS AND ABBREVIATIONS

AAWS	Analysis of Adequate Water Supply
A.R.S.	Arizona Revised Statutes
ADEQ	Arizona Department of Environmental Quality
ADOC	Arizona Department of Commerce
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AF	Acre-feet
AFA	Acre-feet per year
AZGF	Arizona Game and Fish Department
ALERT	Automated Local Evaluation in Real Time
ALRIS	Arizona Land Resource Information System
AMA	Active Management Area
APS	Arizona Public Service
ASPC	Arizona State Prison Complex
ASLD	Arizona State Land Department
AUM	Abandoned Uranium Mines
AWPF	Arizona Water Protection Fund
AWS	Assured Water Supply
AZMET	Arizona Meteorological Network
BIA	Bureau of Indian Affairs (U.S.)
BLM	Bureau of Land Management (U.S.)
bls	Below Land Surface
CDP	Census Designated Place
CFD	Community Facilities District
CLIMAS	Climate Assessment for the Southwest
CODE	Arizona Groundwater Management Act - A.R.S. § 45-401 et seq.
COE	Corps of Engineers (U.S.)
CWR	Certificate of Water Right
CWS	Community Water System
DOD	Department of Defense (U.S.)
DOE	Department of Energy (U.S.)
DWID	Domestic Water Improvement District
EIS	Environmental Impact Statement
ENSO	El Nino/Southern Oscillation
EPA	Environmental Protection Agency (U.S.)
ESA	Endangered Species Act - 7 U.S.C. 136; 16 U.S.C. 460 et seq.
FY	Fiscal Year
GPCD	Gallons Per Capita Per Day
gpm	Gallons per minute
GWSI	Groundwater Site Inventory
HSR	Hydrographic Survey Report
HUC	Hydrologic Unit Code
ID	Irrigation District
INA	Irrigation Non-expansion Area
ITCA	Inter Tribal Council of Arizona

LCR	Little Colorado River
LDIG	Local Drought Impact Group
LUST	Leaking Underground Storage Tank
maf	Million acre-feet
mg/l	Milligrams per liter
mgd	Million gallons per day
MGS	Mohave Generating Station
MHP	Mobile Home Park
NDEQ	Navajo Department of Environmental Quality
NDWR	Navajo Department of Water Resources
NEMO	Non-point Education for Municipal Officials
NGS	Navajo Generating Station
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service (U.S.)
NRA	National Recreation Area
NRCD	Natural Resources Conservation District
NRCS	Natural Resources Conservation Service
NTUA	Navajo Tribal Utility Authority
NWS	National Weather Service
OSM/ OSMRE	Office of Surface Mining Reclamation and Enforcement
Pan ET	Pan evaporation
P.L.	Public Law
PCC	Program Certificate Conveyance
PCE	Perchloroethylene
PWCC	Peabody Western Coal Company
RCD	Resource Conservation District
RCRA	Resource Conservation Recovery Act
RWA	Rapid Watershed Assessment
SB	Senate Bill
SCS	Soil Conservation Service (U.S.)
SNOTEL	SNOwpack TELemetry
SOC	Statement of Claimant
SRP	Salt River Project
sq. mi.	Square miles
SWE	Snow Water Equivalent
TCE	Trichloroethylene
TDS	Total dissolved solids
UMTRA	Uranium Mill Tailings Remedial Action
USBOR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USIHS	U.S. Indian Health Service
VOC	Volatile organic compound

APPENDIX A

Appendix A
Arizona Water Protection Fund Projects
In the Eastern Plateau Planning Area through FY 2008

EASTERN PLATEAU PLANNING AREA			
Groundwater Basin	**AWPF Grant #**	**Project Title**	**Project Category**
Little Colorado River Plateau	96-0003	Hoxworth Springs Riparian Restoration Project	Stream Restoration
Little Colorado River Plateau	96-0022	Saffell Canyon and Murray Basin Watershed Restoration	Feasibility Study
Little Colorado River Plateau	96-0025	Tsaile Creek Watershed Restoration Demonstration	Watershed Restoration
Little Colorado River Plateau	96-0002	Completion Phase: Hi-Point Well Project	Fencing
Little Colorado River Plateau	97-029	Demonstration Enhancement of Pueblo Colorado Wash at Hubbell Trading Post	Stream Restoration & Revegetation
Little Colorado River Plateau	97-037	Talastima (Blue Canyon) Watershed Restoration Project	Exotic Species Control & Fencing
Little Colorado River Plateau	98-046	EC Bar Ranch Water Well Project	Fencing & Water Developments
Little Colorado River Plateau	98-051	Evaluation of Carex Species for Use in Riparian Restoration	Research
Little Colorado River Plateau	99-067	EC Bar Ranch Wildlife Drinker Project	Livestock & Wildlife Water Developments
Little Colorado River Plateau	99-079	Little Colorado River Riparian Restoration Project	Constructed Wetland & Revegetation
Little Colorado River Plateau	99-084	Assessments of Riparian Zones in the Little Colorado River Watershed	Research
Little Colorado River Plateau	99-089	Town of Eager/Round Valley Water Users Association Pressure Irrigation Feasibility Study & Preliminary Design	Feasibility Study
Little Colorado River Plateau	99-092	Little Colorado River Enhancement Demonstration Project	Stream Restoration
Little Colorado River Plateau	99-095	Brown Creek Riparian Restoration	Fencing & Water Developments

Groundwater Basin	AWPF Grant #	Project Title	Project Category
Little Colorado River Plateau	00-101	Murray Basin and Saffell Canyon Watershed Restoration Project	Watershed Restoration
Little Colorado River Plateau	00-104	Continued Enhancement of Pueblo Colorado Wash at Hubbell Trading Post National Historic Site	Exotic Species Control & Stream Restoration
Little Colorado River Plateau	00-105	Hubbell Trading Post Riparian Restoration with Treated Effluent	Revegetation
Little Colorado River Plateau	00-108	Lake Mary Watershed Streams Restoration	Channel Restoration
Little Colorado River Plateau	00-110	Upper Fairchild Draw Riparian Restoration	Fencing & Revegetation
Little Colorado River Plateau	00-112	Town of Eagar/Round Valley Water Users Association Pressure Irrigation Feasibility Study and Preliminary Design – Additional Mapping for Water Quality Improvements in the Watershed	Feasibility Study
Little Colorado River Plateau	00-113	Polacca Wash Grazing Management	Fencing & Exotic Species Control w/ Revegetation
Little Colorado River Plateau	03-119	Wet Meadows for Water Quality and Wildlife – A Riparian Restoration Project	Fencing & Habitat Protection
Little Colorado River Plateau	05-125	Wilkins' family Little Colorado River Riparian Enhancement Project	Stream Restoration
Little Colorado River Plateau	05-126	X Diamond Ranch LCR Riparian Enhancement Project	Stream Restoration
Little Colorado River Plateau	05-127	EC Bar Ranch Reach 8 Water Well and Drinker Project	Water Developments
Little Colorado River Plateau	06-136	The Arboretum at Flagstaff Wetland Habitat Enhancement	Habitat Restoration
Little Colorado River Plateau	07-141	Picture Canyon Rio de Flag Meander Restoration Project	Stream Restoration
Little Colorado River Plateau	07-143	Little Colorado River & Nutrioso Creek Riparian Enhancement Project	Stream Restoration

Groundwater Basin	AWPF Grant #	Project Title	Project Category
Little Colorado River Plateau	07-146	Little Colorado River Project on H-Y Ranch River Recovery Project	Fencing & Habitat Restoration
Little Colorado River Plateau	07-150	Fairchild Draw Riparian Restoration Project	Fencing & Habitat Restoration
Little Colorado River Plateau	07-154	Billy Creek Natural Area Riparian Restoration Project	Stream Restoration
Little Colorado River Plateau	08-159	Hoxworth Springs Stream Channel Restoration Project	Fencing & Stream Restoration

APPENDIX B

APPENDIX B: Community Water System Annual Report Data 2006-2007 and Submitted Plans (all values are in acre-feet)

PCC	FACILITY	Basin	2006 Withdrawn	2006 Diverted	2006 Received	2006 Total Demand	2006 Delivered	2006 Delivered to	2007 Withdrawn	2007 Diverted	2007 Received	2007 Total Demand	2007 Delivered	2007 Delivered to
91-000396	303 DOMESTIC WTR IMPROVEMENT DISTRICT	LCR	2			2	2	CUSTOMER	3			3	3	CUSTOMER
91-000386	A PETERSEN WATER CO	LCR	10			10	9	CUSTOMER	12			12	11	CUSTOMER
91-000100	ADOT GRAY MOUNTAIN M/C	LCR	7			7	7	CUSTOMER	10			10	10	CUSTOMER
91-000108	ADOT PAGE YARD & M/C	LCR	15			15	15	CUSTOMER	13			13	13	CUSTOMER
91-000004	ARIZONA WINDSONG WC	LCR	8			8	9	CUSTOMER	9			9	16	CUSTOMER
91-000021	ASPC APACHE	LCR	NR						NR					
91-000408	ASPC WINSLOW APACHE	LCR	NR						NR					
91-000365	AZ WATER CO - LAKESIDE	LCR	792			792	757 3	CUSTOMER/ SYSTEM	898			898	818	CUSTOMER
91-000366	AZ WATER CO - OVERGAARD	LCR	503			503	453	CUSTOMER	540			540	468	CUSTOMER
91-000409	BLACK MESA RANGER DISTRICT	LCR	9			9	9	CUSTOMER	13			13	14	CUSTOMER
91-000393	BOURDON RANCH ESTATES	LCR	7			7	7	CUSTOMER	9			9	8	CUSTOMER
91-000402	BUCKSKIN ARTISTS COMMUNITY	LCR	65			65	65	CUSTOMER	57			57	57	CUSTOMER
91-000018	CEDAR GROVE WATER CO	LCR	54			54	49 4	CUSTOMER/ SYSTEM	69			69	68 17	CUSTOMER/ SYSTEM
91-000390	CHAPARRAL PINES	LCR	13			13	13	CUSTOMER	NR					
91-000368	CLAY SPRINGS DWID	LCR	43			43	39	CUSTOMER	45			45	44	CUSTOMER
91-000403	COUNTRY LANE TRAILER PARK	LCR	NR						NR					
91-000003	CROSBY SPRING AT GREER	LCR	NR						NR					
91-000084	DONEY PARK WATER	LCR	783			783	782	CUSTOMER	809			809	832	CUSTOMER
91-000002	EAGAR, TOWN OF	LCR	595	105		700	668 98	CUSTOMER/ OTHER	557			557	632 134	CUSTOMER/ OTHER
91-000398	EL RANCHO GRANDE	LCR	22			22	22	CUSTOMER	22			22	22	CUSTOMER
91-000106	FLAGSTAFF RANCH WATER CO	LCR	52			52	53	CUSTOMER	41			41	41	CUSTOMER
91-000086	FLAGSTAFF, CITY OF	LCR	6857	1628		8485	7890 2286	CUSTOMER/ OTHER	8506	334		8840	8224 4990	CUSTOMER/ OTHER
91-000098	FOREST LAKES WATER IMPROV	LCR	235			235	235	CUSTOMER	NR					
91-000099	GREENEHAVEN WATER CO	LCR	NR						NR					
91-000371	HEBER DOMESTIC WID	LCR	138			138	138	CUSTOMER	144			144	144	CUSTOMER
91-000089	HECKETHORN WATER COMPANY	LCR	13			13	12	CUSTOMER				0		
91-000111	HIDDEN HOLLOW MOBILE HOM	LCR	10			10	10	CUSTOMER	19			19	19	CUSTOMER
91-000014	HIDDEN MEADOW RANCH	LCR	13			13	13	CUSTOMER	NR					

PCC	FACILITY	Basin	2006 Withdrawn	2006 Diverted	2006 Received	2006 Total Demand	2006 Delivered	2006 Delivered to	2007 Withdrawn	2007 Diverted	2007 Received	2007 Total Demand	2007 Delivered	2007 Delivered to
91-000405	HIGH COUNTRY PINES WATER	LCR	30			30	30	CUSTOMER	34			34	30	CUSTOMER
91-000372	HOLBROOK, CITY OF	LCR	790			790	790	CUSTOMER	801			801	801	CUSTOMER
91-000373	JOSEPH CITY UTILITY	LCR	NR						NR					
91-000112	KACHINA VILLAGE MHP	LCR			20	20	20	CUSTOMER			15	15	15	CUSTOMER
91-000363	LAGUNA ESTATES	LCR	8			8	8	CUSTOMER	NR					
91-000103	LAKE MARY COUNTRY STORE	LCR	NR						NR					
91-000400	LINDEN TRAILS	LCR	NR						15			15	15	CUSTOMER
91-000011	LIVCO WATER COMPANY	LCR	115			115	100 12	CUSTOMER/ SYSTEM	147		3	150	94 15	CUSTOMER/ SYSTEM
91-000091	MORMON LAKE WC	LCR	7		2	9	6	CUSTOMER	7		1	8	5	CUSTOMER
91-000092	MOUNTAIN DELL WATER INC	LCR	22			22	23	CUSTOMER	23			23	22	CUSTOMER
91-000379	MT GLEN WS-LINDEN EAST	LCR	74			74	67	CUSTOMER	68			68	68	CUSTOMER
91-000395	NAVAJO CO GOVT COMPLEX	LCR	64			64	64	CUSTOMER	NR					
91-000016	OJO BONITO ESTATES DWID	LCR	4			4	5	CUSTOMER	6			6	5	CUSTOMER
91-000006	OLD CONCHO WATER USERS	LCR	NR						NR					
91-000093	PAGE, CITY OF	LCR		2250		2250	1898 97 719	CUSTOMER/ SYSTEM/OTHER		2331		2331	2024	CUSTOMER
91-000369	PARK VALLEY - FOOLS HOLLOW	LCR	185			185	170	CUSTOMER	200			200	183	CUSTOMER
91-000005	PINECREST WATER CO INC	LCR	3			3	3	CUSTOMER	3			3	3	CUSTOMER
91-000375	PINETOP WTR COM FACIL DIS	LCR	468			468	467	CUSTOMER	478			478	407	CUSTOMER
91-000376	PINEVIEW LAND AND WATER C	LCR	335		6	341	279 1	CUSTOMER/ SYSTEM	367			367	288 1	CUSTOMER/ SYSTEM
91-000377	PONDEROSA WATER CO	LCR	484			484	484	CUSTOMER	592			592	592	CUSTOMER
91-000370	PORTER CREEK DWID	LCR	25			25	27	CUSTOMER	27			27	27	CUSTOMER
91-000378	PORTER MOUNTAIN DWID	LCR	16			16	14	CUSTOMER	19			19	17 1	CUSTOMER/ SYSTEM
91-000404	RUNNING BEAR MOBIL RESORT	LCR	8			8	8	CUSTOMER	NR					
91-000013	SANDERS SCHOOL DISTRICT	LCR	NR						NR					
91-000020	SERVICEBERRY WATER CO	LCR	5			5	5	CUSTOMER	4			4	4	CUSTOMER
91-000022	SHOW LOW CROSSROADS HOA	LCR	4			4	4	CUSTOMER	NR					
91-000380	SHOW LOW, CITY OF	LCR	1485			1485	1352/3/898	CUSTOMER/ SYSTEM/OTHER	1651			1651	1543	CUSTOMER
91-000381	SILVER WELL SERVICE CORP	LCR	50			50	48	CUSTOMER	56			56	59	CUSTOMER
91-000391	SITGREAVES WATER CO	LCR	8			8	8	CUSTOMER	NR					

PCC	FACILITY	Basin	2006 Withdrawn	2006 Diverted	2006 Received	2006 Total Demand	2006 Delivered	2006 Delivered to	2007 Withdrawn	2007 Diverted	2007 Received	2007 Total Demand	2007 Delivered	2007 Delivered to
91-000382	SKY-HI DOMESTIC IMP DIST	LCR	NR						18			18	18	CUSTOMER
91-000383	SNOWFLAKE, TOWN OF	LCR	1416			1416	1416/299	CUSTOMER/ OTHER	1621			1621	1627/305	CUSTOMER/ OTHER
91-000008	SPRINGERVILLE, TOWN OF	LCR	290			290	290	CUSTOMER	286			286	286	CUSTOMER
91-000007	ST JOHNS, CITY OF	LCR	662			662	578	CUSTOMER	726			726	618	CUSTOMER
91-000384	SUMMER PINES WATER CO	LCR	36			36	29	CUSTOMER	NR					
91-000364	SUN VALLEY UTILITIES COR	LCR	54			54	54	CUSTOMER	52			52	52	CUSTOMER
91-000399	SWEETWATER RANCH	LCR	21			21	21	CUSTOMER	36			36	36	CUSTOMER
91-000096	TALL PINES ESTATES WATER	LCR	4			4	4	CUSTOMER	7			7	7	CUSTOMER
91-000385	TAYLOR, TOWN OF	LCR	871			871	870	CUSTOMER	973			973	972	CUSTOMER
91-000407	THE PINES AT SHOWLOW MASTER PROP HOA INC	LCR	NR						NR					
91-000023	THE WILDERNESS	LCR	NR						NR					
91-000367	TIMBERLAND ACRES	LCR	54			54	47	CUSTOMER	60			60	53	CUSTOMER
91-000401	TIMBERLINE MOBILE HOME PK	LCR	23			23	23	CUSTOMER	23			23	23	CUSTOMER
91-000010	TK WATER SERVICE	LCR	8			8	8	CUSTOMER	9			9	9	CUSTOMER
91-000157	TWIN LAKES MOBILE PARK	LCR	21			21	21	CUSTOMER	NR					
91-000113	USFS-CONF-BLUE RIDGE R/S	LCR	2			2	1	CUSTOMER	4			4	3	CUSTOMER
91-000012	VERNON D W I D	LCR	12			12	12	CUSTOMER	NR					
91-000095	WEST VILLAGE WATER CO	LCR	6			6	6	CUSTOMER	8		1	9	7	CUSTOMER
91-000387	WHITE MOUNTAIN LAKES EST	LCR	NR						NR					
91-000389	WHITE MOUNTAIN SUMMER HO	LCR	77			77	85	CUSTOMER	NR					
91-000406	WHITE MOUNTAIN WATER CO	LCR	65			65	63	CUSTOMER	78			78	67	CUSTOMER
91-000017	WINCHESTER TRAILS	LCR	28			28	28	CUSTOMER	NR					
91-000074	WINCHESTER WATER CO. LLC	LCR	61			61	62	CUSTOMER	63			63	63	CUSTOMER
91-000388	WINSLOW, CITY OF	LCR	1744	2000		3744	1744	CUSTOMER	1706	1100		2806	1706	CUSTOMER
91-000397	WONDERLAND ACRES DWID	LCR	NR						38			38	38	CUSTOMER
91-000394	WOODRUFF DOMESTIC WTR CO	LCR	NR						NR					

PCC = Program Certificate Conveyance (used as the community water system ID number)

Community Water System Plans submitted to the Department as of 12/2008

PCC	NAME	BASIN
91-000396	303 DOMESTIC WTR IMPRO DISTRICT	LCR
91-000386	A PETERSEN WATER CO	LCR
91-000100	ADOT GRAY MOUNTAIN M/C	LCR
91-000108	ADOT PAGE YARD & M/C	LCR
91-000365	AZ WATER CO - LAKESIDE	LCR
91-000366	AZ WATER CO - OVERGAARD	LCR
91-000409	BLACK MESA RANGER DISTRICT	LCR
91-000393	BOURDON RANCH ESTATES	LCR
91-000402	BUCKSKIN ARTISTS COMMUNITY	LCR
91-000018	CEDAR GROVE WATER CO	LCR
91-000390	CHAPARRAL PINES	LCR
91-000368	CLAY SPRINGS DWID	LCR
91-000084	DONEY PARK WATER	LCR
91-000002	EAGAR, TOWN OF	LCR
91-000398	EL RANCHO GRANDE	LCR
91-000106	FLAGSTAFF RANCH WATER CO	LCR
91-000086	FLAGSTAFF, CITY OF	LCR
91-000098	FOREST LAKES WATER IMPROVEMENT DISTRICT	LCR
91-000371	HEBER DOMESTIC WID	LCR
91-000111	HIDDEN HOLLOW MOBILE HOM	LCR
91-000014	HIDDEN MEADOW RANCH	LCR
91-000405	HIGH COUNTRY PINES WATER	LCR
91-000372	HOLBROOK, CITY OF	LCR
91-000112	KACHINA VILLAGE MHP	LCR
91-000090	KACHINA VILLAGE UTILITIES	LCR
91-000363	LAGUNA ESTATES	LCR
91-000103	LAKE MARY COUNTRY STORE	LCR
91-000400	LINDEN TRAILS	LCR
91-000011	LIVCO WATER COMPANY	LCR
91-000091	MORMON LAKE WC	LCR
91-000092	MOUNTAIN DELL WATER INC	LCR
91-000379	MT GLEN WS-LINDEN EAST	LCR
91-000016	OJO BONITO ESTATES DWID	LCR
91-000093	PAGE, CITY OF	LCR
91-000369	PARK VALLEY - FOOLS HOLLOW	LCR
91-000005	PINECREST WATER CO INC	LCR
91-000376	PINEVIEW LAND AND WATER CO	LCR
91-000377	PONDEROSA WATER CO	LCR
91-000370	PORTER CREEK DWID	LCR
91-000378	PORTER MOUNTAIN DWID	LCR
91-000404	RUNNING BEAR MOBIL RESORT	LCR
91-000020	SERVICEBERRY WATER CO	LCR
91-000381	SILVER WELL SERVICE CORP	LCR
91-000382	SKY-HI DOMESTIC IMP DIST	LCR
91-000383	SNOWFLAKE, TOWN OF	LCR
91-000008	SPRINGERVILLE, TOWN OF	LCR
91-000102	STARLIGHT WATER COMPANY	LCR
91-000384	SUMMER PINES WATER CO	LCR
91-000364	SUN VALLEY UTILITIES CORP	LCR

PCC	NAME	BASIN
91-000399	SWEETWATER RANCH	LCR
91-000096	TALL PINES ESTATES WATER	LCR
91-000385	TAYLOR, TOWN OF	LCR
91-000367	TIMBERLAND ACRES	LCR
91-000010	TK WATER SERVICE	LCR
91-000157	TWIN LAKES MOBILE PARK	LCR
91-000113	USFS-CONF-BLUE RIDGE R/S	LCR
91-000095	WEST VILLAGE WATER CO	LCR
91-000389	WHITE MOUNTAIN SUMMER HOMES	LCR
91-000406	WHITE MOUNTAIN WATER CO	LCR
91-000074	WINCHESTER WATER CO. LLC	LCR
91-000388	WINSLOW, CITY OF	LCR

PCC = Program Certificate Conveyance (used as the community water system ID number)

APPENDIX C

APPENDIX C
SURFACE WATER RIGHT AND ADJUDICATION FILINGS

Surface water is defined in Arizona as "waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwaters, wastewaters, or surplus water, and of lakes, ponds and springs on the surface" (A.R.S. § 45-101).

In 1864, the first territorial legislature of Arizona adopted the doctrine of prior appropriation to govern the use of surface water. The doctrine is based on the tenet of "first in time, first in right" which means that the person who first puts the water to beneficial use acquires a right that is superior to later appropriators of the water. Since the population and water use were both relatively small at that time, no method was initially specified by the legislature for filing surface water right claims or granting rights. By the late 1800s, rapid development of irrigated agriculture combined with drought years had resulted in severe water shortages along the Salt and Gila Rivers. The territorial legislature responded in 1893 with a requirement that new water appropriations be posted at the point of diversion. However, until 1919, a person could acquire a surface water right simply by applying the water to beneficial use and recording a notice of appropriation at the state and country recorder's office. There still was not a mechanism for granting surface water rights (ADWR, 1992).

On June 12, 1919, the state legislature enacted a surface water code. Now known as the Public Water Code, the law generally requires that a person apply for and obtain a permit in order to appropriate surface water. There is an exception for water use from the mainstem of the Colorado River, which requires a contract with the Secretary of the Interior. In addition, most persons claiming surface water rights prior to the code have been required to file a statement of claim under the Water Rights Registration Act of 1974, although the act did not provide a process for determining the validity of these claims. The legislature also enacted the Stockpond Registration Act in 1977 to recognize certain unpermitted stockponds constructed after 1919 that had not gone through the application process.

The Public Water Code provides that beneficial use shall be the basis, measure and limit to the use of water within the state. Beneficial uses are domestic (which includes the watering of gardens and lawns not exceeding one-half acre), municipal, irrigation, stockwatering, water power, recreation, wildlife including fish, nonrecoverable water storage, and mining uses (A.R.S. § 45-151(A)). The quantity of water that is reasonable for a particular beneficial use depends on a number of factors, including the location of the use.

The Department maintains a registry of surface water right applications and claims filed in Arizona since the Public Water Code was enacted. Each filing is assigned a unique number with one of the following prefixes

- "3R" – application to construct a reservoir filed before 1972;
- "4A" – application to appropriate surface water filed before 1972;
- "33" – application for permit to appropriate public water or construct a reservoir filed after

1972. In addition to surface water diversions and reservoirs, instream flow maintenance can be applied for and is defined as a surface water right that remains in-situ or "in-stream", is not physically diverted or consumptively used, and is for maintaining the flow of water necessary to preserve wildlife, including fish, and/or recreation;

- "36" – statement of claim of rights to use public waters of the state. To make this claim, an applicant or predecessor-in-interest must have initiated a water use based on state law before March 17, 1995;
- "38" – claim of water right for a stockpond and application for certification filed for stockponds constructed after June 12, 1919 and before August 27, 1977. To file this claim and application, the stockpond should have been used exclusively for watering of livestock and/or wildlife, have a maximum capacity of 15 acre-feet, and not be subject to water rights litigation or protests prior to August 27, 1977;
- "39" – statement of claimant filed in *The General Adjudication of the Gila River System and Source* (Gila Adjudication) and *The General Adjudication of the Little Colorado River System and Source* (LCR Adjudication). As explained further below, the Department maintains a separate registry of these filings on behalf of the Superior Court of Arizona; and,
- "BB" – decreed water rights determined through judicial action in state or federal court.

These filings specify the source of water, its point of diversion (POD) and place of use (POU), the type and quantity of water use, and date of first use or priority.

If, after moving through a number of administrative steps, an application to appropriate surface water or construct a reservoir (3R, 4A, or 33) is determined to be for beneficial use and not conflict with vested rights or be a menace to public safety or against the interests and welfare of the public, it may be approved and the applicant issued a permit to appropriate. The permit allows the permit holder to construct diversion works, as needed, and put the water to beneficial use. If the terms of the permit are met, the applicant can submit proof of appropriation through an application of certification and may be issued a Certificate of Water Right (CWR). The CWR has a priority date that relates back to the date of application and is evidence of a perfected surface water right that is superior to all other surface water rights with a later priority date, but junior to all rights with an earlier (older) priority date. The CWR also specifies the extent and purpose of the right and may be subject to abandonment and forfeiture if not beneficially used. There are currently approximately 850 applications to appropriate pending with ADWR, and approximately 420 permits and over 7,000 certificates have been issued by ADWR or its predecessors.

A CWR may also be issued based on a stockpond claim (38) if it is found that the facts stated in the claim are true and entitle the claimant to a water right for the stockpond. The priority date depends on the date that the owner of the stockpond filed the claim. If filed prior to March 17, 1996, the priority date is the date of construction. Otherwise, the priority date is the date of filing the claim. Regardless of the date, the CWR for a stockpond claim is junior to (a) Colorado River and other court decreed rights; (b) other rights acquired prior to June 12, 1919 and registered as a statement of claim; and (c) any other CWR issued pursuant to an application filed before August 27, 1977. To date, nearly 20,000 stockpond claims have been filed of which over 3,000 stockpond certificates have been issued by ADWR or its predecessors.

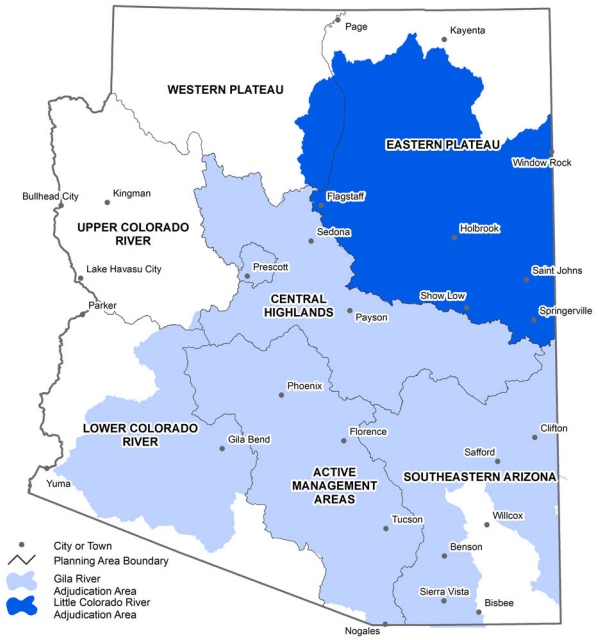
Unlike a CWR, the act of filing a statement of claim (36) does not in itself create a water right, nor does it constitute a judicial determination of the claim. Statements of claim are subject to challenge, but can be admitted "in evidence as a rebuttal presumption of the truth and accuracy of the information contained in the claim" (A.R.S. § 45-185). To date, nearly 30,000 statements of claim have been filed in Arizona.

In addition to the applications and claims described above, ADWR's registry of surface water right filings includes several rights determined through judicial action in state or federal court. These 'adjudications', in which a water right is determined by court action, may be initiated when one or more water users seek to know how their rights compare to the rights of other water users and/or seek judicial relief from alleged interference with their rights by other water users. The court process establishes or confirms the validity of surface water rights and claims, determines whether these have been properly maintained over the years, and ranks them according to their priority. The result is a decree that may, in addition to establishing and confirming rights, specifies terms under which the decreed rights may be exercised if water shortages occur. Court decreed rights are considered the most valued or certain surface water rights because in the absence of abandonment or forfeiture, they are normally accepted as to their validity. More than 1,000 court-decreed rights are listed in ADWR's registry and given the prefix "BB". Further discussion of the major court decrees is provided in Volume 1.

Although several surface water uses have been decreed, many claims and rights established before and after statehood have still not been examined to see if they remain valid. In addition, many water rights established under federal law and claimed by Indian tribes and the United States have not been quantified or prioritized. To better manage water resources in the state, these diverse rights and claims have been joined into large, comprehensive determinations.

Arizona currently has two general stream adjudications – the Gila Adjudication and the LCR Adjudication. The purpose of these judicial proceedings is to determine the nature, extent, and priority of water rights across the entire river systems. In addition to confirming existing state-based surface water rights, the adjudications will quantify and prioritize reserved water rights for Indian and non-Indian federal lands. The latter include military bases, national parks and monuments, and national forests. The adjudications will also determine which wells are pumping appropriable underground water (subflow) and therefore are subject to the jurisdiction of the court. The Gila and LCR Adjudications are being conducted in the Superior Court of Arizona in Maricopa and Apache Counties, respectively. ADWR provides technical, legal and administrative support to the adjudication court, as described in A.R.S. § 45-

Figure C-1 General Stream Adjudications in Arizona



256.
The Gila Adjudication was initiated in 1974 when SRP filed a petition to determine the water rights in the Salt River Watershed above the Granite Reef Diversion. Since that time, the adjudication area has grown and now covers over 53,000 square miles. It is divided into 7 watersheds and includes 12 Indian reservations and over 24,000 parties. The LCR Adjudication was initiated by a petition filed by Phelps Dodge in 1978. This adjudication now covers 27,000 square miles and includes 3 watersheds, 5 Indian reservations, and over 3,000 parties. A party is a person or entity that has filed one or more statement of claimant (SOC) in the adjudication.

All parties who claim to have a water right within the river systems are required to file an SOC or risk the loss of their right. Well owners are also encouraged to file an SOC since the adjudication process may include water use from a well depending on the well's location relative to streams and other factors. However, a person does not obtain a right to use water by filing an SOC nor is an SOC a legal permit to use water. Rights to use water must be acquired in accordance with state or federal law.

Each year, ADWR sends summons to new surface water appropriators and well owners in the adjudication areas that direct them to file an SOC. In response, the number of SOCs filed in the adjudications continues to increase as new water uses are initiated. To date, nearly 81,000 SOCs have been filed in the Gila Adjudication and over 14,000 SOCs have been filed in the LCR Adjudication. ADWR maintains a separate registry of these adjudication filings on behalf of the Superior Court and assigns each a unique number with the prefix "39".

Table C-1 summarizes the number of surface water right and adjudication filings for each planning area. The table was generated by querying ADWR's surface water right and SOC registries in February 2009. Files are only counted in the table if they include sufficient locational information (Township, Range, and Section) to allow a POD and/or POU to be mapped within the planning area. If a file lists more than one POD or POU in a planning area, it is only counted once in the table for that planning area. However, no attempt was made to avoid counting multiple filings for the same POD/POU which can result if a landowner or lessee has two or more filings or if different applicants each have at least one filing. Since many SOCs list surface water right filings as their basis of claim, multiple filings are common and account, in part, for the large number of filings. Sorting through multiple filings is one of the challenges facing the Department and the adjudication courts. Results from the Department's investigation of surface water right and adjudication filings are presented in Hydrographic Survey Reports (HSRs).

Figure C-2 shows the location of surface water diversion points listed in the Department's surface water rights registry. The numerous points mapped reflect the relatively large number of stockponds and reservoirs that have been constructed across the state as well as diversions from streams and springs. Locations for registered wells, many of which are referenced as the basis of claim in SOCs, are also shown in Figure C-2. Instream flow filings are not shown as these filings do not have points of diversion.

Table C-1 Count of Surface Water Right and Adjudication Filings by Planning Area[1]

PLANNING AREA	TYPE OF FILING							TOTAL
	BB[2]	3R[3]	4A[3]	33[3]	36[4]	38[5]	39[6]	
Eastern Plateau	134	163	196	373	3,289	3,275	12,099	**19,529**
Southeastern	483	395	716	898	8,288	6,415	19,288	**36,483**
Upper Colorado River	0	224	329	469	2,858	2,084	0	**5,964**
Central Highlands	1	287	625	897	8,517	3,928	25,443	**39,698**
Western Plateau	0	415	207	554	1,177	1,270	324	**3,947**
Lower Colorado River	0	26	48	86	355	304	2,323	**3,142**
Active Management Areas	1	269	341	687	4,072	2,913	27,134	**35,417**
Total	**619**	**1,779**	**2,462**	**3,964**	**28,556**	**20,189**	**86,611**	**144,180**

Notes:

[1] Based on a query of ADWR's surface water right and adjudication registries in February 2009. A file is only counted in this table if it provides sufficient information to allow a Point of Diversion (POD) and/or Place of Use (POU) to be mapped within the planning area. If a file lists more than one POD or POU in a given planning area, it is only counted once in the table for that planning area. Several surface water right and adjudication filings are not counted here due to unsufficient locational information. However, multiple filings for the same POD/POU are counted.

[2] Court decreed rights; not all of these rights have been identified and/or entered into ADWR's surface water rights registry.

[3] Application to construct a reservoir, filed before 1972 (3R); application to appropriate surface water, filed before 1972 (4A); and application for permit to appropriate public water or construct a reservoir, filed after 1972 (33).

[4] Statement of claimant of rights to use public waters of the state, filed pursuant to the Water Rights Registration Act of 1974.

[5] Claim of water right for a stockpond and application for certification, filed pursuant to the Stockpond Registration Act of 1977.

[6] Statement of claimant, filed in the Gila or LCR General Stream Adjudications.

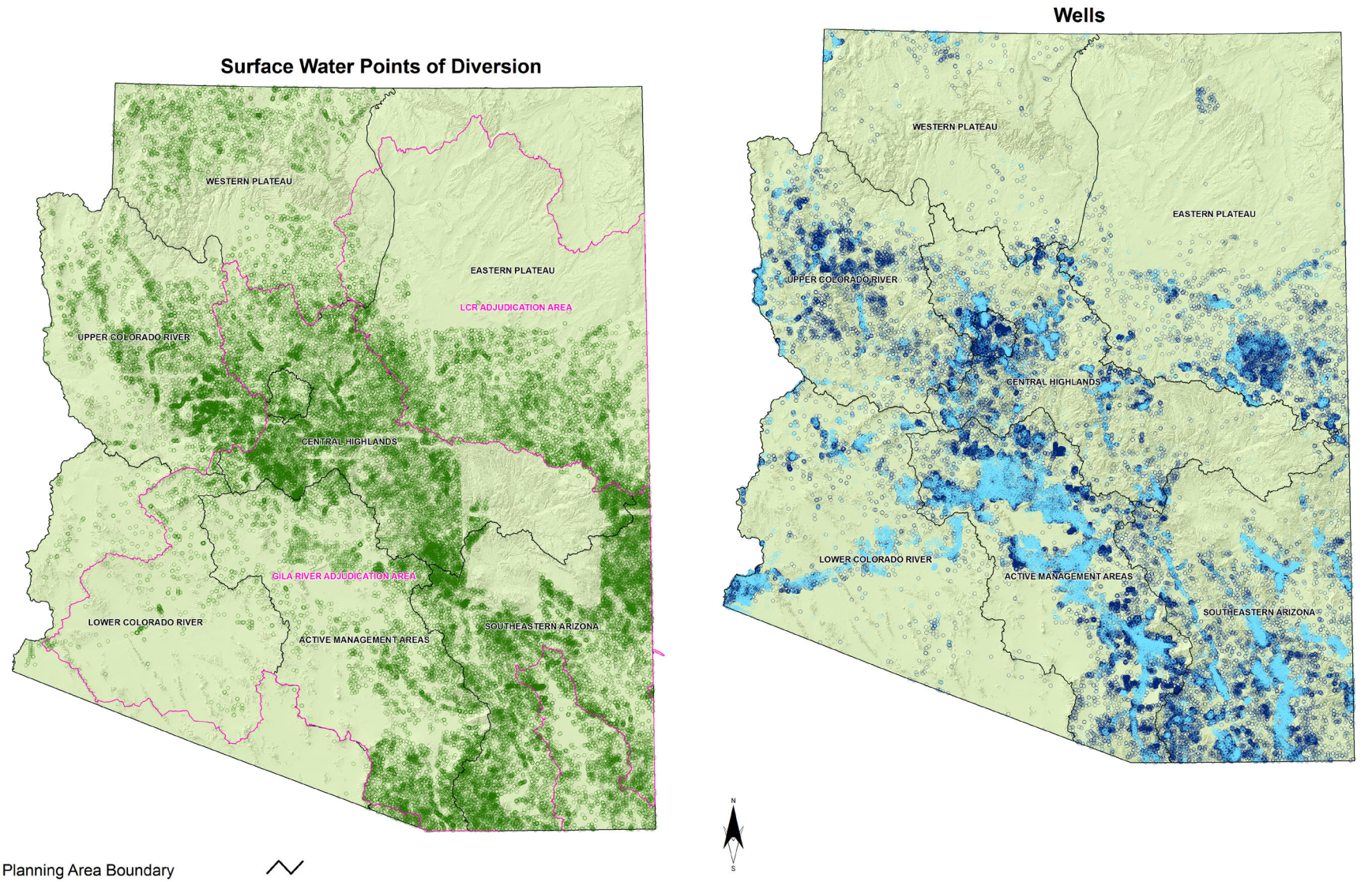


Figure C-2
Registered Wells and Surface Water Diversion Points in Arizona

APPENDIX D

APPENDIX D: RURAL WATERSHED PARTNERSHIPS ISSUE SUMMARY (2008)

Rural watershed partnership participants, projects, accomplishments and issues are summarized below. Some partnerships include more than one planning area as noted.

MULTI-PLANNING AREA - Eastern Plateau, Western Plateau and Central Highlands			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
Coconino Plateau Water Advisory Council	Flagstaff Coconino County Williams Sedona Page Tusayan TNC Grand Canyon Trust Navajo Nation Hopi Tribe Havasupai Tribe Hualapai Tribe ADWR ADEQ State Land NRCD NAU USGS USBoR USFS National Parks US Fish and Wildlife Grand Canyon National Park AZ Game and Fish Doney Park Water Co.	• 4 categories of potential water augmentation projects have been identified along with their associated costs. • Groundwater study and conceptual model completed • Phase I Water Demand Study for Coconino Plateau • Growth Impacts Study • Western Navajo Pipeline Study • Development of study for importing C aquifer groundwater east of Flagstaff has been completed. • Flagstaff, Hopi and Navajo are exploring cooperative opportunities for developing C aquifer groundwater. • Flagstaff purchased Red Gap Ranch for possible future development of groundwater. • Hopi HSR initiated. • Water Supply Appraisal Study Completed, which identifies current & future demands and alternatives for meeting projected demands.	• Continued growth throughout entire plateau region • Limited and deep groundwater supplies. • Drought sensitive surface water supplies of Williams, Flagstaff and others • Groundwater salinity issues in northeastern part of plateau • Numerous water haulers with few hauling stations that are sometimes cutoff during drought • Unable to get adequate water supply designation under current definition • Growth in Page with no current means of additional supply • ESA issues with groundwater usage and impacts on perennial streams • Potential limitation of groundwater usage resulting from reserved groundwater rights of Indians • Uncertainty of Indian water right settlements (LCR & Colorado River) • Proposed San Juan Paiute reservation west of Flagstaff • Potential impacts on springs in Grand Canyon and also on supplies to Havasupai and Hualapai reservations • Access to water development on public lands

MULTI-PLANNING AREA - Eastern Plateau, Western Plateau and Central Highlands			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
		• Numeric Groundwater Model completed • Strategic Plan has been completed to address water conservation and management on the Plateau • Attempting to obtain Congressional Authority to complete a Feasibility Study of the water alternatives identified	• Limited groundwater data for entire region • Minor Arsenic issues in Woody Mtn. Well field (9-14 ppb) • Unregulated lot splits • Limited funding resources for planning, projects, infrastructure and studies • Extremely high cost of water augmentation projects • Competition from Phoenix/Tucson for CAP reallocation water and other Colorado River supplies • Congressional Support for completion of a Feasibility Study • Modifications to the current definition of an adequate water supply resulting from the passage of SB1575
Northern Arizona Municipal Water Users Association (NAMWUA)	Prescott, Prescott Valley, Flagstaff, Williams, Cottonwood, Clarkdale, Sedona, Payson, Chino Valley	• Projected water demands through 2040 have been identified • A request for 70,000 acre-feet of CAP reallocation water has been submitted to ADWR for consideration. • Completed Colorado River Supply Study	• Limited supplies to meet projected demands • ESA issues impacting potential ground and surface water supplies • Limited funding resources for planning, projects, infrastructure and studies • Competition from Phoenix/Tucson for CAP reallocation water and other Colorado River supplies • Funding for Colorado River infrastructure • Water quality issues in Verde Valley and Flagstaff • Upper Basin/Lower Basin issues with Colorado River affect potential for use • Modifications to the current definition of an adequate water supply resulting from the passage of SB1575

EASTERN PLATEAU PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
Little Colorado Watershed Coordinating Council (Formerly Little Colorado River Multi-Objective Management Partnership (LCRMOM))	Winslow Holbrook Navajo County NRCD/RCD NAU USBoR COE	• Development and Ecosystem Restoration Program study for the Montane Forest Regimes completed. • Watershed reconnaissance study completed • Completed Watershed Based Plan	• Potential impacts on groundwater from power plants • Water quality issues involving arsenic and TDS • Unresolved adjudication and Indian water rights settlements • Limited groundwater data for entire region • Invasive species (Tamarisk) • ESA issues • Drought impacts on surface water supplies • Limited funding resources for planning, projects, infrastructure and studies • Modifications to the current definition of an adequate water supply resulting from the passage of SB1575
Navajo Nation	NDWR NTUA NDEQ NHA ADWR USBoR COE BIA HIS	• Survey of agricultural lands in Upper Basin • Groundwater elevation survey of NTUA wells • Water Quality ATLAS • Navajo Drought Report • Western Navajo Water Supply Study	• Lack of technical groundwater data • Limited groundwater supplies to meet projected demands • Water quality issues • Prone to impacts from drought • Unresolved water right claims to LCR, Colorado R. & San Juan R. • Upper Basin/Lower Basin issues with Colorado River • Gallup to Window Rock Pipeline in jeopardy (financial, upper/lower basin issues, ESA and others)

EASTERN PLATEAU PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
Pinetop-Lakeside Watershed Enhancement Partnership	Show Low Lakeside Pinetop Navajo County Show Low Creek Irrigation District Local Citizenry LCRWCC ADWR AZ Game & Fish	• Groundwater elevations study • GPS survey of agricultural lands • Preliminary water budget completed. • Received 319 Grant to address water quality issues in Rainbow Lake • Water Protection Fund Grant for Billy Creek Project • Completed Watershed Based Plan • Obtained TRIF Grant to conduct groundwater age dating	• Drought impacts on surface water supplies and springs resulting in impacts on agriculture and cattle ranching • Seasonal demands impacting peak demands • Growth • Unresolved adjudication and Indian water rights settlements • Limited funding resources for planning, projects, infrastructure and studies • Modifications to the current definition of an adequate water supply resulting from the passage of SB1575
Silver Creek Watershed Partnership	Snowflake Taylor Holbrook Winslow Show Low Navajo County Silver Creek ID Show Low Creek Watershed Partnership LCRWCC ADWR NAU	• Silver Creek channel and riparian restoration study completed. • Value Engineering Analysis of Unsafe Dams completed • Silver Creek HSR	• Limited groundwater data • Potential impacts on groundwater system from Cholla Power plant • Drought impacts on surface water supplies for agriculture • Several high hazard unsafe dams • Unresolved adjudication and Indian water rights settlements • Perception of no real supply problem • Water quality concerns in some areas (salinity) • Limited funding resources for planning, projects, infrastructure and studies • Modifications to the current definition of an adequate water supply resulting from the passage of SB1575
Upper Little Colorado River Watershed	Springerville Eagar Greer Nutrioso Apache County	• Aerial mapping survey and GIS coverage of the Little Colorado River and tributaries completed. • Geomorphic and biological	• Limited groundwater data • Potential impacts to the groundwater system from TEPCO generating station. • Unresolved adjudication and Indian water rights

EASTERN PLATEAU PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
	Round Valley Irrigation District Local Citizens and Special Interest Groups LCRWCC ADWR ADEQ AZG&F NRCS/RCD USFS USBoR	assessment of the LCR completed. • Stream riparian restoration project • Round Valley Irrigation Delivery System partially upgraded. • Preliminary water budget completed • Reconstruction of River Reservoir Dam completed. • Interconnection of Springerville and Eagar's wastewater treatment facilities is complete • Completed Watershed Based Plan	settlements • Proposed development in Greer and impacts on Little Colorado River • Drought impacts on forage for grazing and surface water availability for agriculture • Potential impacts on tourism due to drought • Funding issues for water delivery infrastructure • Political differences between Springerville and Eagar • Limited funding resources for planning, projects, infrastructure and studies • Modifications to the current definition of an adequate water supply resulting from the passage of SB1575