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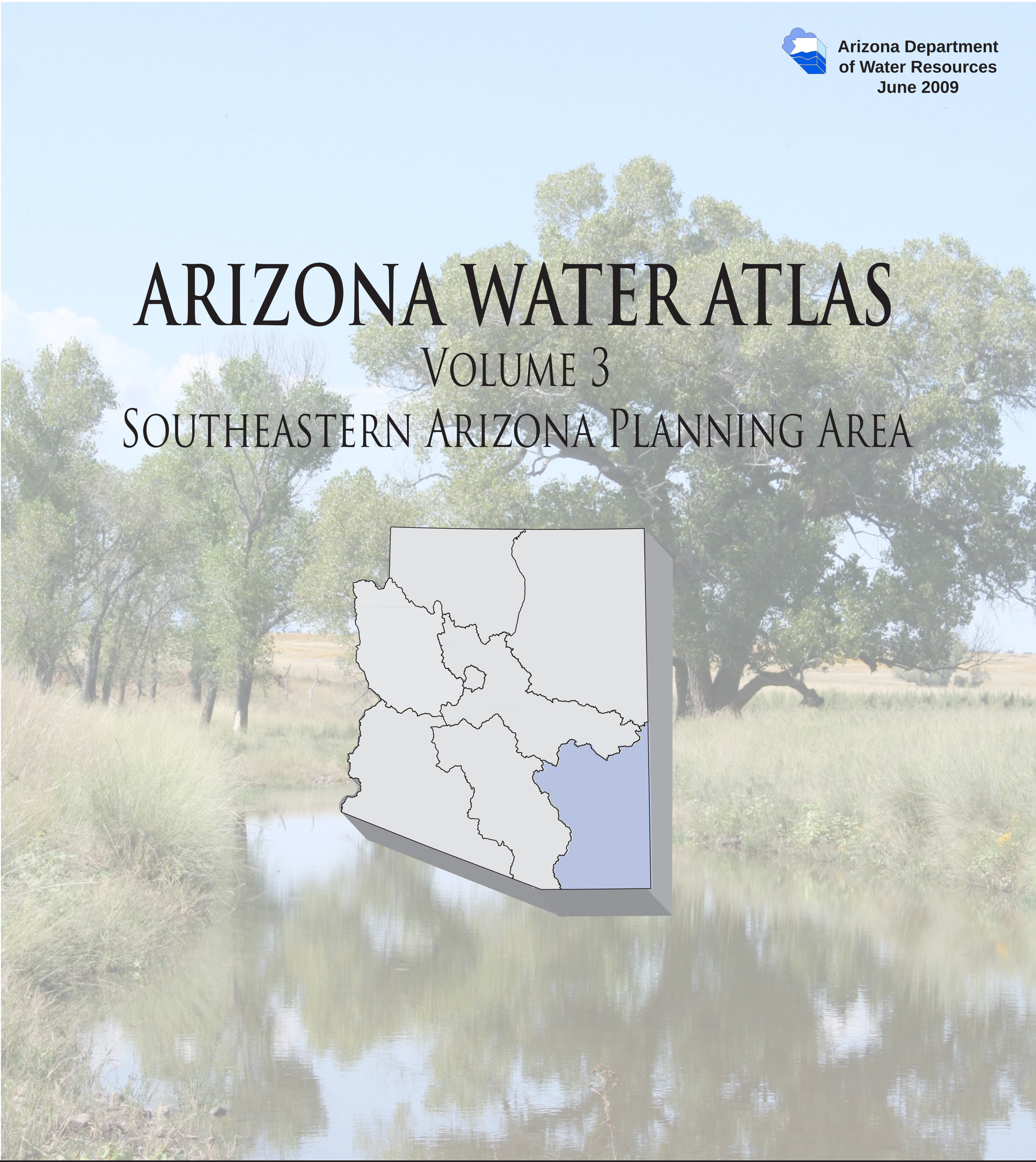

ARIZONA WATER ATLAS

VOLUME 3

SOUTHEASTERN ARIZONA 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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VOLUME 3 - SOUTHEASTERN ARIZONA PLANNING AREA

Preface

Volume 3, the Southeastern Arizona Planning Area, is the third 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 3.0-1). There is a separate Atlas volume for each planning area, an executive summary volume composed of background information, and a resource sustainability volume. "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, a description of data sources and methods of analysis for the tables and maps presented in the Atlas, and appendices that 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 3.0 Overview of the Southeastern Arizona Planning Area

The Southeastern Arizona Planning Area is composed of 14 groundwater basins that vary significantly in size. Elevation ranges from 10,713 feet to 1,830 feet. Cochise County is entirely contained in the planning area as well as portions of seven other counties: Apache (0.1%), Gila (22%), Graham (95%), Greenlee (92%), Pima (6%), Pinal (27%) and Santa Cruz (44%) counties. Most of the San Carlos Apache Reservation, the fourth largest reservation in Arizona, is located within the planning area in parts of six basins: Aravaipa Canyon, Bonita Creek, Dripping Springs Wash, Lower San Pedro, Morenci and Safford basins.

The 2000 Census planning area population was approximately 188,300. Basin population ranged from 21 in the Bonita Creek Basin to over 78,000 in the Upper San Pedro Basin. Sierra Vista is the largest metropolitan area with about 44,900 residents in the incorporated area and an additional 16,500 residents in the unincorporated area southeast of the city in 2006.

An average of 515,100 acre-feet of water (including effluent) is used annually in the planning area for agricultural, municipal and industrial uses (cultural water demand). Of this total, approximately 84% is groundwater.

Agriculture in the Safford Basin. The agricultural demand sector is the largest in the Planning Area with significant agricultural water use in the Douglas, Safford and Willcox Basins.

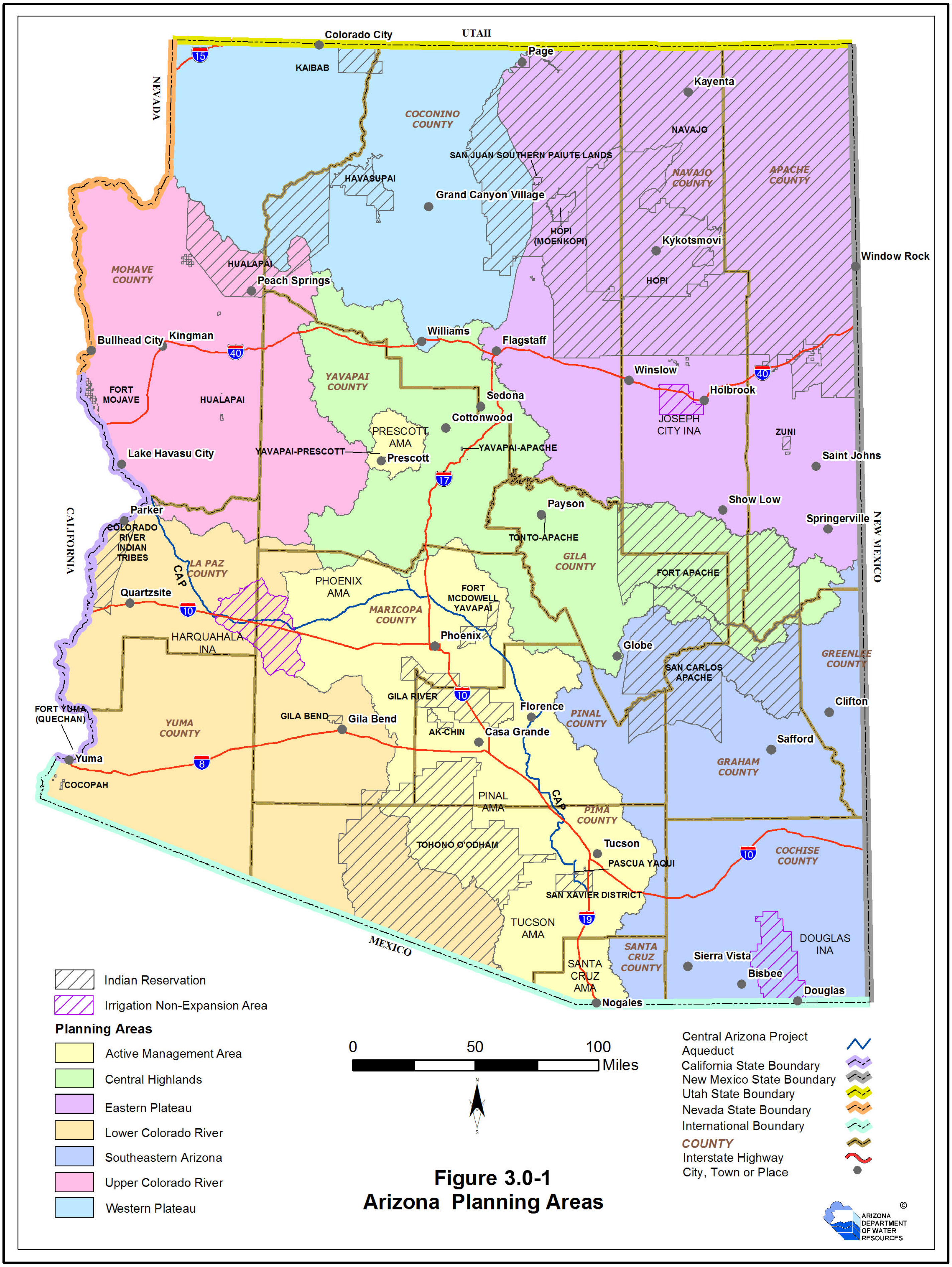


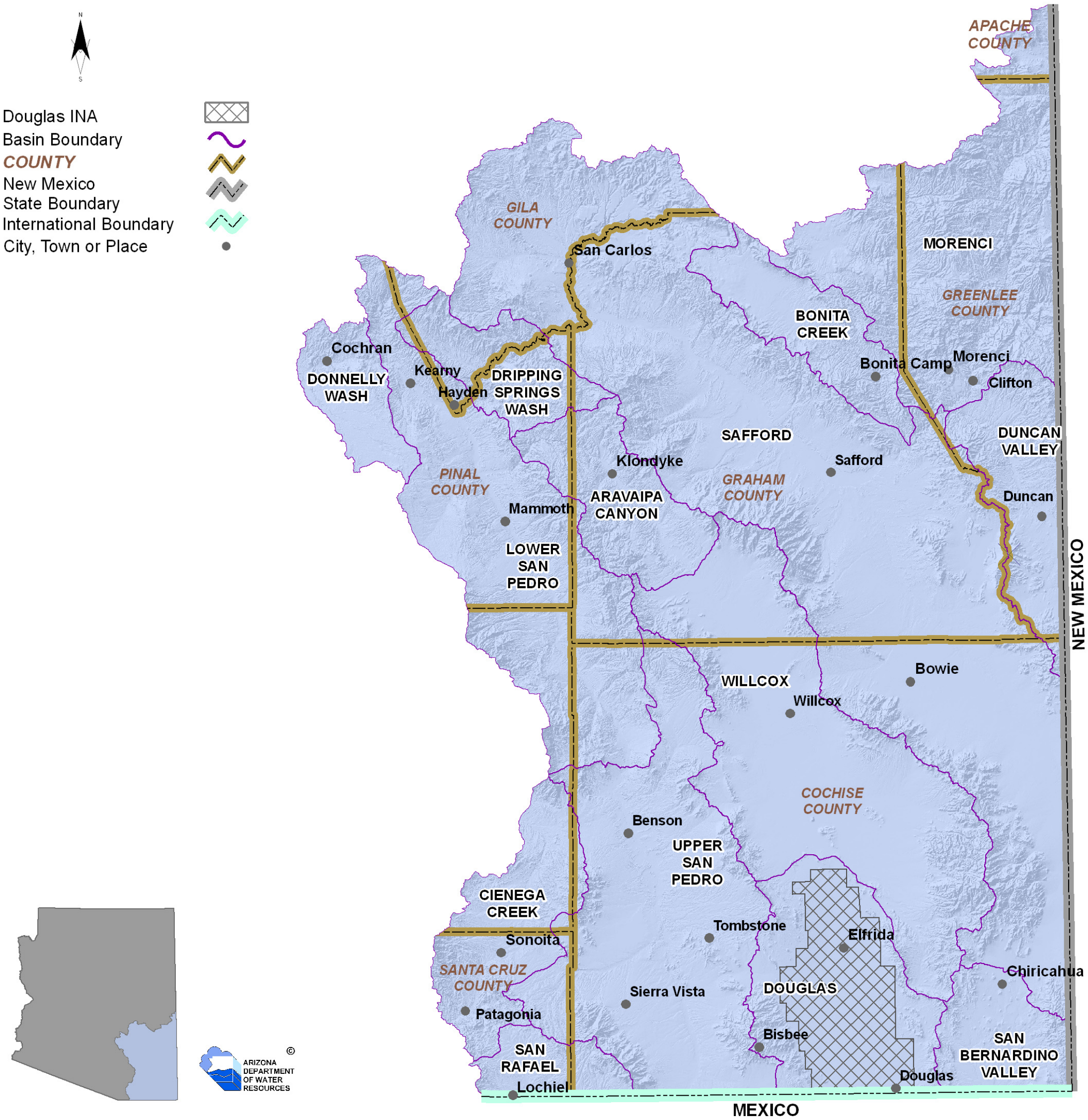
Figure 3.0-1
Arizona Planning Areas

The agricultural water use sector is the largest user by far with an average annual demand of approximately 440,000 acre-feet. There is significant agricultural use in the Douglas, Safford and Willcox basins, with over 88% of the total agricultural demand. Most of the Douglas Basin contains an area designated as the Douglas Irrigation Non-expansion Area (INA). INAs were established in areas determined to have insufficient groundwater to provide a reasonably safe supply for irrigation. Average annual municipal demand in the planning area is approximately 40,500 acre-feet per year (AFA) and industrial demand is approximately 34,550 AFA.

3.0.1 Geography

The Southeastern Arizona Planning Area encompasses 16,072 square miles (sq. mi.) of geographically diverse groundwater basins in the southeastern corner of Arizona. Groundwater basins include: Aravaipa Canyon, Bonita Creek, Cienega Creek, Donnelly Wash, Douglas, Dripping Springs Wash, Duncan Valley, Lower San Pedro, Morenci, Safford, San Bernardino Valley, San Rafael, Upper San Pedro and Willcox. Basin boundaries, counties and prominent cities, towns, and places are shown in Figure 3.0-2.

Figure 3.0-2 Southeastern Arizona Planning Area



The planning area is bounded on the east by New Mexico, on the south by the international boundary with the state of Sonora, Mexico, on the west by the Active Management Area (AMA) Planning Area (Phoenix, Pinal, Santa Cruz and Tucson AMAs) and on the north by the Central Highlands Planning Area and a small portion of the Eastern Plateau Planning Area. The planning area includes parts of 5 watersheds, which are discussed in Section 3.0-2. Most of the 2,900 sq. mi. San Carlos Apache Reservation, (83.1% or about 2,400 sq. mi.), is located in the north central part of the planning area.

The majority of the planning area is within the Mexican Highland section of the Basin and Range physiographic province, which is characterized by northwest-southeast trending mountain ranges separated by broad alluvial valleys (see Figure 3.0-3). The Mexican Highland section is a higher elevation area of the province with valleys ranging from 2,500 to 4,000 feet above sea level and mountains and valleys covering about equal areas. The extreme northern portion of the planning area falls within the Central Highlands transition zone, which is characterized by rugged mountains of igneous, metamorphic and sedimentary rocks. The average elevation in the planning area is 4,500 feet. Elevation ranges from 10,713 feet at Mount Graham in the Pinaleño Mountains in the Safford Basin to 1,830 feet near Kearny where the Gila River exits the planning area in the Lower San Pedro Basin.

A unique feature of the planning area is mountain ranges that are isolated from each other by valleys of desert grasslands and desert scrub. These "sky islands" are part of a unique complex of about 27 mountain ranges in Arizona, New Mexico, and the Mexican States of Sonora and Chihuahua. The southwestern sky island complex extends from subtropical to temperate latitudes, a condition found nowhere else. (Warshall, 2006) The highest elevation sky islands are the Pinaleño Mountains found along the Safford/Willcox/Aravaipa Canyon basin boundary and the Chiricahua Mountains along the southern Willcox and Safford basin boundary. The planning area transitions to one of Arizona's major mountain ranges, the White Mountains, along the northeastern boundary.

The planning area includes drainages of the San Pedro River and Upper Gila River (Figure 3.0-5). The Gila River originates in western New Mexico and enters Arizona near Duncan in the Duncan Valley Basin. The river generally flows west through the Safford Basin. The San Pedro River flows north from Mexico through the Upper and Lower San Pedro Basins and joins the Gila River near Hayden. Surface water in the planning area flows into the Gila River except for the Willcox Basin, a "closed basin" with internal drainage, and several basins where drainage flows south into Mexico. These basins are the Douglas, San Rafael and San Bernardino Valley basins. The Santa Cruz River originates in the San Rafael Basin, flows south into Mexico, turns north and enters the Santa Cruz AMA east of Nogales.

Figure 3.0-3 Physiographic Regions of Arizona

Data source: Fenneman and Johnson, 1946

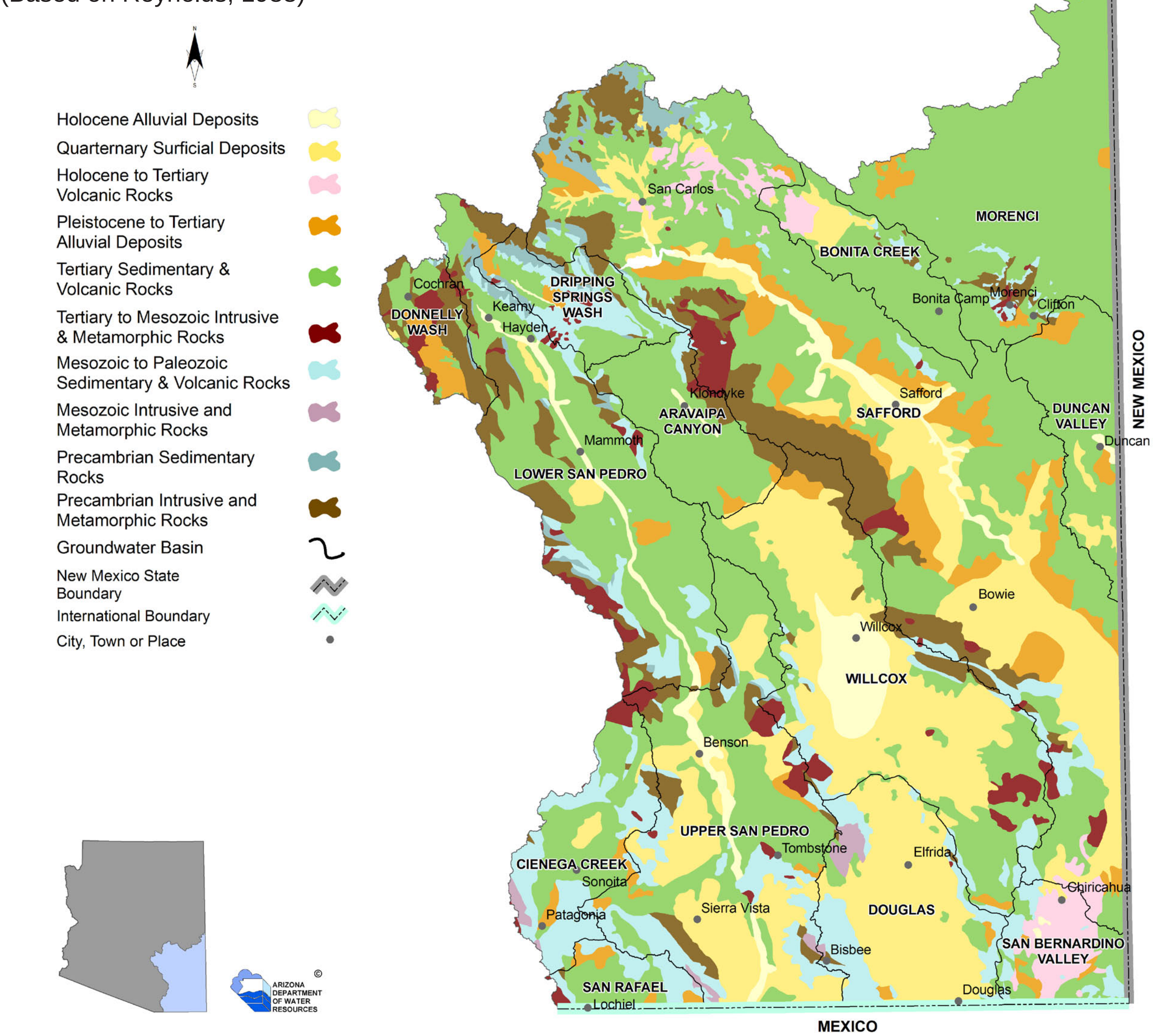
3.0.2 Hydrology[1]

Groundwater Hydrology

The Southeastern Arizona Planning Area is generally characterized by alluvial basins with relatively large reserves of groundwater in gently sloping valleys separated by mountain ranges. (See Figure 3.0-4) Anderson, Freethy and Tucci (1992) divided the alluvial basins of south-central Arizona into five groups based on similar hydrologic and geologic characteristics. One of these, the “Southeast Basins”, covers most of the planning area.

The principal water-bearing deposits in southeast basins are moderately thick sediments deposited prior to the formation of the Basin and Range structure and an overlying layer of lower basin fill that can reach over 1,000 feet thick, derived from the subsequent partial erosion of the ranges. Lower basin fill sediments are composed of fine-grained to moderately fine-grained materials. Upper basin-fill deposits average about 300 feet thick and are generally

Figure 3.0-4 Surface Geology of the Southeastern Arizona Planning Area
(Based on Reynolds, 1988)



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

composed of sands, gravels, silts, clays and some limestones. Aquifers in this region often consist of two or more water-bearing units separated by a fine-grained unit that forms a leaky confining layer over the lower basin fill. Thin layers of sand and gravel along major streams make up the stream alluvium.

Groundwater generally flows from the margins to the central axis of the basin where most groundwater discharge occurs. Confined groundwater (artesian conditions) can occur within the lower basin fill. Artesian conditions occur in a number of locations in the planning area including: the vicinity of Artesia south of Safford; washes and terraces at the base of the Pinaleño Mountains; the vicinity of St. David; the San Bernardino Valley Basin; and the Lower San Pedro Basin.
The major groundwater inflow components are mountain front recharge and stream infiltration with some underflow from adjacent up-gradient basins. Outflow consists of evapotranspiration, pumpage, discharge to streams as baseflow and some underflow to down-gradient basins, including into Mexico.

Each groundwater basin in the planning area is discussed briefly below. They are grouped into geographic areas according to their general location and similar hydrologic characteristics.

Artesian well in the San Bernardino Valley Basin. Artesian conditions also occur in the vicinity of Artesia south of Safford, washes and terraces at the base of the Pinaleno Mountains, the Lower San Pedro Basin and in the vicinity of St. David in the Upper San Pedro Basin.

North/Northeastern Portion

Groundwater basins located in the north and northeastern portion of the planning area are Bonita Creek, Dripping Springs Wash, Duncan Valley, Morenci and Safford. The Safford Basin aquifers are primarily stream alluvium and basin fill, while the other basins also contain aquifers composed of volcanic rock or sedimentary rock (Gila Formation). Groundwater flow is toward the Gila River drainage and the Bonita Creek, Duncan Valley and Morenci basins contribute underflow to the Safford Basin.

Bonita Creek Basin

The portion of the Bonita Creek Basin located within the San Carlos Indian Reservation is characterized by a broad valley bordered by the Nantac Rim and the Gila Mountains. The valley consists of basin fill material with volcanic intrusions where most wells are drilled. The lower part of the basin is characterized by volcanic flows, agglomerates and tuffs interbedded with small sedimentary lenses. In this part of the basin, alluvial deposits along the creek are the main aquifer. Groundwater flow is toward the southeast. Groundwater recharge has been estimated at 9,000 AFA and groundwater in storage estimates vary from 1 to 2 million acre-feet (maf). The reported median well yield from 14 wells is over 1,100 gpm. (Table 3.2-4). Water levels are relatively shallow in the few wells measured in the basin, and all are located near the southern boundary. Water quality data are lacking. The City of Safford operates an infiltration galley along Bonita Creek and conveys water to Safford for municipal use.

Dripping Springs Wash Basin

Dripping Springs Wash is a mountainous basin containing small sediment-filled valleys with relatively little groundwater in storage. The largest valley is north of the Gila River and drained by Dripping Springs Wash. Water producing units consist of younger alluvium and the Gila Conglomerate, with the younger alluvium along Dripping Springs Wash and its tributaries the major water producer. These deposits are reportedly less than 150 feet thick. Consolidated rocks compose the surrounding mountains and contain minor amounts of groundwater. Groundwater flow is towards the Gila River which bisects the basin (Figure 3.3-6). Groundwater recharge has been estimated at 3,000 to 9,000 AFA and groundwater in storage at less than 1maf. Well yields vary widely with a median well yield of about 394 gpm reported (Table 3.6-6). Recent water quality data are lacking.

Duncan Valley Basin

The Duncan Valley Basin consists of an elongate valley filled with sediments, drained by the Gila River and surrounded by low permeability rocks. Younger alluvial deposits along the Gila River and its tributaries are the principal source of groundwater. These deposits are up to 170 feet thick in some locations. Wells also tap the underlying Gila Formation composed of poorly consolidated sand, silt and gravel. The older basin fill contains only minor amounts of groundwater. Groundwater flow is toward the north and west along the Gila River drainage. Groundwater recharge estimates range from 6,000 to 14,200 AFA and groundwater storage estimates range from 9 to 19 maf. The median well yield reported for 165 large diameter wells was 850 gpm (Table 3.7-6). Water levels in measured wells varies from 24 feet to over 500 feet below land surface (bls), with slight water level declines observed from 1990-1991 to 2003-2004 (Figure 3.7-6). Arsenic and fluoride concentrations exceeding drinking water standards have been measured at a number of wells in this basin.

Morenci Basin

The Morenci Basin is characterized by steep canyons, mesas and mountains with numerous streams and washes. The basin consists mainly of volcanic rocks (rhyolite and agglomerates overlain by basalt flows). Groundwater is found primarily in alluvial deposits along major water courses and groundwater flow is to the south along the San Francisco River drainage. Groundwater recharge has been estimated at 15,000 AFA and groundwater in storage at 3 maf. Water level change data in the Morenci Basin are available only for the area near Alpine where the measured depth to water is less than 80 feet bls and water levels rose over 15 feet in one well from 1990-1991 to 2003-2004 (Figure 3.9-7). Water quality data shows metal contamination in the vicinity of the Morenci Mine.

San Francisco River at Clifton. In the Morenci Basin groundwater is found primarily in alluvial deposits along major water courses

Safford Basin

The Safford Basin is a relatively large, alluvial filled depression bordered by elongated mountain ranges. Basin fill is the major aquifer in all three sub-basins of the Safford Basin. Sub-basin delineations are shown in Figures 3.10-7 and 3.10-9. In the San Simon Valley Sub-basin a clay deposit, known as the Blue Clay unit, separates the upper and lower basin-fill aquifers and may be as much as 600 feet thick. Groundwater is found under artesian conditions in the lower aquifer and is generally unconfined in the upper aquifer. Groundwater flow in the sub-basin is toward the north along the San Simon River drainage but also flows toward agricultural pumping centers. The principal aquifer in the Gila Valley Sub-basin, located in the middle part of the Safford Basin, is the upper basin fill, underlain by the Blue Clay unit. Groundwater is also utilized from the lower basin fill, which generally is found under artesian conditions and where well discharges may be quite high. Groundwater flow is from south to north along the Gila River drainage. The main water-bearing unit in the San Carlos Valley Sub-basin, located in the northern part of the Safford Basin, is the upper basin fill, which is found under unconfined conditions. As with the other sub-basins, groundwater in the lower basin fill is generally found under artesian conditions. Groundwater flow in the sub-basin is toward the Gila River drainage.

Groundwater recharge for the entire basin is estimated at 105,000 AFA. Groundwater discharge is to agricultural and municipal pumping, primarily in the Gila Valley Sub-basin, and to spring discharge. Estimates of groundwater in storage range from more than 27 maf to 69 maf (Table 3.10-6).

Depth to water is relatively shallow in wells measured near the Gila River, while water levels are generally deeper in wells in the San Simon Valley Sub-basin, the southernmost sub-basin. Water levels declined in most wells in the basin that were measured in 1990-1991 and 2003-2004, with the most significant declines south of San Simon where water levels declined by more than 30 feet during this time period (Figure 3.10-7). Water levels exceed 600 feet bls at two wells along the western boundary of the San Carlos Valley Sub-basin, the northernmost sub-basin. In one of these wells, water levels declined over 60 feet between 1990 and 2004 (Figure 3.10-7). Most of the groundwater development in the Safford Basin is in the Gila Valley Sub-basin, the central sub-basin, which contain the basin's major population and agricultural centers. The median well yield reported on registration forms for almost 1,500 large (>10-inch) diameter wells was 600 gpm. As shown on Figure 3.10-9, high yield (>2000 gpm) wells are found along the Gila and San Simon river drainages and in the vicinity of Bowie.

Water quality conditions vary in the basin although fluoride and arsenic concentrations consistently exceed drinking water standards. In the San Simon Valley Sub-basin the upper aquifer generally contains elevated total dissolved solids (TDS) and fluoride concentrations. Groundwater in both the upper and lower basin fill of the Gila Valley Sub-basin may also be high in TDS. In the San Carlos Valley Sub-basin, elevated levels of TDS have been measured in stream alluvium.

<u>Western Portion</u>

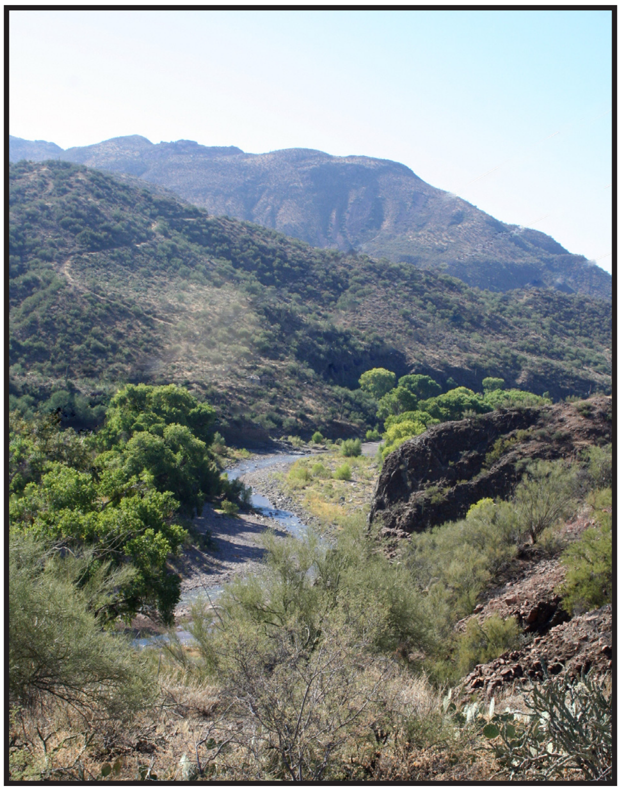
On the western side of the planning area are a group of basins that are tributary to the San Pedro and Gila rivers; Aravaipa Canyon, Donnelly Wash, Lower San Pedro and Upper San Pedro. Groundwater is found in stream alluvium and basin fill sediments in these basins.

Aravaipa Canyon Basin

The sparsely populated Aravaipa Canyon Basin is characterized by a relatively flat northwest-trending valley in the southern half of the basin and an incised valley, Aravaipa Canyon that cuts through the Galiuro Mountains, in the northern half. The principal aquifers are the unconfined stream alluvium, which is the major source of groundwater, and a confined basin fill aquifer. Water level records suggest that the confined aquifer leaks into the unconfined aquifer. The thickness of the younger alluvium decreases to the south. (Holmes, 2003) Groundwater flow is similar to the surface water runoff pattern; northwest along the central axis of the valley. Groundwater flows towards the head of Aravaipa Canyon where its flow path is geologically restricted, resulting in the perennial portion of Aravaipa Creek (Holmes, 2003). Groundwater recharge is from infiltrating precipitation and runoff and is estimated to range from 7,000 to 16,700 AFA (Table 3.1-3). Groundwater discharge is to Aravaipa Creek from springs and baseflow, with small discharge to wells. Freethey and Anderson (1986) estimated 5 maf of water in storage in the basin. Depth to water within the basin fill varies from 25 feet bls where the younger alluvium is thin to over 500 feet bls in the uplands in the southern part of the basin (Holmes, 2003). Two recent water level measurements in the central valley were 64 and 39 feet bls (Figure 3.1-6). Arsenic is the water quality parameter that most frequently exceeds drinking water standards in wells measured in the basin (Table 3.1-4), but groundwater is generally of good chemical quality (Holmes, 2003).

Donnelly Wash Basin

Donnelly Wash Basin is a relatively small basin with few inhabitants. The principal aquifer is a strip of basin fill that covers about 30 percent of the basin. The rest of the basin is composed of hardrock that surrounds and underlies the basin fill (Overby, 2000). A 16-mile reach of the Gila River flows east to west through the basin, which is also drained by Donnelly Wash and Box O Wash located on the south side of the Gila River. In general, groundwater flow follows surface water drainage patterns, flowing toward the Gila River. Aquifer recharge is from the mountain fronts and streambed infiltration. Groundwater is discharged from the alluvium into the Gila River and from domestic and stock wells. Storage estimates for the basin range from 140,000 acre-feet to 2.0 maf. (Table 3.4-3) Depth to water in the basin fill varies from about 150 feet in the north, 256 feet in the center, and about 370 feet in the south. Water levels are more shallow in wells located in the hardrock areas (Overby, 2000). Elevated fluoride concentrations were measured in two springs in the basin (Table 3.4-4). Eleven water samples collected by the Department in 1996 and 1997 did not find elevated fluoride levels in groundwater in either the alluvium or the hardrock (Overby, 2000).



Aravaipa Creek. Groundwater flows toward the head of Aravaipa Canyon where its flow path is geologically restricted, resulting in the perennial portion of Aravaipa Creek

Lower San Pedro Basin

The Lower San Pedro Basin consists of the northwest-trending San Pedro River Valley bordered by mountains ranging in elevation from 6,000 to over 8,000 feet in elevation. There are two sub-basins; the Mammoth Sub-basin and the smaller Camp Grant Wash Sub-basin (Figure 3.8-7). The two major water bearing units are stream alluvium and basin fill. Most mining, industrial and domestic/municipal wells are located in the regional basin fill aquifer while most irrigation wells are located in the stream alluvium. The stream alluvium along the San Pedro River and tributaries can be quite permeable with high well yields but this aquifer is often less than 50 feet thick south of Redington (USGS, 2006a). Groundwater in the alluvium is unconfined. The hydrologic characteristics of the basin fill aquifer vary widely due to the amount of cementation and occurrence of fine-

San Pedro River in the Lower San Pedro Basin. The streambed alluvium along the San Pedro River and tributaries is very permeable with high well yields.

grained layers. Both confined and unconfined conditions exist. Artesian conditions exist from about five miles north to ten miles south of Mammoth in wells drilled deeper than 500 feet.

Groundwater flow direction is from the mountains toward the valley floor and to the north. The estimated groundwater recharge ranges from 24,000 to 29,000 AFA (Table 3.8-7) from mountain front recharge, streambed infiltration and underflow from the Aravaipa Canyon and Upper San Pedro basins. Groundwater is discharged by pumpage, evapotranspiration, evaporation from streams, and springs and seeps. The estimated volume of groundwater in storage ranges from 11 maf to more than 27 maf (Table 3.8-7). Water level change data between 1990-1991 and 2003-2004 for 16 wells shows relatively stable water levels in most wells (Figure 3.8-6). (A water level sweep was conducted in winter 2006-2007 and a hydrologic map series report is expected to be completed by fall 2009). Water quality data from selected sites show that fluoride was the parameter that most frequently exceeded drinking water standards, with elevated levels of cadmium found in the vicinity of Hayden and Dudleyville (Table 3.8-7).

Upper San Pedro Basin

The Upper San Pedro Basin consists of the northwest trending San Pedro River Valley and surrounding mountains that range from 5,000 to almost 10,000 feet in elevation. The basin contains two sub-basins: the Sierra Vista and the small Allen Flat sub-basin. Basin fill is the principal aquifer although the stream alluvium is also utilized. Groundwater in the basin fill aquifer is found in both unconfined and confined conditions. Artesian conditions exist near Palominas, Hereford, and more extensively near Benson and Saint David. These conditions supported modest groundwater discharges for irrigation use primarily in the Benson-Pomerene area. An interesting feature is a limestone aquifer in the Whetstone Mountains that contains a "live" or wet cave, Kartchner Caverns, a state park. The water level in the cavern is about 700 feet higher than that of the underlying alluvial aquifer (ADWR, 2005a).

Groundwater flow direction is from the mountain fronts toward the central valley and to the north. A cone of depression has formed in the Sierra Vista area that has altered flow direction (Figure 3.13-6). Groundwater recharge is approximately 35,700 AFA from the mountain fronts, underflow from Mexico and streambed infiltration. Two effluent recharge projects in the basin also recharge the aquifer. The most populous basin in the planning area, major

Allen Flat, Upper San Pedro Basin. The basin contains two sub-basins: the Sierra Vista and the small Allen Flat sub-basin.

discharge is from municipal and agricultural pumpage and from riparian evapotranspiration. (ADWR, 2005a) The most recent estimate of groundwater in storage is 19.8 to 26.1 maf although estimates of up to 59 maf exist (Table 3.13-5).

As shown in Figure 3.13-6, water levels declined in most wells measured in 1990-1991 and 2003-2004. Additional data show annual declines of 0.9 to 2.9 feet in some wells in the Bisbee-Naco area and rises of up to 0.6 feet per year in the Pomerene area north of Benson (ADWR, 2005a). The Department measured water levels in the basin in 2006 and these data are expected to be released in a water level change map series report in 2009. Preliminary data show water levels decreasing in most wells in the Bisbee and Naco area; about seven feet in five years from 2001 to 2006. In the Benson area, water levels have declined the most in wells west of the San Pedro River.

Groundwater quality is generally suitable for most uses. Arsenic and fluoride were the water quality parameters that most frequently exceeded drinking water standards in wells sampled in the basin. Localized contamination near St. David is being remediated as part of the Superfund Program (See Table 3.0-8).

<u>Southern Portion</u>

Groundwater from three basins in the southern portion of the planning area flows south into Mexico. These basins are the Douglas and San Bernardino Valley basins in the southeastern part of the planning area and the San Rafael Basin in the southwest corner.

Douglas Basin

The Douglas Basin occupies the southern portion of a northwest-southeast trending structural trough that extends from the central part of the Aravaipa Canyon Basin, through the Willcox Basin, to the northeastern part of Sonora, Mexico. The long alluvial valley in the Douglas Basin, (the southern part of the Sulphur Springs Valley), contains its main aquifer, basin fill, which supplies most of its large-capacity wells. The basin fill is composed of sand and gravel lenses interbedded with silt and clay lenses. The sand and gravel lenses are the main source of groundwater. Groundwater is primarily unconfined although artesian conditions were reported locally in the upper alluvial deposits in the early 1950s prior to the start of heavy groundwater pumping (Rascona, 1993). Groundwater is also found in the mountain bedrock which provides relatively small amounts of water for stock and domestic use. In and adjacent to the City of Douglas, groundwater is pumped from basin fill with interbedded volcanic rock. Groundwater flow is generally from north to south although agricultural pumpage has altered flow directions in the vicinity of Elfrida where a cone of depression has developed.

Groundwater recharge occurs mainly in washes and along mountain fronts (Rascona, 1993) and is estimated at 15,500 to 22,000 AFA (Table 3.5-5). Incidental recharge may also come from infiltration of agricultural irrigation (USGS, 2006b). Groundwater discharge is primarily from groundwater pumping of almost 53,000

Agriculture near Elfrida, Douglas Basin. The basin has been severely over-drafted since the late 1940s and much of the basin is designated as an Irrigation Non-Expansion Area to restrict agricultural expansion.

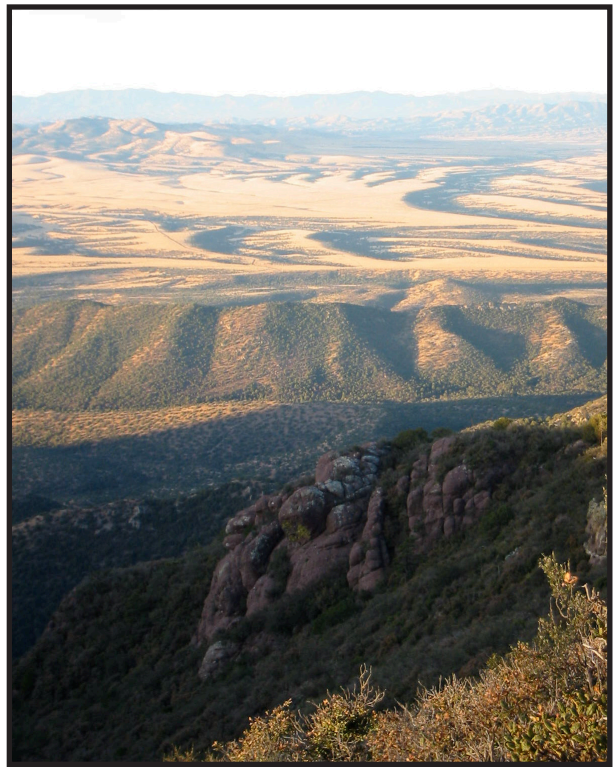
AFA. Groundwater in storage estimates range from 26 to 32 maf. The basin has been severely over-drafted since the late 1940s and much of the basin was designated as an Irrigation Non-Expansion Area in 1980 to restrict agricultural expansion. Concerns about the future availability of water in the basin is a subject of an investigation to compile hydrologic data and information (USGS, 2006b). Between 1990-1991 and 2003-2004, water levels declined in most wells measured in the basin, particularly in the Elfrida area and north of Douglas (Figure 3.5-6). Groundwater quality is generally suitable for most uses although elevated fluoride concentrations have been measured in a number of wells (Table 3.5-6).

San Bernardino Valley

The San Bernardino Valley Basin is covered by volcanic flows and cinder cones with some relatively thin alluvial deposits. Groundwater is obtained from sand and gravel interbedded with basalt flows or from shallow alluvium. Springs and artesian wells support wetlands designated as the San Bernardino National Wildlife Refuge adjacent to the international border. Groundwater flow is from the mountains toward the valley center and south to Mexico. Estimated groundwater recharge is 9,000 AFA and groundwater storage estimates range from 1.6 to 2.0 maf (Table 3.11-3). Most wells in the basin are located immediately north of the international border where water levels are generally less than 100 feet bls. The depth to water increases to the north and toward the mountains along the basin margins on the west, north and east. Little groundwater or water quality data are available for the basin. Elevated nitrate levels were found in two wells measured in the basin (Table 3.11-4).

San Rafael Basin

The San Rafael Basin consists of a broad north-trending valley surrounded by block-fault mountains and drained by the Santa Cruz River whose headwaters are in the northern portion of the valley. Groundwater is found in stream alluvium and in basin fill along the Santa Cruz River and its major tributaries. Basin fill occupies most of the valley and is composed of clay, silt, sand and gravel. The basin fill has been estimated to be as much as 1,900 feet deep based on well logs. Bultman (1999) estimated that the San Rafael basin may contain an aquifer up to approximately 1,000 feet thick over a substantial area consisting of upper basin fill. Groundwater flow is from the mountains toward the Santa Cruz River and then south. Groundwater recharge is from mountain front recharge and infiltration of runoff in stream channels. Groundwater recharge is estimated at 5,000 AFA (Table 3.12-5). Estimated groundwater in storage ranges from 4 to 5 maf. Water levels are relatively shallow (25 feet bls or less) in the streambed alluvium and generally at levels over 100 feet bls in the basin fill. Well yields are generally higher in the streambed alluvium. There is little water quality data available for the basin but drinking water exceedences of arsenic, antimony, lead and radionuclides have been detected in wells in the western part of the basin, an area of historic mining activity.



San Rafael Valley, San Rafael Basin.

Other Basins
Two basins, Cienega Creek and Willcox, have hydrogeologic conditions that are unique in the planning area. The Cienega Creek Basin has three groundwater sections based on the presence of distinctive aquifers and groundwater flows to the north and to the southwest. Groundwater in the Willcox Basin is generally isolated from surrounding basins, with groundwater flow primarily to the center of the basin, the Willcox Playa.

Cienega Creek Basin
The Cienega Creek Basin consists of a narrow northeast trending alluvial valley, drained by Cienega and Sonoita creeks, and surrounded by fault-block mountains. There is a surface water divide southwest of Sonoita, with Cienega Creek flowing northeast and Sonoita Creek flowing to the south and west. Hydrogeologic conditions in the basin are complex. The basin has been divided into three subareas based on the presence of a distinctive aquifer or set of aquifers: upper Cienega Creek, lower Cienega Creek and Sonoita Creek.

"The Narrows" (T18S, R18E, S6), where bedrock outcrops on both sides of the Cienega Creek channel, divides the lower and upper Cienega Creek subareas (Bota, 1997). The upper Cienega Creek subarea includes most of the basin's central valley. The main aquifer is basin fill, which is deepest in the southern part of the subarea between Sonoita and Elgin. To the north, the lower Cienega Creek subarea extends to the northern basin boundary. It contains three aquifers: stream alluvium, basin fill and the Pantano formation. The main aquifer in this subarea is stream alluvium. The basin-fill alluvium is a relatively poor aquifer in this subarea with relatively low well yields and interbedded clay layers that create leaky confined and artesian aquifer conditions.

The southwestern part of the basin is the Sonoita Creek subarea where the main aquifer is stream alluvium that forms the floodplain of Sonoita Creek and its tributaries and may be up to 90-feet thick. Wells drilled in the basin fill are generally low yielding. Groundwater flow follows the surface water flow direction with flow toward the northeast, north of Sonoita, and to the south, south of Sonoita.

Groundwater recharge comes from mountain front recharge and streambed infiltration along Cienega and Sonoita creeks and their tributaries. Groundwater recharge estimates vary from 8,500 to 25,500 AFA, although this estimate does not include the Sonoita Creek subarea (Table 3.3-5). Estimates of groundwater in storage range from 5.1 to 11 maf. Water level trends are generally stable with some declines noted near Patagonia and east of Sonoita (Figure 3.3-6). Groundwater quality is generally good although cadmium and copper concentrations exceeding drinking water standards have been measured in several wells in the vicinity of Patagonia.

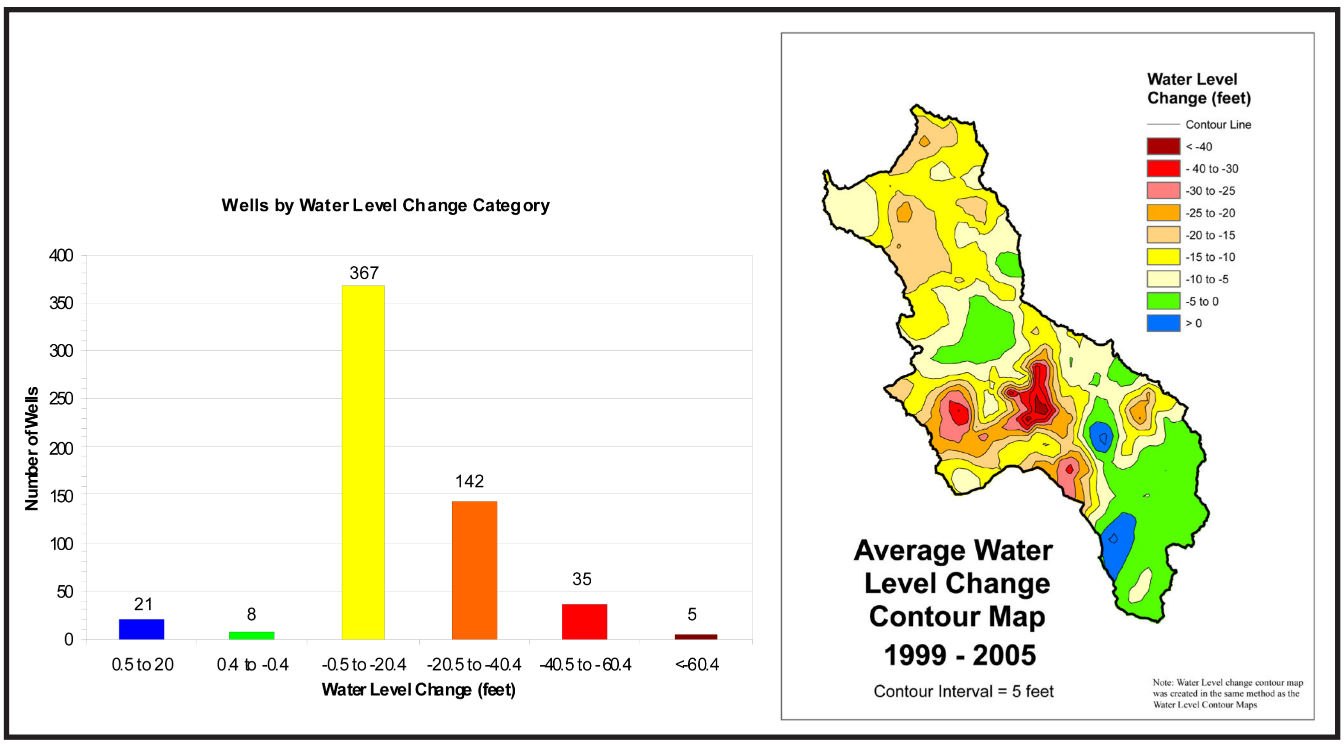
Willcox Basin
The Willcox Basin occupies the northern part of the Sulphur Springs Valley and is hydrologically separate from the southern part of the valley, the Douglas Basin. Groundwater in the Willcox Basin is found in alluvial deposits consisting of stream and lake-bed deposits. The stream deposits are the most productive water-bearing unit. The clay-rich lake bed deposits outcrop in the Willcox Playa. There they create localized artesian conditions. Where the coarse-grained stream deposits are underlain by the lake-bed deposits, perched groundwater conditions may occur. A playa is a nearly level area at the bottom of a closed desert basin, sometimes temporarily covered by water.

The Willcox Basin has internal surface water drainage and groundwater flow is thought to have mirrored surface drainage under predevelopment conditions; moving from the outer margins toward the Willcox Playa (Oram, 1993). However, groundwater flow conditions have been altered significantly due to groundwater pumping for agriculture. Several relatively large cones of depression have developed in the basin including one southeast of the Willcox Playa and another north of the City of Willcox (Figure 3.14-6). Groundwater recharge has been estimated at 15,000 to 47,000 AFA primarily from mountain front recharge and also from agricultural irrigation and stream channel runoff (USGS, 2006b). Groundwater discharge is primarily from groundwater pumping of more than 176,000 AFA. Estimates of groundwater in storage range from 42 to 59 maf (Table 3.14-6).

Declines in groundwater levels (in excess of 200 feet measured in nine wells between 1954 and 1975), may have caused land subsidence in the basin (USGS, 2006b). Figure 3.14-6 shows groundwater level changes between 1990-1991 and 2003-2004. A number of declines of greater than 30 feet were measured in wells in the central part of the basin during this period.
Concerns about groundwater level declines and future availability of water for all uses has led to an investigation of the geology and hydrology of the Willcox and Douglas basins (USGS, 2006b). As part of this effort, the Department released a Water Level Change Map Series Report (No. 1) in 2008 summarizing depth to water measurements taken at 578 wells in the Willcox Basin in November/December 1999 and November/December 2005. Most of the wells (549 of 578 or 95%) showed a water level decline. Forty had declines of more than 40 feet and most of these were located in the area southeast of the Willcox Playa in a predominantly agricultural area (Jacobson and others, 2008). A summary of the water level changes and a water level change contour map from the map series report are shown in the graphic below. As shown, most water levels declined between 0.5 and 20.4 feet.

Well yields are relatively high in the basin with A median well yield of 750 gpm was reported from over 1,000 large (>10 inch) diameter wells (Table 3.14-6).

Elevated TDS concentrations exist in some areas and fluoride and arsenic concentrations above drinking water standards have been reported in a number of wells (Table 3.14-7).



Excerpt from ADWR Water Level Change Map Series Report No. 1 on the Willcox Basin (Jacobson and others, 2008)

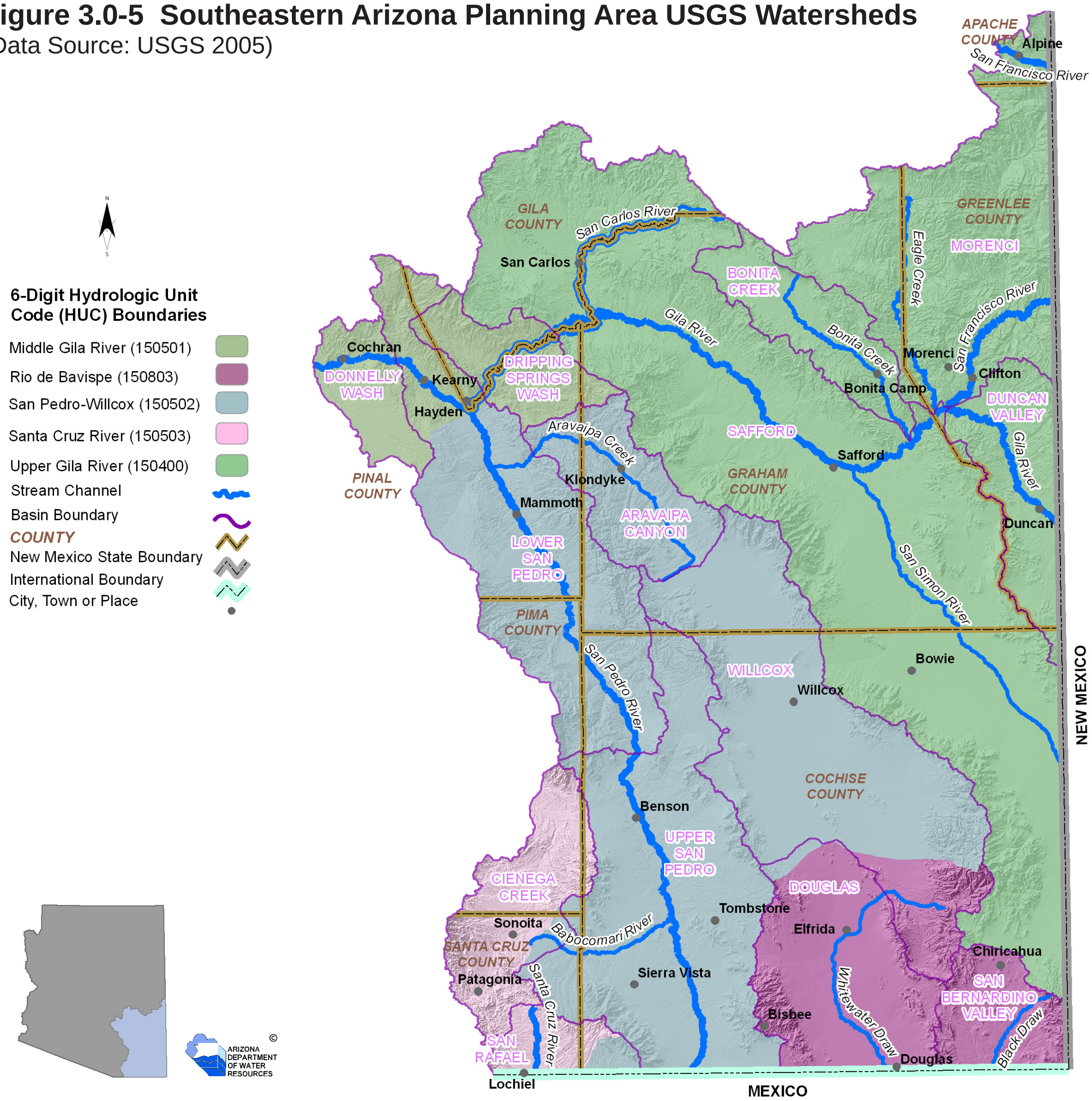
Surface Water Hydrology

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 any hydrologic area (Seaber et al., 1987). A 6-digit 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 unit level: Middle Gila River; Rio de Bavispe; San Pedro River-Willcox; Santa Cruz River; and the Upper Gila River (Figure 3.0-5). More detailed information on stream flow, springs, reservoirs and general surface water characteristics are found in the individual basin sections.

<u>Middle Gila</u>

The Middle Gila Watershed extends west from Coolidge Dam to the confluence of the Gila and Salt rivers in the Phoenix AMA. The San Pedro River is the major tributary to this watershed

Figure 3.0-5 Southeastern Arizona Planning Area USGS Watersheds
(Data Source: USGS 2005)



in the Southeastern Arizona Planning Area. Dripping Springs Wash, Donnelly Wash and the northernmost part of the Lower San Pedro basins are included in the Watershed. Below Coolidge Dam, flow in the Gila River is from releases from the San Carlos Reservoir and flood flow from the San Pedro River (ADWR, 1994). Perennial streams include the Gila River, and portions of the San Pedro River and Mineral Creek in the Lower San Pedro Basin, Box Canyon in the Donnelly Wash Basin and Mescal Creek in the Dripping Springs Wash Basin (see Figures 3.8-6, 3.5-5 and 3.6-5).

Since 1936, an average of 260,000 AFA of reservoir storage and inflows have been released to the river below Coolidge Dam (ADWR, 2006). There are three streamgages in the watershed. The highest annual flow was recorded at the Kelvin gage located downstream of the confluence of the San Pedro and Gila rivers where a flow of 2.375 maf was measured in 1993. Annual median flow at this gage is approximately 324,300 acre-feet (see Table 3.8-2).

There are two major (10 gpm or greater) springs in the watershed, both located in the Dripping Springs Wash Basin. Both are warm springs with measured discharges of 200 gpm (Mescal Warm Spring) and 165 gpm (Coolidge Dam Warm Spring). These measurements were taken during or prior to 1982 and may not be indicative of current conditions.

Gila River, Donnelly Wash Basin.

Ten miles of Mineral Creek, located northwest of Kearny, are impaired due to elevated concentration of copper and selenium.

Rio de Bavispe

The Rio de Bavispe Watershed drains south and extends into New Mexico and Mexico. Major drainages in Arizona are Whitewater Draw and Black Draw, which are tributary to the Rio de Bavispe in Mexico. The Rio de Bavispe joins the Rio Yaqui which discharges into the Gulf of California. The watershed includes most of the Douglas Basin, the southernmost portion of the Willcox Basin, and the entire San Bernardino Valley Basin. Whitewater Draw is the major drainage in the Douglas Basin. Black Draw is the main surface water drainage in the San Bernardino Valley Basin and becomes perennial just north of the international boundary. In this basin, artesian wells and springs support wetlands near the border. In addition to Black Draw, perennial streams in the watershed include reaches of Rucker Canyon in the Willcox Basin, and Leslie Creek in the Douglas and Willcox basins (see Figures 3.5-5 and 3.14-5).

There are two active streamgages in the watershed. The gage at Whitewater Draw near Douglas recorded a maximum annual flow of approximately 22,300 acre-feet in 1955 with a median annual flow of 5,960 acre-feet. The other operating gage is on Leslie Creek near McNeal with a median annual flow of approximately 750 acre-feet. There are no major springs in the watershed.

San Pedro-Willcox Watershed

The Arizona portion of the San Pedro-Willcox Watershed is contained entirely within the planning area. Approximately 696 square miles of the Watershed extends into Mexico. In Arizona, the Watershed includes all of the Aravaipa Canyon and Upper San Pedro basins, most of the Lower San Pedro and Willcox basins and relatively small portions of the Cienega Creek, Douglas and San Rafael basins. A few tributaries to the San Pedro River begin on the

San Pedro River at Charleston, Upper San Pedro Basin. The largest annual flow ever measured in the watershed, 152,798 acre-feet, was recorded at this gage in 1914.

southwest slopes of the Huachuca Mountains in the San Rafael Basin and drain into Mexico. (ADWR, 2005a) The San Pedro River enters the U.S. from Mexico near Palominas (see Figure 3.13-1) and flows north to its confluence with the Gila River. Major tributaries are the Babocomari River and Aravaipa Creek.

With the exception of Whitewater Draw in the extreme southern end of the basin that drains into the Douglas Basin, most of the surface water drainage in the Willcox Basin is to the Willcox Playa. The playa occupies about 50 square miles in the center of the basin and is a remnant of Pleistocene-age Lake Cochise. (Oram, 1993)

Some stretches of the San Pedro River are perennial, although recent drought and delay of the summer monsoon has affected some previously perennial stretches for short periods of time, most notably at Charleston in the Upper San Pedro Basin. The Babocomari River, in the Upper San Pedro Basin, is perennial in its upper reach and near its confluence with the San Pedro River. Aravaipa Creek is perennial within Aravaipa Canyon above its confluence with the San Pedro River as are three of its tributaries in the Aravaipa Canyon Basin (see Figures 3.1-5 and 3.8-5). Other perennial streams are found in the Lower San Pedro, Upper San Pedro and Willcox basins (Figures 3.8-5, 3.13-5 and 3.14-5).

There are 12 active streamgages in the watershed; two in the Lower San Pedro Basin and 10 in the Upper San Pedro Basin. The gage on the San Pedro River at Charleston has been in operation since 1904. The largest annual flow ever measured in the watershed, (152,798 acre-feet), was recorded at this gage in 1914. More recently, in 1984, a maximum annual flow of 102,107 acre-feet was measured at the gage on the San Pedro River near Tombstone. Median annual flow at these gages is 33,203 acre-feet and 29,654 acre-feet, respectively.

The only major springs in the watershed are found in the Lower San Pedro and Upper San Pedro basins. There are 14 major springs in the Lower San Pedro Basin. The largest, Cooks Lake Spring located downstream of the confluence of Aravaipa Creek and the San Pedro River, had a discharge rate of 1,000 gpm when last measured in 1951. Twelve major springs have been identified in the Upper San Pedro Basin. The largest is Garden Canyon No. 1 in the Huachuca Mountains with a discharge of 134 gpm measured in 1963. Most of the spring measurements in both basins date from before 1980 and may not be indicative of current conditions (see Tables 3.8-5 and 3.13-4).

Fifteen miles of the San Pedro River in the Lower San Pedro Basin, from Aravaipa Creek to the Gila River, are impaired due to elevated concentrations of E. coli and selenium (Table 3.8-7). In the Upper San Pedro Basin, water quality standards were exceeded in three reaches of the San Pedro River for a total of 53 miles. These reaches are impaired due to elevated levels of E. coli, nitrate and copper (Table 3.13-6).

<u>Santa Cruz Watershed</u>
The Santa Cruz Watershed includes most of

Santa Cruz River near the headwaters, San Rafael Basin.

the Cienega Creek and San Rafael basins and extends south into Mexico and west to include the Santa Cruz AMA and most of the Tucson and Pinal AMAs. The Santa Cruz River originates in the San Rafael Valley and flows southward to Mexico before turning north and reentering the U.S. east of Nogales, Arizona. Surface water in the Cienega Creek Basin drains west to the Santa Cruz River from Sonoita Creek and north to tributaries of the Santa Cruz River from Cienega Creek.

The Santa Cruz River is perennial in the planning area. In the Cienega Creek Basin there are perennial reaches of Cienega Creek, Sonoita Creek and Red Rock Canyon. The only streamgage on the Santa Cruz River is near Lochiel with a maximum annual flow of 12,600 acre-feet measured in 1955. Median annual flow at this gage is 1,410 acre-feet. The only other streamgage in the watershed is a gage on Cienega Creek near Sonoita (see Table 3.3-1).

Major springs are located only in the Cienega Creek Basin. The largest of the seven major springs is Monkey Spring southwest of Sonoita with a discharge rate of 430 gpm. A measurement date is lacking for this spring (Table 3.3-5).

There are several impaired waters in the Santa Cruz Watershed. Parker Canyon Lake in the San Rafael Basin contains elevated levels of mercury. In the Cienega Creek Basin, a total of 20 miles of impaired stream reaches occur on Alum Gulch, Harshaw Creek, Humboldt Canyon and on an unnamed tributary to Harshaw Creek. These waters contain concentrations of cadmium, copper, zinc or pH that exceed standards (Table 3.3-6).

<u>Upper Gila Watershed</u>

The Upper Gila Watershed drains about 7,400 square miles in the planning area above Coolidge Dam and contains the Bonita Creek, Duncan Valley, Morenci, and Safford basins. Major tributaries include the San Francisco River, Eagle Creek, Bonita Creek, San Simon Creek and the San Carlos River.

An average of about 160,000 AFA of Gila River water flows into Arizona from New Mexico and over 40% of this flow typically occurs in the winter. Tributary inflows from the San Francisco River are significant, typically over 150,000 AFA. Inflow to the San Carlos Reservoir from the Gila and San Carlos Rivers averages about 310,000 AFA (ADWR, 2006). There are three active streamgages on the Gila River. The maximum annual flow recorded was at a gage near Solomon with a flow of 1.56 maf in 1993. Median flow at this gage is approximately 273,000 AFA (see Table 3.10-2).

The San Francisco River is perennial with a number of hot springs located above Clifton. The Gila River has a 35-mile perennial stretch about 20 miles northwest of the New Mexico border. Flow in this stretch is maintained by tributary inflow and springs, including hot springs (ADWR, 1994). Flow in the Gila River becomes intermittent farther downstream due to irrigation diversions and seasonal variations in flow (ADWR, 2006).

The largest spring in the planning area is located in the Safford Basin. Warm Springs, with a measured discharge of almost 3,400 gpm is located at the headwaters of the San Carlos River. There are also a number of large springs downstream of Pima near the Gila River (USGS, 2006c). In total, there are 22 major springs in the Safford Basin. Other major springs are found in the Bonita Creek Basin (1 spring), Duncan Valley Basin (2), and Morenci Basin (9). Most of the spring measurements shown on the springs tables in sections 3.2, 3.7, 3.9 and 3.10 were taken between 1940 and 1982 and may not be indicative of current conditions.

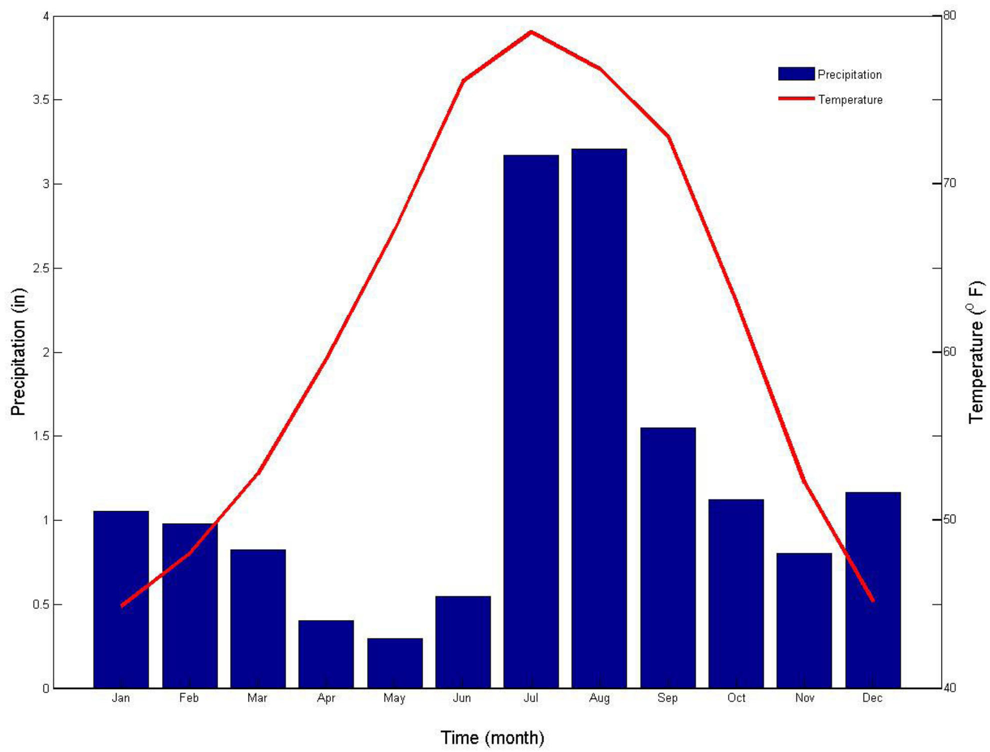
A 15-mile reach of the Gila River in the Duncan Valley Basin is impaired due to elevated selenium concentrations (Table 3.7-7).

In the Safford Basin, a 6-mile reach of the Gila River exceeded the water quality standard for E.coli and turbidity and a 8-mile reach of Cave Creek exceeded the standard for selenium (Table 3.10-7). In the Morenci Basin, water quality standards were exceeded at Luna Lake and in a 13-mile reach of the San Francisco River near Alpine (Table 3.9-7).

3.0.3 Climate[2]

Annual average precipitation in the planning area is 14.7 inches, with over 52% coming in July, August, and September (Figure 3.0-6). This planning area receives the highest percentage of summer precipitation in the state because of its proximity to the core monsoon region in Mexico.

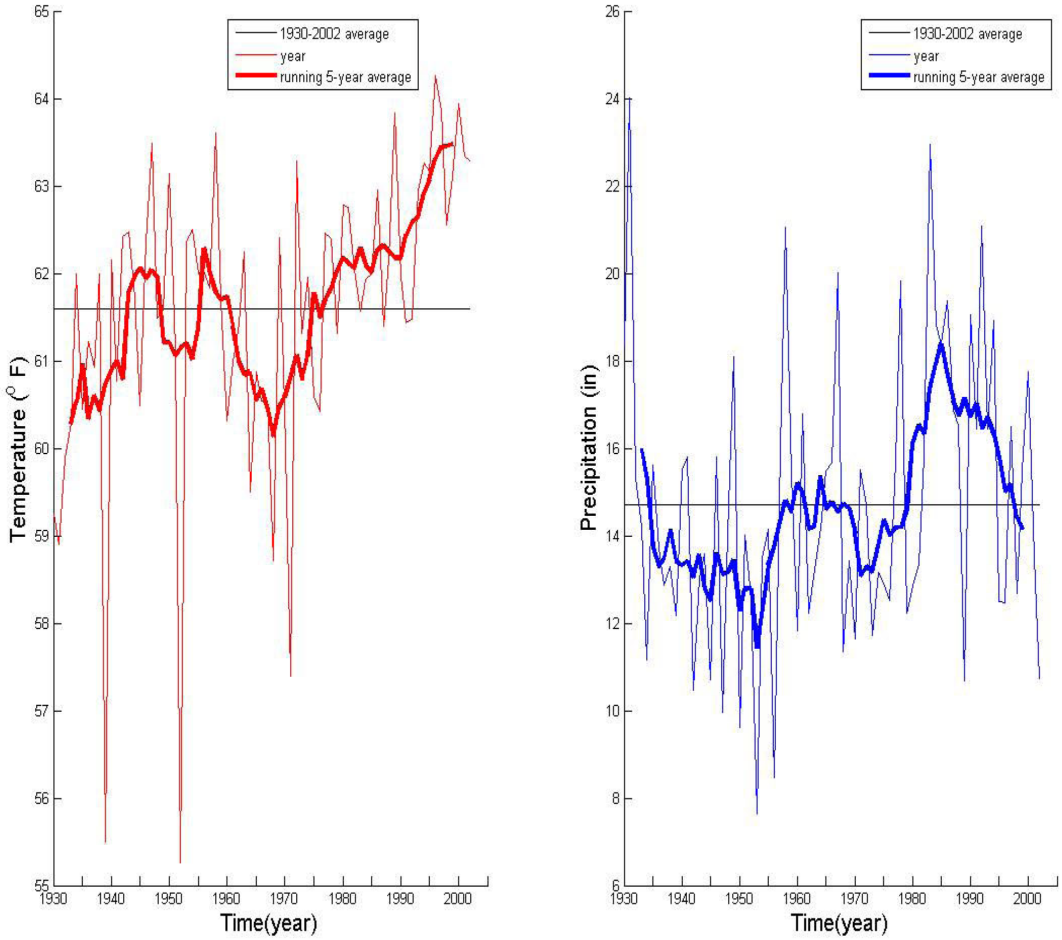
Figure 3.0-6 Average Monthly Precipitation and Temperature in the Southeastern Arizona Planning Area, 1930-2002



Data are from selected Western Regional Climate Center cooperative weather observation stations.
Figure author: CLIMAS.

[2] Information in this section was provided by the Institute for the Study of Planet Earth, Climate Assessment for the Southwest (CLIMAS), University of Arizona, October, 2006.

Figure 3.0-7 Average Annual Temperature and Total Annual Precipitation in the Southeastern Arizona Planning Area from 1930-2002



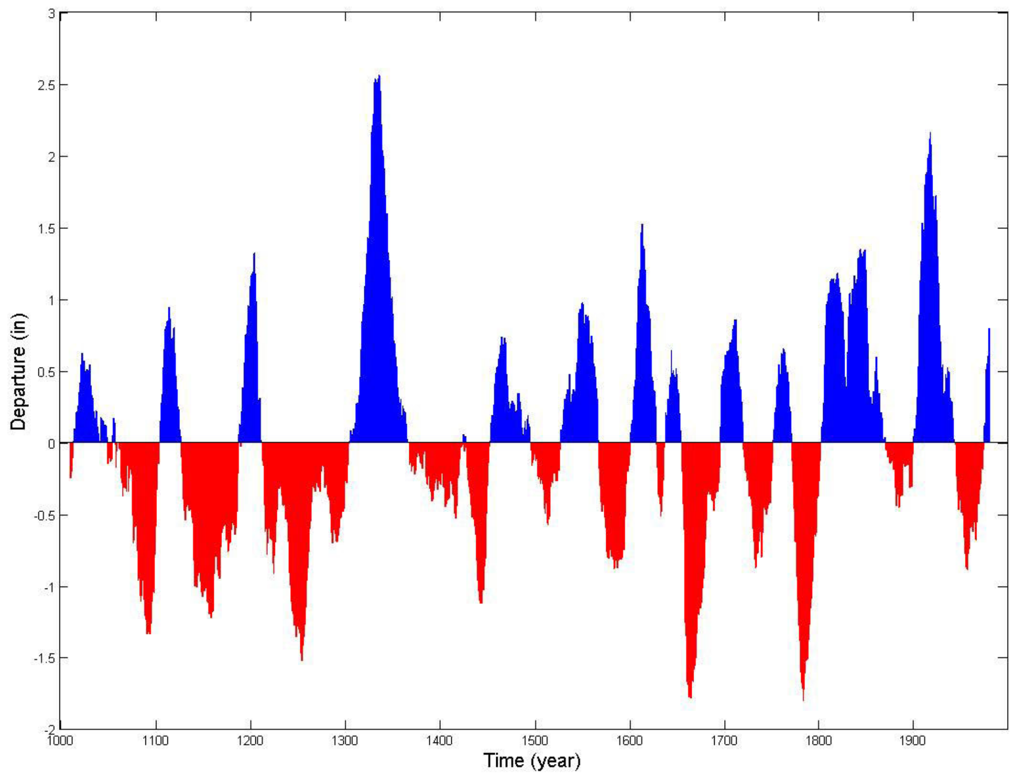
Horizontal lines are average temperature (61.6 °F) and precipitation (14.7 inches), respectively. Light lines are yearly values and highlighted lines are 5-year moving average values. Data are from selected Western Regional Climate Center cooperative weather observation stations. Figure author: CLIMAS.

The monsoon is strongest in northwestern Mexico, and Arizona usually only receives the northernmost fringes of precipitation. Pool and Coes (1999) noted that trends in seasonal precipitation at four stations in the southern half of the Upper San Pedro Basin showed a general trend of increasing winter precipitation and decreasing wet-season (summer) precipitation during the period 1956-1997.

Summer precipitation from thunderstorms is less hydrologically efficient than winter precipitation, because monsoon storm cells are spatially discontinuous and high summer temperatures result in high evaporation rates. About 35% of planning area precipitation occurs during winter months (November – April), mostly from frontal storm systems. At higher elevations, this precipitation falls as snow. Slow water release from high elevation spring snowmelt and low evaporation rates make winter precipitation more hydrologically efficient because there is less runoff and greater gain to streams.

As in other areas of Arizona, precipitation is extremely variable, both spatially and from year to year. For example, during the 2005-2006

Figure 3.0-8 Winter (November-April) precipitation departures from average, 1000-1988, reconstructed from tree rings - Arizona NOAA Climate Division 7



Arizona NOAA Climate Division 7 (Southeastern Arizona) includes Graham, Greenlee, Cochise, Santa Cruz, and Pima counties. Data are presented as a 20-year moving average to show variability on decadal time scales. Values shown for each year are centered on a 20 year period. The average winter precipitation for 1000-1988 is 4.9 inches. Data: Fenbiao Ni, University of Arizona Laboratory of Tree-Ring Research and CLIMAS. Figure author: CLIMAS

winter, the planning area received 6.3 inches less precipitation than during the 2004-2005 winter. This variability can also be observed on longer time scales. The 1950s were a relatively dry decade with an average annual precipitation deficit of -1.46 inches, while the 1980s were a relatively wet decade with an average annual precipitation surplus of 1.86 inches (Figure 3.0-7). Annual average temperature in the planning area is 61.6° F, compared to the statewide average of 59.9° F. As in other parts of Arizona, temperatures have been increasing the past several decades. Temperature observations are consistent with global temperature trends; however, some warming may be attributed to changes in land-cover resulting from population growth.

Winter precipitation records dating to 1000 A.D. reconstructed from tree rings show extended periods of above and below average precipitation in every century (Figure 3.0-8) in the area encompassed in Climate Division 7, which includes the planning area and parts of others. A climate division is a region within a state that is generally climatically homogeneous. Arizona has been divided into seven climate divisions. These decadal and shorter time period shifts are related to circulation changes in the Pacific Ocean. On time scales of 10-30 years, precipitation variability is likely related to shifts in Pacific Ocean circulation patterns, such as the El Niño-Southern Oscillation (ENSO) or the Pacific Decadal Oscillation (PDO). On time scales of 2-7 years, the ENSO, 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 are greater chances for above-average winter precipitation, while La Niña conditions are usually associated with below-average winter precipitation. However, El Niño winters can also produce below-average precipitation. Generally, La Niña conditions are associated with drought in the region. The ENSO phases also impact precipitation and monsoon strength in the region.

3.0.4 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. The sky island ecosystems of the planning area are relatively isolated from each other, and as a result there are a large number of endemic species in the planning area mountain ranges. These ecosystems are of major interest to resource managers due to their biological diversity and distinct biogeography. (Warshall, 2006) 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, memorials, wildlife refuges, national conservation areas, wilderness areas and other protected areas, and unique waters.

Vegetation[3]

Four of Arizona's six ecoregions are included in the planning area: the Arizona Mountains Forests along the northern boundary; the Chihuahuan Desert, interspersed with Sierra Madre Occidental Pine-oak Forests, which covers most of the planning area; and the easternmost extension of the Sonoran Desert in the northwest. (Figure 3.0-9) The Chihuahuan Desert region may have grown by as much as a third in the last few hundred years due to human activities including poor agricultural practices that have eroded grasslands (CDRI, 2008).

Because of the wide elevation range in the planning area, many biotic communities are represented, ranging from subalpine forests at the highest elevations in the Pinaleño, Chiricahua and White mountains to Arizona Uplands Sonoran desertscrub.

As shown in Figure 3.0-9, high elevation subalpine and montane conifer forests, consisting of dense stands of fir, spruce and aspen trees, are found at the highest elevations in the planning area, primarily in the Morenci Basin. These areas receive much of their annual precipitation as snow. Because of the forest density, sunlight reaches the ground and snow

Blue River, Morenci Basin. Conifer woodlands, consisting of primarily of ponderosa pine, occur at elevations between 6,000 and 9,000 feet that receive about 18 to 26 inches of annual precipitation.

[3] Except as noted, information in this section is from Brown, D, 1982 and from AZGF, 2004.

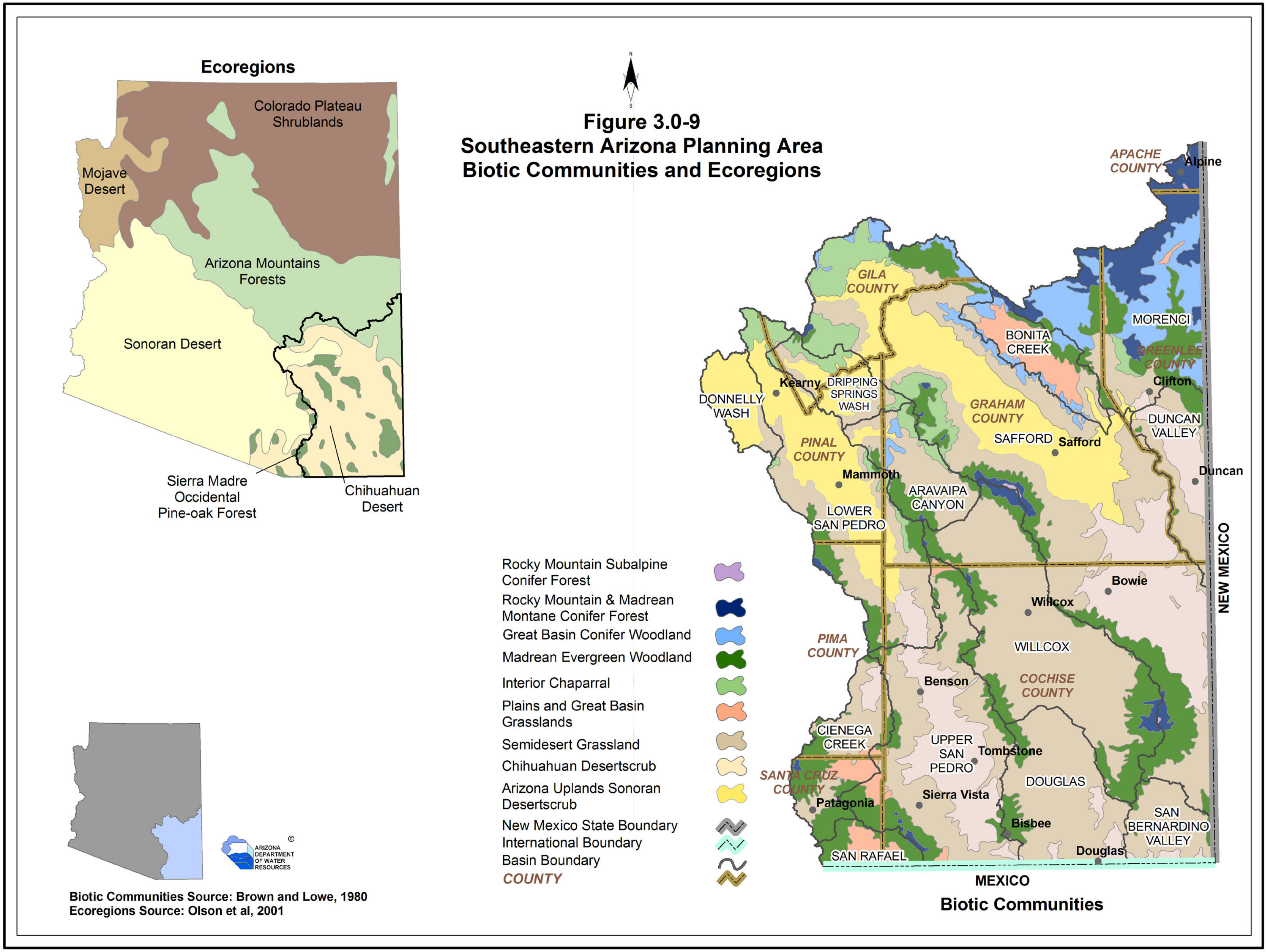


Figure 3.0-9
Southeastern Arizona Planning Area
Biotic Communities and Ecoregions

melts slowly, releasing snowmelt gradually to streams. Annual precipitation amounts are about 25 to over 30 inches a year in these areas.

Great Basin conifer woodlands consisting primarily of ponderosa pine occur at elevations between 6,000 and 9,000 feet that receive about 18 to 26 inches of annual precipitation. Piñon-juniper woodlands cover large areas below the ponderosa pine forest at elevations between 5,500 and 7,000 feet that receive 12 to 20 inches of precipitation. Plains and Great Plains grasslands occur in several locations in the planning area at elevations between 5,000 and 7,000 feet that receive between 11 and 18 inches of annual precipitation. These areas are located primarily in the Bonita Creek, Cienega Creek, San Rafael and Upper San Pedro basins. The piñon-juniper woodland and madrean evergreen woodland is often intermixed with this grassland in the planning area.

Madrean evergreen woodlands are found in almost every basin in the planning area. The largest area of this community is in the mountain ranges that create the boundary between the Willcox and Safford basins. The woodland consists of evergreen oaks, alligator bark and one-seed junipers and Mexican piñon pine, and transitions to semidesert grassland at lower elevations. Cacti of the semidesert grassland may extend into the woodland.

At lower elevations (4,000-6,000 feet), interior chaparral is found in areas that receive 13 to 23 inches of annual precipitation. Chaparral consists of dense shrubs that grow around the same height with occasional taller shrubs or small trees. Chaparral communities typically are a mix of several shrubby species such as mountain mahogany, shrub live oak, and manzanita and commonly include cactus, agave, and yucca. Chaparral plants are well adapted to drought conditions. This community is found in the northwestern part of the planning area.

Chihuahuan desertscrub in the Upper San Pedro Basin. The planning area contains the only Chihuahuan desertscrub community in Arizona.

Semi-desert grasslands are found in all planning area basins except the San Rafael basin, occurring in valleys between the desert and woodlands or chaparral at elevations between 3,500 and 5,000 feet that receive annual precipitation of 10 to 15 inches. This community is particularly predominant in the Douglas and Willcox basins. Desert grasslands often contain a mixture of grasses, shrubs and small trees.

The planning area contains the only Chihuahuan desertscrub community in Arizona. Found primarily in northeastern Mexico, its easternmost extension occurs extensively in the Duncan Valley, Safford, and Upper San Pedro basins, with smaller areas in the Cienega Creek, Douglas, Lower San Pedro and San Bernardino Valley basins. In Arizona, this community occupies plains, low hills and bajadas generally above 4,000 feet in elevation. Precipitation averages range from about 8 inches to more than 12 inches, much of which falls during the summer. Prominent plant species include creosotebush, lechuguilla, sotol, yucca, ocotillo, acacia and mesquite. (CDRI, 2008)

Arizona Uplands Sonoran desertscrub extends into the northwestern portion of the planning area below about 3,500 feet, in Aravaipa Canyon, Dripping Springs, Donnelly Wash, Lower San Pedro and Safford basins. Typical vegetation includes palo verde, mesquite, creosote, and cacti, including Saguaro cacti.

There are extensive reaches of riparian vegetation in some locations in the planning area. The general location of riparian vegetation is shown in Figure 3.0-11. Cultural water use has lowered groundwater levels and surface water diversions and impoundments have impacted streamflow in a number of areas. On Bonita Creek, woodcutting for mines, overgrazing, beaver trapping and a water conveyance system to Safford has reportedly reduced topsoil as much as 50% and down cut the creek as much as 12 feet (Tellman, et al, 1997).

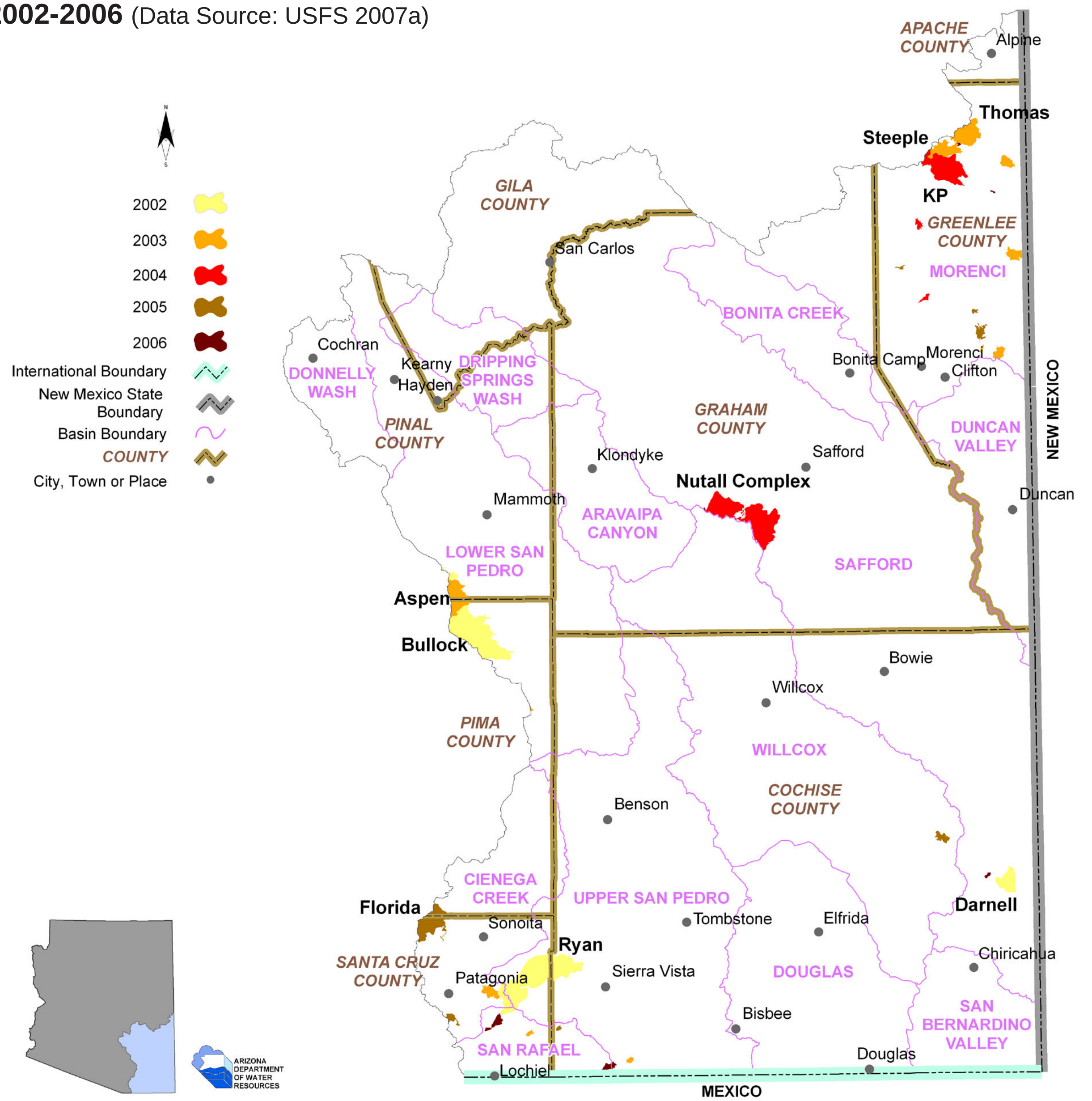
The Gila River, which once was perennial for most of its length in Arizona has been altered in the planning area by Coolidge Dam and farming activities. However, groundwater levels along the river remain high. Floods have had significant impacts on riparian vegetation at a number of locations. Cottonwood has increased in narrow reaches of the river and in bedrock canyons but has decreased in the wide valleys where it once was common due to channel-widening floods in the early part of the 20th century. Tamarisk and mesquite species have increased since the middle of the twentieth century, and large floods in the last third of the 20th century did not significantly reduce tamarisk. (Webb, et al 2007)

Gila River, Dripping Springs Wash Basin. Tamarisk and mesquite species have increased since the middle of the twentieth century on the Gila River.

The San Pedro River was a broad river of cienegas (marshes) when first observed by Spanish expeditions in the 1600s and 1700s. Stream entrenchment began in the 1880s and by the early 1890s had spread along the length of the river. The San Pedro River channel began to stabilize during the 1950s (ADWR, 2005a). Riparian vegetation has generally increased along the river north of the international border despite notable floods in 1983 and 1993. Gallery cottonwood forests exist along the upper San Pedro River, at scattered locations between Benson and San Manuel and near its confluence with the Gila River (Webb, et al., 2007).

Historically, the San Simon River was a broad intermittent stream that meandered through the San Simon Valley. Settlers channelized the river in the 1880s to control flooding and direct its flow until it eventually became a 60 mile long, 600 to 800 foot wide river, 10 to 30 feet deep. Restoration efforts began in the 1930s and numerous erosion control structures have been built on the river. (Tellman, et al, 1997) Since then, riparian vegetation, primarily tamarisk, has increased while mesquite have increased on channel banks. Downstream, near Solomon, native riparian species are increasing including Fremont cottonwood and black willow. (Webb, et al., 2007)

Figure 3.0-10 Southeastern Arizona Planning Area Location of Major Wildfires 2002-2006 (Data Source: USFS 2007a)



Several large fires have occurred in the planning area since 2002 as shown in Figure 3.0-10. The largest were the Nutall Complex fire in the Pinaleño Mountains, the Ryan Fire in the Huachuca Mountains and surrounding grasslands, and the Bullock and Aspen fires in the Santa Catalina Mountains. The Nutall Complex fire burned over 29,400 acres and threatened the Large Binocular Telescope Observatory on Mount Graham. The Aspen Fire burned for a month and destroyed much of the community of Summerhaven in the Tucson AMA.

Arizona Water Protection Fund Program

Forty-five riparian restoration projects in the Southeastern Arizona Planning Area have been funded by the Arizona Water Protection Fund Program (AWPF) through FY 2008. The objective of the AWPF program is to provide funds for protection and restoration of Arizona's rivers and streams and associated riparian habitats. There are funded projects in ten of the fourteen planning area basins. Most projects have been funded in the Safford, Upper San Pedro, Cienega Creek and Lower San Pedro basins. Many of these projects were for the purpose of fencing, often in conjunction with water development, and for research. A list of projects and types of projects funded in the planning area through FY 2008 is found in Appendix A. A description of the program, a complete listing of all projects funded, and a reference map is found in Volume 1.

Instream Flow Claims

An instream flow right is a non-diversionary appropriation of surface water for recreation and wildlife use. Thirty-four applications for instream flow claims have been filed in the Southeastern Arizona Planning Area as of August 2008. They are listed in Table 3.0-1 and shown on Figure 3.0-11. Claims have been filed in nine of the fourteen planning area basins. Certificates have been issued for claims on Aravaipa Creek in the Aravaipa Canyon and Lower San Pedro basins; Bass Canyon in the Lower and Upper San Pedro basins; Hot Springs Canyon and Wildcat Canyon in the Lower San Pedro Basin; Leslie Creek in the Douglas Basin; Mescal Creek in the Dripping Springs Wash Basin; and O'Donnell Creek, Ramsey Canyon

Table 3.0-1 Instream flow applications in the Southeastern Arizona Planning Area

Map Key	Stream	Applicant	Application No.	Permit No.	Certificate No.	Filing Date
1	Aravaipa Creek	BLM (Phoenix)	33-87114.0	87114	87114	6/1/1981
2	Aravaipa Creek	The Nature Conservancy	33-95488.0	95488	95488	10/31/1990
3	Aravaipa Creek	The Nature Conservancy	33-95489.0	95489	95489	10/31/1990
4	Aravaipa Creek	The Nature Conservancy	33-95490.0	95490	95490	10/31/1990
5	Aravaipa Creek	The Nature Conservancy	33-95771.0	95771	95771	10/31/1990
6	Babocomari River	BLM (Safford)	33-95487.0	Pending	Pending	10/2/1990
7	Babocomari River	BLM (Safford)	33-96167.0	Pending	Pending	2/3/1992
8	Bass Canyon	BLM (Safford)	33-94371.0	94371	94371	12/1/1988
9	Bass Canyon	The Nature Conservancy	33-96278.0	96278	96278	12/1/1988
10	Bonita Creek	BLM (Safford)	33-90250.0	Pending	Pending	10/21/1985
11	Buehman Canyon	Arizona State Land Department	33-90249.1	Pending	Pending	10/21/1985
12	Buehman Creek	The Nature Conservancy	33-96545.0	Pending	Pending	3/4/1997
13	Gila River	BLM (Safford)	33-94379.0	Pending	Pending	12/14/1988
14	Hot Springs Canyon	BLM (Safford)	33-94372.0	94372	94372	12/1/1988
15	Hot Springs Canyon	The Nature Conservancy	33-96279.0	96279	96279	12/1/1988
16	Leslie Creek	U.S. Fish & Wildlife Service	33-96176.0	96176	96176	3/20/1992

Table 3.0-1 Instream flow applications in the Southeastern Arizona Planning Area (Cont)

Map Key	Stream	Applicant	Application No.	Permit No.	Certificate No.	Filing Date
17	Mescal Creek	BLM (Phoenix)	33-90252.0	90252	90252	10/21/1985
18	Miller Canyon Draw	Coronado National Forest	33-95366.0	Pending	Pending	12/29/1989
19	Oak Grove Canyon	BLM (Safford)	33-96811.0	Pending	Pending	7/21/2005
20	O'Donnell Creek	The Nature Conservancy	33-78421.0	78421	78421	6/27/1979
21	O'Donnell Creek	The Nature Conservancy	33-96449.0	96449	96449	2/21/1991
22	Peppersauce Creek	Murray, William L.	33-96564.0	Pending	Pending	8/6/1997
23	Ramsey Creek	The Nature Conservancy	33-78419.0	78419	78419	6/27/1979
24	Redfield Canyon	BLM (Safford)	33-94369.0	Pending	Pending	12/1/1988
25	San Francisco River	BLM (Safford)	33-90251.0	Pending	Pending	10/21/1985
26	San Francisco River	Phelps Dodge Corporation	33-96759.0	Pending	Pending	6/3/2004
27	San Pedro River	BLM (Safford)	33-90103.1	90103	90103	8/12/1985
28	San Pedro River	BLM (Safford)	33-95780.0	Pending	Pending	1/8/1991
29	San Pedro River	BLM (Safford)	33-95789.0	Pending	Pending	4/1/1991
30	San Pedro River	BLM (Safford)	33-96126.1	Pending	Pending	8/6/1991
31	San Pedro River	BLM (Safford)	33-96127.1	Pending	Pending	8/6/1991
32	Spring Canyon Spring	BLM (Safford)	33-96799.0	Pending	Pending	6/13/2005
33	Wet Canyon	Coronado National Forest	33-96681.0	Pending	Pending	10/6/2000
34	Wildcat Canyon	BLM (Safford)	33-95454.0	95454	95454	6/6/1990

Source: ADWR 2008a

and the San Pedro River in the Upper San Pedro Basin. Other basins with instream flow applications are Bonita Creek, Duncan Valley, Morenci and Safford.

Threatened and Endangered Species[4]

A number of listed threatened and endangered species may be present in the Southeastern Arizona Planning Area. Those listed by the U.S. Fish and Wildlife Service (USFWS) as of 2008 are shown in Table 3.0-2. 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.

[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

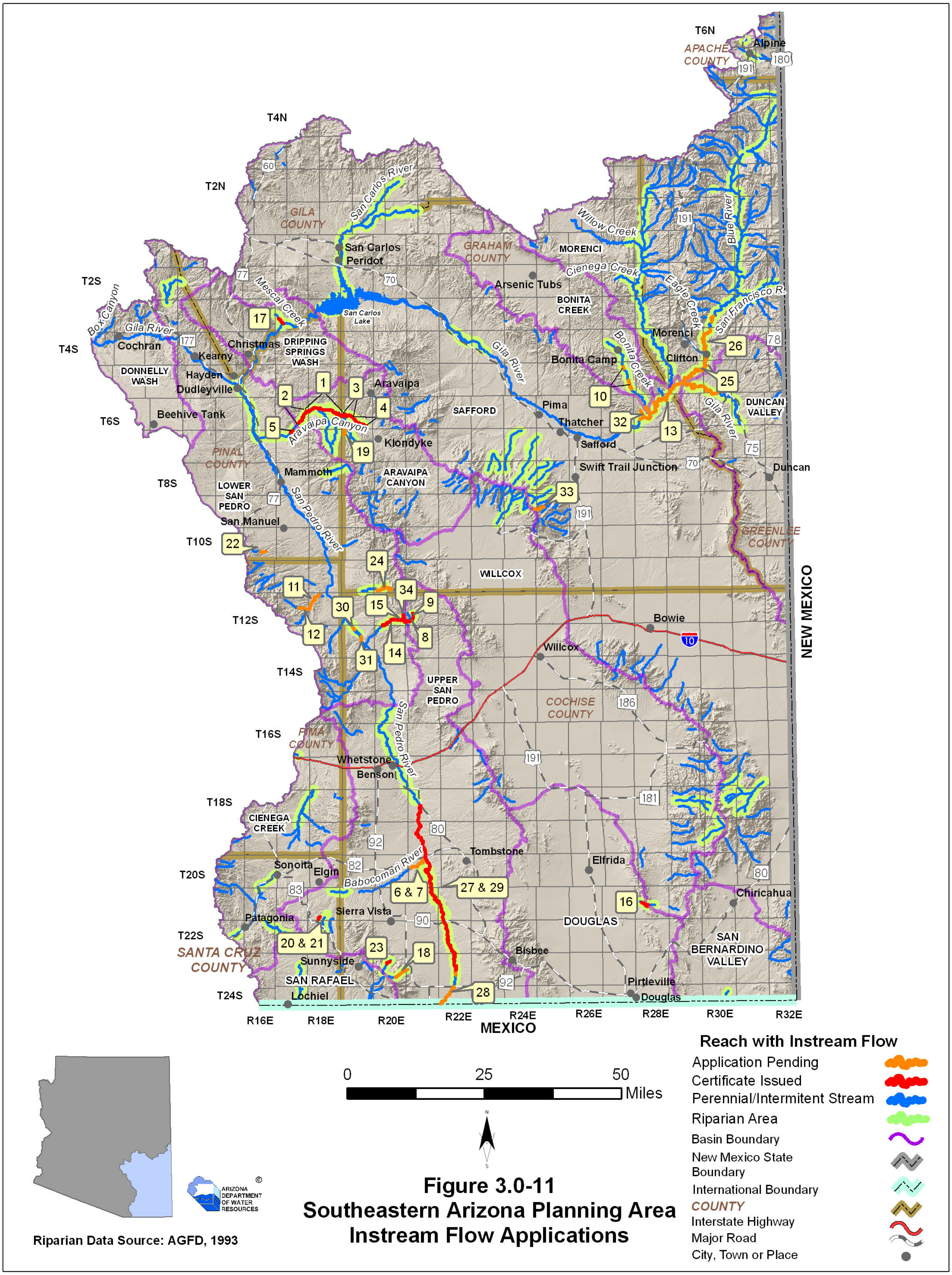


Figure 3.0-11
Southeastern Arizona Planning Area
Instream Flow Applications

Table 3.0-2 Listed threatened and endangered species in the Southeastern Arizona Planning Area

Common Name	Threatened	Endangered	Elevation/Habitat
Apache Trout	X		>5,000 ft./cold mountain streams
Arizona Cliff-rose		X	<4,000 ft./white soils of tertiary limestone lakebed deposits
Arizona hedgehog cactus		X	3,700-5,200 ft./ecotone between interior chaparral and madrean evergreen woodland
Bald Eagle	X		Varies/large trees or cliffs near water
California Brown Pelican		X	Varies/lakes and rivers
Canelo Hills ladies'- tresses		X	5,000 ft./finely grained, highly organic, saturated soils of cienegas
Chiricahua Leopard Frog	X		3,300-8,900 ft./streams, rivers, backwaters, ponds stock tanks
Cochise pincushion cactus	X		>4,200 ft./ semidesert grassland with small shrubs, agave, cacti, grama grass
Desert pupfish		X	<5,000 ft./shallow springs, small streams and marshes. Tolerates saline and warm water
Gila Chub		X	2,000-5,500 ft./pools, springs, cienegas and streams
Gila topminnow		X	<4,500 ft./small streams, springs and cienegas vegetated shallows
Gila trout	X		5,000-10,000 ft./small, high mountain streams
Huachuca water umbel		X	3,500-6,500 ft./cienegas, perennial low gradient streams, wetlands
Jaguar		X	1,600->9,000 ft./Sonoran desertscrub through subalpine conifer forest
Lesser long-nosed bat		X	<6,000 ft./desert scrub with agave and columnar cacti
Loach Minnow	X		<8,000 ft./benthic species of small to large perennial streams
Mexican Gray Wolf		X	4,000-12,000 ft. /chaparral, woodland, forests
Mexican Spotted Owl	X		4,100-9,000 ft./canyons, dense forests with multi-layered foliage structure
Mount Graham red squirrel		X	>8,000 ft./montane upper elevation mature to old-growth conifer forest
New Mexico ridge-nosed rattlesnake	X		5,000-6,600 ft./canyon bottoms in pine-oak communities
Nichol's Turk's head cactus		X	2,400-4,100 ft./Sonoran desertscrub
Northern aplomado falcon		X	3,500-9,000 ft./grassland and savannah
Ocelot		X	<8,000 ft./humid tropical and sub-tropical forests, savannahs and semi-arid thornscrub
Pima pineapple cactus		X	2,300-5,000 ft./Sonoran desertscrub or semi-desert grassland
Razorback sucker		X	<6,000 ft./riverine and lacustrine areas, not in fast moving water
Sonora tiger salamander		X	4,000-6,300 ft./stock tanks and impounded cienegas
Southwestern Willow Flycatcher		X	<8,500 ft./cottonwood-willow and tamarisk along rivers and streams

Table 3.0-2 Listed threatened and endangered species in the Southeastern Arizona Planning Area (Cont)

Common Name	Threatened	Endangered	Elevation/Habitat
Spikedace	X		<6,000 ft./moderate to large perennial streams with gravel cobble substrates
Yaqui catfish	X		4,000-5,000 ft./moderate to large streams with slow current
Yaqui chub		X	4,000-6,000 ft./deep pools of small streams or ponds near undercut banks
Yaqui topminnow		X	<4,500 ft./small to moderate sized streams, springs, cienegas in shallows

Source: AGFD 2008, USFWS 2008

National Parks, Monuments and Memorials, Wildlife Refuges, National Conservation Areas, Wilderness Areas and other Protected Areas

Protected areas are shown in Figure 3.0-12. There are parts of one national park, a national monument, a national memorial, a national conservation area, two national riparian conservation areas, two wildlife refuges and fifteen wilderness areas in the planning area.

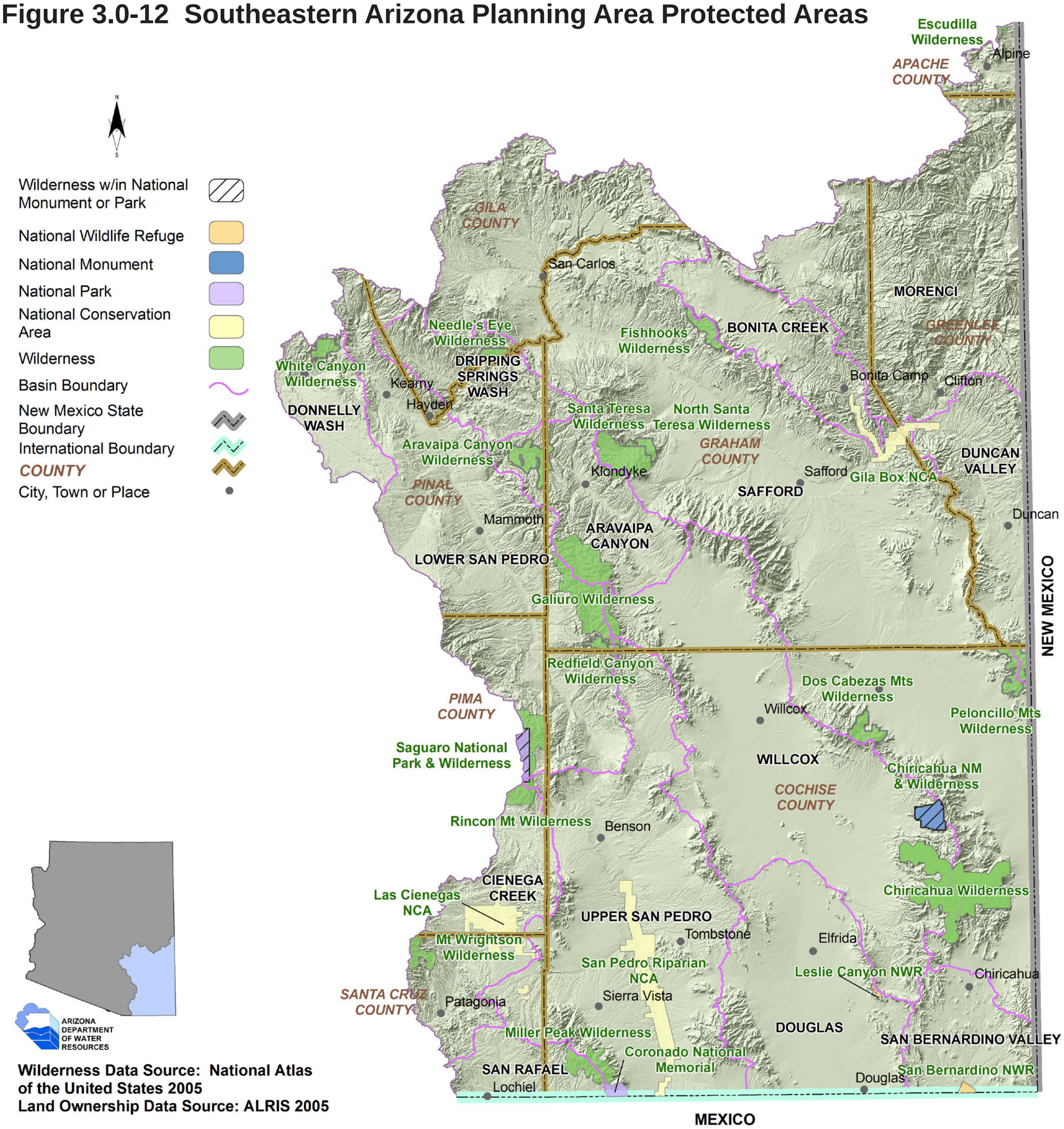
An almost 9,000-acre portion of the Rincon Mountain District of Saguaro National Park extends into the Lower San Pedro Basin. The park was established as a national monument in 1933 to protect Saguaro cactus forests, and it achieved national park status in 1994. Much of the Rincon Mountain District is wilderness area.

The planning area contains Chiricahua National Monument and Coronado National Memorial. The monument, located almost entirely in the Willcox Basin, was created in 1924 to protect its unique rock formations. In 1976, 87% of the monument's approximately 12,000 acres were designated as wilderness to further preserve the geologic formations and unique plants and animals. (NPS, 2006) Coronado National Memorial, located primarily in the Upper San Pedro Basin adjacent to the Mexican border, commemorates the significance of Francisco Vásquez de Coronado's expedition of 1540-1542. The Memorial was created in 1941 and has two sister parks in Mexico. (NPS, 2007)

The two National Wildlife Refuges (NWR) in the planning area are the San Bernardino NWR in the San Bernardino Valley Basin and Leslie Canyon NWR located in the Douglas and Willcox Basins. Both refuges were established in the 1980s to protect water resources and habitat for endangered native fishes and rare velvet ash-cottonwood-black willow gallery forest. (USFWS, 2006)

The only two Riparian National Conservation Areas in the nation are found in the planning area: the San Pedro Riparian National Conservation Area (SPRNCA) and the Gila Box Riparian National Conservation Area. The SPRNCA was established in November 1988 and contains about 40 miles of riparian area along the San Pedro River in the Upper San Pedro Basin. It includes over 58,000 acres of land between the international border with Mexico and the community of St. David south of Benson. The primary purpose for the designation is to protect and enhance the desert riparian ecosystem (BLM, 2006a). The 22,000 acre Gila Box Riparian National Conservation Area was established in November 1990 to "conserve, protect, and enhance" the riparian and associated values of the area. The conservation area is located within the Bonita Creek, Duncan Valley, Morenci and Safford basins. Portions of four perennial waterways, the Gila River (23

Figure 3.0-12 Southeastern Arizona Planning Area Protected Areas



miles), Bonita Creek (15 miles), Eagle Creek, and the San Francisco River are contained in the conservation area (BLM, 2006b).

The Las Cienegas National Conservation Area was established in December 2000 and encompasses about 45,000 acres. Most of the conservation area is located between the Empire and Whetstone mountain ranges generally north of Sonoita within the Cienega Creek Basin. A small part of the conservation area extends into the Upper San Pedro Basin. The conservation area was designated to protect aquatic, wildlife, vegetative and riparian resources. Livestock grazing and recreation are allowed to continue in "appropriate" areas. Goals include protecting water quality and water quantity (BLM, 2006c).

All or portions of 15 wilderness areas, with a combined area of 318,797 acres, are located in the planning area. Wilderness Areas are

Leslie Canyon National Wildlife Refuge in the Douglas Basin.

designated under the 1964 Wilderness Act to preserve and protect the designated area in its natural condition. Designated wilderness areas, their size, basin location and a brief description of the area are listed in Table 3.0-3.

A notable wilderness area, Aravaipa Canyon, is located in the Aravaipa Canyon Basin. Administered by the Bureau of Land Management, it was designated in 1984 and includes 19,700 acres along the 10-mile long central gorge of the canyon, which cuts through the northern end of the Galiuro Mountains. The Nature Conservancy's (TNC) Aravaipa Canyon Preserve, consisting of about 7,000 acres, includes lands at both the east and west ends of Aravaipa Canyon as well as lands on the canyon's south rim (TNC, 2006). In 2007, the 1,250-acre Cobra Ranch near the east end of the canyon was donated to the TNC. Cobra Ranch contains Stowe Gulch, a drainage area estimated to contribute nearly half of the groundwater flowing to the headwaters of Aravaipa Creek (TNC, 2007).

The Nature Conservancy has acquired a number of properties in the planning area for habitat protection, particularly in the Lower San Pedro Basin. In addition to the Aravaipa Canyon Preserve, TNC preserves include Buehman Canyon Preserve and the San Pedro River Preserve near Winkelman, located in the Lower San Pedro Basin. Other TNC preserves include the Ramsey Canyon Preserve in the Huachuca Mountains in the Upper San Pedro Basin, and the Patagonia-Sonoita Creek Preserve in the Cienega Creek Basin. The Muleshoe Ranch Cooperative Management Area is a 49,000 acre preserve established to preserve native fish and grassland located in the Lower San Pedro, Upper San Pedro and Willcox Basins. This area is managed cooperatively by the TNC, BLM and U.S. Forest Service (USFS). (TNC, 2006)

In addition to preserves, the TNC has acquired properties to establish conservation easements that retire irrigated agriculture and reduce groundwater pumping along the San Pedro River. These include the 2,150 acre Three Links Farm located about 15 miles north of Benson in the Lower San Pedro Basin that contains more than six miles along the river, and a property near the San Pedro River Preserve. Other TNC-facilitated areas with conservation easements are the 18,500 acre San Rafael Ranch Natural Area in the San Rafael Basin and the 909 acre Sylvester Ranch at Palominas in the Upper San Pedro Basin. (TNC, 2008)

Pima County has acquired two ranches in the Lower San Pedro Basin as part of the Sonoran Desert Conservation Plan; the A-7 Ranch located in the northeast corner of Pima County and the northwest corner of Cochise County, and the

Aravaipa Canyon Wilderness Area. The wilderness area includes 19,700 acres along the 10-mile long central gorge of the Canyon

Table 3.0-3 Wilderness areas in the Southeastern Arizona Planning Area

Wilderness Area	Acres in the Planning Area	Basin	Description
Aravaipa Canyon	19,410	Aravaipa Canyon	11-mile long Aravaipa Canyon, surrounding tablelands and nine side canyons.
Chiricahua*	87,700	Willcox, Safford	Sharp ridges, high peaks, including Chiricahua Peak (9,797 ft), and deep canyons. Largest mountain range of the sky islands.
Dos Cabezas Mountains	11,700	Safford	Steep mountain slopes, granite outcroppings and vegetated canyon floors.
Escudilla	1,330 (Partial)	Morenci	Mountain meadows and Escudilla Mountain (10,912 ft).
Fishhooks	10,500	Safford	Pinon pine forest, grassland, chaparral and canyons.
Galiuro	76,317	Aravaipa Canyon, Lower San Pedro, Upper San Pedro, Willcox	Douglas-fir, big tooth maple and aspen trees, canyons and peaks.
Miller Peaks	20,190	San Rafael, Upper San Pedro	Sheer cliffs, summits and deep canyons. Habitats ranging from desert grassland to mixed conifer and aspen forest.
Mount Wrightson	9,730 (Partial)	Cienega Creek	Deep canyons, ridges and peaks surrounded by semiarid hills and grasslands. Ponderosa pine, douglas fir and montane Mexican plants that grow nowhere else north of the border
Needles Eye	8,760	Dripping Springs Wash	Gila River, Needle's Eye canyon and riparian areas.
North Santa Teresa	5,800	Safford	Contains the Black Rock, a 1,000 ft high rhyolitic plug, desert and mountain shrub, grassland and riparian vegetation.
Peloncillo Mountains	19,440	Duncan Valley, Safford	Desert shrub grasslands to oak juniper woodlands in the higher reaches of the Peloncillo Mountains.
Redfield Canyon	6,600	Lower San Pedro, Upper San Pedro	Galiuro escarpment, canyons and perennial streams.
Saguaro*	8,740 (Partial)	Cienega Creek, Upper San Pedro, Lower San Pedro	Vegetation varies with elevation and includes desert scrub, desert grassland, oak woodland, pine-oak woodland, pine forest and mixed conifer forest.
Santa Teresa	26,780	Safford, Aravaipa Canyon	Deep canyons, rocky outcrops and bald summits. Vegetation is predominantly chaparral with forests of ponderosa pine on high ridges.
White Canyon	5,800	Donnelly Wash	Box Canyon stream, White Canyon, Sonoran desert and chaparral.
Total	**318,797**		

Source: BLM 2008, USFS 2007b
*A portion of these wilderness areas are within the boundaries of a National Monument or National Park

Six-Bar Ranch located ten miles south of San Manuel west of the San Pedro River. These two conservation preserves total over 10,000 acres (Pima County, 2006). The County also owns the Bingham Cienega Preserve in the Lower San Pedro Basin where it is restoring riparian and grassland ecosystems.

In the Lower San Pedro Basin, the Salt River Project and the U.S. Bureau of Reclamation (USBOR) have acquired, or are proposing to acquire, lands for Southwestern Willow Flycatcher habitat along the San Pedro River. The USBOR has also completed an Environmental Assessment as part of the acquisition of lands for Southwestern Willow Flycatcher habitat in the Safford Basin. (USBOR, 2006)

Kartchner Caverns State Park is located southwest of Benson in the Whetstone Mountains. A wet cave, it is supported by a limestone aquifer that is recharged by infiltration from ephemeral washes. There is concern about the impact on this hydrologic system from impending development in the area.

Unique Waters

Six “unique waters”, 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, have been identified in the planning area. These include:

- Aravaipa Creek from its confluence with Stowe Gulch to the downstream boundary of Aravaipa Canyon Wilderness Area (Aravaipa Canyon and Lower San Pedro basins)
- Bonita Creek, tributary to the upper Gila River (Bonita Creek and Safford basins)
- Buehman Canyon Creek from its headwaters to approximately 9.8 miles downstream (Lower San Pedro Basin)
- Cave Creek and the South Fork of Cave Creek (Chiricahua Mountains), from the headwaters to the Coronado National Forest boundary (Safford Basin)
- Cienega Creek, from its confluence with Gardner Canyon and Spring Water Canyon to the USGS gaging station in Pima County (Cienega Creek Basin)
- KP Creek, from its headwaters to its confluence with the Blue River (Morenci Basin)

3.0.5 Population

Census data for 2000 show about 188,300 residents in the Southeastern Arizona Planning Area. Arizona Department of Economic Security (DES) population projections forecast about 294,600 residents by 2030. Historic, current (2006) and projected basin populations are shown in the cultural water demand tables for each basin in Sections 3.1-3.14. Projections may not accurately reflect the most recent proposed developments.

The 2000 Census populations for each basin and Indian reservation, listed from highest to lowest, are shown in Table 3.0-4. The most populous basins reported in the 2000 census are the Upper San Pedro (78,013), Safford (42,281), Douglas (26,220), Lower San Pedro (15,515), and Willcox (12,354) basins. As shown on Table 3.0-4, six basins in the planning area are sparsely populated, with less than 200 residents. The 2000 Census population of the entire San Carlos Apache Reservation, which extends into the Central Highlands Planning Area, was 9,385, an increase of over 2,000 residents since the 1990 census.

Shown in Table 3.0-5 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. As shown, there are several rapidly growing communities with double digit growth

Table 3.0-4 2000 Census population of basins and Indian reservations in the Southeastern Arizona Planning Area

Basin/*Reservation*	2000 Census Population
Upper San Pedro	78,013
Safford	42,281
San Carlos Apache	*8,270*
Douglas	26,220
Lower San Pedro	15,515
Willcox	12,354
Morenci	5,141
Cienega Creek	4,355
Duncan Valley	3,757
Dripping Springs Wash	175
Donnelly Wash	165
San Rafael	147
Aravaipa Canyon	135
San Bernardino Valley	66
Bonita Creek	21
San Carlos Apache	*21*

rates between 2000 and 2006 including Sierra Vista and adjacent areas, Douglas, Thatcher, San Carlos, Whetstone and Swift Trail Junction south of Safford. The largest municipality in the planning area is Sierra Vista with a 2000 Census population of 37,775, or 20% of the planning area population. The population of the Sierra Vista subwatershed (roughly the southern half of the basin), contained about 37% of the planning area population in 2000. Approximately half the population of the San Carlos Apache Reservation resides in the communities of Peridot and San Carlos (the 10th largest community in the planning area (2000) and the tribal headquarters). Some communities including Clifton and Morenci have lost population between 2000 and 2006 due to declines or closures of mining operations. Between 1990 and 2000, the population living in smaller communities and rural areas grew faster than the population living in communities with 1,000 or more residents.

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. None of the counties in the planning area fit this population criterion. However, Cochise County has incorporated water resource planning into its comprehensive plan, has adopted water use guidelines in certain area plans and has adopted a Water Conservation and Management Policy Plan for the Sierra Vista sub-watershed portion of the basin. Its goal is to “sustain an adequate, safe water supply through water conservation measures, policies, incentive programs, education, conservation and enhancement of natural recharge areas, and cooperative, multi-jurisdictional planning”. (Cochise County, 2006a) The Act also requires that twenty-three communities outside AMAs include a water resources element in their general plans. In the Southeastern Arizona Planning Area this includes the communities of Benson, Douglas, Safford and Sierra Vista. Plans must consider water demand and water resource availability in conjunction with growth, land use and infrastructure. References to completed plans are listed in basin references in this volume.

Fort Huachuca, with Sierra Vista in the background, in the Upper San Pedro Basin. Sierra Vista is the largest municipality in the planning area. The Sierra Vista Subwatershed contained about 37% of the planning area population in 2000.

Table 3.0-5 Communities in the Southeastern Arizona Planning Area with a 2000 Census population greater than 1,000

Communities	Basin	1990 Census Pop.	2000 Census Pop.	Percent Change 1990 2000	2006 Pop. Estimate[1]	Percent Change 2000-2006	Projected 2030 Pop.
Sierra Vista	USP	32,983	37,775	14.5	44,870	18.8%	67,264
Sierra Vista SE	USP	9,237	14,348	55.3	16,551	15.4%	23,398
Douglas	DOU	13,137	14,312	8.9	17,660	23.4%	28,685
Safford	SAF	7,359	9,232	25.5	9,835	6.5%	9,953
Bisbee	USP/DOU	6,288	6,090	-3.1	6,355	4.4%	8,483
Benson	USP	3,824	4,711	23.2	4,820	2.3%	4,856
San Manuel	LSP	4,009	4,375	9.1	NA	--	5,102
Thatcher	SAF	3,763	4,022	6.9	4,970	23.6%	6,994
Willcox	WIL	3,122	3,733	19.6	3,910	4.7%	4,491
San Carlos	SAF	2,918	3,716	2.7	4,918	32.4%	6,074
Oracle[2]	LSP	3,043	3,563	17.1	NA	--	NA
Clifton	MOR	2,840	2,596	-8.6	2,485	-4.3%	2,526
Whetstone	USP	1,289	2,354	82.6	2,810	19.4%	4,228
Kearny	LSP	2,262	2,249	-0.6	2,270	0.9%	3,740
Swift Trail Jct.	SAF	1,203	2,195	82.5	2,558	16.5%	3,878
Pima	SAF	1,725	1,989	15.3	2,080	4.6%	2,529
Morenci	MOR	1,799	1,879	4.4	1,821	-3.1%	1,828
Mammoth	LSP	1,845	1,762	-4.5	1,805	2.4%	2,228
Huachuca City	USP	1,782	1,751	-1.7	1,825	4.2%	2,145
St. David	USP	1,468	1,744	18.8	1,862	6.8%	2,229
Tombstone	USP	1,220	1,504	23.3	1,655	10.0%	2,032
Dudleyville	LSP	1,356	1,323	-2.4	NA	--	2,769
Peridot	SAF	957	1,266	32.3	NA	--	NA
Total >1,000		109,429	128,489	17.4	NA	--	>195,431
Remainder of Planning Area		46,236	59,793	29.3	NA	--	<99,197
Total		**155,665**	**188,282**	**20.9**	**NA**	**--**	**294,628**

Sources: ADOC 2006, U.S. Census 2006
[1] 2006 population shown is the 2006 estimate for incorporated areas and the 2006 projection for unincorporated areas.
[2] The community of Oracle is located in the Lower San Pedro Basin but its water supply comes from wells at Oracle Junction in the Tucson AMA.
USP = Upper San Pedro, DOU = Douglas Basin, SAF = Safford Basin, WIL = Willcox Basin, LSP = Lower San Pedro Basin MOR = Morenci Basin

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 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 and by the end of 2008, plans were submitted by 61 community water systems in the planning area. Almost all of the larger systems submitted plans and were used to prepare this document. Annual water report information and a list of water plans are found in Appendix B.

The Department's Water Adequacy Program also relates 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 that requires a new subdivision to have an adequate water supply in order for the subdivision to be approved by the platting authority. If adopted, cities and towns within the county may not approve a subdivision unless it has an adequate water supply. If the county does not adopt the provision, the legislation allows a city or town to adopt a local adequacy ordinance that requires a demonstration of adequacy before the final plat can be approved. The Cochise County Board of Supervisors was the first in the state to adopt the provisions of SB 1575 in March, 2008. The Town of Patagonia, located in Santa Cruz County, has also adopted the provision since Santa Cruz County has not adopted the new standards.

Subdivision adequacy determinations (Water Adequacy Reports), including the reason for the inadequate determination, are provided in

Table 3.0-6 Water adequacy determinations in the Southeastern Arizona Planing Area as of 12/2008

Basin	Number of Subdivisions	Number of Lots[1]	Lots w/Adequate Detrm.	Lots w/Inadequate Detrm.	Approx. Percent Inadequate
Aravaipa Canyon	none	none	none	none	none
Bonita Creek	none	none	none	none	none
Cienega Creek	13	>1,023	867	>156	15%
Donnelly Wash	1	59	0	59	100%
Douglas	8	433	83	350	81%
Dripping Springs Wash	none	none	none	none	none
Duncan Valley	3	>268	61	>207	77%
Lower San Pedro	12	>1,211	1,195	>16	1%
Morenci	11	>1,859	>1,825	34	2%
Safford	23	>905	139	>766	85%
San Bernardino Valley	none	none	none	none	none
San Rafael	none	none	none	none	none
Upper San Pedro	202	>24,923	>18,218	>6,705	27%
Willcox	20	>1577	989	>588	37%
TOTAL	**293**	**>32,258**	**>23,377**	**>8,881**	**28%**

Source: ADWR 2008b
Notes:
[1] Data on number of lots are missing for some subdivisions, actual number is larger

basin tables and maps and are summarized in Table 3.0-6. Also shown in the basin sections 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, AAWS applications had been approved in three basins for a total of 10,357 lots: Cienega Creek Basin, 189; Lower San Pedro Basin, 2,948; and Upper San Pedro Basin, 7,220. (See Tables 3.3-9, 3.8-10 and 3.13-9)

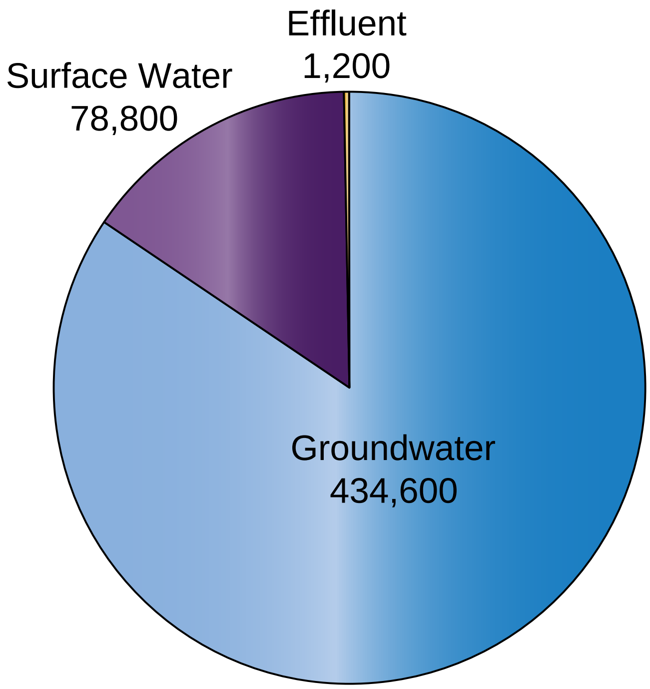
Six water providers in the planning area are designated as having an adequate water supply for their entire service area. A service area designation exempts subdivisions from demonstrating water adequacy if served by the provider. Designation information and the general location of the service area are also shown in basin maps and tables. As of December, 2008, designated providers included:

- City of Benson
- City of Douglas
- City of Safford
- City of Willcox
- Empirita Water Company (West of Benson, Cienega Creek Basin)
- Bachmann Springs Utility Company (Bachman Springs Development near Tombstone)

3.0.6 Water Supply

Local aquifers are the primary water supply for the planning area for municipal, industrial and agricultural use as shown in Figure 3.0-13. Approximately 15% of the cultural water demand is served by surface water. Most of the surface water is for agricultural use, and includes diversion from the San Pedro River, Aravaipa Creek and the Gila River. Gila River diversions are substantial, accounting for 92% of all surface water diversions in the planning area during the period 2001-2005. Small amounts of surface water are diverted for municipal use in the Morenci, Upper San Pedro and Willcox Basins and

Figure 3.0-13 Average Annual Water Supplies Utilized in the Southeastern Arizona Planning Area, 2001-2005 (in acre-feet)



Total Water Demand = 514,000 af

for industrial use in the Morenci Basin. Some communities utilize effluent for golf course irrigation and for groundwater recharge. Sites of environmental contamination may impact the availability of water supplies in some locations.

Legal availability of water supplies is an issue in the Southeastern Arizona Planning Area. The right to use Gila River water is governed by the Globe Equity Decree (described below). The Arizona Water Rights Settlement Act of 2004 (P.L. 108-45) includes settlement of the Gila River Indian Community's water rights claims in Title II of the Act. This settlement affects the volume and utilization of groundwater and surface water upstream from the Community in parts of the planning area (See ADWR, 2006).

Surface Water

Surface water is a municipal supply for the City of Tombstone in the Upper San Pedro Basin, for the town of Morenci in the Morenci Basin and Fort Grant in the Willcox Basin. The City of Safford uses water collected in an infiltration gallery along Bonita Creek in the Bonita Creek Basin, and for the purposes of this report the water is considered groundwater. The City of Tombstone began using surface water from springs in the Huachuca Mountains west of Tombstone in 1881 and currently diverts water from Miller and Carr Springs. This water is conveyed through a more than 25-mile, gravity fed, seven-inch diameter steel pipeline to Tombstone. (ADWR 2005a)

Surface water is diverted from several rivers in the planning area for agricultural irrigation. This supply may not always be available when needed. For example, surface water from the San Pedro River in the vicinity of St. David is typically only available during the period from November to May. In addition to diversions from the San Pedro River in the Lower and Upper San Pedro Basins, there are small surface water diversions from Aravaipa Creek in the Lower San Pedro and Aravaipa Canyon basins, and larger diversions from the Gila River. Water diverted from the Gila River is delivered to agricultural lands in the Safford and Duncan Valley Basins. When sufficient surface water is not available, the shortfall is made up by additional groundwater withdrawals. This shortfall may be dramatic. For example, the percentage of surface water used in the Safford and Duncan Valley Basins in 2000 was 27% compared to 60% in 1999.

Freeport-McMoRan Copper & Gold Inc (formerly Phelps Dodge Corporation) provides water to the Morenci Mine Complex and the town of Morenci in part through complex exchange agreements involving several water sources, some of which are located outside the planning area. Currently, Freeport-McMoRan utilizes exchange credits from both Horseshoe Reservoir on the Verde River and the Central Arizona Project through lease agreements with the San Carlos Apache Tribe, to divert water from the Black River at the Black River Pump Station in the Salt River Basin. This water is pumped over the watershed divide into Willow and Eagle Creeks where it is transported about 51 miles before being commingled with water from Freeport-McMoRan's Upper Eagle Creek Well Field. Freeport-McMoRan also uses water from Eagle Creek, Chase Creek and the San Francisco River (ADWR, 2005b). Historically, Phelps Dodge also had water exchange agreements involving Show Low Lake and Blue Ridge Reservoir in the Little Colorado River Basin. It relinquished its certificated rights to both water sources in 2005.

Legal availability of a surface water supply is 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".

Upper Gila River near Three Way in the Duncan Valley Basin. Water diverted from the Gila River is delivered to agricultural lands in the Safford and Duncan Valley Basins. When sufficient surface water is not available, the shortfall is made up by additional groundwater withdrawals.

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 3.0-7. 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. However, the act of filing a statement of claim of right to use public waters (36) does not in itself create a water right.

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. There are several court determinations in the planning area including the Doan and Jenkes decrees involving landowners, canal companies and irrigation water users in the Safford Valley, the Ling Decree in the San Francisco River Valley and Duncan Valley, and the Globe Equity No.59 Decree. In 1935 the U.S. District Court entered a consent decree (Globe Equity No. 59) for all diversions of the mainstem of the Gila River from its confluence with the Salt River to the headwaters in New Mexico, including the Gila River and San Carlos Apache reservations, and non-Indian landowners below and above Coolidge Dam. It awarded rights to use water on lands within the Gila River Indian Reservation with a priority date of “time immemorial” and also awarded rights to the San Carlos Apache Tribe with a priority date of 1846. Rights and priority dates were established for non-Indian land in the San Carlos Project area including the Safford Valley, the Duncan Valley and the Winkelman Valley (Pearce, 2002). The Gila Water Commissioner is appointed by the U.S. District Court to administer the Decree. Each year the Commissioner issues a report on the distribution of waters of the Gila River.

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 Southeastern Arizona Planning Area, the Gila River Adjudication is being conducted in the Superior court of Arizona in Maricopa County. The Gila Adjudication was initiated by petitions filed by several parties in the 1970’s, including Salt River Project, Phelps Dodge Corporation and the Buckeye Irrigation Company. The petitions were consolidated in 1981 into a single proceeding. The Gila Adjudication includes seven adjudication watersheds; Upper Salt, San Pedro, Agua Fria, Upper Gila, Lower Gila, Verde, and Upper Santa Cruz. The entire Upper Gila and San Pedro adjudication watersheds and part of the Upper Santa Cruz watershed are within the planning area boundaries. (See Figure 3.0-14) These watersheds do not coincide with the 6-digit HUC watersheds discussed previously and shown in Figure 3.0-5. The Willcox, Douglas and San Bernardino Valley basins are not included within the adjudication boundary.

The entire Gila Adjudication includes over 24,000 parties. All parties who claim to have a water right within the river system are required to file a statement of claimant or SOC (39), or risk loss of their right. This includes reserved water rights for public lands and Indian reservations, of which only some 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 Southeastern Arizona Planning Area, an HSR has been published for the San Pedro River Watershed (ADWR, 1991). In conjunction with the Gila Adjudication, a subflow zone delineation for the San Pedro River Watershed was published in June 2009.

Table 3.0-7 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 36,483 filings that specify surface water diversion points and places of use in the planning area, 2,766 CWRs have been issued to date. Figure 3.0-14 shows the 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 3.0-14.

The location of surface water resources are shown on surface water condition maps and maps showing perennial and intermittent streams and major springs for each basin, and in basin tables that contain data on streamflow, flood ALERT equipment, reservoirs, stockponds and springs.

Table 3.0-7 Inventory of surface water right and adjudication filings in the Southeastern Arizona Planning Area

Basin	Type of Filing							Total
	BB[2]	3R[3]	4A[3]	33[3]	36[4]	38[5]	39[6]	
Aravaipa Canyon	0	37	37	67	586	316	1,063	**2,106**
Bonita Creek	0	2	15	10	13	17	55	**112**
Cienega Creek	0	14	19	47	472	432	2,123	**3,107**
Donnelly Wash	0	9	23	25	117	100	237	**511**
Douglas	0	24	16	26	272	245	0	**583**
Dripping Springs Wash	0	13	63	21	237	82	340	**756**
Duncan Valley	161	38	22	33	347	402	1,113	**2,116**
Lower San Pedro	0	62	115	91	1,329	711	2,320	**4,628**
Morenci	33	16	136	62	1,408	711	2,273	**4,639**
Safford	289	51	141	244	1,269	1,345	4,408	**7,747**
San Bernardino Valley	0	12	4	21	150	167	0	**354**
San Rafael	0	4	6	76	268	235	639	**1,228**
Upper San Pedro	0	56	44	75	1,212	967	4,717	**7,071**
Willcox	0	57	75	100	608	685	0	**1,525**
Total	**483**	**395**	**716**	**898**	**8,288**	**6,415**	**19,288**	**36,483**

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 claim of right 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.

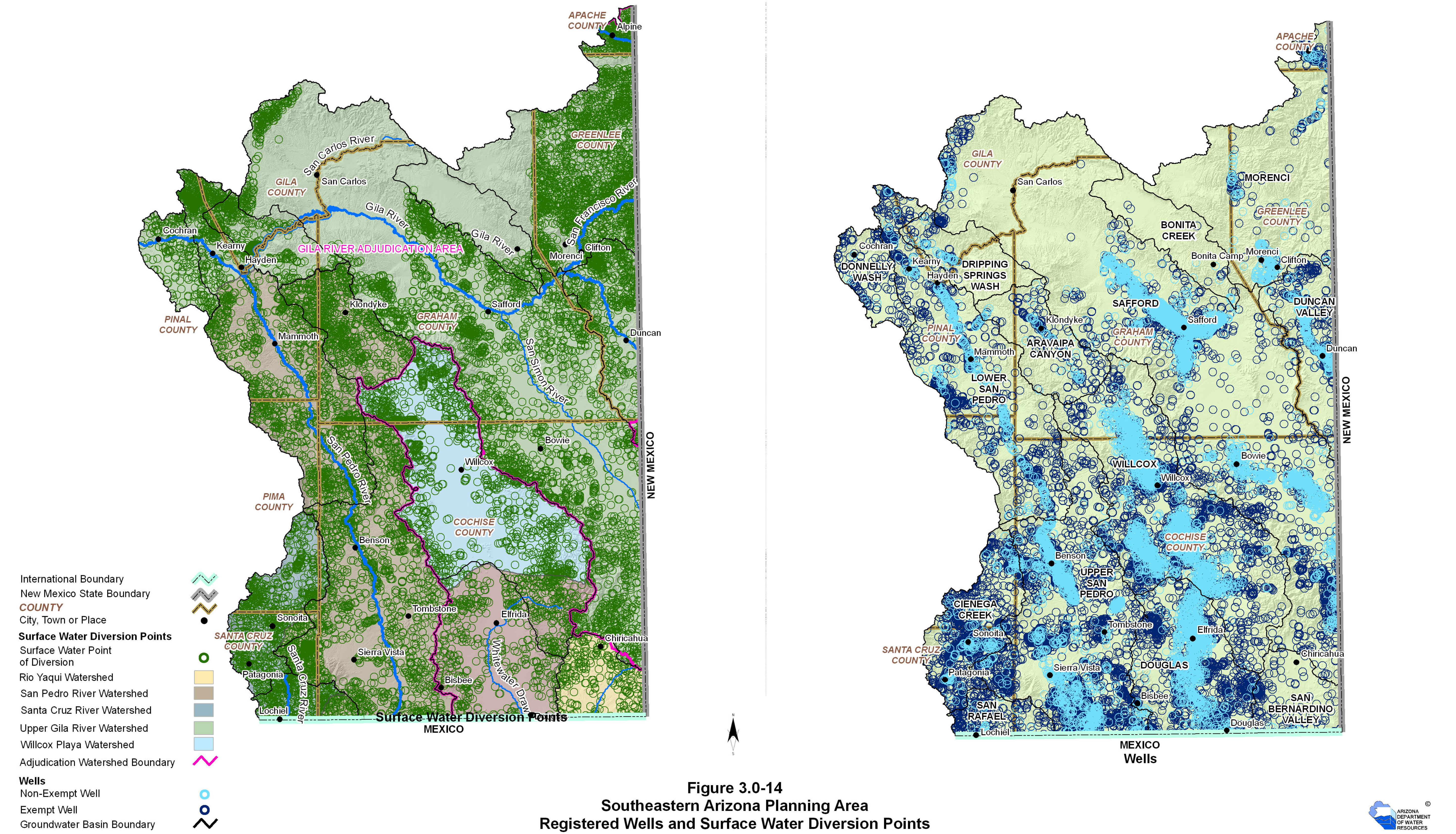


Figure 3.0-14
Southeastern Arizona Planning Area
Registered Wells and Surface Water Diversion Points

Groundwater

Groundwater is the major water supply in the planning area, meeting 85% of the total demand, 92% of the municipal demand, 83% of the agricultural demand and 97% of the industrial demand during the period 2001-2005. The location of registered exempt and non-exempt wells is shown in Figure 3.0-14. Groundwater is the sole water supply utilized in Bonita Creek, Cienega Creek, Donnelly Wash, Douglas, Dripping Springs Wash, San Bernardino Valley and San Rafael Valley basins. Major aquifers supplying groundwater are basin fill, sedimentary rock (Gila Conglomerate), volcanic rock and recent stream alluvium. Groundwater is relatively abundant and well yields are high in most basins.

In the north and northeastern portion of the planning area (Bonita Creek, Dripping Springs Wash, Duncan Valley and Morenci basins), groundwater development is primarily from wells that tap the younger basin fill or the Gila Conglomerate. Median well yields from large (>10 inch diameter) wells ranges from 395 gpm in Dripping Springs Wash Basin to over 1,100 gpm in the southern part of Bonita Creek Basin. Estimated groundwater in storage ranges from as low as 150,000 acre-feet in Dripping Springs Wash Basin to as high as 19 maf in the Duncan Basin.

Groundwater is a stock and domestic supply in the Bonita Creek and Dripping Springs Wash basins. In the Duncan Valley Basin groundwater meets about half (10,000 acre-feet) of the agricultural demand and supplies all the municipal and industrial water. Groundwater from a volcanic rock aquifer is the primary water supply for mining and municipal uses in the Morenci Basin.

The Safford Basin contains almost 5,000 registered wells completed in basin fill, the major aquifer, and in streambed alluvium along the Gila River drainage. Well yields are generally high with a median well yield of 600 gpm reported from almost 1,500 wells. Groundwater in storage may be as high as 69 maf in the basin. While surface water is an important agricultural water supply in the basin, groundwater is now the largest supply utilized, with over 121,000 acre-feet pumped annually from the basin during the period 2001-2005, particularly from the Gila Valley sub-basin, which contain the basin's population and agricultural centers.

Basins located on the western side of the planning area (Aravaipa Canyon, Donnelly Wash, Cienega Creek and Lower and Upper San Pedro), yield groundwater from the stream alluvium and basin fill. Most irrigation wells are located in the stream alluvium while most industrial and municipal wells are located in the basin fill. Stream alluvium aquifers support stock, agricultural and domestic uses in the northern and southwestern parts of the Cienega Creek Basin, while basin fill is the principal aquifer in the central valley.

As shown in the groundwater data tables for each basin, median well yields range from 62

Agriculture in the Safford Basin. In this basin over 121,000 acre-feet of groundwater was pumped annually from during the period 2001-2005, particularly from the Gila Valley sub-basin, which contain the basin's population and agricultural centers.

gpm in the Donnelly Wash Basin to as high as 1,000 gpm in the Lower San Pedro Basin. Groundwater in storage estimates range from as low as 140,000 acre-feet in the relatively undeveloped Donnelly Wash Basin to as high as 26.1 maf in the populous Upper San Pedro Basin.

Groundwater supplies the domestic and about half of the small scale farming demands in the Aravaipa Canyon Basin. Historically, mining and grazing activities were also important land and water uses. Groundwater is the sole water supply available for domestic uses in the Donnelly Wash Basin and for municipal, agricultural and industrial purposes in the Cienega Creek Basin. All of the industrial demand, the largest demand sector in the Lower San Pedro Basin (almost 16,000 AFA), is met by groundwater, which is also the primary water supply for agricultural and municipal purposes. In the Upper San Pedro Basin, groundwater meets almost all the municipal demand (17,300 AFA) and the majority of the agricultural demand.

Almost all the water supply available for agricultural, municipal and industrial purposes

ASARCO Hayden Smelter, Lower San Pedro Basin. All of the industrial demand, the largest demand sector in the Lower San Pedro Basin (almost 16,000 AFA), is met by groundwater, which is also the primary water supply for agricultural and municipal purposes

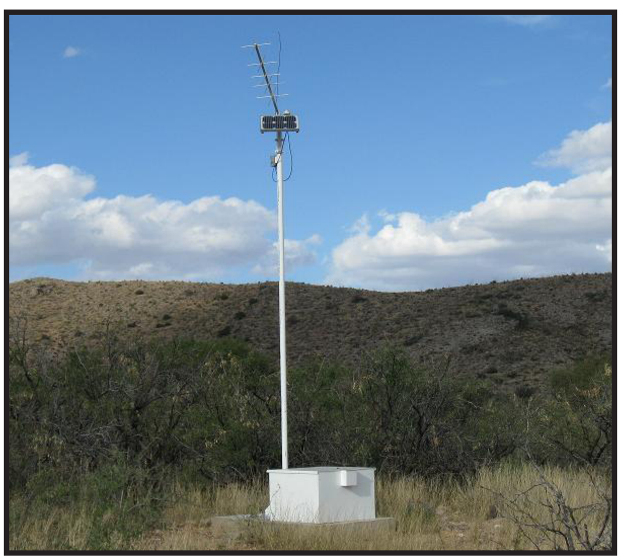
APECO Power Plant, Willcox Basin. Almost all the water supply for this basin is found in basin fill deposits.

in the Willcox Basin is groundwater found primarily in basin-fill deposits. Median well yield is 750 gpm with as much as 59 maf of groundwater in storage (Table 3.14-6). Groundwater has been heavily utilized for agricultural purposes for many years and there are concerns about the future availability of this water supply, prompting recent water level monitoring investigations (USGS, 2006b).

The three basins with groundwater outflow to Mexico have differing groundwater supply conditions. In the San Bernardino Valley Basin, groundwater is obtained from thin units of sand and gravel interbedded with basalt flows or from shallow alluvium. There are only 12 registered wells with a pump capacity greater than 35 gpm in the basin with a yield of 22 to 600 gpm reported for three of them. Groundwater is the water supply for stock and domestic uses. The main aquifer in the Douglas Basin is basin fill, which is used to support extensive agricultural irrigation. As with the Willcox Basin, there are concerns about the long-term pumpage of groundwater from the basin aquifers and future groundwater supply availability. Protection of the groundwater supply from agricultural expansion was first initiated in 1965 when the area was designated as a Critical Groundwater area and its subsequent designation as an Irrigation Non-expansion Area in 1980. In the vicinity of the Douglas area, groundwater is pumped from basin fill with interbedded volcanic rock. Median well yield in the Douglas basin is 600 gpm (Table 3.5-5). In the San Rafael Basin, where ranching is the primary activity, groundwater is obtained from stream alluvium and basin fill and median well yields are about 145 gpm from large diameter wells (Table 3.12-5).

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 contains 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 (Automated Wells), 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 wells but include other types of sites such as springs and drains).



Automated Well, Upper San Pedro Basin

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 Wells 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 and Automated wells as of January 2009. At that time there were a total of 250 Index Wells and 9 Automated Wells in the Southeastern Arizona Planning Area. The Automated Wells are located at Bowie, Sunizona, Kansas Settlement, near Sierra Vista, south of Safford, Benson (3) and in the vicinity of the San Pedro River near the southern boundary of the Lower San Pedro Basin. The most updated maps of well locations 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 for each basin in the basin sections.

Effluent

Effluent is utilized as a water supply in the Lower San Pedro, Morenci, Safford, Upper San Pedro and Willcox basins for golf course irrigation, industrial processes and groundwater recharge. An average of approximately 1,700 acre-feet of effluent was used annually for golf course irrigation, and an unknown quantity was used for mining purposes at the Morenci Mine during the period 2001-2005. Effluent is recharged to the basin-fill aquifer in the Upper San Pedro Basin. Over 10,600 acre-feet of effluent is estimated to be produced annually in the Planning Area, with about half of it generated in the Upper San Pedro Basin.

In the Upper San Pedro Basin, about 800 acre-feet of effluent from the Fort Huachuca and Benson Wastewater Treatment Plants was delivered for golf course irrigation and approximately 2,380 acre-feet of effluent was recharged to the aquifer beneath Fort Huachuca and the Sierra Vista Recharge Facility in 2005 (USGS, 2007a). By 2007, over 10,700 acre-feet had been recharged at the Sierra Vista Facility. Beginning in 2009, the Turquoise Valley Golf Course will receive approximately 100 AFA of effluent from the City of Bisbee San Jose Wastewater Treatment Facility. Any unused effluent from this facility will be discharged to Greenbush Draw.

Elsewhere, effluent is used to irrigate the Mt. Graham Golf Course in the Safford Basin, the Kearny Golf Course in the Lower San Pedro Basin and the Twin Lakes Golf Course in the Willcox Basin. At some treatment plants, for example the Safford WWTF, wastewater is applied to pasture as a disposal method.

There are two effluent treatment wetlands located in the Upper San Pedro Basin. A wetland at the Apache Nitrogen Products facility was constructed as part of the Superfund clean-up and a wetland at the Sierra Vista Treatment Plant is operated in conjunction with the recharge facility.

Contamination Sites

Sites of environmental contamination may impact the availability of water supplies. An inventory of Department of Defense (DOD), Superfund (Environmental Protection Agency designated sites), Water Quality Assurance Revolving Fund (WQARF, state designated sites), Voluntary Remediation Program (VRP) and Leaking Underground Storage Tank (LUST) sites was conducted for the planning area.

Recharge basins at Fort Huachuca, Upper San Pedro Basin. Approximately 2,380 acre-feet of effluent were recharged to the aquifer at the Fort Huacucha and Sierra Vista Recharge facilities in 2007.

Table 3.0-8 lists the DOD, Superfund, VRP and WQARF sites, the contaminant and affected media and the basin location of the site. In addition, there are 203 active LUST sites in the planning area, most of which are located in the Safford Basin (38), the Upper San Pedro Basin (81) and the Willcox Basin (32). The location of all contamination sites is shown on Figure 3.0-15.

There are nine active VRP sites in the planning area. All sites in the Douglas and Morenci basins are associated with mining-related activities. The only other site is a fuel oil contamination site at San Simon in the Safford Basin. 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)

The Apache Powder Superfund site located about 2.5 miles southwest of Saint David in the Upper San Pedro Basin is the only Superfund site in the planning area. Apache Nitrogen Products (ANP) Inc., formerly known as Apache Powder Company, owns and operates a fertilizer and nitric acid manufacturing plant at the site. Soil, groundwater and surface water contamination has occurred due to past manufacturing and disposal practices. Sampling has identified a nitrate plume affecting both groundwater and a short reach of the San Pedro River. Additional contaminants of concern include arsenic, fluoride, perchlorate and metals. Cleanup efforts to date include removal of waste barrels and contaminated soils and construction of a treatment wetland. A future cleanup schedule has been developed by ANP and remedial activities are being coordinated with the EPA and ADEQ. (ADWR, 2005a)

Morenci Mine, Morenci Basin. There are nine active VRP sites in the planning area. All sites in the Douglas and Morenci basins are associated with mining-related activities.

The Klondyke Tailings WQARF site consists of two piles of mine tailings adjacent to Aravaipa Creek approximately 4.5 miles upstream of the Aravaipa Canyon Wilderness Area. ADEQ has completed several studies, groundwater and soil sampling and geophysical surveys to identify the presence of buried tanks or drums at the site. In response to significant flooding in July 2006, ADEQ conducted a floodplain analysis and installed erosion protection and capping of the upper tailings pile in 2008. (ADEQ, 2008)

DOD Installation Restoration Program funding has supported environmental cleanup of contaminated soils at Fort Huachuca in the Upper San Pedro Basin. Groundwater monitoring wells have been installed at the South Range Landfill and East Range Mine Shaft to monitor contamination. Groundwater contamination has not been identified. These sites are part of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) cleanup program. (ADWR, 2005a)

Table 3.0-8 Contamination sites in the Southeastern Arizona Planning Area

SITE NAME	MEDIA AFFECTED AND CONTAMINANT	GROUNDWATER BASIN
Department of Defense (DOD) Sites		
Fort Huachuca	Groundwater and soil – leaking underground storage tanks and solid waste disposal	Upper San Pedro
Safford Military Range	Soil-lead	Safford
Federal National Priority List (Superfund Sites)		
Apache Powder	Groundwater-arsenic, fluoride, nitrate, perchlorate Surface water-dinitoglycerine (DNT) Soil – arsenic, barium, metals, nitrate, vanadium pentoxide, trinitroglycerine (TNT)	Upper San Pedro
Voluntary Remediation Sites		
Arizona Copper Co	Soil – metals and solvents	Morenci
Bisbee Smelter	Soil and groundwater – metals	Douglas
Clifton School – Phelps Dodge	Soil - smelter fallout metals	Morenci
Douglas Parcel 408-18-025C	Soil – arsenic and copper	Douglas
Firebird Fuel Spill	Soil - Benzene, Toluene, Ethyl Benzene, Xylene (BTEX)	Douglas
Jobbing Warehouse	Soil – arsenic, lead and copper	Douglas
Phelps Dodge American Avenue	Soil – metals	Douglas
Shannon Hills Smelter	Soil – mine tailings, arsenic and copper	Morenci
Union Pacific Railroad San Simon Depot	Bunker C fuel oil	Safford
WQARF Sites		
Klondyke Tailings	Groundwater, surface water and soil - metals	Aravaipa Canyon

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

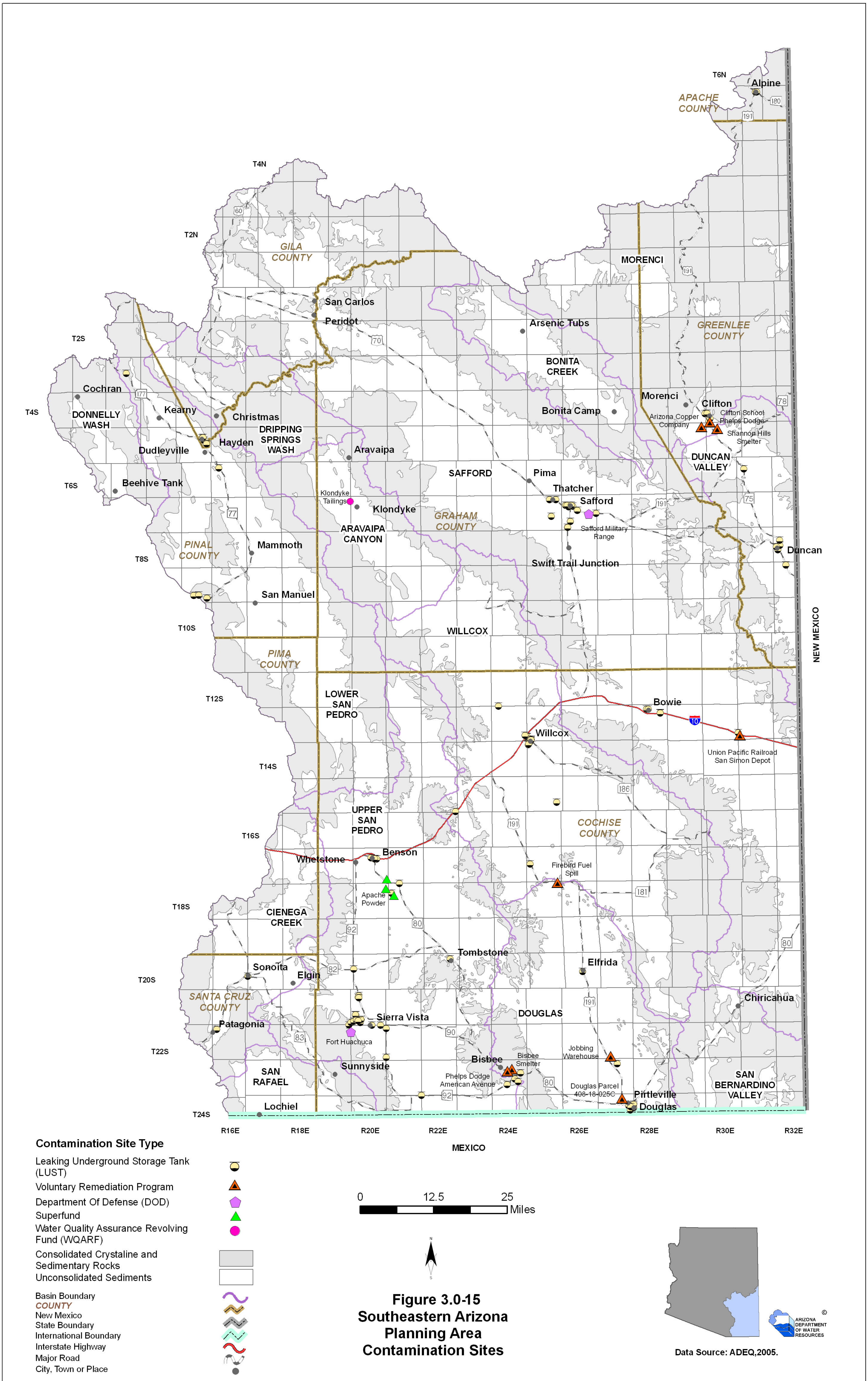


Figure 3.0-15
Southeastern Arizona Planning Area Contamination Sites

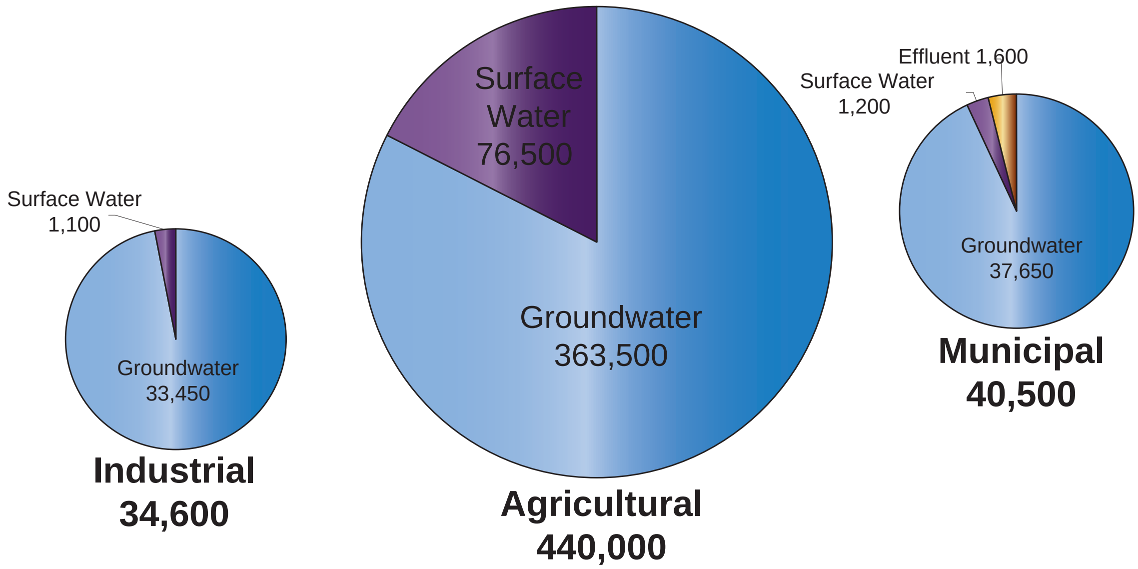
3.0.7 Cultural Water Demand

Total cultural water demand in the Southeastern Arizona Planning Area averaged approximately 515,100 AFA in the period from 2001-2005. The agricultural demand sector is by far the largest water demand sector with over 440,000 acre-feet of annual demand (see Figure 3.0-16). This is primarily due to agricultural demand in four basins Willcox, Safford, Duncan Valley and Douglas, which account for 410,600 acre-feet, or 95% of the agricultural demand. About one-fifth of the agricultural demand is met with surface water.

The volume of municipal water demand and industrial water demand is similar. Municipal demand was approximately 40,500 AFA of primarily groundwater demand during the period from 2001-2005.[5] Only about 1,200 acre-feet of surface water was reported for municipal purposes. Industrial demand, primarily from mining, is about 34,600 AFA. Of this, about 1,100 acre-feet of surface water is used. The demand sector composition varies substantially from basin to basin as shown in the basin cultural demand tables. For example, there is no agricultural irrigation in six of the basins and total demand ranges from less than 300 acre-feet in several basins to almost 205,000 AFA in the Safford Basin as shown in Figure 3.0-17.

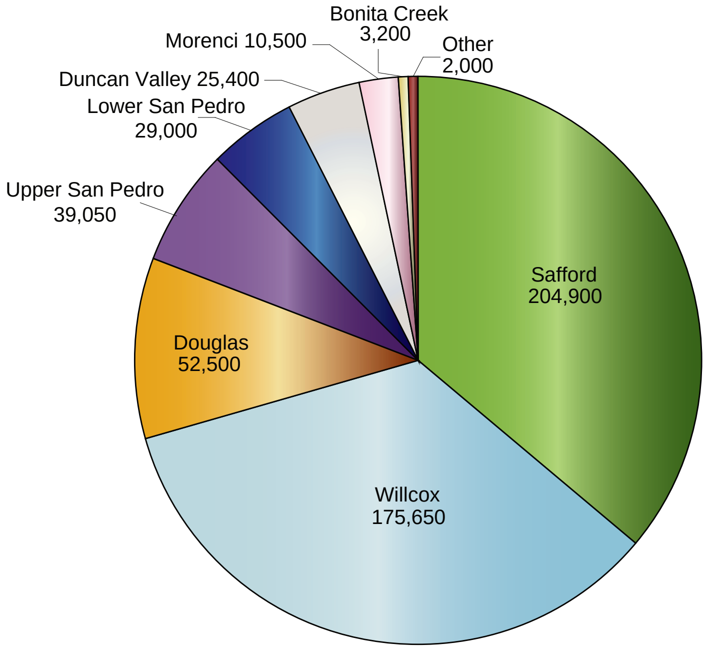
Provisions of the Arizona Water Rights Settlement Act of 2004 have implications for water use in the planning area. Under Title II of the Act, Congress authorized a 2003 Settlement Agreement concerning the Gila River Indian Community's (GRIC) water rights. The 2003 Settlement Agreement was amended to conform to the Settlement Act and became enforceable on December 31, 2007. The Settlement Agreement established an Upper Gila River Watershed Maintenance Program that was incorporated into state law in 2005 (H.B. 2728). The program defines a Gila River Maintenance Area that covers much of the planning area except for the Willcox, Douglas and San Bernardino Valley basins and portions of other basins in Cochise County. There are certain restrictions within the area, subject to specific exemptions, including construction of new dams or enlargement of existing dams and irrigation of land is prohibited unless the land was previously irrigated between January 1, 2000 and August 12, 2005. (ADWR, 2006)

Figure 3.0-16 Average Annual Cultural Water Demand by Sector in the Southeastern Arizona Planning Area 2001-2005, in acre-feet



[5] The demand by the community of Oracle in the Lower San Pedro Basin is not included in this total since its water supply is groundwater withdrawn in the Tucson AMA and transported to Oracle.

Figure 3.0-17 Average Annual Cultural Water Demand by Basin in the Southeastern Arizona Planning Area 2001-2005, in acre-feet



the Department. The current reservation population in the planning area is approximately 8,300, primarily residing in the communities of San Carlos/Peridot and Bylas/Calva. There is a golf course, hotel and casino complex (Apache Gold) west of the community of San Carlos. Principal economic activities on the reservation include cattle ranching, forestry, recreation and gemstone mining (San Carlos Apache Nation, 2006). Farming has historically been important. Total cultural water use in the Gila River drainage portion of the reservation was estimated at 4,120 acre-feet in a Bureau of Indian Affairs (BIA) report from the early 1970s (BIA, 1974). With population increases since the BIA estimate, construction of the casino complex and assuming that agricultural, livestock and industrial uses have remained constant, it is estimated that current demand is approximately 5,300 AFA.

The settlement agreement also established "Safe Harbor" areas within which the Gila River Indian Community, the San Carlos Irrigation and Drainage District and the United States "agree not to exercise their rights to challenge, object to or call certain water users based on their normal flow rights and stored water rights under the Globe Equity Decree". The Safe Harbor provisions establish three Impact Zones with specific conditions for each. The impact zones are: 1) the San Pedro Ag and New Large Industrial Use Impact Zone, 2) the San Pedro M&I and Domestic Purposes Impact Zone, and 3) the Gila River Impact Zone. These zones are in proximity of the Gila and San Pedro Rivers and include named tributaries. For information on these provisions, refer to the Settlement Agreement and to the Technical Assessment of the Gila River Indian Community Water Rights Settlement. (ADWR, 2006)

Tribal Water Demand

Detailed current information on San Carlos Apache Tribe water demand was not available to

Municipal demand on the Reservation is assumed to be relatively small. Community water systems serve the San Carlos-Peridot community and Bylas-Calva, all in the Safford Basin (BIA, 1974). Based on population, a reasonable municipal demand estimate is 1,000 to 1,250 AFA.

According to a CLIMAS report, several hundred acres of hay irrigation are occurring on the

Talkalai Lake, San Carlos Apache Reservation. Principal economic activities on the reservation include cattle ranching, forestry, recreation, and gemstone mining

San Carlos Apache Reservation and the tribe has plans for expansion. Farming has been a culturally important activity and was economically important during the early years of the reservation (CLIMAS, 2004). A total of 1,900 acres were historically irrigated although flooding and inundation of lands by filling of the San Carlos Reservoir reduced the amount of irrigable acres (BIA 1974). Most of the irrigable acreage was located along the San Carlos and Gila Rivers and irrigated with surface water, supplemented with well water (Bookman-Edmonston Engineering, Inc., 1979). The Gila Commissioner 2007 Annual Report showed 225 acres planted (Allred, 2007). In October 2008, Department staff observed two cotton fields along the San Carlos River between San Carlos and Highway 70.

Municipal Demand

Groundwater is the primary water supply for municipal use throughout the planning area. Average annual municipal water demand for the period 2001-2005 is summarized by groundwater basin in Table 3.0-9. There is little population or municipal demand in a number of basins including Aravaipa Canyon, Bonita Creek, Donnelly Wash, Dripping Springs Wash, San Bernardino Valley and San Rafael. As shown, almost half of the municipal demand in the planning area is in the Upper San Pedro Basin.

Only 13 water providers in the planning area served 450 acre-feet or more in 2006. These providers and their demand in selected years are shown in Table 3.0-10 and discussed below. Municipal gallon per capita per day (gpcd) rates are estimated to be about 125 gpcd in San Manuel, 157 gpcd in the Benson area, 168 gpcd in the Sierra Vista area, 177 gpcd in Safford, and 225 gpcd in Douglas.

Most of the population in the planning area is served by private water companies. Municipal water utilities have more flexibility in setting water rates than private water companies, which are regulated by the Arizona Corporation Com-

Table 3.0-9 Average annual municipal water demand in the Southeastern Arizona Planning Area (2001-2005) in acre-feet

Basin	Groundwater	Surface Water	Effluent[1]	Total
Aravaipa Canyon	<300	0	0	150
Bonita Creek[2]	<300	0	0	150
Cienega Creek	600	0	0	600
Donnelly Wash	<300	0	0	150
Douglas	5,500	0	0	5,500
Dripping Springs Wash	<300	0	0	150
Duncan Valley	600	0	0	600
Lower San Pedro[3]	2,300	300	145	2,745
Morenci	1,400	600	0	2,000
Safford[2]	6,500	0	500	7,000
San Bernardino Valley	<300	0	0	150
San Rafael	<300	0	0	150
Upper San Pedro	17,300	<300	830	18,280
Willcox	2,700	<300	211	3,061
Total Municipal	37,800	<1,500	1,686	40,686

Source: USGS 2007a

Notes: Volumes <300 acre-feet assumed to be 150 acre-feet for computation purposes.

[1] Data on effluent demand is taken from effluent use for golf courses in 2005/2006.

[2] Shown on Table 3.0-9 is water utilized within the basin. The Cultural Demand Table for Bonita Creek (Table 3.2-5) reflects water withdrawn in the basin. Most of the approximately 3,200 acre-feet withdrawn in the Bonita Creek Basin is conveyed to the Safford Basin.

[3] Water demand by the community of Oracle is not included since its water supply is groundwater witdrawn in the Tucson AMA

Table 3.0-10 Water providers serving 450 acre-feet or more per year in 2006 in the Southeastern Arizona Planning Area

Basin /Water Provider	1991 (acre-feet)	2000 (acre-feet)	2006 (acre-feet)
Douglas			
Douglas Water Department	2,999	3,621	3,880
Duncan Valley			
Town of Duncan	176	529	628
Lower San Pedro			
Arizona Water Company San Manuel	855	743	646
Town of Kearny	483	648	483
Morenci			
Morenci Water and Electric	773	1,180	793
Safford			
Gila Resources - Safford	3,748	3,836	4,720[1]
Upper San Pedro			
Arizona Water Company Bisbee	962	1,003	1,131
Arizona Water Company Sierra Vista	862	1,109	1,262
Bella Vista Water Company Sierra Vista	2,907	3,208	3,594
City of Benson	545	728	876
Pueblo del Sol Water Company - Sierra Vista	360	1,136	1,501
Willcox			
City of Willcox	NA	NA	1,111

Source: USGS 2007a, Community Water System 2006 Annual Reports

[1] Includes 120 acre-feet delivered to Arizona State Prison - San Jose

mission. In addition, municipal utilities have the authority to enact water conservation ordinances. These authorities enable municipal utilities to better manage water resources within water service areas. Water provider issues are discussed in Section 3.0.8.

Provisions of the Settlement Agreement described above include individual agreements with the City of Safford and with the Towns of Duncan, Kearny and Mammoth to resolve disputes regarding use of water for municipal and industrial purposes. These agreements set limits on future annual water use although actual use can exceed these limits under certain conditions and/or by implementing mitigation measures. (ADWR, 2006)

City of Douglas

The border community of Douglas has a population of about 17,700 residents and served 3,880 acre-feet of groundwater in 2006. It was founded as a site for a smelter to treat the copper ore mined at Bisbee. Agriculture, ranching and international commerce are important economic activities. Agua Prieta, Sonora is located directly south of Douglas and has a population of over 110,000 residents. Douglas is served by a municipal water utility that operates eight wells. In 2006 it delivered about 3,560 acre-feet to more than 5,000 residential connections and 320 acre-feet to about 450 commercial connections. The Douglas WWTF treats about 1,400 acre-feet of wastewater to secondary standards. The wastewater is discharged to Whitewater Draw just north of the international boundary and flows south into Mexico where it is used for agricultural irrigation. There are no plans to utilize effluent in Douglas due to the quality of the water and the historic commitment to deliver the effluent to Mexico.

Northeast of Douglas, the Bisbee-Douglas International Airport Water system serves about 400 acre-feet of groundwater withdrawn from 2 wells to the Arizona State Prison Complex-Douglas. The facility housed approximately 2,300 inmates in December, 2008 (ADC, 2008).

Town of Duncan

Duncan, with a population of about 800 residents, is located along the Gila River just west of the New Mexico border. Primary economic activities in the area are farming, cattle ranching and mining. Duncan is served by a municipal provider consisting of two systems; Town of Duncan and Town of Duncan-Hunter Water. In 2006 it withdrew a combined total of 628 acre-feet from three wells. Withdrawals are estimated from electrical records and are much higher than the amount of water reported as delivered on Community Water System Reports; 125 acre-feet.

Town of San Manuel

San Manuel, in the Lower San Pedro Basin, is an unincorporated community built in 1953 as a company town to serve the San Manuel copper mine, mill and smelter complex. Both the mine and smelter were permanently closed in 2003. Approximately 4,400 residents resided in San Manuel in 2000. The town is now considered a bedroom community with some commercial businesses (ADOC, 2007a). Arizona Water Company receives water from BHP Copper Company to serve approximately 1,500 residential and 70 non-residential connections. In 2006 it received 646 acre-feet from BHP Copper and delivered 582 acre-feet to customers. Santec Corporation operates Coronado Utilities WWTP that serves the community. Approximately 291 AFA is generated at the facility and discharged to infiltration basins. The 9-hole San Manuel Golf Course uses water pumped from a facility well, not from Arizona Water Company.

Town of Kearny

Located in the northern part of the Lower San Pedro Basin, Kearny was a planned community built in 1958 for workers at the Kennecott Copper Company open pit mine and reduction plant, now operated by the American Smelting and Refining Company (ASARCO), which also operates smelters at Kearny and Hayden. The Town had a population of 2,270 in 2006. It withdrew 126 acre-feet of groundwater and diverted 357 acre-feet of surface water from the Gila River pursuant to the Globe Equity Decree in 2006. In that year it delivered 435 acre-feet of water to 821 residential and 71 commercial connections. The Kearny Water Reclamation Facility generated 190 acre-feet of effluent in 2006. Of this, 145 acre-feet was delivered to

Kearny Golf Course. In 2006 the Town of Kearny delivered 145 acre-feet of effluent to the Golf Course.

the 9-hole Kearny Golf Course and 45 acre-feet to a wetland.

Towns of Clifton/Morenci

Morenci Water and Electric serves the communities of Clifton and Morenci, which were established in the late 1880's as mining towns. These communities had a combined population of 4,306 in 2006 and population is declining due to a decrease in mining activity, the principal economic activity in the area. In 2006, Morenci Water and Electric withdrew 274 acre-feet of groundwater and diverted 519 acre-feet of surface water from Eagle Creek. About three-quarters of its deliveries (559 acre-feet) were to residential customers. Both communities are served by treatment plants but data from the Morenci WWTF was not available (Table 3.9-9).

Safford/Thatcher/Pima

These incorporated towns along the Gila River were established in the 1870s and 1880s as farming communities. Agriculture remains the primary economic activity although retail, education, retirement and mining are also important. Safford is the Graham County seat and Thatcher is the location of Eastern Arizona College. The City of Safford Water Utility (formerly Gila Resources) serves both Safford and Thatcher. In 2006, it withdrew 4,720 acre-feet of groundwater from nine wells, of which almost 3,300 acre-

Town of Clifton. In 2006 Morenci Water and Electric withdrew 274 acre-feet of groundwater and diverted 519 acre-feet of surface water from Eagle Creek for the Towns of Clifton and Morenci.

feet was groundwater imported from the Bonita Creek Basin, and served 2,521 residential and 1,180 non-residential connections. The City of Safford WWTP generated 1,226 acre-feet of effluent in 2006 and delivered 483 acre-feet to the Mt. Graham Municipal Golf Course. Graham County Utilities operates two systems; one serves the small community of Fort Thomas and the other serves the community of Pima (pop. 2,080). In 2006 the Pima system withdrew 416 acre-feet of groundwater, of which 62 acre-feet was delivered to Eden Utilities. Ninety-two percent of the Pima system deliveries are to residential customers.

City of Bisbee

Arizona Water Company serves the community of Bisbee, the Cochise County seat located in the Mule Mountains that straddles the border of the Upper San Pedro and Douglas basins. A former mining town, Bisbee is a well-known artist's community with preserved historic architecture that makes it a popular tourist destination. Bisbee consists of historic Old Bisbee, Warren, Lowell and San Jose with a combined 2006 population of 6,355. San Jose is located on the southern side of the Mule Mountains and is the location of the Arizona Water Company well field that serves the community. In 2006 Arizona Water Company withdrew 1,131 acre-feet of water from four wells. Approximately 70% of water deliveries are to residential customers.

San Jose is also the location of an updated and expanded wastewater treatment plant that consolidated three separate systems (Old Bisbee, Warren and San Jose) in 2006. Prior to consolidation, effluent from Old Bisbee (approximately 130,000 gpd) had been discharged into the Douglas Basin via Mule Gulch. Approximately 4,900 acre-feet of effluent is treated annually at the plant. The Bisbee sewer collection system is also undergoing improvements and a substantial number of residents on septic systems will be connected to the sewer system. Bisbee effluent is slated to be delivered to the Turquoise Valley Golf Course in 2009 and the remainder discharged to Greenbush Draw. The Turquoise Valley Golf Course is an industrial facility.

City of Sierra Vista/Fort Huachuca

Sierra Vista is the population center of southeastern Arizona with an economy closely tied to Fort Huachuca, with more than 11,000 military and civilian employees (ADOC, 2007b). Three large private water companies, as well as several small systems, serve Sierra Vista. The large systems are Arizona Water Company (AWC)-Sierra Vista, Bella Vista Water Company and Pueblo del Sol (PDS) Water Company. The 2006 population of Sierra Vista, which in-

Old Bisbee. Bisbee consists of Old Bisbee, Warren, Lowell and San Jose.

cludes Fort Huachuca within its city limits, was 44,870 but the area population is much larger with more than 16,500 residents in the Sierra Vista SE CDP in 2006 (Table 3.0-5). Bella Vista is the largest water provider, consisting of two systems, Bella Vista City and Bella Vista South. The City system withdrew 3,399 acre-feet of groundwater from 18 wells in 2006 and delivered 1,756 acre-feet to residential customers and 1,456 acre-feet to non-residential connections. The South system withdrew 195 acre-feet from 12 wells and delivered 176.5 acre-feet to primarily residential customers. PDS serves primarily residential customers (90% of deliveries) and delivered a small amount of water (11 acre-feet) to the Pueblo del Sol Golf Course in 2006. Most of the irrigation needs at this course are met by facility wells, therefore it is considered an industrial facility. In 2006 PDS withdrew 1,501 acre-feet of groundwater from four wells. AWC –Sierra Vista withdrew 1,262 acre-feet of water from seven wells and delivered almost 1,000 acre-feet to residential customers in 2006. Another 175 acre-feet was delivered to non-residential customers.

The City of Sierra Vista Water Reclamation Facility currently produces approximately 2,800 AFA. The facility was permitted in August 2001 to store up to 4,149 acre-feet of effluent per year for 20 years. Located east of the City, recharge is intended to mitigate any impact of groundwater pumping in the Sierra Vista area on the flow of the San Pedro River. Between 2002 and 2007 a total of approximately 10,700 acre-feet of effluent was recharged at the Sierra Vista facility.

Fort Huachuca is a large military installation located at the base of the Huachuca Mountains. Established in 1877, it has a fluctuating population, averaging about 8,400. In 2007, 1,414 acre-feet of groundwater was withdrawn from eight wells to serve the residential and non-residential needs of the installation. The Fort Huachuca WWTP treated 661 acre-feet of

City of Sierra Vista recharge facility. Between 2002 and 2007 a total of approximately 10,700 acre-feet of effluent was recharged at the Sierra Vista facility.

effluent in 2007 and delivered 318 acre-feet for landscape and golf course irrigation (Chaffee Parade Field and Mountain View Golf Course) and recharged the remaining 343 acre-feet in a constructed recharge facility. Fort Huachuca and the City of Huachuca City have entered into an Intergovernmental Agreement in which the Fort has agreed to accept wastewater from Huachuca City and to recharge it to the aquifer (USPP, 2007). The annual volume of effluent produced at Huachuca City is approximately 150 acre-feet.

City of Benson

The City of Benson, founded in 1880, began as a transportation center, with a Butterfield Overland Stage station house on the San Pedro River in the 1870s and construction of rail lines that linked Benson to Mexico, California and the East. Copper and silver from the mines at Bisbee and Tombstone were shipped from the Southern Pacific Railroad station in Benson (City of Benson, 2009). When mining declined and the rail center moved to Tucson, ranching became the predominant industry. Benson is now a growing community and has expanded its city limits and water service area to serve large master-planned residential developments to the southwest.

The City of Benson, with a 2006 population of approximately 4,800, is served by a municipal utility that withdrew 876 acre-feet of groundwater from five wells that year. Most of its deliveries were to non-residential customers (401 acre-feet), with 361 acre-feet delivered to residences. The City of Benson WWTP treated 762 acre-feet of effluent in 2006 and delivered 470 acre-feet of effluent to the 18-hole San Pedro Golf Course.

Table 3.0-11 Golf course demand in the Southeastern Arizona Planning Area (c.2008)

Facility	Basin	# of Holes	Demand (acre-feet)	Water Supply
Douglas Municipal Golf Course	Douglas	18	440	Groundwater
Greenlee Country Club*	Duncan	9	211	Groundwater
Hayden Golf Course	Lower San Pedro	9	211	Groundwater
Kearny Golf Course	Lower San Pedro	9	145	Effluent
San Manuel Golf Club*	Lower San Pedro	9	211	Groundwater
Alpine Country Club*	Morenci	18	75	Groundwater
Apache Stronghold Golf*	Safford	18	423	Groundwater
Mt. Graham Municipal Golf Course	Safford	18	483	Effluent
Mountain View Golf Course	Upper San Pedro	18	370	Effluent
Pueblo del Sol Country Club (Sierra Vista)*	Upper San Pedro	18	475	Groundwater
San Pedro Golf Course	Upper San Pedro	18	460/90	Effluent/ Groundwater
Turquoise Hills Country Club (Benson)*	Upper San Pedro	18	500	Groundwater
Turquoise Valley Country Club (Naco)*	Upper San Pedro	18	577	Groundwater
Twin Lakes Municipal Golf Course	Willcox	9	211	Effluent

Source: ADWR 2008c
* These golf courses are served by their own wells and, therefore, are considered to be industrial users.

City of Willcox

Willcox is an agricultural and ranching center established in 1880 and incorporated in 1915. It is served by a municipal water utility that withdrew water from one potable well for domestic deliveries and from several non-potable wells for other uses in 2006. One of the non-potable wells is used for construction purposes due to high fluoride levels. Another well is used for cemetery irrigation and the third is located close to effluent-dependent Cochise Lake and is used to maintain water levels for migratory birds (City of Willcox, 2006). In 2006, 856 acre-feet of water was withdrawn from the potable well and 148 acre-feet was withdrawn from the non-potable wells. Of the total potable and non-potable withdrawals, 394 acre-feet was delivered to residential customers, 547 acre-feet to commercial customers and 22 acre-feet to turf.

The City of Willcox WWTP produced 492 acre-feet of effluent in 2006, of which 197 acre-feet was delivered to the Twin Lakes Golf Course.

There are seven golf courses in the planning area that are served from a municipal water supply. They are listed in Table 3.0-11 with estimated demand and source of water. If actual demand was not available, estimates were made that account for the elevation of the facility and duration of the irrigation season. This demand is included in the municipal demand total. Also shown in Table 3.0-11 are golf courses served by their own wells and classified as industrial users.

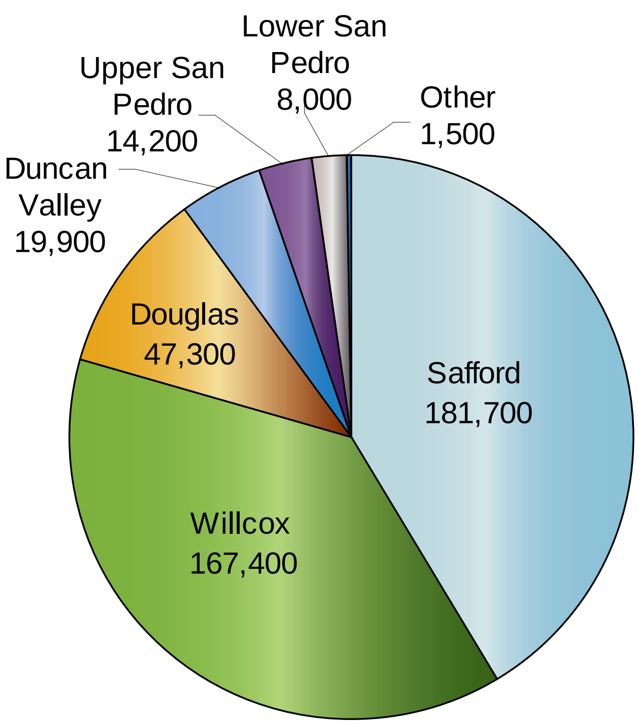
Agricultural Demand

Agriculture is the largest water demand sector and an important segment of the economy in the planning area, particularly in the Safford, Willcox, Douglas and Duncan Valley basins (Figure 3.0-18). Relatively recent declines in irrigated acreage have occurred in some planning area basins, including the Lower San Pedro Basin due in part to land conservation efforts, and in the Upper San Pedro Basin due to the establishment of the SPRNCA, conservation easements, urbanization and economic factors.

Conditions of the GRIC Water Rights Settlement affect agricultural water use in the Duncan Valley and Safford basins. Several provisions of the Upper Valley Districts (UVD) Agreement affect upper valley irrigators in several basins (including those in New Mexico) and could potentially impact flows in the Gila River (ADWR, 2006).

Historic and recent agricultural demand is shown in Table 3.0-12. While demand has diminished in several basins, demand has expanded in the Willcox and Douglas basins over the last 15 years, and overall, demand has increased. In the Safford and Duncan Valley basins, agricultural water demand has decreased since 1991, and the proportion of surface water available for use appears to have declined due to drought, leading to increased well pumpage in both basins. In the Willcox Basin, agricultural demand has declined significantly from the early 1970s when over 300,000 AFA was used. However, demand is now increasing. In 2007 the USGS conducted agricultural surveys of some of the basins in the planning area. Information on the number of active irrigated acres, percentage of crop grown and irrigation method is summarized in Table 3.0-13. As shown, crop type and irrigation method varies significantly between basins. Following is a brief description of agricultural areas, which are listed generally in descending order of water demand.

Figure 3.0-18 Average Annual Agricultural Demand in the Southeastern Arizona Planning Area (2001-2005) by Basin, in acre-feet



Safford Basin

In the Safford Basin, agricultural irrigation occurs along the Gila River where cotton and wheat are the predominant crops and in the San Simon Valley in the southern part of the basin where predominant crops include cotton, alfalfa, corn and nut orchards. The Gila Valley Irrigation District (GVID), incorporated in 1923, encompasses about 35,500 acres along the Gila River from the San Carlos Apache Reservation boundary to about 12 miles east of Safford. There are ten canal companies within the GVID that deliver water to farmers who also irrigate using privately owned wells. Surface water use in the Safford area is pursuant to the Gila River Decree (Globe Equity No. 59 Decree) and when surface water is limited it is allocated to downstream users and not available for irrigation in the area. During the period of 2001-2005, an average of 120,400 acre-feet of groundwater and 61,300 acre-feet of surface water were used annually in the Safford Basin. In 2007 the USGS found 28,300 active irrigated acres in the basin. As shown in Table 3.0-13, cotton is by far the predominant crop and almost all agricultural lands are flood irrigated.

Willcox Basin

There is significant irrigation throughout the Sulphur Springs Valley in the Willcox Basin. North of the Town of Willcox, extensive orchards of apples and other fruits including U-pick orchards and vegetable farms exist. One of Arizona's few

Table 3.0-12 Agricultural demand in the Southeastern Arizona Planning Area

	1991-1995 (acre-feet)	1996-2000 (acre-feet)	2001-2005 (acre-feet)
Aravaipa Canyon			
Surface Water	<1,000	<1,000	<1,000
Groundwater	<1,000	<1,000	<1,000
Total	1,000	1,000	1,000
Cienega Creek			
Groundwater	500	500	500
Douglas			
Groundwater	32,800	37,100	47,300
Duncan Valley			
Surface Water	21,500	18,500	9,900
Groundwater	5,900	8,300	10,000
Total	27,400	26,800	19,900
Lower San Pedro			
Surface Water	<1,000	<1,000	<1,000
Groundwater	12,800	11,100	7,500
Total	13,300	11,600	8,000
Safford			
Surface Water	117,000	99,500	61,300
Groundwater	86,000	91,500	120,400
Total	203,000	191,000	181,700
Upper San Pedro			
Surface Water	4,300	4,300	4,300
Groundwater	16,500	15,100	9,900
Total	20,800	19,400	14,200
Willcox			
Groundwater	123,600	123,600	167,400
Total	422,400	411,000	440,000

Source: USGS 2007a, ADWR 2005c
Notes: Volume <1,000 acre-feet assumed to be 500 acre-feet for computation purposes.

hydroponic tomato nurseries, Eurofresh Farms, a large, year-round producer of greenhouse tomatoes, is located in the northern part of the basin (AZDA, 2005). South of the Town of Willcox, irrigation is principally for alfalfa and corn. As in the Douglas Basin, groundwater withdrawals for agricultural irrigation in the Willcox Basin have resulted in large declines in groundwater levels. These groundwater level declines may have caused land subsidence and surface fissures south of the Town of Willcox (USGS, 2006b). Approximately 50,600 acres are currently irrigated, with an annual average of about 167,000 acre-feet of groundwater demand during the period 2001-2005. The crop mix is relatively diversified as shown in Table 3.0-13.

Douglas Basin

Most of the Douglas Basin was designated as an Irrigation Non-Expansion Area (INA) in 1980, and as a result, agricultural irrigation is restricted to lands that were irrigated during the five-year period preceding designation. A requirement within an INA is that groundwater withdrawals for irrigation on more than ten acres must be measured and annually reported to the Department. These reports indicate that from 1984 to 2000, annual groundwater withdrawals fluctuated between about 30,000 AFA to about 45,000 AFA. However, demand is increasing with an annual average of 47,300 acre-feet withdrawn during the period 2001-2005. Groundwater withdrawals for agricultural irrigation have resulted in significant declines in groundwater levels and a large cone of depression has formed in the northern part of the basin (USGS, 2006b). Irrigated acreage is located primarily in the central and northern part of the basin in the Sulfur Springs Valley. Currently, approximately 13,150 acres of predominantly corn and alfalfa are being irrigated. Center-pivot irrigation is the main irrigation method in the basin (Table 3.0-13).

Duncan Valley Basin

Duncan Valley Basin agricultural irrigation is located southeast of the Town of Duncan in the Duncan Valley and northwest of Duncan in the York Valley area. Principal crops include alfalfa, cotton, corn and sorghum. The Franklin Irrigation District, also known as the Duncan Valley Irrigation District, serves farmers in the Duncan Valley. The district boundaries extend into New Mexico and irrigation wells in Arizona and New Mexico are used to irrigate lands in both states (Upper Gila Watershed Partnership, 2004). The District was formed in 1922 and encompasses about 4,700 acres

Table 3.0-13 Active irrigation acres, percentage of crops grown and irrigation method in selected basins in the Southeastern Arizona Planning Area, 2007

Basin	Willcox	Safford	Douglas	Duncan	Upper San Pedro	Lower San Pedro
2007 Irrigated Acreage	*50,600 acres*	*41,300 acres*	*13,150 acres*	*3,450 acres*	*1,000 acres*	*600 acres*
Crop Type						
Corn	38%	<1%	52%	15%	1%	NA
Cotton	2%	58%	1%	6%	NA	38%
Orchard	10%	9%	10%	NA	15%	NA
Pasture (Alfalfa, Hay)	28%	29%	27%	54%	78%	54%
Sorghum	3%	<1%	2%	24%	NA	8%
Vegetables	10%	1%	7%	NA	NA	NA
Wheat	1%	2%	NA	1%	NA	NA
Other	8%	<1%	1%	NA	6%	NA
Irrigation Type						
Center Pivot	79%	21%	85%	2%	2%	17%
Flood	16%	74%	6%	98%	63%	33%
Drip	2%	3%	8%	NA	25%	33%
Sprinkler	3%	2%	1%	NA	10%	17%

Source: USGS 2009

of Gila River bottom land. Surface water rights for use within this district are also specified in the Globe Equity Decree (ADWR, 1998). An average of 10,000 acre-feet of groundwater and 9,900 acre-feet of surface water were used annually during the period 2001-2005. The USGS found 3,450 irrigated acres in 2007 of predominantly pasture and sorghum, almost all flood irrigated (Table 3.0-13).

Upper San Pedro Basin

Almost all the remaining agriculture is in the Benson area in the Upper San Pedro Basin. In 2002, an estimated 2,200 acres in the Benson area and 800 acres in the Palominas area were irrigated with a demand of about 9,900 acre-feet of groundwater and 4,300 acre feet of surface water. In 2006, approximately 500 acres of irrigation in the Palominas area were taken out of production. When the USGS surveyed the basin in 2007, they found only 1,000 acres being actively irrigated. Pasture was by far the predominant crop grown with smaller amounts of orchard, grapes and corn. Flood irrigation is the predominant irrigation method with drip irrigation of grapes and pecans observed.

Two irrigation providers in the Benson area delivered surface water from the San Pedro River: the Saint David Irrigation District (SDID) and the Pomerene Water Users Association (PWUA). Approximately 39% of the irrigated lands in the Benson area were served by one of these two districts in 2005. When insufficient surface water is available, SDID delivers groundwater pumped from two district wells (ADWR, 2005a). The PWUA diversion structure suffered repeated damage over the years from flooding and significant repairs were last preformed in 2003. Subsequent flooding damaged the diversion gate and eroded the banks. Diversions and canal maintenance have since ceased. The Arizona Corporation Commission administratively dissolved the PWUA in 2005 for failure to file an annual report. The PWUA did not operate groundwater wells to supplement the surface water supply although members used the canal system to deliver their own pumped water to their fields. It is not known if this is still the case.

Lower San Pedro Basin

Agricultural demand in the Lower San Pedro Basin averaged about 8,000 AFA during the period 2001-2005. Irrigated acreage is located along the San Pedro River throughout the length

Vineyard in the Cienega Creek Basin.

of the basin but primarily in the northern and southern portions. The USGS estimated that approximately 600 acres were irrigated in 2007. Groundwater is the primary water supply for irrigation. Surface water diversions from the San Pedro River account for less than 1,000 AFA of the total water supply. In 2007, approximately 600 acres of primarily pasture and cotton were irrigated. A variety of irrigation methods are used including the highest percentage of drip irrigation in the planning area (Table 3.0-13).

Cienega Creek Basin
Irrigation in the Cienega Creek Basin is limited but expanding and is largely vineyards under drip irrigation. These lands are located east of Sonoita in the Elgin area. Based on an informal survey conducted by ADWR in 2008, it is estimated that between 200 and 300 acres are under cultivation.

Industrial Demand

Industrial water demand in the planning area includes mining, electrical power generation, dairies and feedlots, and golf course irrigation served by a facility water system. This demand is summarized in Table 3.0-14 for selected years. Mining is the largest industrial water user in the planning area averaging about 25,800 AFA during the period 2001-2005, primarily due to activities in the Lower San Pedro and Morenci basins.

The Morenci Mine in the Morenci Basin is North America's largest producer of copper and one of the largest open pit mines in the world. The mine property covers about 60,000 acres and includes five pits, three of which are currently in operation, and SX/EW (solution extraction/ electrowinning) facilities. During the 2001-2005 time period, approximately 9,200 AFA was used. Reportedly, almost all of the water used at Morenci is recycled, some of it many times (InfoMine, 2006). Most of the water utilized by the mine and by the Morenci Water & Electric Company (a subsidiary of Freeport-McMoRan Copper & Gold Inc, formerly Phelps Dodge Corporation) is diverted from the Black River in the Salt River Basin and transported into the basin, or is from the Upper Eagle Creek Well Field. Water diverted from Gila River tributaries typically accounts for about 10% of the total (ADWR, 2005c). Freeport-McMoRan has a 50-year lease agreement with the San Carlos Apache Tribe pursuant to the San Carlos Apache Tribe Water Rights Settlement Act of 1992, as amended in 1997, to lease up to 14,000 AFA of its allocation of CAP water by means of an exchange at the Black River. Under the 1944 Horseshoe Exchange Agreement, Freeport-McMoRan also is entitled to a total diversion of up to 250,000 acre-feet from the Black River (ADWR, 2005c). As of the beginning of 2009, Freeport-McMoRan had used almost 102,500 acre-feet of Horseshoe Reservoir credits (SRP, personal communication, 2009). Water from recovery wells installed in the mine area for dewatering purposes is also used at the mine, as is effluent from the Morenci Water & Electric Company.

In the Lower San Pedro Basin, the ASARCO Ray Complex includes a 250,000 ton/day open pit mine northwest of Kearny, a SX/EW operation and a smelter at Hayden. Approximetly 15,700 AFA of groundwater was used during the 2001-

Table 3.0-14 Industrial Demand in the Southeastern Arizona Planning Area

	1991-1995	1996-2000	2001-2005
Type/Basin	**Water Use (acre-feet)**		
Mining Total	**48,195**	**47,085**	**25,831**
Cienega Creek			
Groundwater	<300	<300	<300
Lower San Pedro			
Groundwater	30,800	26,100	15,700
Morenci			
Surface Water	2,425	2,105	1,141
Groundwater	13,700	17,800	8,100
Safford			
Groundwater	650	500	370
Upper San Pedro			
Groundwater	170	200	210
Willcox			
Groundwater	300	230	160
Power Plant Total	**6,000**	**5,200**	**5,700**
Willcox			
Groundwater	6,000	5,200	5,700
Golf Course Total	**1,596**	**1,806**	**2,316**
Duncan Valley			
Groundwater	210	210	210
Lower San Pedro			
Groundwater	211	211	211
Morenci			
Groundwater	75	75	75
Safford			
Groundwater	0	210	420
Upper San Pedro			
Groundwater	1,100	1,100	1,400
Dairy/Feedlot Total	**262**	**272**	**502**
Duncan Valley			
Groundwater	100	100	100
Upper San Pedro			
Groundwater	42	42	42
Willcox			
Groundwater	120	130	360
Other Total	**290**	**290**	**290**
Upper San Pedro			
Groundwater	290	290	290
Total	56,343	54,653	34,639

Sources: ADWR 2008d, USGS 2007a
Notes: Volume <300 acre-feet assumed to be 150 acre-feet for computation purposes.

2005 time period in the Lower San Pedro Basin.

Two large copper mines in the planning area are currently out of production. The BHP Billiton Base Metals in-situ copper leaching operations at San Manuel in the Lower San Pedro Basin closed in early 2002 and underground mining at the site ceased in August 1999. In February 2002, Pima County approved BHP's request to redesignate some of its property for uses other than mining. (ADWR, 2006)

The Copper Queen mine in the Upper San Pedro and Douglas basins currently consists of a small dump leaching and precipitation operation at the Lavender pit (Arizona Mining Association, 2006). Open pit mining started in 1917 and continued, with some interruptions, at the Sacramento pit and Lavender pit until 1974. All active mining stopped in 1984. Considerable dewatering of the mine workings was necessary with long-term groundwater production of about 4,000 AFA (Southwest Ground-water Consultants, Inc., 2004).

Freeport-McMoRan Copper & Gold Inc. began full operation of a large open-pit mining operation in the Safford Basin in 2008. Located eight miles north of the town of Safford, the 3,400 acre Safford (Dos Pobres) operation includes two open pits, one heap leach pad, one process solution pond, one evaporation pond, a SX/EW process plant and other infrastructure and support facilities (InfoMine, 2008; ADEQ, 2006c). As of early 2009 the mine was producing at half-capacity due to market conditions. (Freeport-McMoRan, 2009). Average annual groundwater demand by the mine is projected to be about 5,500 AFA (ADWR, 2006).

The only power plant in the planning area is the Arizona Electric Power Cooperative (AEPCO) Apache Station Generation Plant located in the Willcox Basin in Cochise, southwest of Willcox. The plant is a gas-fired combined cycle plant built in 1963 that generates 520 megawatts of electric energy for its cooperative members located throughout Arizona and California

Ray Mine, Lower San Pedro Basin. Mining is the largest industrial user in the planning area, primarily due to activities in the Lower San Pedro and Morenci basins.

(AEPCO, 2006). Average annual demand during the period 2001-2005 was slightly lower than the average annual demand during the priod 1991-1995 but annual demand can vary considerably, from a low of 4,100 acre-feet in 1996 to a high of 6,600 acre-feet in 1991.

There are seven industrial golf courses in the planning area, which are defined as those courses with their own facility water supply. They are shown in Table 3.0-11, along with municipally served golf courses, with estimated demand and source of water. Total industrial golf course demand is approximately 2,300 acre-feet.

Three dairies and two feedlots have been identified in the planning area. There is a small, approximately 350-animal dairy north of Benson in the Upper San Pedro Basin (Cliff's Dairy), a large dairy of about 5,400 animals near Kansas Settlement (Faria Dairy) in the Willcox Basin that began operation in 2004, and an approximately 855-animal dairy in the Duncan Basin (Lunt's Dairy). Demand was about 42 acre-feet, 588 acre-feet and 120 acre-feet respectively in 2005. There are also two feedlots in the Willcox Basin with a combined total of about 4,000 animals and a demand of about 130 acre-feet in 2005. Development of dairies and feedlots typically results in increased agricultural irrigation for feed.

The Apache Nitrogen Products facility is an ammonium nitrate manufacturing plant located south of Benson in the Upper San Pedro Basin. The facility has made efforts to reduce its water consumption, and in 2005 used an estimated 289 acre-feet of groundwater, a reduction of about 250 acre-feet since 1991.

A number of sand and gravel facilities are located throughout the planning area. Some of these are identified on the cultural demand maps for each basin. However, not all are identified in the source data used for the maps. Water is used for aggregate washing, dust control, vehicle washing and equipment cooling. Typically, there is relatively little water consumed at these sites since most facilities recycle wash water. The

Faria Dairy, Willcox Basin. There are three dairies and two feedlots in the Southeastern Arizona Planning Area

Department estimated that a typical sand and gravel facility in the Upper San Pedro Basin uses less than 50 AFA (ADWR, 2005a).

3.0.8 Water Resource Issues in the Southeastern Arizona Planning Area

Population growth and associated concerns about sustainable water supplies, water level declines, increased agricultural demand and environmental protection activities have resulted in groundwater studies, regional planning actions, establishment of conservation easements and other activities in the planning area.

Water resource issues have been identified by community watershed groups, through the distribution of surveys and from other sources. Primary issues identified are the lack of sufficient data to make informed water management decisions, legal issues related to surface water availability and the legal nature of water supplies, Endangered Species Act implications, and concerns about whether there will be sufficient water supplies to meet future demand. A number of water systems have reported concerns about aging infrastructure and the lack of financial resources to make capital improvements.

Watershed Groups

Several watershed groups have formed in the planning area to address water resource concerns. Groups currently active within the planning area are the Middle San Pedro Watershed Partnership, the Eagle Creek Partnership, the Gila Watershed Partnership, the Lower San Pedro Watershed Partnership, the Upper San Pedro Partnership and the Willcox Playa Watershed Group. A complete description of participants, activities and issues is found in Appendix D. Primary issues identified by these groups are summarized as follows:

Growth:
- Excessive growth in some areas
- Unregulated lot splits
- Desire to maintain rural setting, including agriculture, at current levels in Gila Valley

Water Supplies and Demand:
- Limited groundwater data
- Pumping impacts by Mexico on the San Pedro River and downstream users
- Large volume of overdraft in Willcox Basin
- Increased agricultural production in some basins

Legal:
- Unresolved Indian water rights settlements
- Unresolved surface water adjudication
- Potential impact of adjudication court subflow definition
- Interbasin transfer prohibition
- Mandatory water adequacy required for all new subdivisions in Cochise County

Water Quality:
- Poor quality groundwater and surface water in some areas
- Ability to meet new arsenic standard
- Concern about Superfund site and poor quality groundwater conditions

Environmental:
- Endangered Species Act (ESA) issues, critical habitat designation and mitigation efforts
- Impact of invasive species (tamarisk) on surface water supply
- Lawsuits from environmental groups
- Potential impacts on riparian areas by continuation of current pumping

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

Drought:
- Drought impacts on surface water supplies, agriculture and cattle ranching

Other:
- Different perceptions of issues and goals in Benson community

- Difficulty in getting principle players to the table to discuss water
- Several high hazard unsafe dams in Gila Valley area
- Regular flooding in the Duncan-Virden area
- Opposition to government assistance to obtain groundwater information
- Potential loss of Fort Huachuca due to water/ESA issues
- Federal mandate to achieve sustainability by 2011 in the Sierra Vista subwatershed
- Political obstacles to potential water augmentation projects
- Potential for subsidence

Two of the partnerships in the planning area, the Gila Watershed Partnership in the Safford, Duncan Valley and part of the Morenci basin and the Upper San Pedro Partnership (USPP) in the Upper San Pedro Basin, have been organized for a number of years and have completed many projects. The Gila Watershed Partnership initiated a Fluvial Geomorphology Study of the Upper Gila River that was funded through the Department's Water Protection Fund Program (98-054WPF), Graham County and the Bureau of Reclamation. The study area was of the Gila River from the boundary of the San Carlos Apache Reservation to the New Mexico Border. Its purpose was to demonstrate ways to manage the river, taking into account the geomorphic processes that dominate the fluvial systems (USBOR, 2004). It also produced a study on current and projected water demand for the watershed.

A number of water management practices have been implemented in the Sierra Vista subwatershed portion of the Upper San Pedro Basin by the USPP. These include groundwater recharge, direct effluent use, water conservation ordinances, municipal conservation programs, water management and land use policies.

The USPP annually adopts and updates a water management and conservation plan for the Sierra Vista portion of the Basin. In addition, beginning in 2004, the Partnership must annually prepare a report (referred to as the "321 Report") on water use management and conservation measures that have been implemented and are needed to restore and maintain the sustainable yield of the regional aquifer by September 30, 2011 (Public Law 108-136).

Planning, Management and Studies

The USPP and its members have initiated many conservation programs including the Water Wise program, a toilet rebate program and water conservation ordinances. Cochise County has a Water Conservation Office and Sierra Vista and Bisbee have incorporated water conservation into their zoning codes, which are as strict, or stricter than those required by Cochise County. Fort Huachuca, a partnership member, has implemented aggressive conservation efforts at the Fort that have reduced on-post water

San Pedro River. Water management practices such as groundwater recharge, direct effluent use, water conservation ordinances and municipal conservation programs have been implemented in the Sierra Vista subwatershed portion of the Upper San Pedro Basin.

consumption by almost 45% since 1993. The USPP is also evaluating water augmentation options including the costs and feasibility of constructing a pipeline to transport Central Arizona Project Water to the area.

On March 21, 2006 the Cochise County Board of Supervisors adopted the Sierra Vista Sub-watershed Water Conservation and Management Policy Plan (Plan) to guide development in the unincorporated areas of the subwatershed.[6] According to the Plan, development density will be no greater than one unit per acre unless the subdivider incorporates water saving measures that mitigate any increase in usage over the current zoning, and effluent is recharged or densities are transferred from elsewhere in the subwatershed. The Plan also prohibits increasing densities within two miles of the SPRNCA. (USGS, 2007) Many of the Plan's policies are carried out through the Sierra Vista Sub-watershed Overlay District and other changes to the code that went into effect on January 5, 2007. The overlay district provides water use restrictions, in addition to those already required in the county, on new development within the subwatershed; it does not change the underlying zoning.[7] (Cochise County Code § 1802.2) Concurrent with the passage of the overlay district, the Cochise County zoning regulations were amended to encourage transfer of development rights from the area within two miles of the SPRNCA boundary and one mile of the Babocomari River to other portions of Cochise County. (Cochise County Code § 2208.3) In addition to the Plan, the Babocomari Area Plan adopted in 2005 indicates that future upzoning should not increase groundwater withdrawals beyond the current assumed impact of one unit per four acres. The plan also discourages new wells in the 100-year floodplain of the Babocomari River. (Cochise County, 2006b)

In 2006, Congress passed the U.S.- Mexico Transboundary Aquifer Assessment Act (U.S. Public Law 109-448) that authorized $50M over 10 years for the study of four transboundary aquifers including the Santa Cruz and San Pedro aquifers in Arizona. Plans are underway to identify and pursue scientific and informational studies, in particular the creation of a physically-based hydrologic model of each binational basin.

Because the Upper San Pedro groundwater basin extends into Mexico, the Partnership is pursuing research and cooperative efforts with Mexico. Conservation efforts in the Mexican portion of the basin have been underway, including establishment of the Ajos-Bavispe National Forest and Wildlife Refuge and a 10,000 acre private reserve in the watershed (Sierra Vista Herald, 2006). (See the Upper San Pedro Partnership website for more information at www.usppartnership.com.)

In response to concerns of water planners, local citizens and environmental groups about the impacts of groundwater development, the Department, in collaboration with the USGS and funding from local partners, began conducting hydrogeologic investigations in 2005 to improve the understanding of water resources in two areas within the planning area: 1) the middle San Pedro Basin, which includes the Benson subwatershed and a portion of the Lower San Pedro Basin and 2) the Willcox and Douglas basins. These investigations will assess the existing data collection networks and examine the current state of knowledge of the groundwater system, quantify the water budget for the area, including total water in storage, and establish a hydrologic monitoring network for on-going assessment of the aquifer. The San Pedro investigation was expected to take seven years and result in a groundwater flow

[6] The Cochise County Comprehensive Plan also includes a Water Conservation Goal and Policies section. This portion of the Comprehensive Plan is almost identical to elements within the Sierra Vista Sub-watershed Water Conservation and Management Policy Plan, however, the Comprehensive Plan applies to all Cochise County.

[7] Examples of the overlay conservation requirements include: gray water plumbing in all new construction, humidity sensors on any new installation or replacement of outdoor sprinkler systems and a moratorium on decorative water features not fed solely by rainwater.

Santa Cruz River, San Rafael Basin. In 2006, Congress passed the U.S.- Mexico Transboundary Aquifer Assessment Act that authorized $50M over 10 years for the study of four transboundary aquifers including the Santa Cruz and San Pedro aquifers in Arizona.

model. The Willcox/Douglas investigations were scheduled for three years and include establishment of a monitoring network for each basin, an inventory of agricultural groundwater pumpage in each basin, and a preliminary assessment of subsidence in the Willcox Basin (USGS, 2006b). Recent State budget cuts will delay completion of these studies. In 2008, the Department produced a Water Level Change Map report for the Willcox Basin as part of the Willcox/Douglas study.

The Natural Resources Conservation Service (NRCS) has produced a rapid watershed assessment (RWA) for two watersheds in the planning area. These are the San Simon River and the Pantano Wash-Rillito River Watersheds. Only part of the Pantano Wash-Rillito River watershed is within the planning area. An 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. (Reports are available online at http://www.az.nrcs.usda.gov/technical/rwa.html).

Arizona NEMO (Non-point Education for Municipal Officials) has produced watershed based plans for the Middle and Lower San Pedro Watershed and for the Upper Gila Watershed. These plans characterize and classify watershed features. The goal of NEMO is to educate land-use decision makers to make choices and take actions that will lessen nonpoint source pollution and protect natural resources. (Plans are available online at http://www.srnr.arizona.edu/nemo/).

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.

Finally, state legislation passed in 2007 (HB 2300) authorizes formation of an Upper San Pedro Water District whose purpose is to maintain the aquifer and base-flow conditions needed to sustain the upper San Pedro River and to help meet the water supply needs and water conservation requirements for the communities within the district. The legislation allows the District and a District Board to be established if approved by qualified voters of the District. A District Organizing Board has been formed to prepare organizational, financial and election plans for the District. If approved, the District could acquire water supplies and water rights and operate augmentation projects. It could issue revenue bonds, impose fees and other taxes and receive loans or grants from the State Water Infrastructure Finance Authority to finance necessary projects. The date of the election has not yet been scheduled.

Issue Surveys

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

There were 29 water provider and jurisdiction respondents in the Southeastern Arizona Planning Area and 14 numerically ranked issues. Respondents were asked to rank eighteen issues. Infrastructure issues, including well capacity problems and inadequate capital to pay for infrastructure improvements, were ranked among the top five issues by half of respondents. Future water supply concerns also ranked relatively high (Table 3.0-15). In a separate question, about half 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 3.0-15 Water resource issues ranked by survey respondents in the Southeastern Arizona 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	21%	34%
Inadequate well capacity to meet peak demand	50	25
Inadequate water supplies to meet current demand	14	20
Inadequate water supplies to meet future demand	36	32
Infrastructure in need of replacement	36	41
Inadequate capital to pay for infrastructure improvements	50	61
Drought related water supply problems	29	39

Source: ADWR 2004

Note: 2003 respondents consist of 12 water providers and 2 jurisdictions. 2004 respondents included 44 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, 55 water providers in the planning area, with a total of approximately 46,900 service connections, were willing to participate and provide information on water supply, demand, infrastructure and to rank a list of seven issues.

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 55 water providers that responded to the survey, 44 ranked issues. These respondents include many of the largest water providers in the planning area including Bella Vista Water Company (Sierra Vista), City of Benson, City of Douglas, Gila Resources/Safford, Town of Kearny, Pueblo del Sol Water Company (Sierra Vista) and the City of Willcox.

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 issues are somewhat similar as shown in Table 3.0-15. The 2004 responses indicate that inadequate capital for infrastructure improvements is an overwhelming concern in the planning area. Other infrastructure issues and drought also ranked high.

3.0.9 Groundwater Basin Water Resource Characteristics

Sections 3.1 through 3.14 present data and maps on water resource characteristics of the fourteen groundwater basins in the Southeastern Arizona 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 all of the basins and the purpose of the information. This information is organized in the order in which the characteristics are discussed in Sections 3.1 through 3.14.

Geographic Features
Geographic feature maps are included to provide 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 in a basin has implications for land and water use. Large amounts of private land typically translate into opportunities for land development and associated water demand, whereas public lands are typically maintained for a specific purpose or multi-use with little associated water use. State owned land may be sold or traded, and is often leased for grazing and farming. 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 specified purposes, which are identified for each basin (ASLD, 2006).

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

Surface Water Conditions
Depending on physical and legal availability, surface water may be an important water supply in some basins. 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 areas where flooding has been or may be a problem. Large reservoir storage information includes data on the amount of surface water stored in large reservoirs, its uses and ownership. The number and capacity of small reservoirs is also provided as well as the number of stockponds in each basin. The number of stockponds is a general indicator of small-scale surface water capture and livestock demand. Runoff contours reflect the average annual runoff that can be expected in tributary streams over a particular area.

Perennial and Intermittent Streams and Major Springs

A map of perennial and intermittent streams is provided for each basin. For some basins, more than one source of information was used. Stream designations may not 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. Not all basins have a sufficient number of representative hydrographs.

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. However, flow directions in some basins indicate how localized pumping has altered regional flow patterns.

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 3.0-5)

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.

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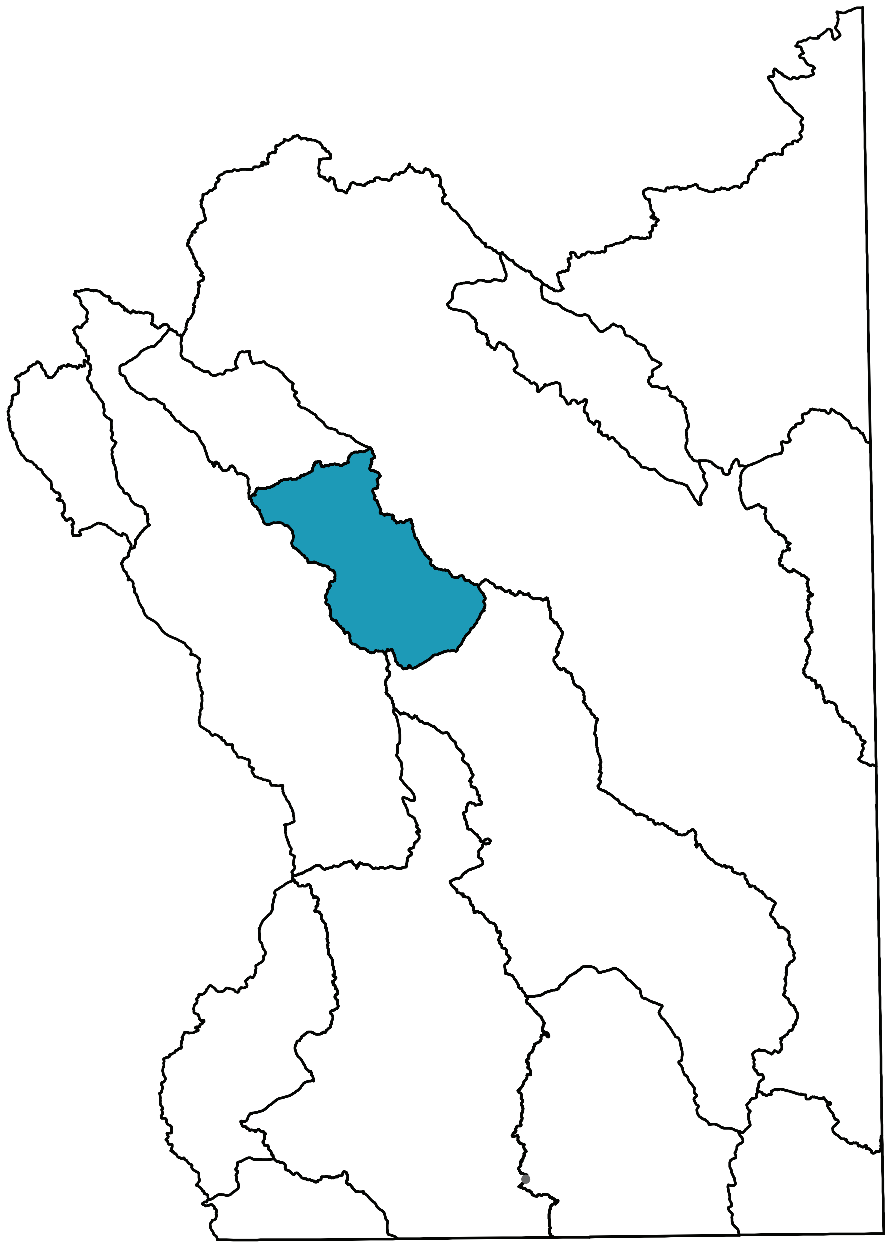
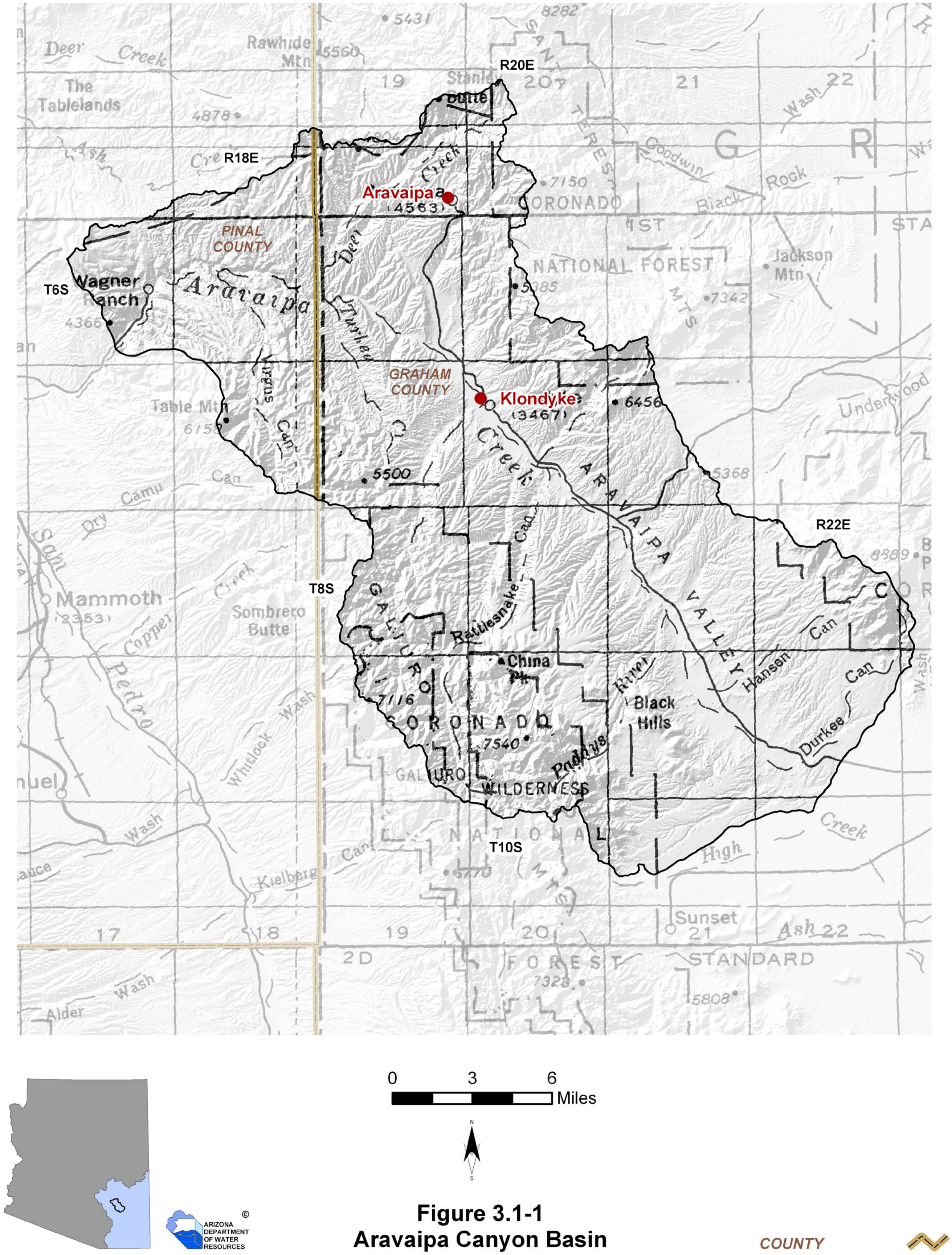
Section 3.1
Aravaipa Canyon Basin



3.1.1 Geography of the Aravaipa Canyon Basin

The Aravaipa Canyon Basin is a relatively small, 517 square mile basin in the center of the planning area. Geographic features and principal communities are shown on Figure 3.1-1. The basin is characterized by medium-elevation mountain ranges, canyons and valleys. Vegetation is primarily semi-desert grassland with smaller areas of Great Basin conifer woodland, madrean evergreen woodland, interior chaparral and Arizona uplands Sonoran desertscrub. (see Figure 3.0-9) Riparian vegetation includes cottonwood/willow, mesquite and mixed broadleaf along Aravaipa Creek and cottonwood/willow and mixed broadleaf along Turkey Creek.

- Principal geographic features shown on Figure 3.1-1 are:
  - Aravaipa Creek, which runs north-south through Klondyke and turns west north of Klondyke where it enters Aravaipa Canyon
  - Galiuro Mountains along the southwest basin boundary, which contain the highest point in the basin at 7,540 feet (Kennedy Peak)
  - Aravaipa Valley south of Klondyke
  - Santa Teresa Mountains on the northwestern basin boundary
  - The lowest point at 2,400 feet where Aravaipa Creek exits the basin



Base Map: USGS 1:500,000, 1981

Figure 3.1-1
Aravaipa Canyon Basin
Geographic Features

3.1.2 Land Ownership in the Aravaipa Canyon Basin

Land ownership, including the percentage of ownership by category, for the Aravaipa Canyon Basin is shown in Figure 3.1-2. Principal features of land ownership in this basin are the large amount of federal land holdings and state trust lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

State Trust Land

- 38.3% of the land is held in trust for the public schools and 10 other beneficiaries under the State Trust Land system.
- Most state trust land is in two bands flanking the Klondyke and Klondyke-Bonita roads and extending to national forest boundaries.
- Primary land use is grazing.

National Forest

- 25.6% of the land is federally owned and managed by the United States Forest Service (USFS).
- All forest lands in the basin are in the Safford Ranger District of the Coronado National Forest.
- The westernmost national forest land contains a portion of the Galiuro Wilderness Area and a small portion of the Santa Teresa Wilderness east of Klondyke. (see Figure 3.0-12)
- Land uses include resource conservation, recreation and grazing.

U.S. Bureau of Land Management (BLM)

- 20.6% of the land is federally owned and managed by the Safford Field Office of the BLM.
- Just over a quarter of the BLM land in the basin, 18,970 acres, is managed as the Aravaipa Canyon Wilderness located in T6S and T7S, R18E. (see Figure 3.0-12)
- Land uses include recreation and grazing.

Private

- 14.2% of the land is private.
- Primary land uses are domestic, ranching and farming.

Indian Reservations

- 1.3% of the land is under ownership of the San Carlos Apache Tribe located in a small strip along the northern boundary of the basin.
- Primary land use is grazing.

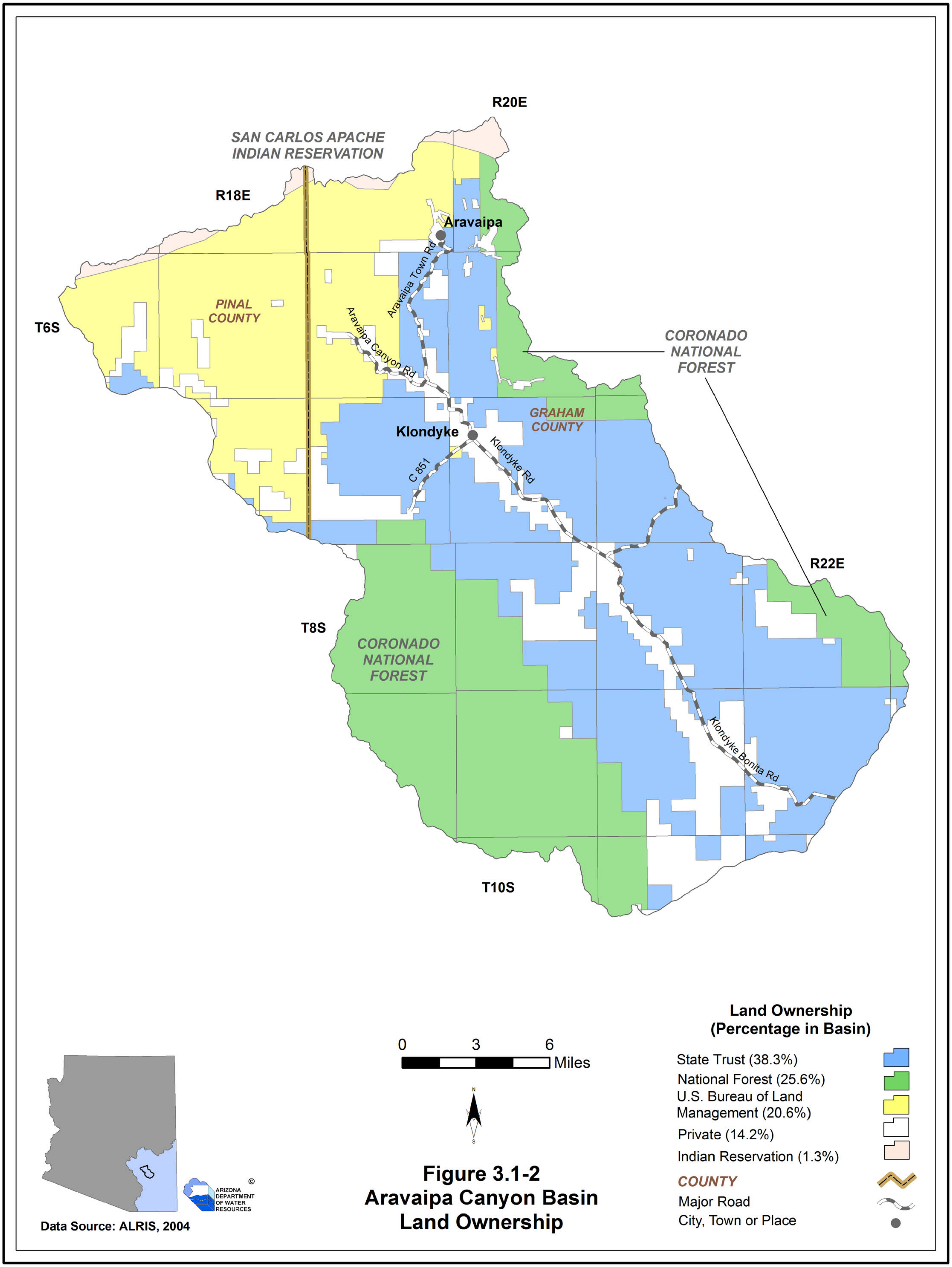


Figure 3.1-2
Aravaipa Canyon Basin
Land Ownership

3.1.3 Climate of the Aravaipa Canyon Basin

The Aravaipa Canyon Basin does not contain any NOAA/NWS Co-op Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 3.1-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 3.1-3
- Average annual precipitation is as high as 28 inches in the Galiuro Mountains in the southwestern portion of the basin and as low as 14 inches in the Aravaipa Canyon area in the northwestern portion of the basin.

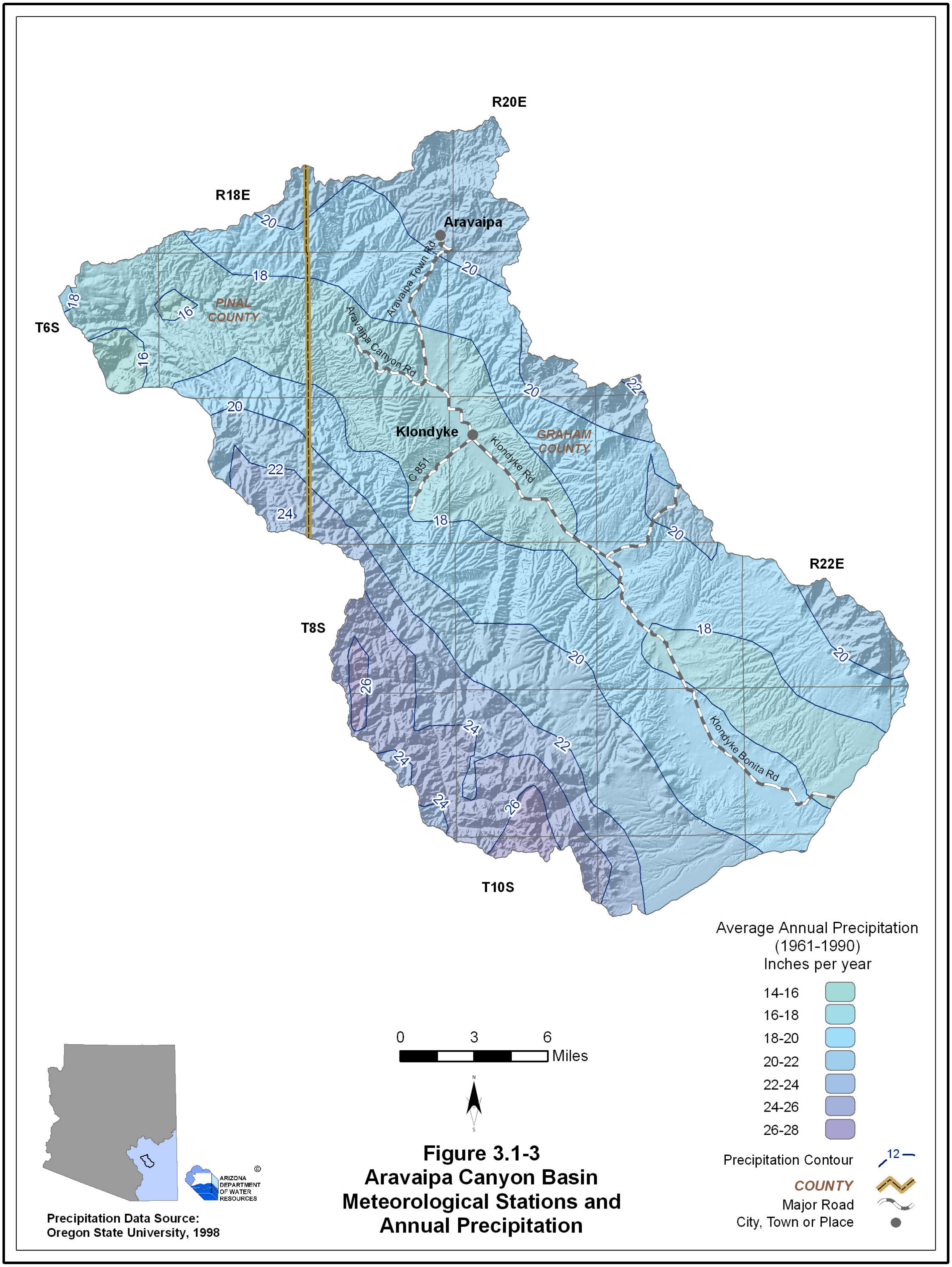


Figure 3.1-3
Aravaipa Canyon Basin
Meteorological Stations and
Annual Precipitation

3.1.4 Surface Water Conditions in the Aravaipa Canyon Basin

There are no streamflow data or flood ALERT equipment in this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.1-1. USGS runoff contours are shown on Figure 3.1-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Reservoirs and Stockponds

- Refer to Table 3.1-1.
- Surface water is stored or could be stored in four small reservoirs.
- There are 349 registered stockponds in the basin.

Runoff Contour

- Refer to Figure 3.1-4.
- Average annual runoff varies from 0.5 inches per year, or 26.6 acre-feet per square mile, along Aravaipa Creek to one inch per year, or 53.3 acre-feet per square mile, in the south-western portion of the basin.

Table 3.1-1 Reservoirs and Stockponds in the Aravaipa Canyon Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 2
Total maximum storage: 117 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 2
Total surface area: 38 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 349 (from water right filings)

Notes:
[1]Capacity data not available to ADWR

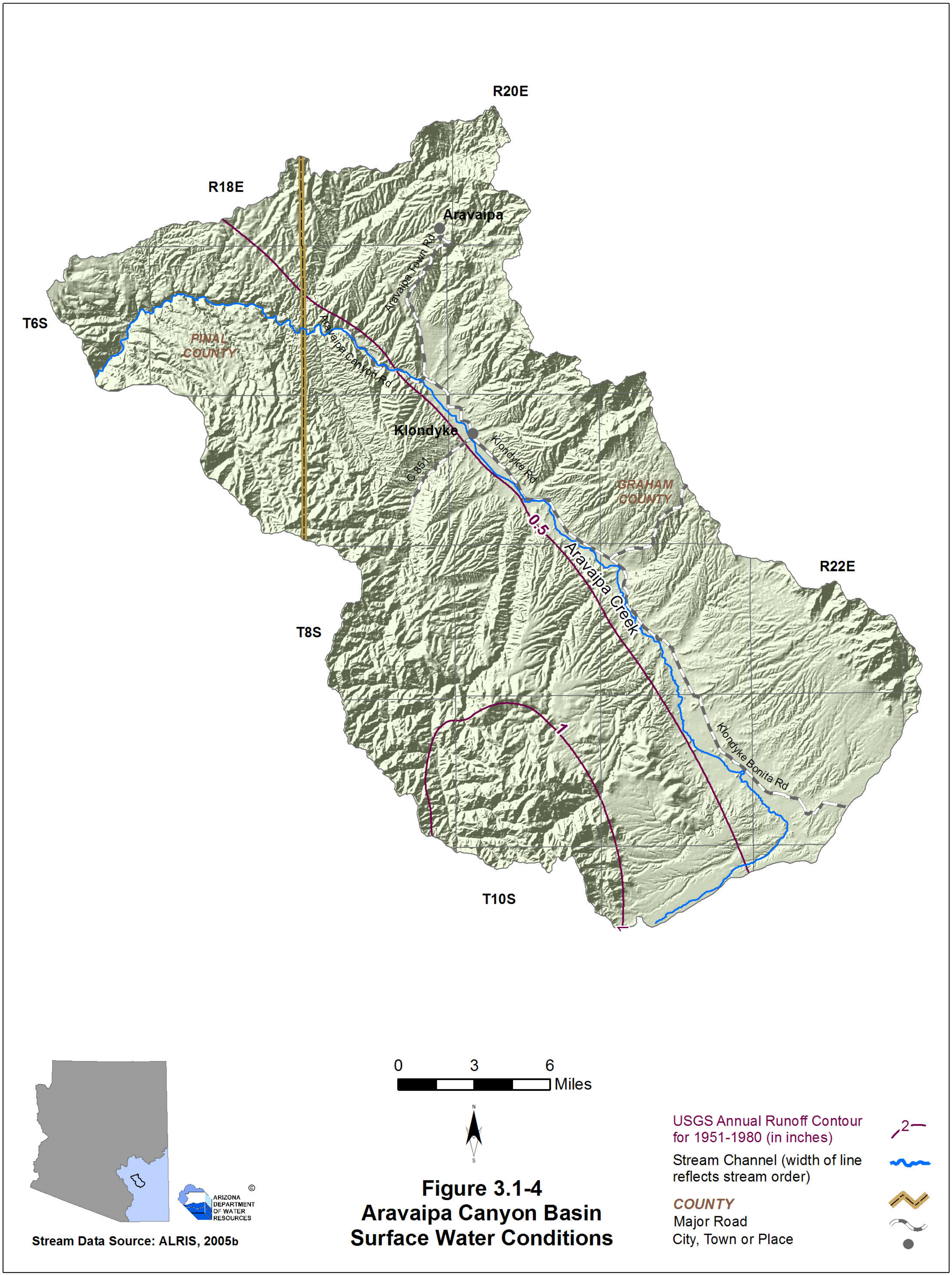


Figure 3.1-4
Aravaipa Canyon Basin
Surface Water Conditions

3.1.5 Perennial/Intermittent Streams and Major Springs in the Aravaipa Canyon 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 3.1-2. The locations of major springs and perennial and intermittent streams are shown on Figure 3.1-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are four perennial streams including, Aravaipa Canyon, Parsons Creek, Turkey Creek and Virgus Canyon. All perennial streams are located in the northeastern portion of the basin.
- A number of intermittent streams are located in the Galiuro Mountains along the southern boundary and on the eastern boundary of the basin.
- There are seven major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge rate is 100 gpm at Hanging Spring.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.1-2. There are 15 minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. For example, some springs have variable discharge and recent measurements for two major springs, Jackson and Saltuna, were less than 10 gpm.
- The total number of springs identified by the USGS varies from 87 to 116, depending on the database reference.

Table 3.1-2 Springs in the Aravaipa Canyon Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Hanging	325507	1102620	100	04/1987
2	Goat	325250	1102743	30	11/2002
3	Jackson	325121	1102618	30[2]	11/1999
4	Saltuna[3]	325439	1102715	15[2]	04/1987
5	Warm	325901	1102224	15	11/1/2002
6	McRae	325230	1102704	10	11/1/1999
7	Sycamore Saddle[4]	324921	1102944	10	08/1986

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Brandi[3,4]	325052	1102624	6	02/2004
Natural Boundary[3,4]	325512	1102648	6	04/1987
East Booger[3,4]	325524	1102918	5	07/1986
Red Basalt[3,4]	324859	1102734	4	06/1986
Janette[3,4]	325540	1102627	4	04/1991
#2[3,4]	325833	1102511	3	11/2002
Wait a Minute Bush[3,4]	324839	1102714	3	03/2000
Oak Grove[3,4]	325053	1102624	3	02/2004
Willow[3,4]	325940	1102047	2	04/1996
Walnut[3,4]	324736	1102730	2	11/1951
Cammie[3,4]	330009	1102100	2	04/1996
Upper Boulder[3,4]	325856	1102524	1[5]	12/1979
Jed[3,4]	324805	1102657	1	04/2001
Parsons Grove[3,4]	324926	1102832	1	01/2001
Turkey Creek[3,4]	325253	1102610	1	06/2001

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 87 to 116

Notes:
[1]Most recent measurement identified by ADWR
[2]Discharge measurements vary. Shown is greatest measured discharge; most recent measurement < 10 gpm
[3]Spring not displayed on current USGS topo map
[4]Location approximated by ADWR
[5]Discharge measurements vary. Shown is greatest measured discharge; most recent measurement < 1 gpm

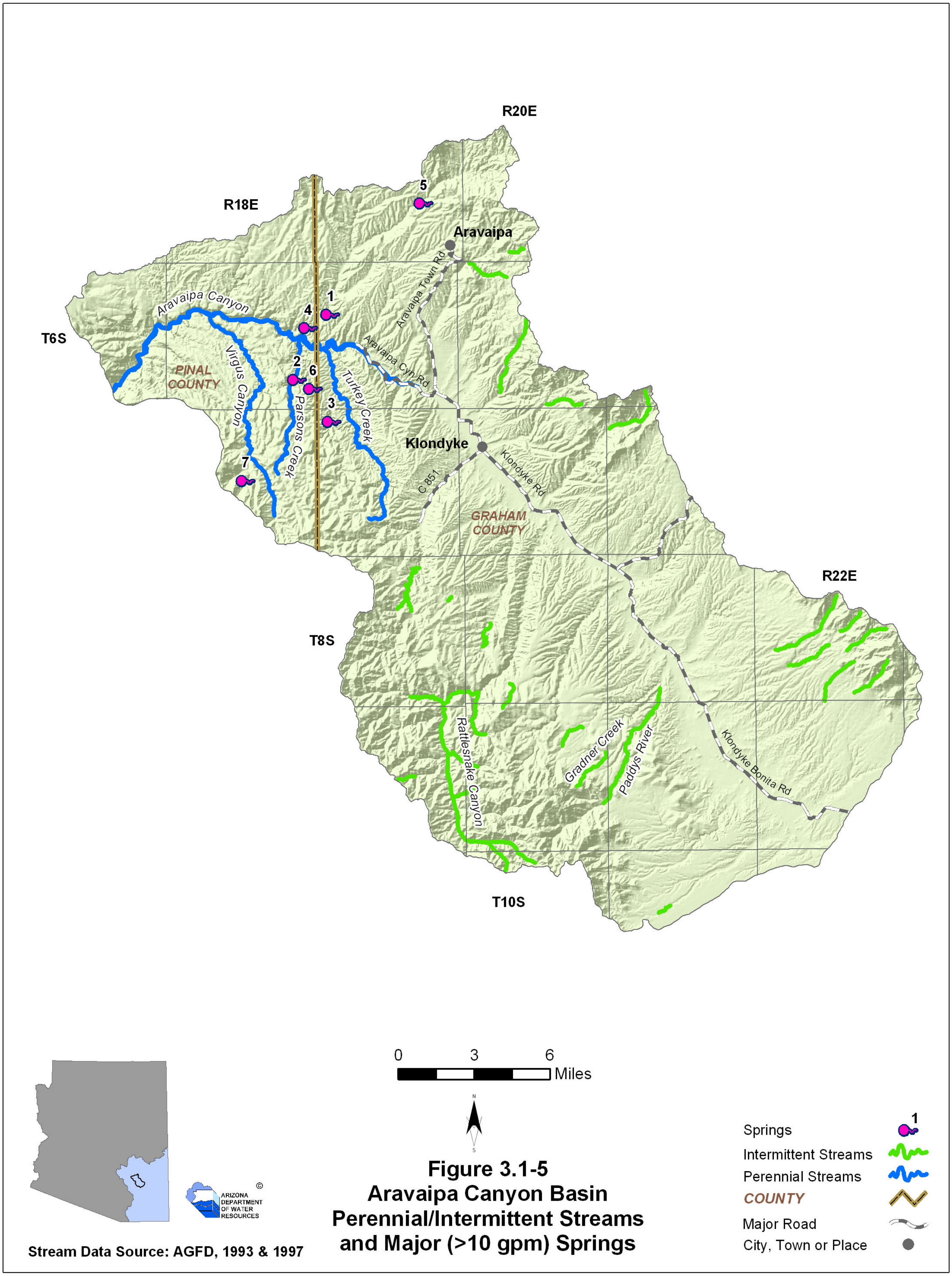


Figure 3.1-5
Aravaipa Canyon Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

3.1.6 Groundwater Conditions of the Aravaipa Canyon 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 3.1-3. Figure 3.1-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.1-7 contains hydrographs for selected wells shown on Figure 3.1-6. Figure 3.1-8 shows well yields in four 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 3.1-3 and Figure 3.1-6.
- Major aquifers in the basin are recent stream alluvium and basin fill; the recent stream alluvium is the primary source of groundwater in the basin.
- Flow direction is generally from southeast to northwest.

Well Yields

- Refer to Table 3.1-3 and Figure 3.1-8.
- As shown on Figure 3.1-8 well yields in this basin range from less than 100 gpm to 2,000 gpm.
- One source of well yield information, based on 36 reported wells, indicates that the median well yield in this basin is 350 gpm.
- The highest reported well yields in the basin are located in unconsolidated sediments in the vicinity of the Klondyke and Klondyke-Bonita Roads.

Natural Recharge

- Refer to Table 3.1-3.
- Natural recharge estimates range from 7,000 acre-feet per year (AFA) to 16,700 AFA.

Water in Storage

- Refer to Table 3.1-3.
- Storage estimates for this basin range from 5.0 million acre-feet (maf) to 5.1 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.1-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures three index wells in this basin. Hydrographs for these three wells are shown in Figure 3.1-7.
- There are two wells with water depth reported in 2003-2004. The wells are located along the Klondyke and Klondyke-Bonita Roads and measure 39 feet and 64 feet to water.

Table 3.1-3 Groundwater Data for the Aravaipa Canyon Basin

Basin Area, in square miles:	517	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 2-1,500 Median 350 (36 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	1,500	ADWR (1994b)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	7,000 - 16,700	ADWR (1994b)
	7,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	5,000,000 - 5,100,000 (to 1,200 ft)	ADWR (1990 and 1994b)
	5,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
Current Number of Index Wells:	3	
Date of Last Water-level Sweep:	1996 (60 wells measured)	

Notes:
[1]Predevelopment Estimate

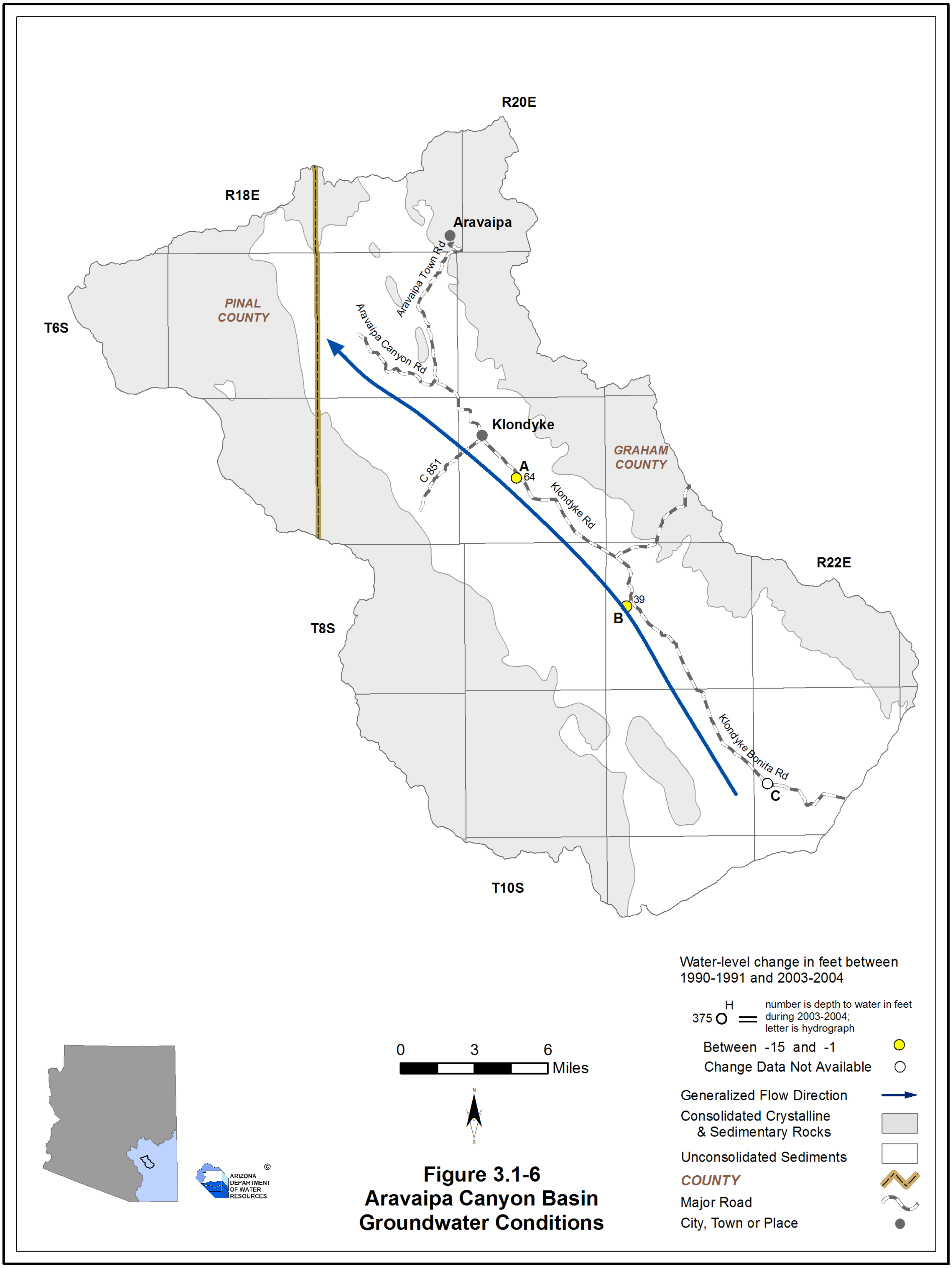
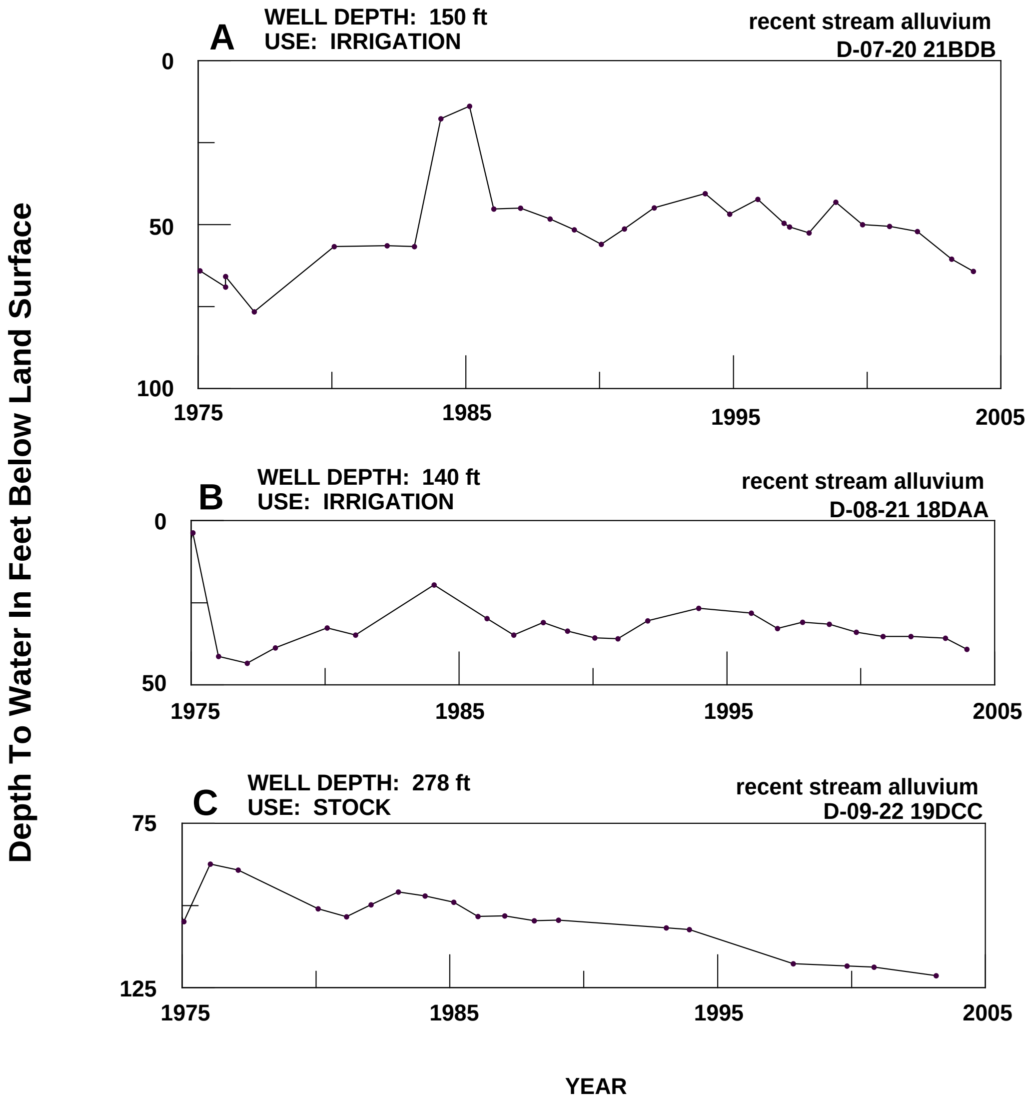


Figure 3.1-6
Aravaipa Canyon Basin
Groundwater Conditions

Figure 3.1-7
Aravaipa Canyon Basin
Hydrographs Showing Depth to Water in Selected Wells



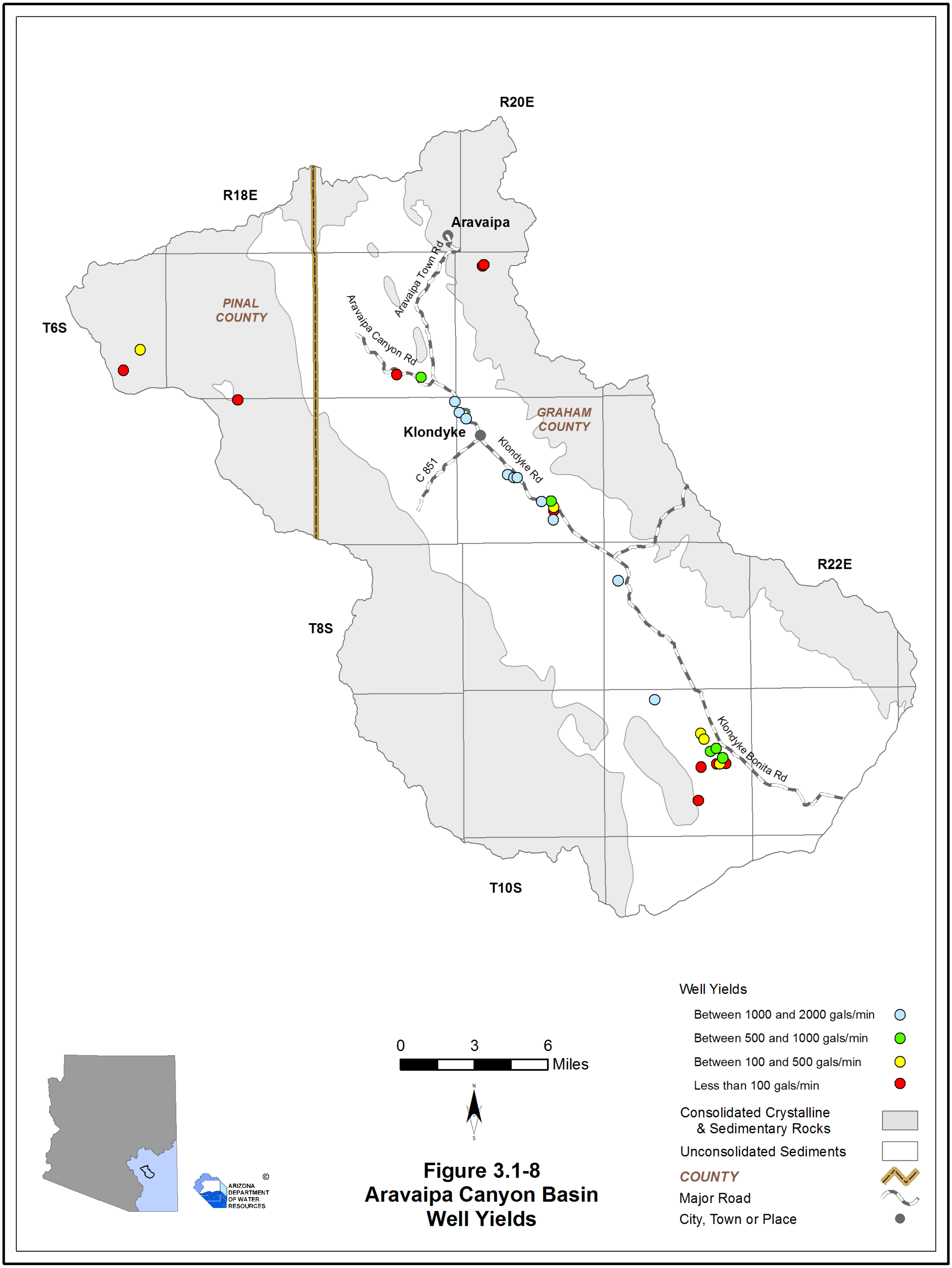


Figure 3.1-8
Aravaipa Canyon Basin
Well Yields

3.1.7 Water Quality of the Aravaipa Canyon Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.1-4A. There are no data on impaired lakes and streams in this basin. Figure 3.1-9 shows the location of water quality exceedences keyed to Table 3.1-4A. A description of water quality data sources and methods is found in Volume 1, Appendix A. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.1-4A.
- Eight measured wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter most frequently equaled or exceeded in the sites measured was arsenic. Other parameters equaled or exceeded included nitrates, beryllium, cadmium, copper, lead and fluoride.

Table 3.1-4 Water Quality Exceedences in the Aravaipa Canyon Basin[1]

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	6 South	17 East	26	NO3
2	Well	6 South	17 East	26	NO3
3	Well	7 South	20 East	6	As, Be, Cd, Cu, Pb
4	Well	7 South	20 East	6	As, Be, Cd, Pb
5	Well	9 South	20 East	33	F
6	Well	9 South	21 East	10	As
7	Well	9 South	22 East	21	As
8	Well	9 South	22 East	21	As

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	Parameter(s) Exceeding Use Standard
None identified at this time						

Notes:
Because of map scale feature locations may appear different than the location indicated on the table
[1] Water quality samples collected between 1989 and 2004.
[2] As = Arsenic
Be = Beryllium
Cd = Cadmium
Cu = Copper
F = Fluoride
Pb = Lead
NO3 = Nitrates

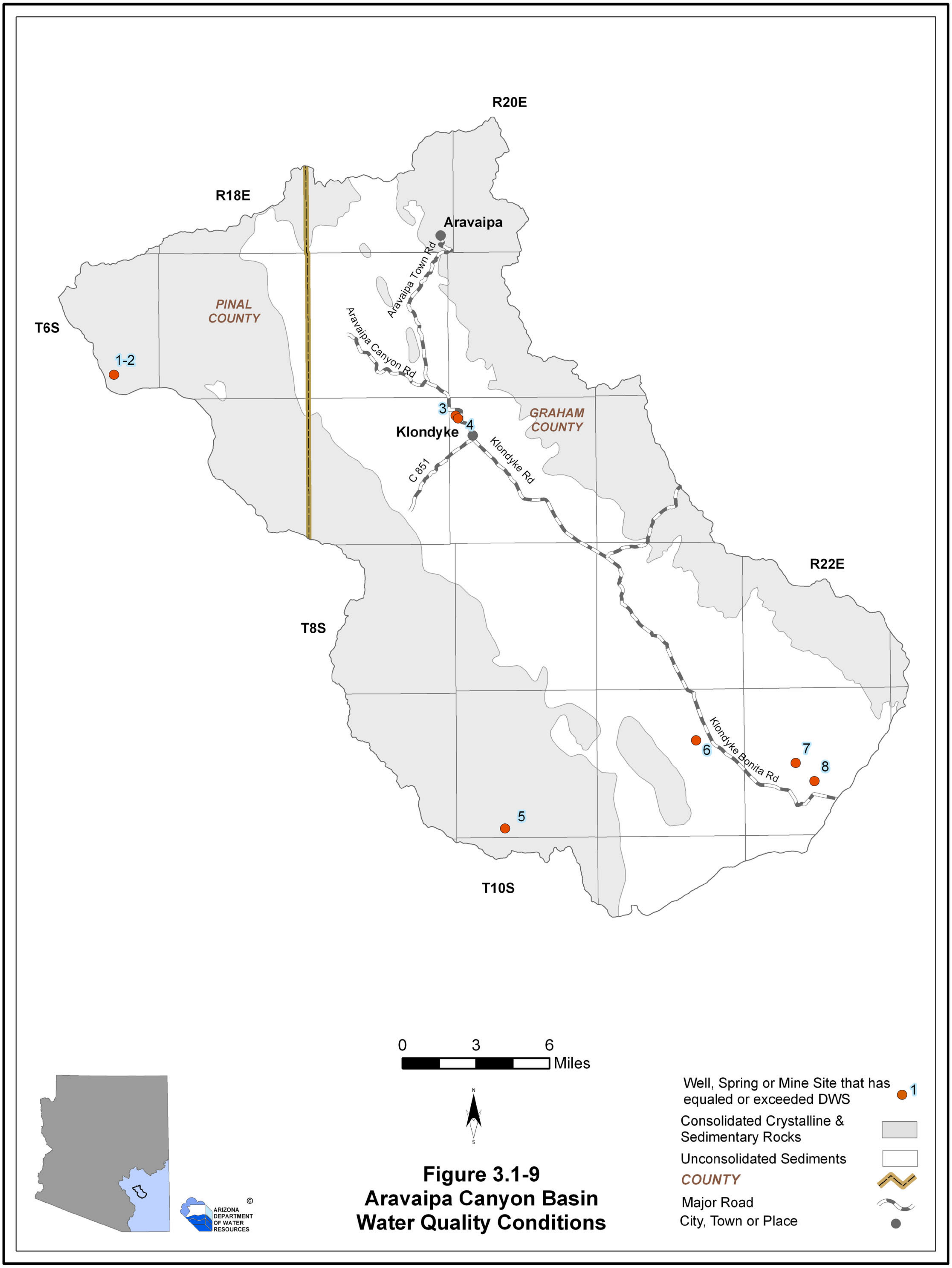


Figure 3.1-9
Aravaipa Canyon Basin
Water Quality Conditions

3.1.8 Cultural Water Demand in the Aravaipa Canyon 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 3.1-5. There is no recorded effluent generation in this basin. Figure 3.1-10 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.1-5 and Figure 3.1-10.
- Population increased from 74 to 135 people from 1980 to 2000.
- Groundwater pumping is decreasing with an average of less than 1,300 AFA in the period from 2001 – 2005. Municipal and industrial demand is minimal, less than 300 AFA.
- Information on surface water diversions is only available for the period of 1991 – 2005. During this time all surface water diversions have been for agriculture and were less than 1,000 AFA.
- The only agricultural lands shown on the map are located along the Klondyke Bonita Road in T9S, R21E. Agricultural lands also historically existed in small pastures scattered along Aravaipa Creek.
- As of 2005 there were 192 registered wells with a pumping capacity of less than or equal to 35 gpm and 50 wells with a pumping capacity of more than 35 gpm.

Table 3.1-5 Cultural Water Demand in the Aravaipa Canyon Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971		131[2]	32[2]	3,000			NR			ADWR (1994b)
1972										
1973										
1974										
1975										
1976				3,000			NR			
1977										
1978										
1979										
1980	74									
1981	79	10	3	2,000			NR			
1982	85									
1983	90									
1984	96									
1985	101									
1986	107	9	8	2,000			NR			
1987	112									
1988	118									
1989	123									
1990	129									
1991	129	16	4	<300	NR	<1,000	NR	NR	<1,000	USGS (2007) ADWR (2005a)
1992	130									
1993	131									
1994	131									
1995	132									
1996	133	15	1	<300	NR	<1,000	NR	NR	<1,000	
1997	133									
1998	134									
1999	134									
2000	135									
2001	136	11	2	<300	NR	<1,000	NR	NR	<1,000	
2002	137									
2003	138									
2004	139									
2005	140									
2010	144									
2020	151									
2030	159									
	TOTALS:	**192**	**50**							

Notes:
NR - Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through 1980.

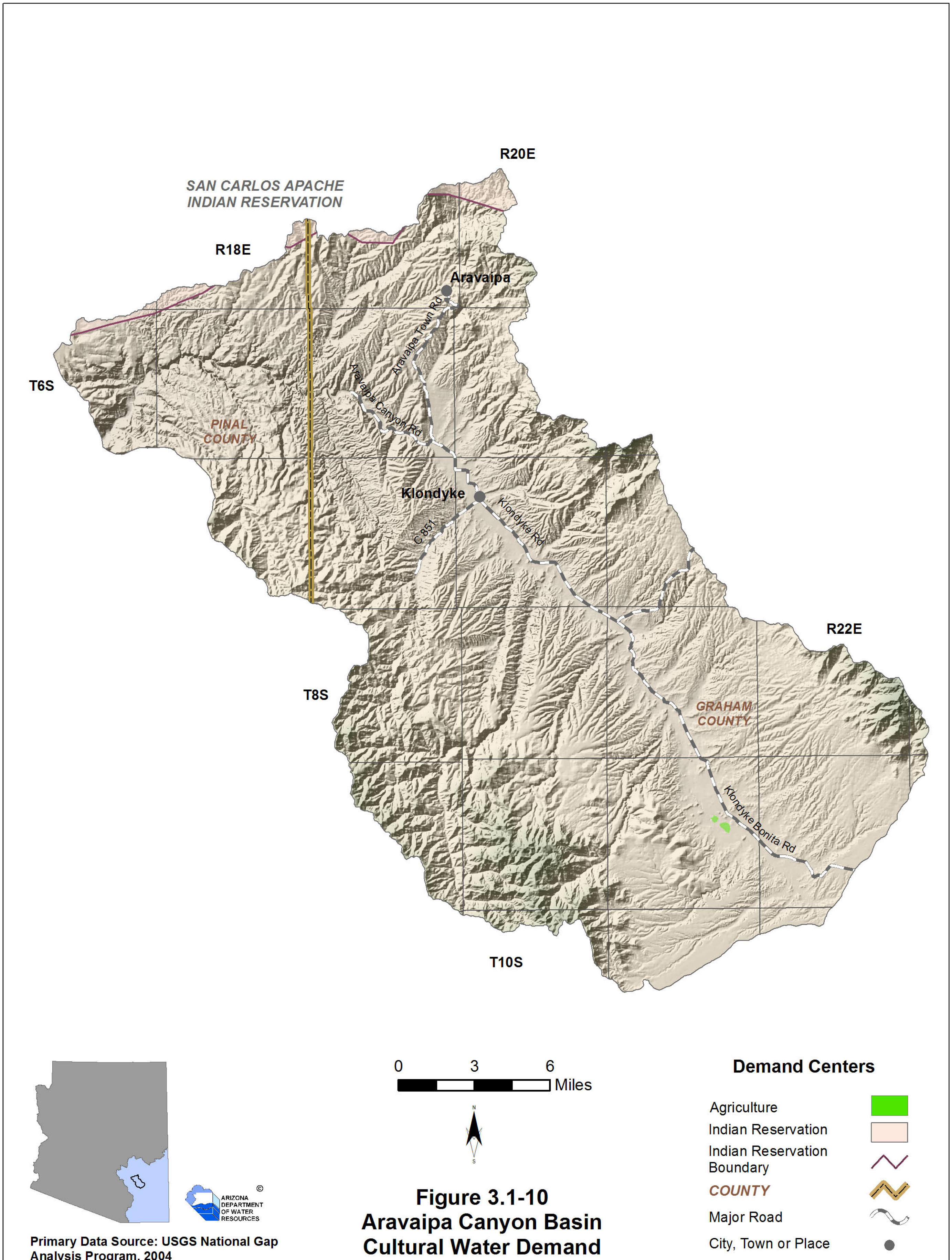


Figure 3.1-10
Aravaipa Canyon Basin
Cultural Water Demand

3.1.9 Water Adequacy Determinations in the Aravaipa Canyon Basin

There are no water adequacy applications on file with the Department as of December 2008 for the Aravaipa Canyon Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

ARAVAIPA CANYON
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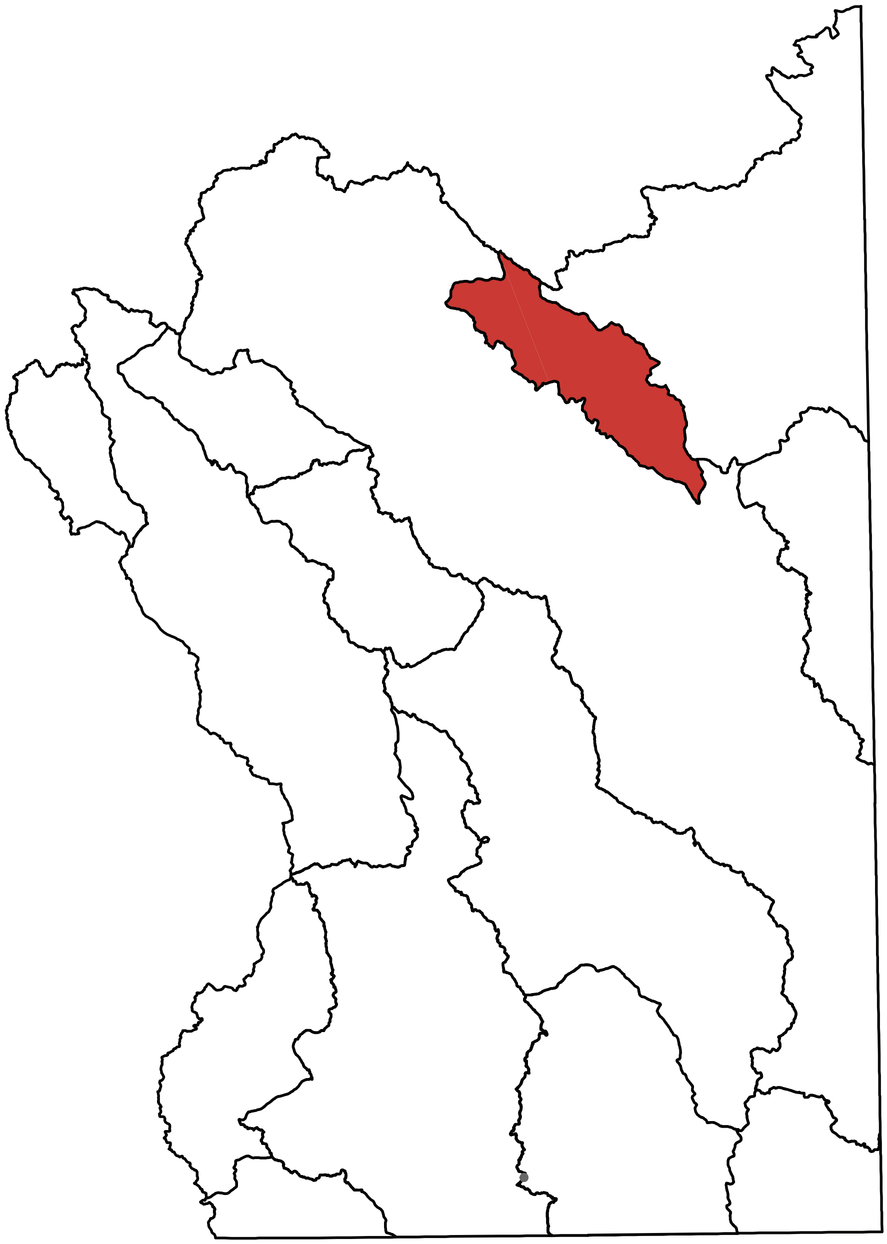
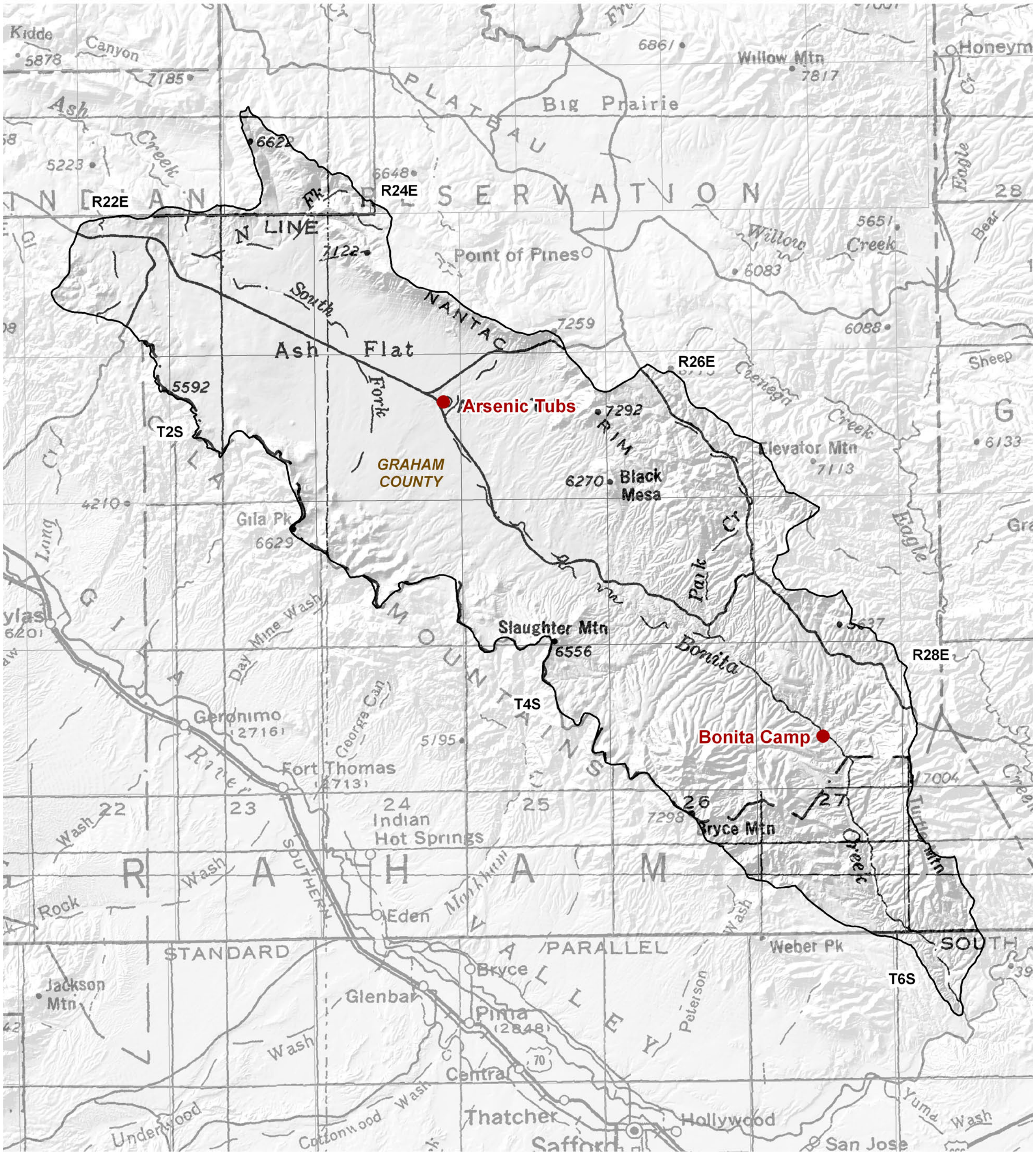
Section 3.2
Bonita Creek Basin



3.2.1 Geography of the Bonita Creek Basin

The Bonita Creek Basin is a relatively small, 457 square mile basin in the northeast portion of the planning area. Geographic features and principal communities are shown on Figure 3.2-1. The basin is characterized by medium-high elevation plains and mountain ranges. Vegetation is primarily Plains and Great Basin grassland with smaller areas of Great Basin conifer forest, madrean evergreen woodland, semi-desert grassland and Arizona uplands Sonoran desertscrub (see Figure 3.0-9). Riparian vegetation includes mixed broadleaf, strand and mesquite on Bonita Creek.

- Principal geographic features shown on Figure 3.2-1 are:
    - Ash Flat, a medium-high elevation plain north of Arsenic Tubs
    - Bonita Creek, which runs north-south through Bonita Camp
    - South Fork Ash Creek west of Arsenic Tubs and Park Creek, a tributary to Bonita Creek
    - The Gila Mountains along the southern basin boundary
    - Nantac Rim along the northern boundary, with the highest point in the basin at 7,292 feet.
    - The lowest point in the basin at 3,800 feet where Bonita Creek exits the basin



0 3 6 Miles

Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 3.2-1
Bonita Creek Basin
Geographic Features

City, Town or Place ●

3.2.2 Land Ownership in the Bonita Creek Basin

Land ownership, including the percentage of ownership by category, for the Bonita Creek Basin is shown in Figure 3.2-2. Principal features of land ownership in this basin are the large amount of San Carlos Apache tribal land, the largely solid portion of U.S. Bureau of Land Management lands in the south and the lack of diversity in land ownership types. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

Indian Reservation

- 88.5% of the land in this basin is under ownership of the San Carlos Apache Tribe.
- Primary land uses are domestic and grazing.

U.S. Bureau of Land Management (BLM)

- 11.0% of the land is federally owned and managed by the Safford Field Office of the BLM.
- The majority of the BLM land is in the southern portion of the basin, however, there are a few very small portions of BLM land along the western boundary of the basin in T2S, R23E; T3S, R24E; and T4S, R25E.
- The basin contains a portion of the Gila Box Riparian National Conservation Area as shown.
- Primary land use is grazing.

Private

- 0.5% of land is private.
- All private lands are in-holdings within BLM land.
- Primary land uses are domestic and grazing.

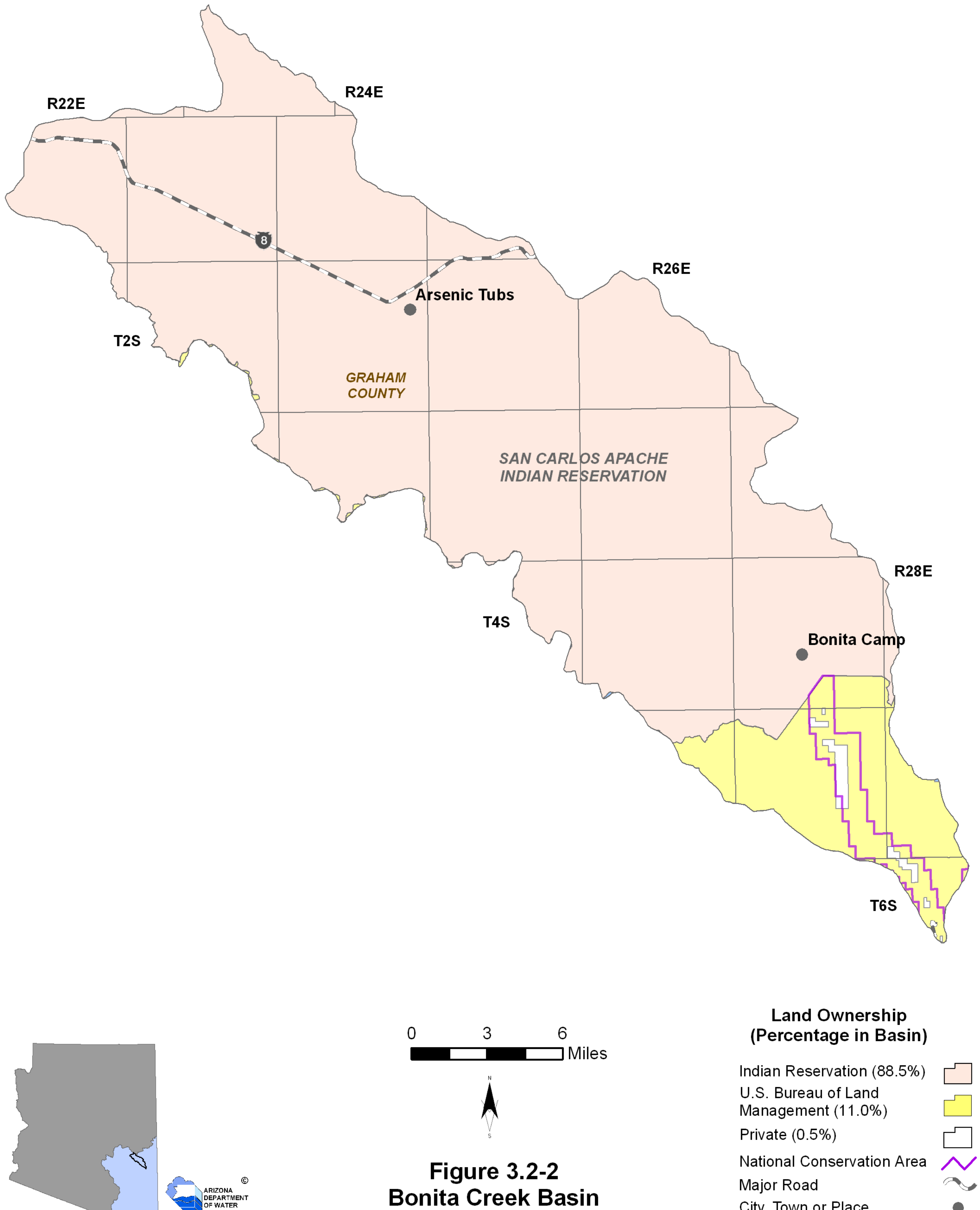


Figure 3.2-2
Bonita Creek Basin
Land Ownership

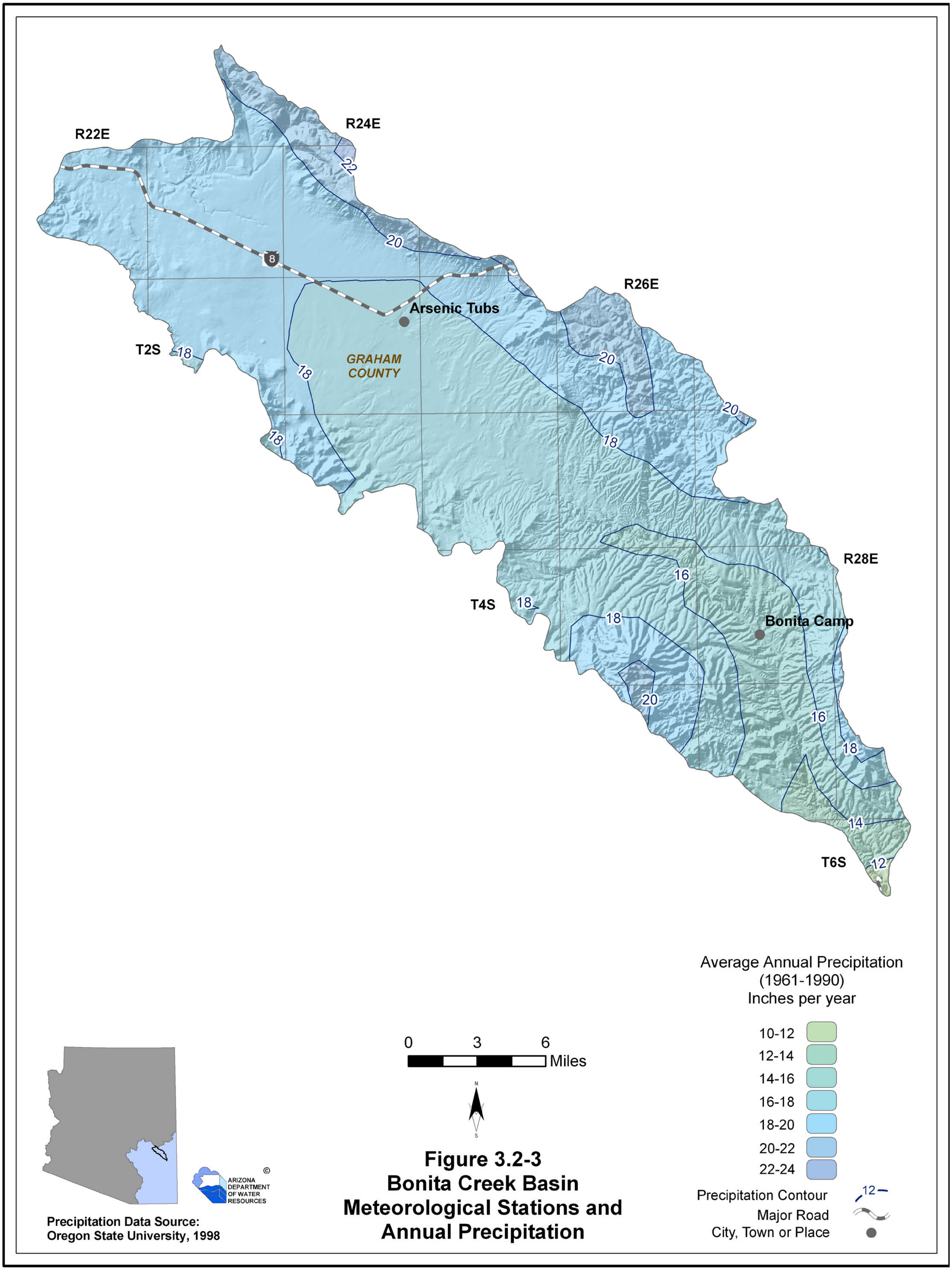
Source: ALRIS , 2004
Bureau of Land Management, 1999

3.2.3 Climate of the Bonita Creek Basin

The Bonita Creek Basin does not contain any NOAA/NWS Co-op Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 3.2-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 3.2-3
- Average annual precipitation is as high as 24 inches along the Nantac Rim in the northeastern part of the basin and as low as 10 inches at the southern tip of the basin where the Gila Mountains meet the San Simon Valley.



Precipitation Data Source:
Oregon State University, 1998

Figure 3.2-3
Bonita Creek Basin
Meteorological Stations and Annual Precipitation

3.2.4 Surface Water Conditions in the Bonita Creek Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.2-1. The basin does not contain flood ALERT equipment. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.2-2 The location of streamflow gages, identified by USGS number, USGS runoff contours and large reservoirs are shown on Figure 3.2-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.2-1.
- Data from one station located at Bonita Creek are shown on the table and on Figure 3.2-4.
- Average seasonal flow is highest in the winter (January-March), with over half the annual flow, and lowest in the spring (April-June).
- The maximum annual flow was 60,395 acre-feet in 1993 and minimum annual flow was 2,129 acre-feet in 2000.

Reservoirs and Stockponds

- Refer to Table 3.2-2.
- Surface water is stored or could be stored in one large and 16 small reservoirs.
- There are 24 registered stockponds in the basin.

Runoff Contour

- Refer to Figure 3.2-4.
- Average annual runoff is 0.5 inches per year, or 26.6 acre-feet per square mile.

Table 3.2-1 Streamflow Data for the Bonita Creek Basin

Station Number	USGS Station Name	Drainage Area (in sq. miles)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9447800	Bonita Creek near Morenci	302	3,500	8/1981-current (real time)	58	8	14	20	2,129 (2000)	5,424	9,553	60,395 (1993)	21

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding.
Period of record may not equal Year of 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

Table 3.2-2 Reservoirs and Stockponds in the Bonita Creek Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

B. Other Large Reservoirs (50 acre surface area or greater)[1]

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[2]	JURISDICTION
1	Big Bonita (#1,2,3,& 4)	San Carlos Apache Tribe	59	F,S	Tribal

Source: Compilation of databases from ADWR & others

C. Small Reservoirs (greater than 15 acre-feet and less than 500 acre-feet capacity)
Total number: 2
Total maximum storage: 289 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]
Total number: 14
Total surface area: 121 acres

E. Stockponds (up to 15 acre-feet capacity)
Total number: 24 (from water rights filings)

Notes:
[1]Capacity data not available to ADWR
[2] F=fish & wildlife pond; S=water supply

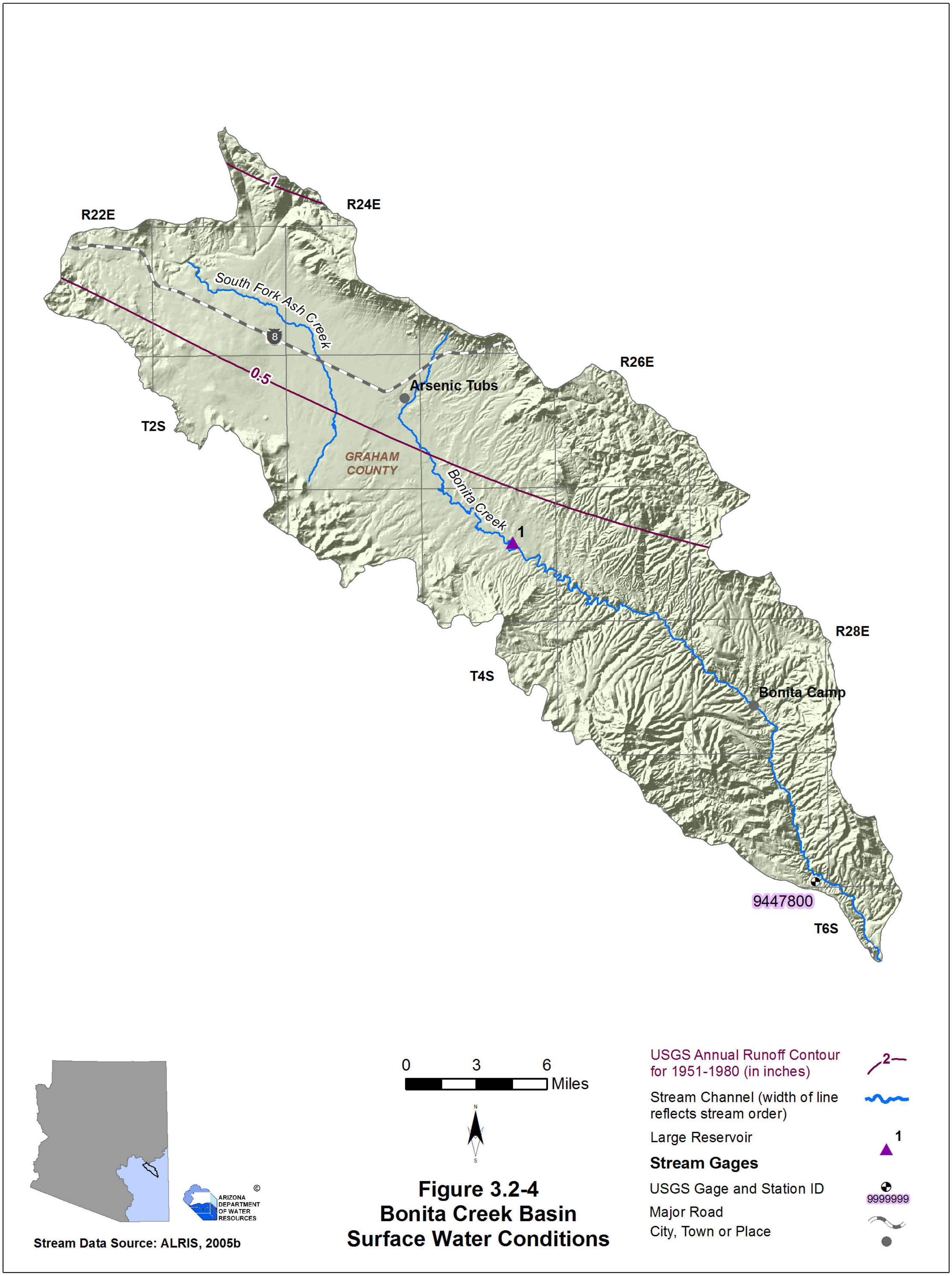


Figure 3.2-4
Bonita Creek Basin
Surface Water Conditions

3.2.5 Perennial/Intermittent Streams and Major Springs in the Bonita Creek 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 3.2-3. The locations of major springs and perennial and intermittent streams are shown on Figure 3.2-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one perennial stream, Bonita Creek, located in the southern portion of the basin.
- The basin contains one major spring located on the northeastern boundary of the basin with a measured discharge of 20 gallons per minute (gpm) or greater at any time.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.2-3B. There are four minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. The measurement for the major spring was taken in 1951 and only one of the four minor spring measurements post-date 1984.
- The total number of springs, regardless of discharge, identified by the USGS varies from 37 to 41, depending on the database reference.

Table 3.2-3 Springs in the Bonita Creek Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Tule	332036	1095338	20	3/20/1951

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Cottonwood[2,3]	325956	1093130	8	12/1981
Lion[2,3]	330014	1093143	3	08/1984
Hackberry	330016	1093110	3	04/1980
Farrell	330117	1093231	2	01/1991

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 37 to 41

Notes:
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Location approximated by ADWR

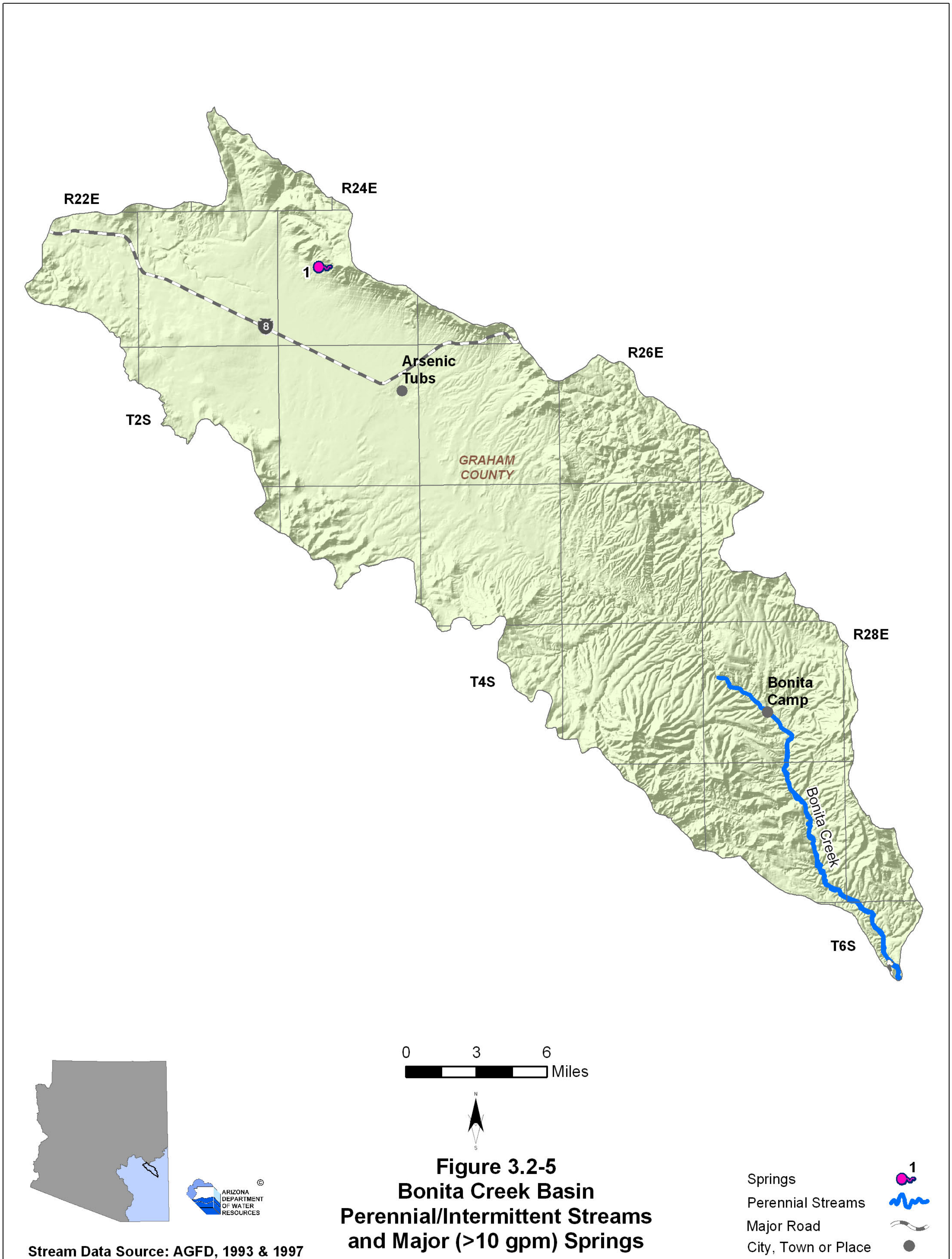


Figure 3.2-5
Bonita Creek Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

Stream Data Source: AGFD, 1993 & 1997

3.2.6 Groundwater Conditions of the Bonita Creek 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 3.2-4. Figure 3.2-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.2-7 shows well yields in three 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 3.2-4 and Figure 3.2-6.
- Major aquifers in the basin include recent stream alluvium, basin fill and volcanic rock.
- Flow direction is generally from the northwest to the southeast.

Well Yields

- Refer to Table 3.2-4 and Figure 3.2-7.
- As shown on Figure 3.2-7 well yields in this basin range from less than 100 gpm to 2,000 gpm.
- One source of well yield information, based on 14 reported wells, indicates that the median well yield in this basin is 1,144.5 gpm.

Natural Recharge

- Refer to Table 3.2-4.
- The only natural recharge estimate for this basin is 9,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 3.2-4.
- There are three storage estimates for this basin, ranging from 1.0 million acre-feet (maf) to 2.0 maf. The most recent estimate, from a 1994 ADWR study, indicates the basin has 1.3 maf in storage to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.2-6. Water levels are shown for wells measured in 2003-2004.
- There are no index wells in this basin or recorded well sweeps
- There are three wells with water depth reported in 2003-2004. Water level change data is not available. All registered wells are near Bonita Creek in the extreme southern end of the basin with depth to water ranges from four feet to 12 feet.

Table 3.2-4 Groundwater Data for the Bonita Creek Basin

Basin Area, in square miles:	457	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
	Volcanic Rock	
Well Yields, in gal/min:	Range 3-1,426 Median 1,144.5 (14 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	280	ADWR (1994b)
	Range 0-500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	9,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	1,300,000 (to 1,200 ft)	ADWR (1994b)
	1,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	2,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	0	
Date of Last Water-level Sweep:	NA	

Notes:
NA = Not Applicable
[1]Predevelopment Estimate

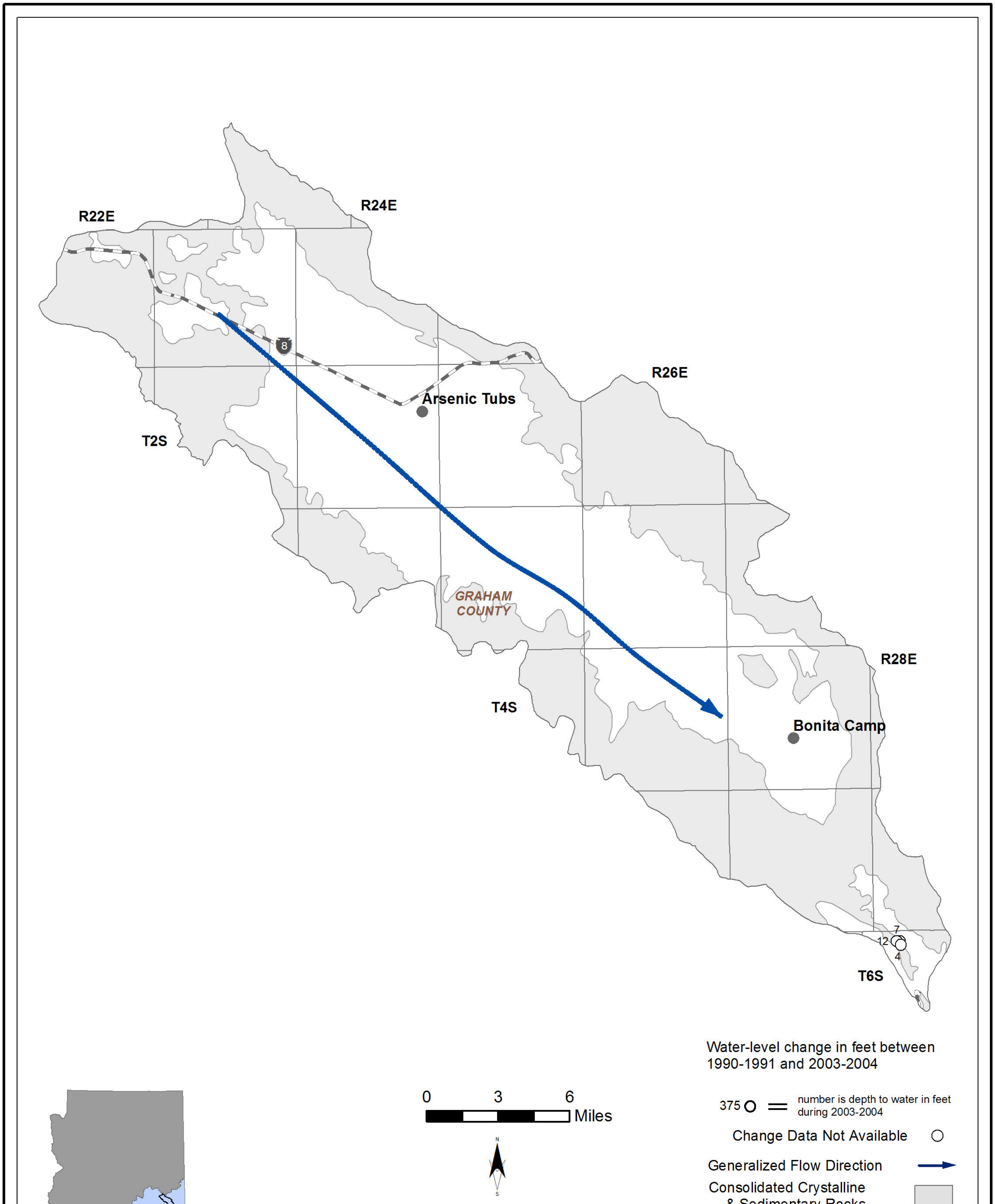


Figure 3.2-6
Bonita Creek Basin
Groundwater Conditions

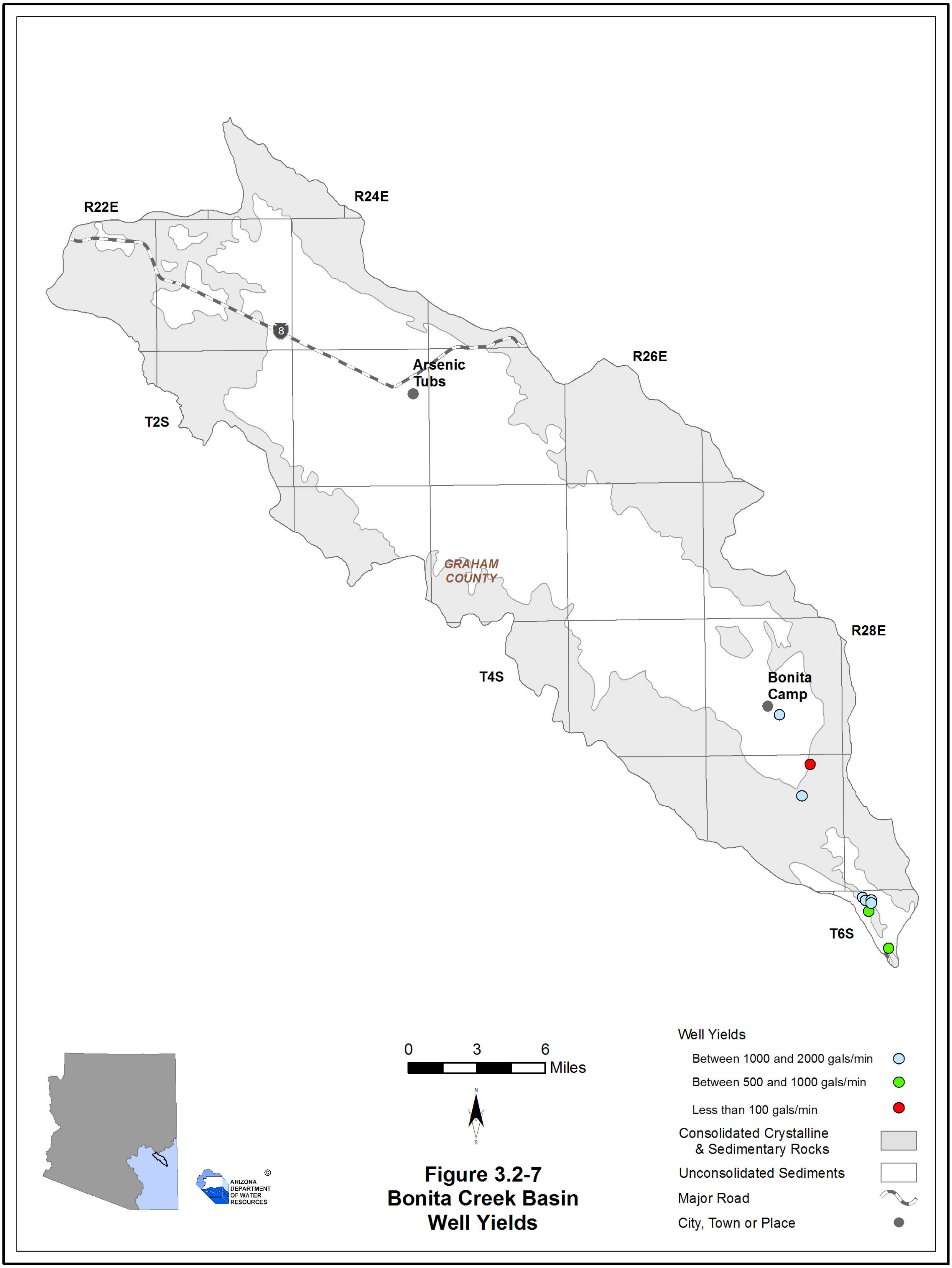


Figure 3.2-7
Bonita Creek Basin
Well Yields

3.2.7 Water Quality of the Bonita Creek Basin

Data on drinking water standard exceedences in wells, springs and mine sites and impaired lakes and streams are not available for this basin. A description of water quality data sources and methods is found in Volume 1, Appendix A.

3.2.8 Cultural Water Demand in the Bonita Creek 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 3.2-5. There is no recorded effluent generation in this basin. Figure 3.2-8 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 3.0.7.

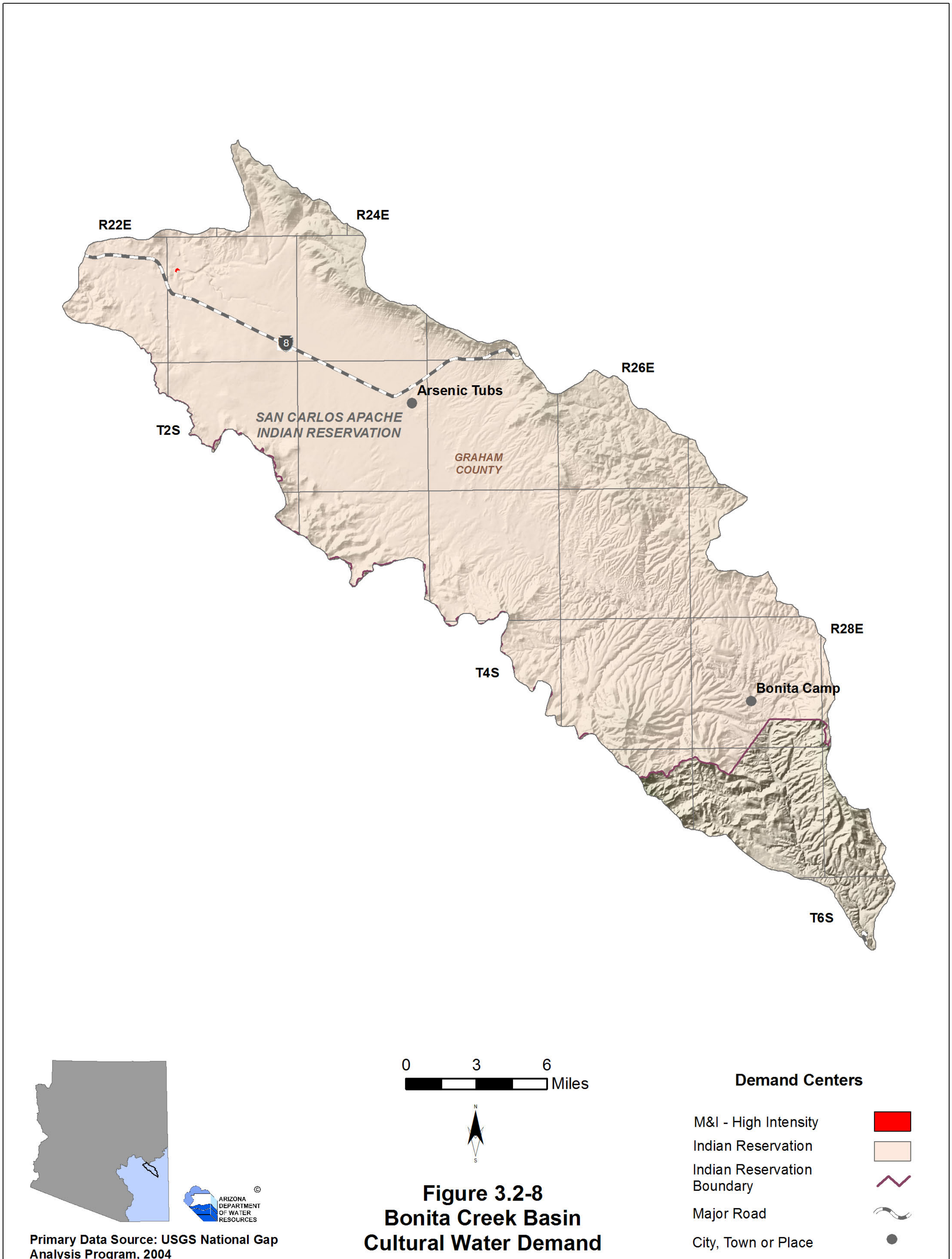
Cultural Water Demand

- Refer to Table 3.2-5 and Figure 3.2-8.
- Population in this basin is very small with 21 residents in 2000.
- Overall groundwater pumping is relatively constant between 1971 and 2005 with an average of 3,200 AFA in the period from 2001-2005. Almost all groundwater demand in the basin is water collected in infiltration galleries near Bonita Creek and delivered to the Safford Basin for municipal use. This water is considered to be groundwater in the Atlas.
- There are no recorded surface water diversions in the basin.
- The only municipal demand center according to the USGS Gap Analysis Program (2004) is located near Highway 8 in T1S, R23E. However, there is also municipal demand at Arsenic Tubs.
- As of 2005 there were 12 registered wells with a pumping capacity of less than or equal to 35 gpm and 15 wells with a pumping capacity of more than 35 gpm. This is the smallest number of registered wells in a planning area basin.

Table 3.2-5 Cultural Water Demand in the Bonita Creek Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="6">Average Annual Demand (in acre-feet)</th><th rowspan="3">Data Source</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">10[2]</td><td rowspan="10">15[2]</td><td colspan="3" rowspan="5">3,100[3]</td><td colspan="3" rowspan="5">NR</td><td rowspan="35">USGS (2007)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5">3,100[3]</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>5</td></tr>
<tr><td>1981</td><td>7</td><td rowspan="5">0</td><td rowspan="5">0</td><td colspan="3" rowspan="5">3,100[3]</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>8</td></tr>
<tr><td>1983</td><td>10</td></tr>
<tr><td>1984</td><td>11</td></tr>
<tr><td>1985</td><td>13</td></tr>
<tr><td>1986</td><td>14</td><td rowspan="5">0</td><td rowspan="5">0</td><td colspan="3" rowspan="5">3,100[3]</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>16</td></tr>
<tr><td>1988</td><td>17</td></tr>
<tr><td>1989</td><td>19</td></tr>
<tr><td>1990</td><td>20</td></tr>
<tr><td>1991</td><td>20</td><td rowspan="5">0</td><td rowspan="5">0</td><td rowspan="5">2,700</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1992</td><td>20</td></tr>
<tr><td>1993</td><td>21</td></tr>
<tr><td>1994</td><td>21</td></tr>
<tr><td>1995</td><td>21</td></tr>
<tr><td>1996</td><td>21</td><td rowspan="5">1</td><td rowspan="5">0</td><td rowspan="5">3,300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>21</td></tr>
<tr><td>1998</td><td>21</td></tr>
<tr><td>1999</td><td>21</td></tr>
<tr><td>2000</td><td>21</td></tr>
<tr><td>2001</td><td>21</td><td rowspan="5">1</td><td rowspan="5">0</td><td rowspan="5">3,200</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>22</td></tr>
<tr><td>2003</td><td>22</td></tr>
<tr><td>2004</td><td>22</td></tr>
<tr><td>2005</td><td>23</td></tr>
<tr><td>2010</td><td>24</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>26</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>28</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">*WELL TOTALS:*</td><td>12</td><td>15</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through 1980.
[3] Estimated based on average demand 1991-2005.
Note: <300 acre-feet of groundwater is used in the basin. Most water withdrawn is delivered to the Safford Basin for municipal use.



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 3.2-8
Bonita Creek Basin
Cultural Water Demand

3.2.9 Water Adequacy Determinations in the Bonita Creek Basin

There are no water adequacy applications on file with the Department as of December 2008 for the Bonita Creek Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

BONITA CREEK BASIN

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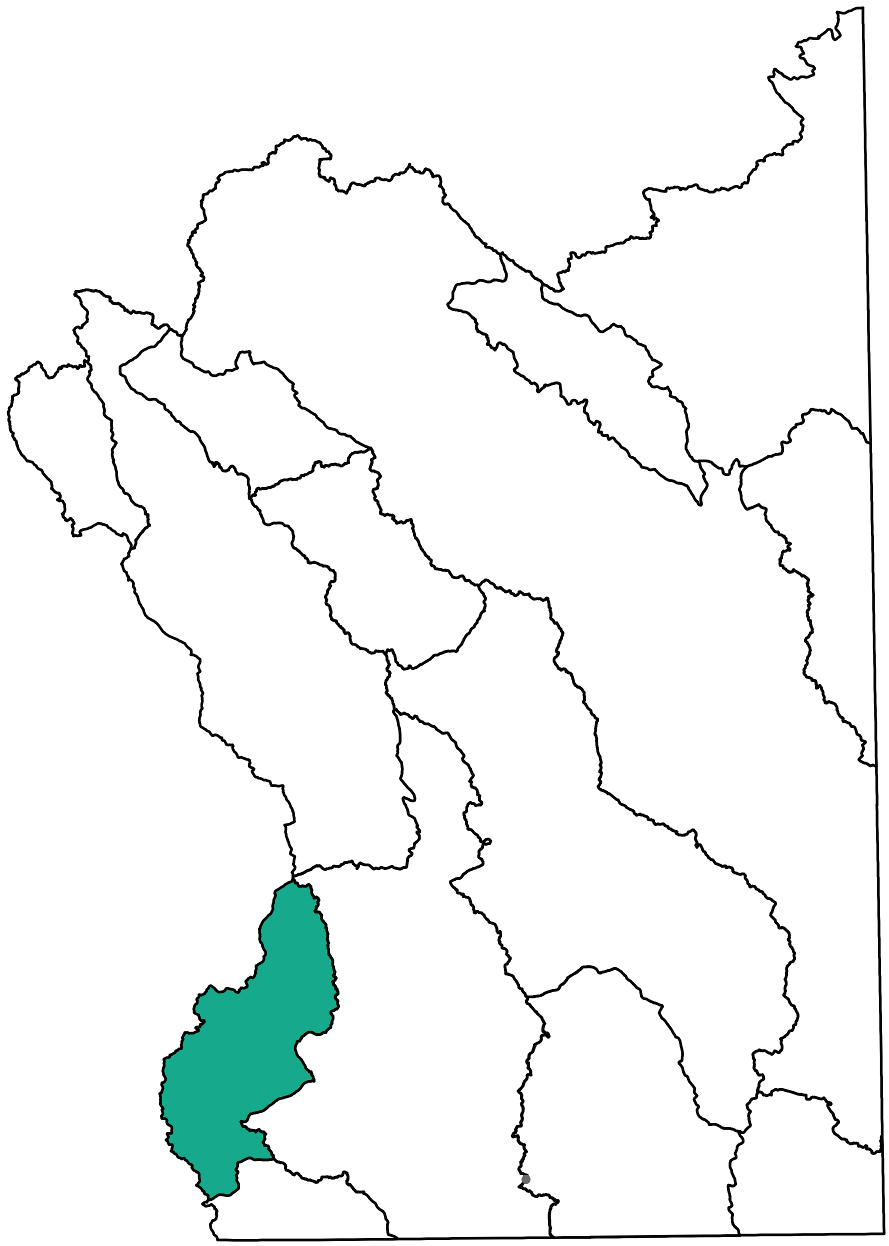
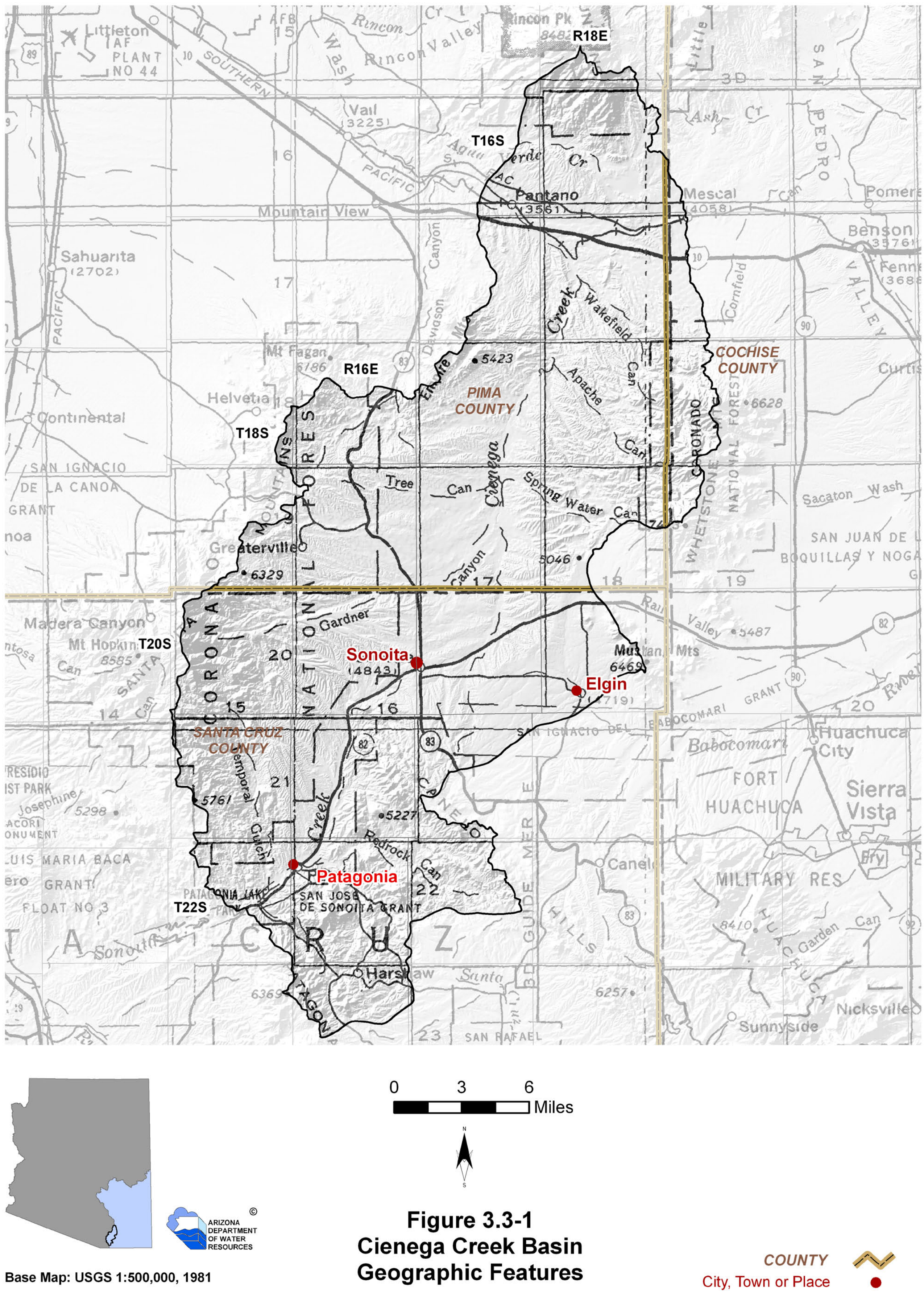
Section 3.3
Cienega Creek Basin



3.3.1 Geography of the Cienega Creek Basin

Cienega Creek is a small, 606 square mile basin in the southwest portion of the planning area. Geographic features and principal communities are shown on Figure 3.3-1. The basin is characterized by a series of mid- to high-elevation mountain ranges, grasslands and woodlands. Vegetation includes Plains and Great Basin and semi-desert grasslands, Chiuahuan desertscrub, madrean evergreen woodland and a small portion of Rocky Mountain and madrean montane conifer forest. (see Figure 3.0-9) Riparian vegetation includes mixed broadleaf and strand on Red Rock Canyon and mixed broadleaf, mesquite and strand on Sonoita and Cienega Creeks.

- Principal geographic features shown on Figure 3.3-1 are:
  - Cienega Creek, beginning in T21S, R17E and flowing north toward Interstate 10
  - Sonoita Creek flowing along Highway 82 in the southern portion of the basin
  - Redrock Canyon north of Patagonia
  - Gardner Canyon north of Sonoita
  - Empire Mountains in the northwest, Whetstone Mountains in the northeast and Patagonia Mountains on the western boundary
  - Santa Rita Mountain range along the southwestern boundary, which include Mt. Wrightson, the highest point in the basin at 9,453 feet
  - The lowest point at 3,200 feet where Cienega Creek exits the basin



Base Map: USGS 1:500,000, 1981

Figure 3.3-1
Cienega Creek Basin
Geographic Features

3.3.2 Land Ownership in the Cienega Creek Basin

Land ownership, including the percentage of ownership in each category, is shown for the Cienega Creek Basin in Figure 3.3-2. Principal features of land ownership are the national forest lands along the boundaries of the basin and relatively large portions of contiguous private and state trust lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

National Forest

- 40.7% of land is federally owned and managed by the United States Forest Service (USFS).
- All forest lands in the basin, although they are not contiguous, are in the Coronado National Forest. There are two ranger districts in the basin, Nogales Ranger District and Sierra Vista Ranger District.
- A portion of the Mt. Wrightson Wilderness area is located in T19S and T20S, R15E. (see Figure 3.0-12)
- Primary land uses are grazing, recreation and timber production.

Private

- 24.2% of land is private.
- Most private land in the basin is contiguous and located in the vicinity of the three principal basin communities of Sonoita, Patagonia and Elgin.
- A number of private land in-holdings exist in national forest land in the Nogales Ranger District west of Patagonia and in the southern portion of the Sierra Vista Ranger District east of Patagonia.
- Primary land uses are domestic, ranching and farming.

State Trust

- 23.3% of land in this basin is held in trust for public schools, penitentiaries and state charitable penal reform.
- The majority of the state land ownership is contiguous, but there are a number of small isolated parcels in the southern portion of the basin.
- Primary land use is grazing.

U.S. Bureau of Land Management (BLM)

- 11.8% of land is federally owned and managed by the Safford Field Office of the Bureau of Land Management.
- The majority of the BLM land in this basin is within the Las Cienegas National Conservation Area, a 42,000 acre area north and east of Sonoita along Cienega Creek.
- Primary land uses are recreation and grazing.

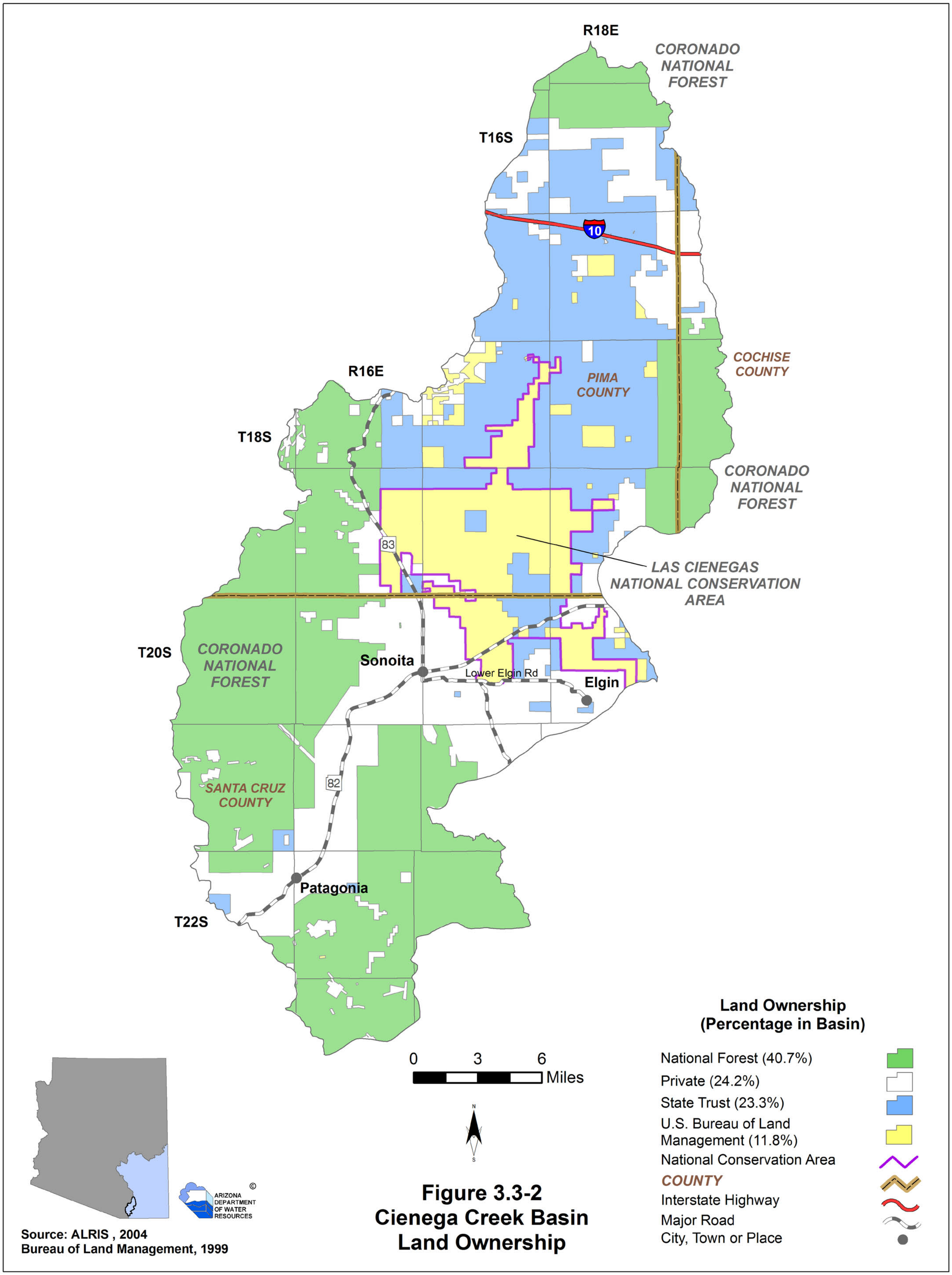


Figure 3.3-2
Cienega Creek Basin
Land Ownership

3.3.3 Climate of the Cienega Creek Basin

The Cienega Creek Basin does not contain any NOAA/NWS Co-op Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 3.3-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 3.0.3. A description of this and other climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 3.3-3
- Precipitation data shows average annual rainfall is as high as 40 inches in the vicinity of McCleary Peak in the Santa Rita Mountains and as low as low as 14 inches at the Mescal Arroyo north of Interstate 10.

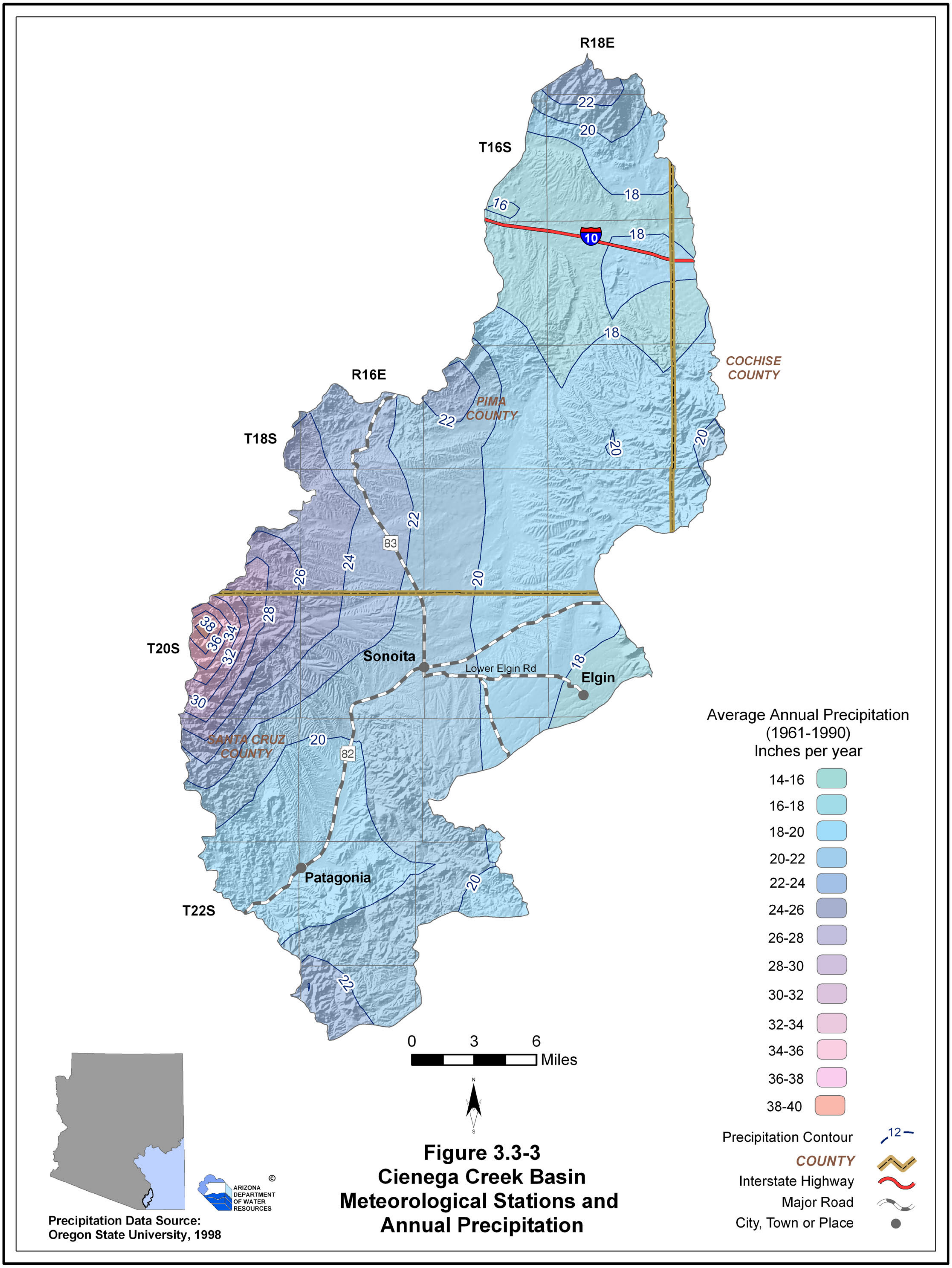


Figure 3.3-3
Cienega Creek Basin
Meteorological Stations and Annual Precipitation

3.3.4 Surface Water Conditions in the Cienega Creek Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.3-1. Flood ALERT equipment in the basin is shown on Table 3.3-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.3-3. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 3.3-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data
- Refer to Table 3.3-1
- Data from two stations, one discontinued and one real-time, located at Cienega Creek are shown on the table and on Figure 3.3-4.
- The average seasonal flow for the discontinued Pantano station is highest in the Summer (July-September) and lowest in the Spring (April-June) and the Fall (October-December). As of 2005 a full three years of data were not available for the other station, therefore no statistics were run.
- Maximum annual flow was 4,496 acre-feet in 1974 and minimum annual flow was 608 acre-feet in 1969 at the station near Pantano.

Flood ALERT Equipment
- Refer to Table 3.3-2.
- There are seven stations in the basin as of October 2005, all but one is located in Pima County.

Reservoirs and Stockponds
- Refer to Table 3.3-3.
- Surface water is stored or could be stored in four small reservoirs in the basin.
- There are 426 registered stockponds in this basin.

Runoff Contour
- Refer to Figure 3.3-4.
- Average annual runoff is two inches per year, or 106.6 acre-feet per square mile in the northwestern portion of the basin and decreases to 0.5 inches per year, or 26.65 acre-feet per square mile, in the central and southern part of the basin.

Table 3.3-1 Streamflow Data for the Cienega Creek 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	
9484550	Cienega Creek near Sonoita	NA	4,180	10/2001- current (real time)	No statistics run, less than 3 years data								2
9484560	Cienega Creek near Pantano	289	3,560	3/1968-9/1975 (discontinued)	5	1	93	1	608 (1969)	1,408	1,919	4,496 (1974)	6

Source: USGS (NWIS) 2005 & 2008

Notes:
NA= Not available
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding.
Period of record may not equal Year of 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

Table 3.3-2 Flood ALERT Equipment in the Cienega Creek Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
2520	Sonoita Creek @ Casa Blanca Canyon	Precipitation	10/16/2001	ADWR
4270	Salcido Place	Precipitation	3/1/1993	Pima County FCD
4280	Cienega I-10	Precipitation/Stage	3/1/1993	Pima County FCD
4290	Mescal	Precipitation	3/1/1993	Pima County FCD
4300	Doppler Tower	Weather Station	9/1/1997	Pima County FCD
4320	Empire Mountain Repeater	Repeater/Precipitation	3/1/1993	Pima County FCD
4410	Haystack Mountain	Precipitation	3/1/1993	Pima County FCD

Source: ADWR 2005b

Notes:
ADWR = Arizona Department of Water Resources
FCD = Flood Control District

Table 3.3-3 Reservoirs and Stockponds in the Cienega Creek Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 2
Total maximum storage: 68 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 2
Total surface area: 10 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 426 (from water right filings)

Notes:
[1]Capacity data not available to ADWR

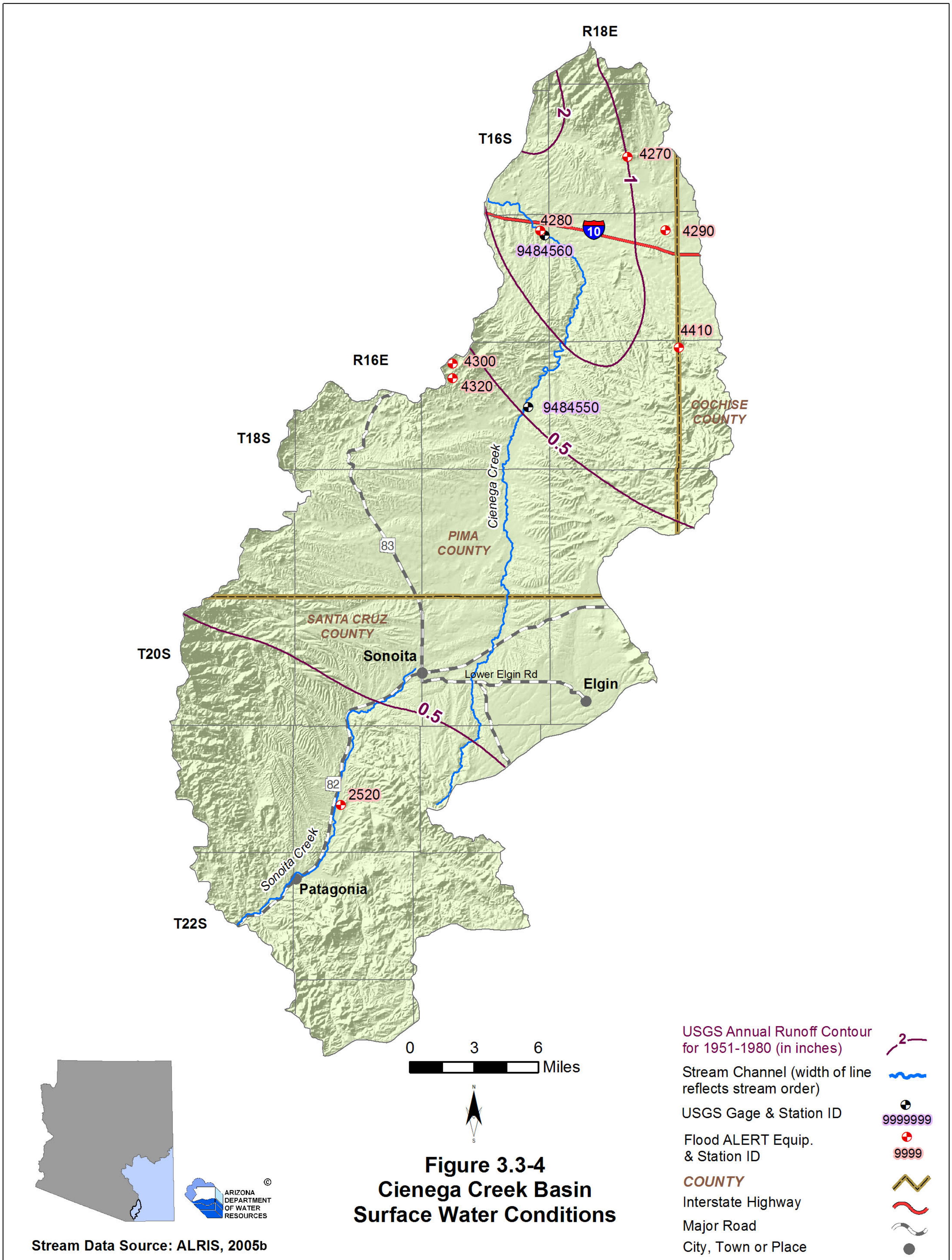


Figure 3.3-4
Cienega Creek Basin
Surface Water Conditions

Stream Data Source: ALRIS, 2005b

3.3.5 Perennial/Intermittent Streams and Major Springs in the Cienega Creek 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 3.3-4. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.3-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are four streams with perennial reaches, Sonoita Creek, Cienega Creek, Redrock Canyon and Big Casa Blanca Canyon.
- There are a number of intermittent streams as well as intermittent reaches of perennial streams in the basin.
- There are eight major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge rate is 430 gpm at Monkey Spring.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.3-4B. There are two minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. All of the spring measurements in the basin were taken prior to 1983.
- The total number of springs identified by the USGS is 78.

Table 3.3-4 Springs in the Cienega Creek Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Monkey	313803	1104212	430	NA
2	Cottonwood	313910	1104225	150	3/18/1982
3	Apache	314310	1104450	90	04/1941
4	Unnamed	313158	1104553	70	4/1/1982
5	Unnamed	314716	1103820	40	3/25/1982
6	Unnamed	313135	1104740	14	4/1/1982
7	Barrell	315203	1104054	13	3/31/1981
8	Scholefield	315144	1104311	10	NA

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Apache	315012	1102926	4	3/24/1982
Bootlegger	315424	1103252	3	12/23/1981

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 78

Notes:
NA = Not Available
[1]Most recent measurement identified by ADWR

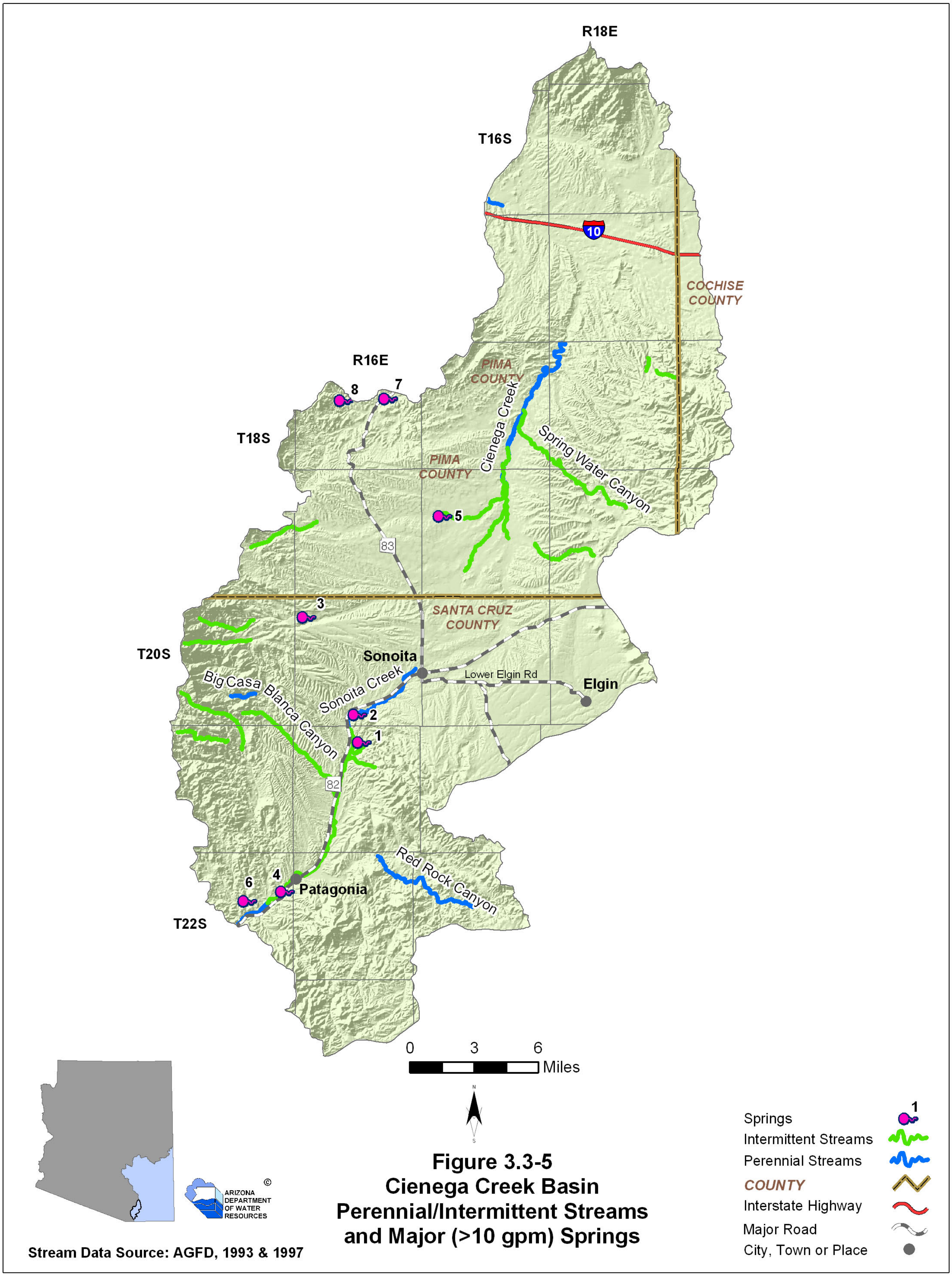


Figure 3.3-5
Cienega Creek Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

Stream Data Source: AGFD, 1993 & 1997

3.3.6 Groundwater Conditions of the Cienega Creek 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 3.3-5. Figure 3.3-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.3-7 contains hydrographs for selected wells shown on Figure 3.3-6. Figure 3.3-8 shows well yields in four yield categories. Descriptions of aquifer and well data sources and methods, including water-level changes and well yields, are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 3.3-5 and Figure 3.3-6.
- Major aquifers in the basin include recent stream alluvium and basin fill.
- In the central valley the principal aquifer is the basin-fill alluvium.
- From "the Narrows" south of Interstate 10 there are three aquifers: stream alluvium, basin fill and the Pantano formation. The main aquifer in this section is the stream alluvium.
- In the southwestern portion of the basin the main aquifer is the stream alluvium that forms the floodplain of Sonoita Creek and its tributaries.
- Flow direction south of Sonoita is generally from north to southwest and north of Sonoita it is from the southwest to the northeast.

Well Yields

- Refer to Table 3.3-5 and Figure 3.3-8.
- As shown on Figure 3.3-8 well yields in this basin range from less than 100 gpm to 2,000 gpm.
- One source of well yield information, based on 35 reported wells, indicates that the median well yield in this basin is 250 gpm.

Natural Recharge

- Refer to Table 3.3-5.
- Natural recharge estimates range from 8,500 acre-feet per year (AFA) to 25,500 AFA.

Water in Storage

- Refer to Table 3.3-5.
- Storage estimates for this basin range from 5.1 million acre-feet (maf) to 11 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.3-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 14 index wells in this basin. Hydrographs for two index wells (B and C) and one other well are shown in Figure 3.3-7.
- The deepest recorded water level in 2003-2004 is 207 feet in Sonoita and the shallowest is 21 feet in the vicinity of Elgin.

Table 3.3-5 Groundwater Data for the Cienega Creek Basin

Basin Area, in square miles:	606	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
	Range 25-600 Median 250 (35 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 2-1,500	ADWR (1994b)
	Range 0-2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet:	8,500 - 25,500 (does not include Sonoita Creek section)	ADWR (1994b)
	11,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	5,100,000 (to 1,200 ft)	ADWR (1994b)
	6,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	11,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	14	
Date of Last Water-level Sweep:	2005 (117 wells measured)	

Notes:
[1]Predevelopment Estimate

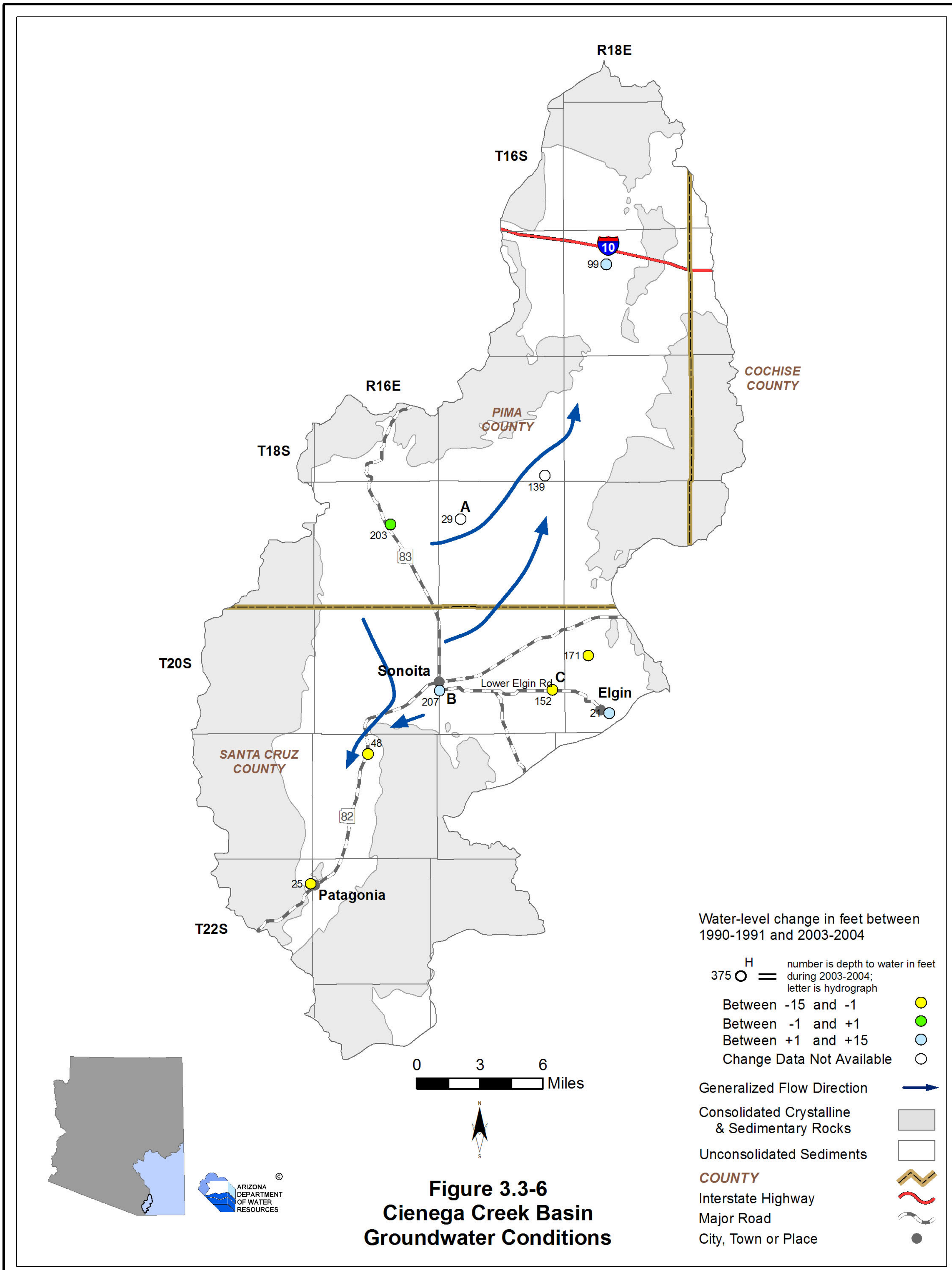
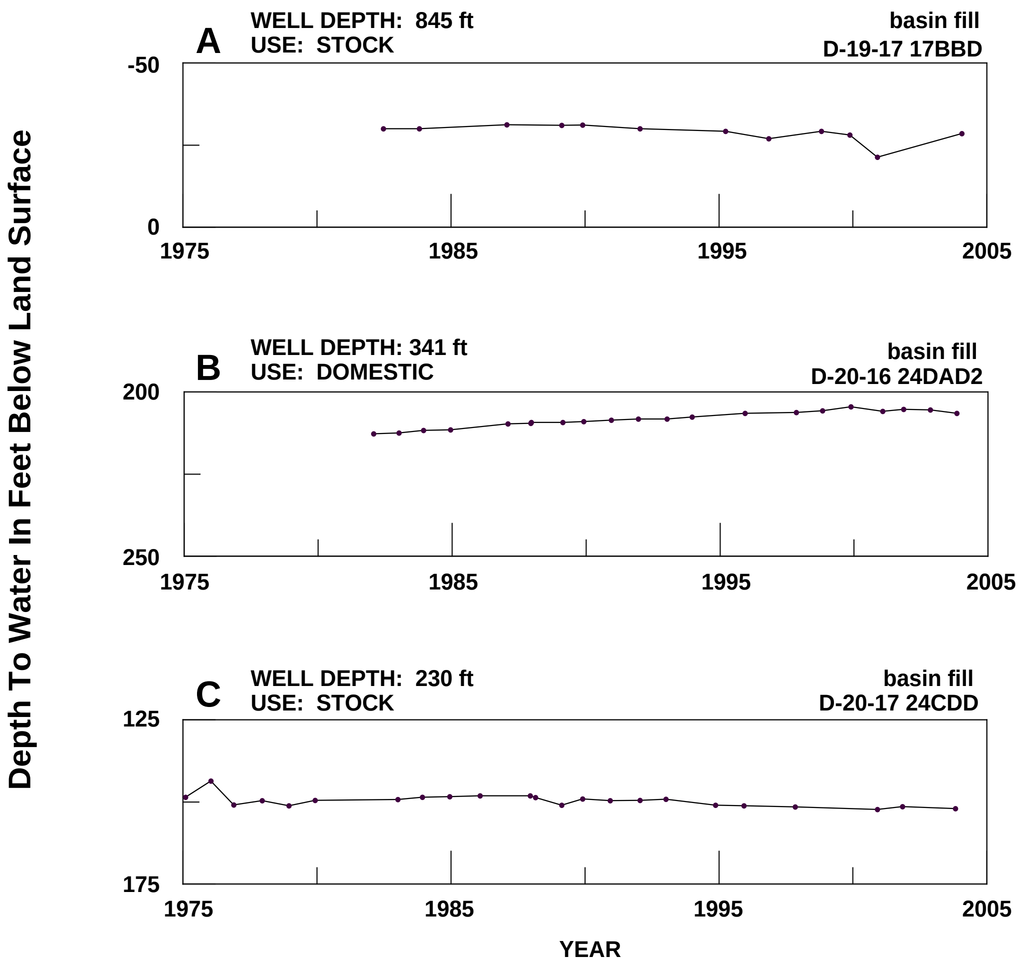


Figure 3.3-6
Cienega Creek Basin
Groundwater Conditions

Figure 3.3-7
Cienega Creek Basin
Hydrographs Showing Depth to Water in Selected Wells



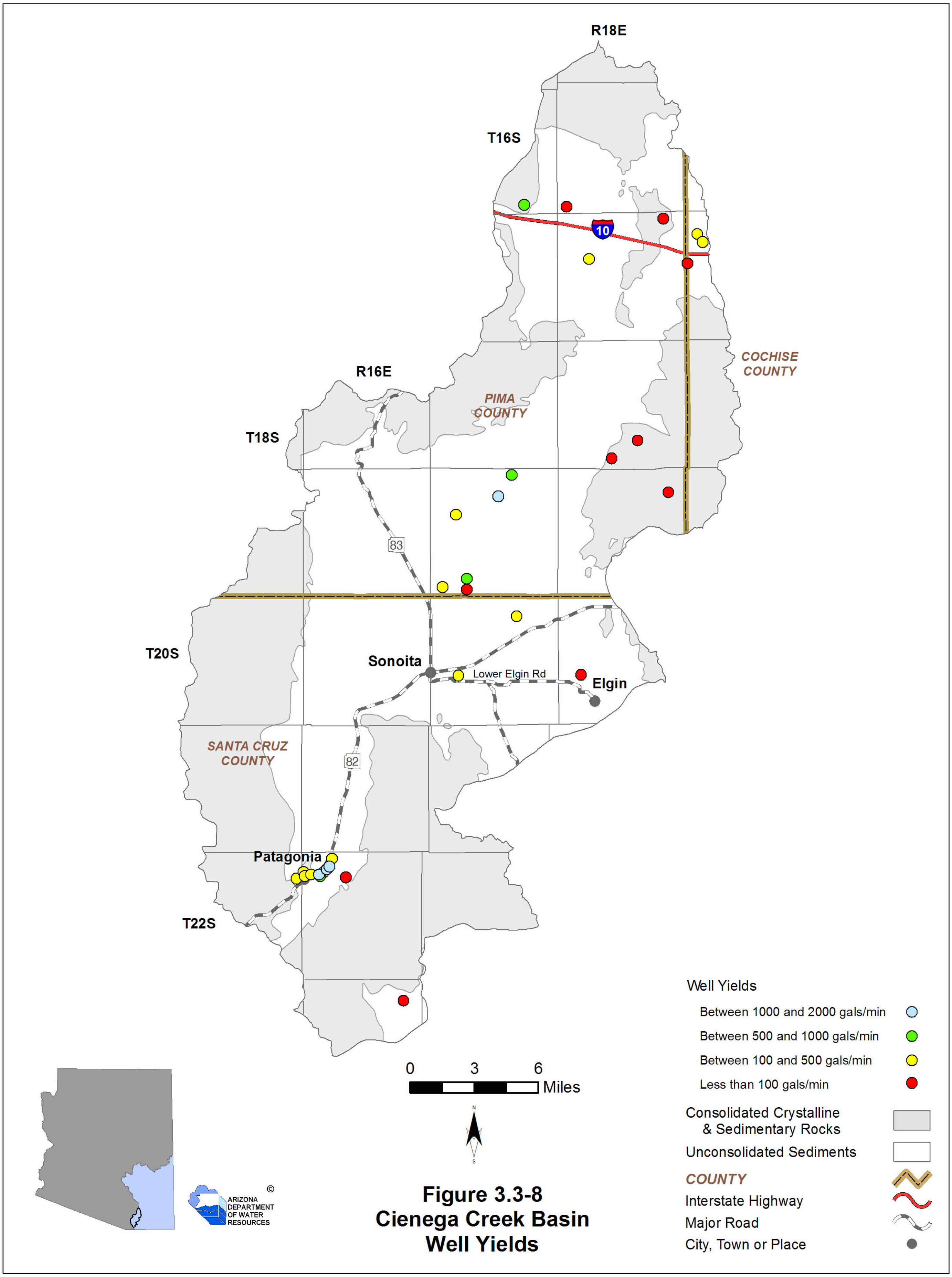


Figure 3.3-8
Cienega Creek Basin
Well Yields

3.3.7 Water Quality of the Cienega Creek Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.3-6A. 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 3.3-6B. Figure 3.3-9 shows the location of exceedences and impairment keyed to Table 3.3-6. 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. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.3-6A.
- Forty-six sites have parameter concentrations that have equaled or exceeded DWS.
- Frequently equaled or exceeded parameters include cadmium and copper. Almost all of these sites are in the vicinity of Patagonia.
- Other parameters commonly equaled or exceeded in the sites measured in this basin were arsenic, fluoride and lead.

Lakes and Streams with impaired waters

- Refer to Table 3.3-6B.
- Water quality standards were equaled or exceeded in two reaches of Alum Gulch, the entire length of Harshaw Creek, a tributary of the Endless Mine tributary and Humbolt Canyon.
- The parameters exceeded in every stream were copper and pH levels. Other parameters exceeded include cadmium and zinc.
- Harshaw Creek and Alum Gulch are part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. The TMDL report for both streams was accepted by the EPA in 2003. USFS has completed remediation of the World's Fair and Humboldt Canyon mines on Alum Gulch and a draft TMDL Implementation Plan is available from ADEQ.

Effluent Dependent Reaches

- Refer to Figure 3.3-9.
- There is one small portion of Sonoita Creek in the vicinity of Patagonia that is effluent dependent.

Table 3.3-6 Water Quality Exceedences in the Cienega Creek Basin[1]

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	17 South	19 East	17	F
2	Well	18 South	16 East	32	Rad
3	Well	18 South	17 East	26	As, Cu, Pb
4	Well	19 South	17 East	3	As
5	Well	19 South	18 East	29	Rad
6	NR	22 South	15 East	9	NO3
7	NR	22 South	15 East	12	As
8	NR	22 South	15 East	12	As
9	NR	22 South	15 East	14	Cd
10	NR	22 South	15 East	14	Cd
11	NR	22 South	15 East	14	Cd
12	NR	22 South	15 East	23	As
13	NR	22 South	15 East	23	Cd, Cu, Pb
14	NR	22 South	15 East	23	Cd, Cu, Pb
15	NR	22 South	15 East	23	As
16	NR	22 South	15 East	23	Cd, Cu, Pb
17	NR	22 South	15 East	23	Cd, Cu, Pb
18	NR	22 South	15 East	23	As
19	NR	22 South	16 East	9	As, F, Pb
20	NR	22 South	16 East	14	Cd, Cu
21	NR	22 South	16 East	20	Cd, F
22	NR	22 South	16 East	20	Cd, Cu
23	NR	22 South	16 East	20	Cd, Cu
24	NR	22 South	16 East	20	Cd, Cu
25	NR	22 South	16 East	20	Cd, Cu
26	NR	22 South	16 East	20	Cd, Cu
27	NR	22 South	16 East	26	F
28	NR	22 South	16 East	27	As
29	NR	22 South	16 East	27	Cd
30	NR	22 South	16 East	28	Cd, Tl
31	NR	22 South	16 East	32	Cd, Cu, Pb
32	NR	22 South	16 East	32	Cd, F
33	NR	22 South	16 East	32	As, Cd, Cu, F, Pb
34	NR	22 South	16 East	32	Cd, F, Pb
35	NR	22 South	16 East	32	Cd, Cu, F, Pb
36	NR	22 South	16 East	32	Cd, Cu, Pb
37	NR	22 South	16 East	32	As, Cd, Cu, Pb
38	Well	23 South	16 East	3	As
39	NR	23 South	16 East	4	As
40	NR	23 South	16 East	5	Cd, Cu, Pb
41	NR	23 South	16 East	5	Cd, Cu
42	NR	23 South	16 East	5	Cd, Cu
43	NR	23 South	16 East	5	Cd, Pb
44	NR	23 South	16 East	6	Cd, Cu
45	NR	23 South	16 East	6	Cd, Cu
46	NR	23 South	16 East	6	Cd, Cu

Source: Compilation of databases from ADWR & others

Table 3.3-6 Water Quality Exceedences in the Cienega Creek Basin (Cont)[1]

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Alum Gulch (headwaters to Latitude 312820, Longitude 1104351)	1	NA	A&W, AgL, PBC	Cd, Cu, pH, Zn
b	Stream	Alum Gulch (Latitude 312820, Longitude 1104351 to Latitude 312917, Longitude 1104425)	1	NA	A&W, AgL, FBC, FC	Cd, Cu, pH, Zn
c	Stream	Harshaw Creek (headwaters to Sonoita Creek)	14	NA	A&W, AgL, PBC	Cu, pH
d	Stream	Headwaters of unnamed tributary of Harshaw Creek to Endless Chain Mine tributary	2	NA	A&W, PBC	Cu, pH
e	Stream	Humbolt Canyon	2	NA	A&W, FBC, FC	Cd, Cu, pH, Zn

Source: ADEQ 2005b

Notes:
NR = Information not available to ADWR
NA = Not applicable
Because of map scale feature locations may appear different than the location indicated on the table
[1] Water quality samples collected between 1982 and 2001.
[2] As = Arsenic
Cd = Cadmium
Cu = Copper
F= Fluoride
Pb = Lead
Hg = Mercury
pH = Measurement of acidity or alkalinity
NO3 = Nitrate
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
Tl = Thallium
Zn = Zinc
[3] A&W = Aquatic and Wildlife
AgL = Agricultural Livestock Watering
FBC = Full Body Contact
FC = Fish Consumption
PBC = Partial Body Contact

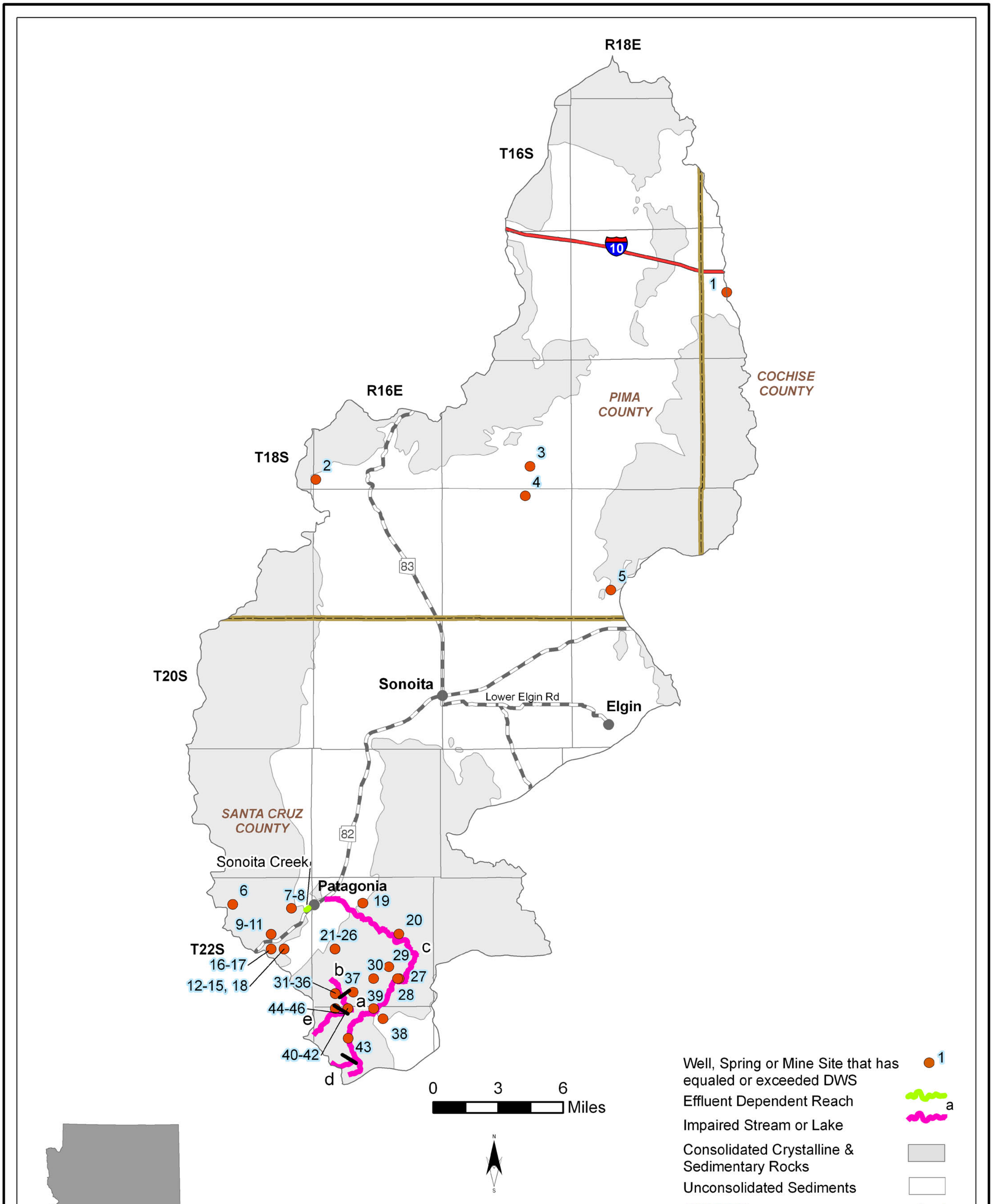


Figure 3.3-9
Cienega Creek Basin
Water Quality Conditions

3.3.8 Cultural Water Demand in the Cienega Creek 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 3.3-7. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.3-8. Figure 3.3-10 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.3-7 and Figure 3.3-10.
- Population in this basin is small but has more than doubled since 1980, increasing from 1,695 in 1980 to 4,355 in 2000.
- Overall groundwater pumping is estimated to be comparable to historic pumping with an annual average of about 1,400 AFA from 2001-2005.
- All water use in this basin is groundwater, there are no recorded surface water diversions.
- Most concentrations of municipal and industrial demand are either around Patagonia or along Interstate 10 along the Cochise County line.
- Both municipal and industrial groundwater demand has remained fairly constant since 1991, with municipal demand about 550 AFA and industrial demand less than 300 AFA.
- Agricultural demand has also remained relatively constant since 1992 with less than 500 AFA. The only agricultural demand center shown on the map is located along Highway 82 in T21S, R16E.
- In addition to the agricultural demand center shown on the map there are approximately 170 acres of vineyards in this basin. Most vineyards are located in the Elgin area and all are irrigated with groundwater.
- As of 2005 there were 1,874 registered wells with a pumping capacity of less than or equal to 35 gpm and 169 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.3-8.
- There is one wastewater treatment facility, the Patagonia Wastewater Treatment Facility, located at Patagonia.
- 945 people are served by this facility.
- 73 acre-feet of effluent per year is generated by the facility and discharged into Sonoita Creek.

Table 3.3-7 Cultural Water Demand in the Cienega Creek Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th rowspan="2" colspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">759[2]</td><td rowspan="10">91[2]</td><td rowspan="5" colspan="3">1,200</td><td rowspan="5" colspan="3">NR</td><td rowspan="20">ADWR (1994a) USGS (2007)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td rowspan="5" colspan="3">1,200</td><td rowspan="5" colspan="3">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>1,695</td></tr>
<tr><td>1981</td><td>1,792</td><td rowspan="5">136</td><td rowspan="5">15</td><td rowspan="5" colspan="3">1,200</td><td rowspan="5" colspan="3">NR</td></tr>
<tr><td>1982</td><td>1,888</td></tr>
<tr><td>1983</td><td>1,985</td></tr>
<tr><td>1984</td><td>2,082</td></tr>
<tr><td>1985</td><td>2,178</td></tr>
<tr><td>1986</td><td>2,275</td><td rowspan="5">249</td><td rowspan="5">22</td><td rowspan="5" colspan="3">1,200</td><td rowspan="5" colspan="3">NR</td></tr>
<tr><td>1987</td><td>2,372</td></tr>
<tr><td>1988</td><td>2,468</td></tr>
<tr><td>1989</td><td>2,565</td></tr>
<tr><td>1990</td><td>2,662</td></tr>
<tr><td>1991</td><td>2,831</td><td rowspan="5">226</td><td rowspan="5">17</td><td rowspan="5">500</td><td rowspan="5"><300</td><td rowspan="5">500</td><td rowspan="5" colspan="3">NR</td><td rowspan="15">USGS (2007) ADWR (2005a) ADWR (2008b)</td></tr>
<tr><td>1992</td><td>3,000</td></tr>
<tr><td>1993</td><td>3,170</td></tr>
<tr><td>1994</td><td>3,339</td></tr>
<tr><td>1995</td><td>3,508</td></tr>
<tr><td>1996</td><td>3,678</td><td rowspan="5">247</td><td rowspan="5">6</td><td rowspan="5">550</td><td rowspan="5"><300</td><td rowspan="5">500</td><td rowspan="5" colspan="3">NR</td></tr>
<tr><td>1997</td><td>3,847</td></tr>
<tr><td>1998</td><td>4,016</td></tr>
<tr><td>1999</td><td>4,186</td></tr>
<tr><td>2000</td><td>4,355</td></tr>
<tr><td>2001</td><td>4,460</td><td rowspan="5">256</td><td rowspan="5">18</td><td rowspan="5">600</td><td rowspan="5"><300</td><td rowspan="5">500</td><td rowspan="5" colspan="3">NR</td></tr>
<tr><td>2002</td><td>4,565</td></tr>
<tr><td>2003</td><td>4,670</td></tr>
<tr><td>2004</td><td>4,775</td></tr>
<tr><td>2005</td><td>4,880</td></tr>
<tr><td>2010</td><td>5,404</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>6,672</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>7,820</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">***WELL TOTALS:***</td><td>**1,874**</td><td>**169**</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

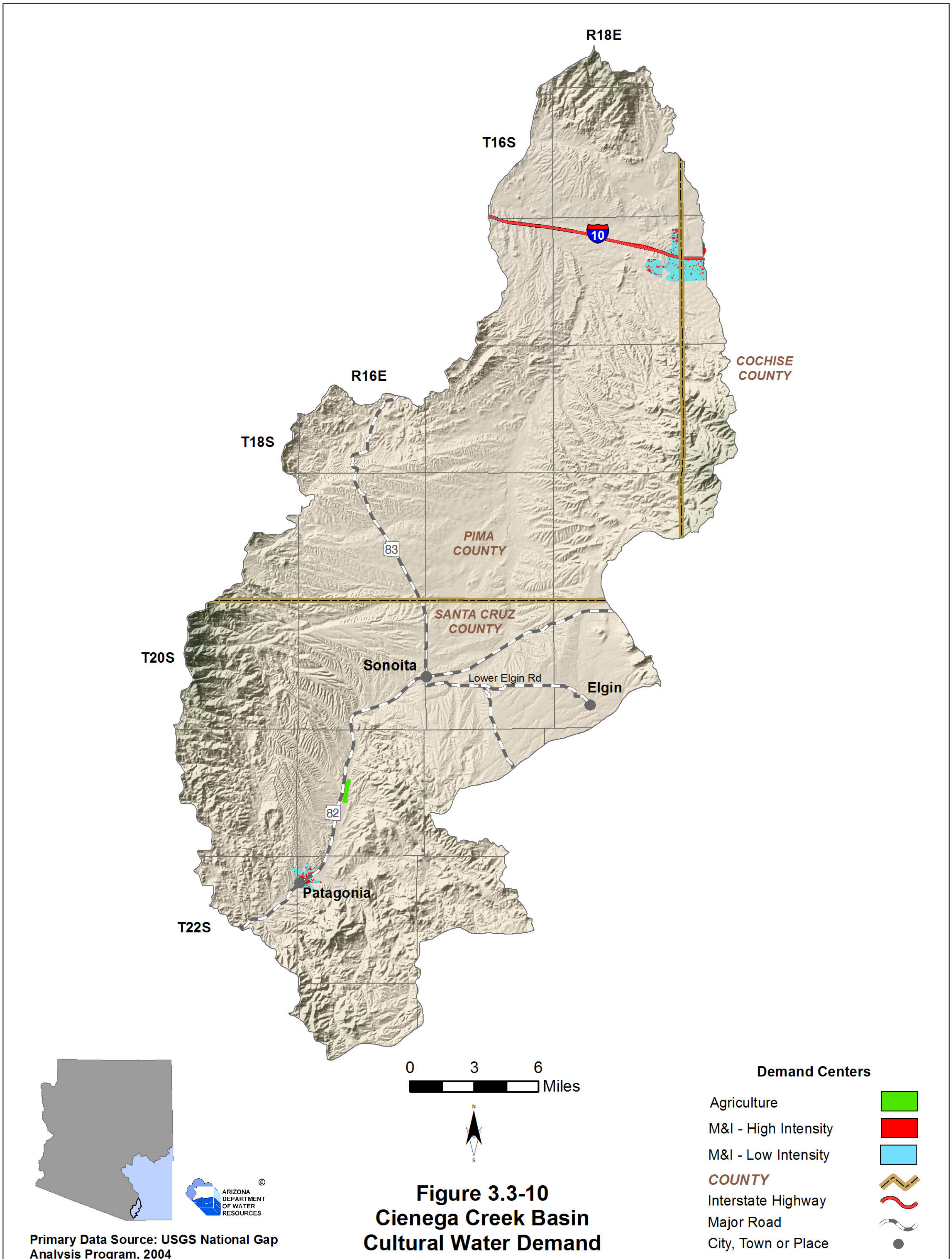
Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through June 1980.

Table 3.3-8 Effluent Generation in the Cienega Creek Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method									Treatment Level		Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course/Turf/ Landscape	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other	Current	Projected		
Patagonia WWTF	Town of Patagonia	Patagonia	945	123	Sonoita Creek									Adv.Tr. I	Adv.Trt.I	NA	2003

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
WWTF: Wastewater Treatment Facility
Adv. Tr. I: Advance Treatment Level I



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 3.3-10
Cienega Creek Basin
Cultural Water Demand

3.3.9 Water Adequacy Determinations in the Cienega Creek 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 3.3-9A and B for water reports and analysis of adequate water supply. Designated water provider information is shown in Table 3.3-9C with date of application, date the designation was issued and projected or annual estimated demand. Figure 3.3-11 shows the locations of subdivisions and designated providers keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- Thirteen water adequacy determinations have been made in this basin through December 2008.
- Eight determinations of inadequacy have been made, all in the vicinity of Sonoita and Patagonia.
- All eight determinations of inadequacy were because of the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination. One inadequacy determination was also due to poor water quality.
- There is one analysis of adequate water supply for 189 lots.
- There is one designated water provider, Empirita Water Company, with a projected or annual estimated demand of 427 acre-feet.
- The number of lots receiving a water adequacy determination, by county, are:

County	Number of Subdivision Lots	Number of Lots Determined to be Adequate	Percent Adequate
Cochise	269	269	100
Santa Cruz	>767	598	~77%

Table 3.3-9 Adequacy Determinations in the Cienega Creek 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	Empirita Highlands at the J-6 Ranch	Cochise	17 South	19 West	19	91	53-400432	Adequate		12/8/2000	Anderson Water Company
2	Mesa, The	Santa Cruz	22 South	16 West	7, 18	NA	53-500971	Inadequate	A1	6/22/1989	Dry Lot Subdivision
3	Mescal Lakes #4,5	Cochise	17 South	19 West	7, 8	117	53-500205	Adequate		8/21/1973	Verde Utilities
4	Ranch Oasis	Santa Cruz	20 South	17 West	19, 20	13	53-300122	Inadequate	A1	3/22/1996	Dry Lot Subdivision
5	Red Mountain Mesas Development	Santa Cruz	22 South	16 East	7,18	44	NA	Inadequate	A1	4/1/1981	Unformed Homeowners Association
6	Red Rock Acres	Santa Cruz	22 South	16 West	5, 8	33	53-501289	Inadequate	A1	7/7/1982	Redrock Acres Homeowners Association
7	Rolling Hills Subdivision Lots 1-61	Cochise	17 South	19 West	7	61	53-400866	Adequate		1/24/2003	Mescal Lakes Water System
8	Sonoita Estates	Santa Cruz	20 South	17 West	25	NA	53-501437	Inadequate	A1	12/18/1989	Dry Lot Subdivision
9	Sonoita Hills	Santa Cruz	20 South	17 West	20, 29, 32	31	53-501438	Inadequate	A1	10/10/1994	Dry Lot Subdivision
10	Sonoita Meadows	Santa Cruz	20 South	16 West	25	24	53-501439	Inadequate	A1	4/11/1984	Dry Lot Subdivision
11	Starr View Estates	Santa Cruz	20 South	17 West	20	400	53-501457	Adequate		8/6/1979	Dry Lot Subdivision
13	Three Canyons	Santa Cruz	21 South	16 West	17, 20, 21, 29, 30, 32	198	53-401928	Adequate		12/19/2005	Three Canyons Domestic Water Improvement District
14	Valley of Thousand Oaks	Santa Cruz	22 South	15 West	24	11	53-501599	Inadequate	A1,C	10/16/1980	Subdivision Wells

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
12	Three Canyons	Santa Cruz	22 South	16 West	17, 20, 21, 29, 30, 32	189	43-401865	12/19/2005	Three Canyons Domestic Water Improvement District

C. Designated Adequate Water Supply

Map Key	Water Provider Name	County	Designation No.	Projected or Annual Estimated Demand *(af/yr)*	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	Empirita Water Company	Cochise	41-401435.0001	427	6/28/2006	12/10/2008	2024

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 unavailable; 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= Data not currently available to ADWR

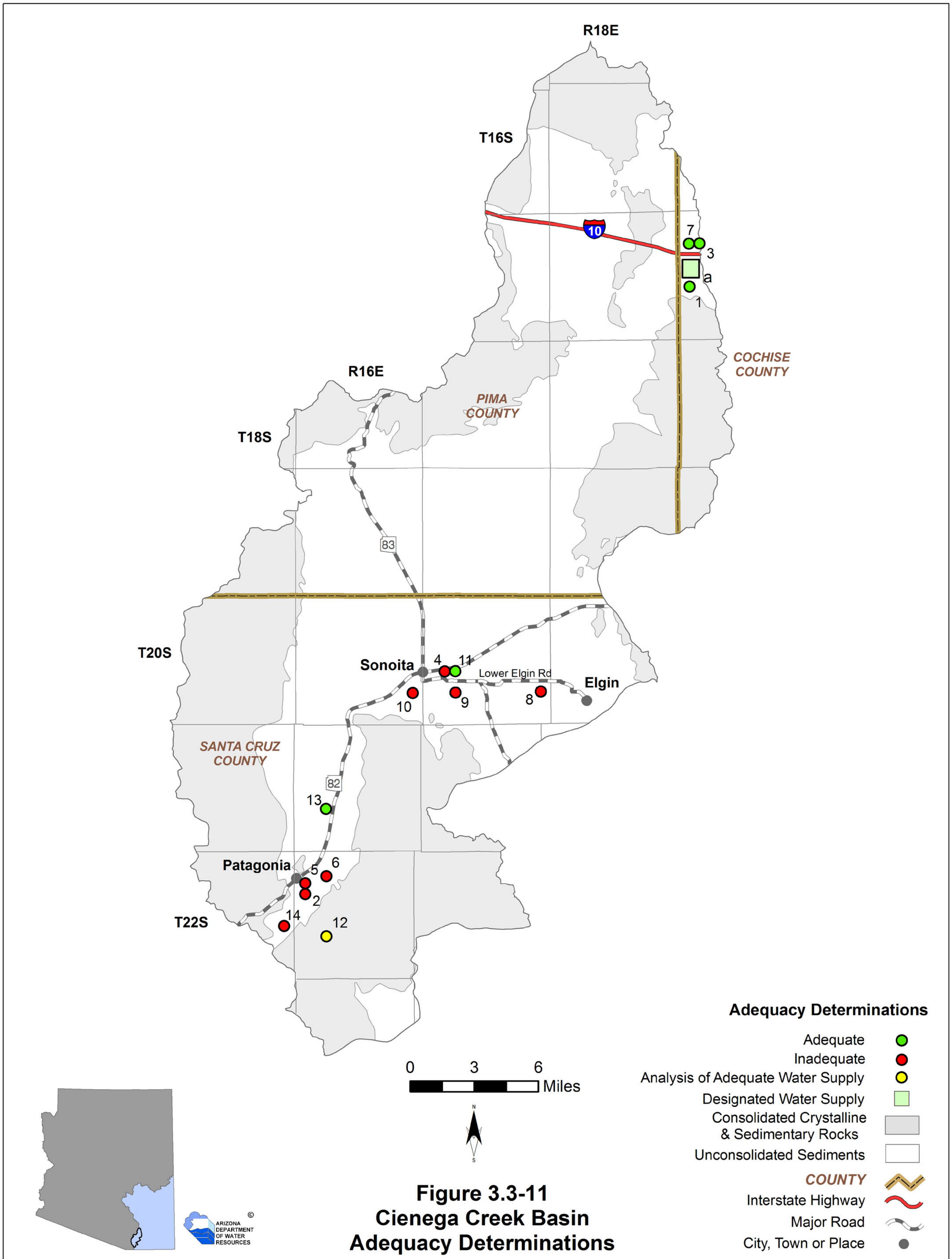


Figure 3.3-11
Cienega Creek Basin
Adequacy Determinations

CIENEGA CREEK BASIN

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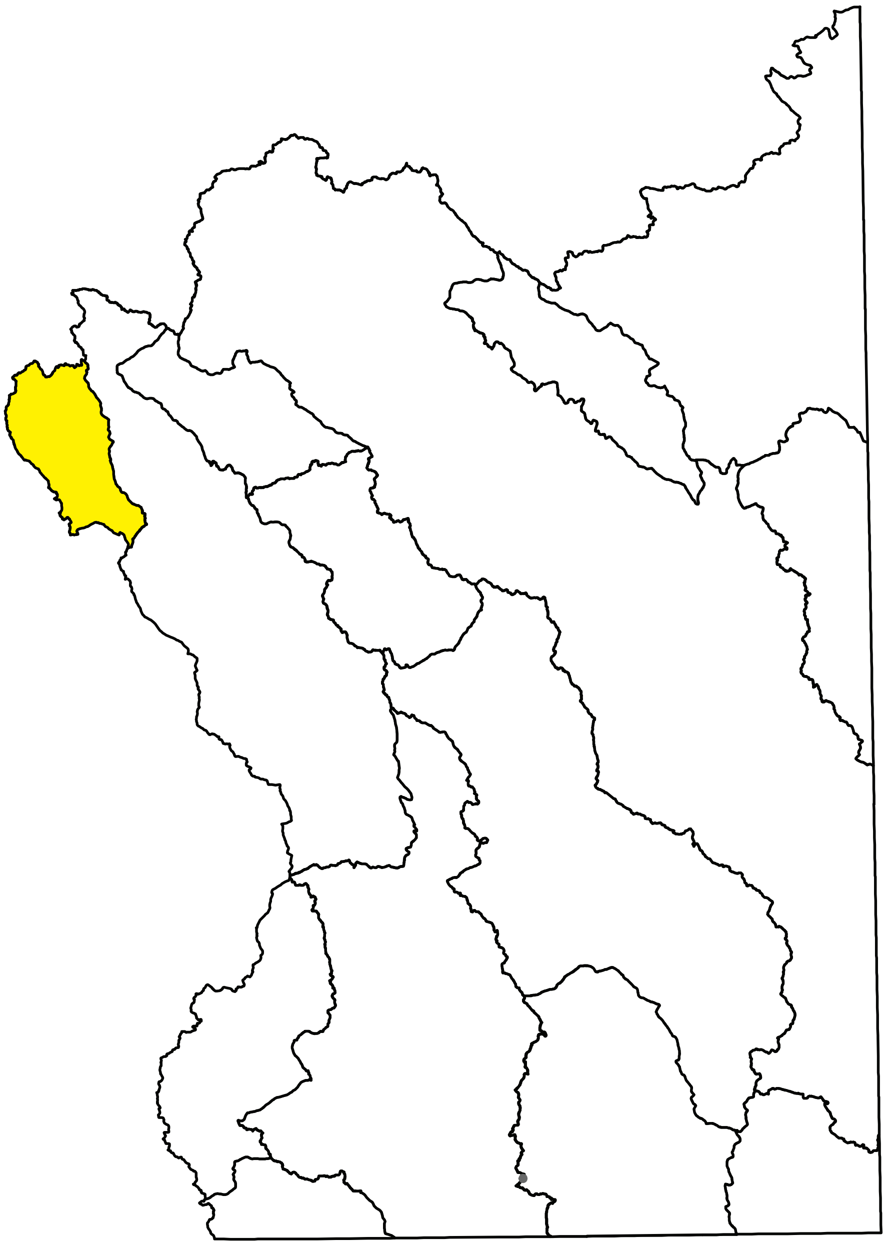
Section 3.4
Donnelly Wash Basin



3.4.1 Geography of the Donnelly Wash Basin

The Donnelly Wash Basin is a small, 293 square mile basin in the northwestern portion of the planning area. Geographic features and principal communities are shown on Figure 3.4-1. The basin is characterized by low elevation hills, washes and canyons. Vegetation is primarily Arizona Sonoran desertscrub with a smaller area of semi-desert grassland. (see Figure 3.0-9).

- Principal geographic features shown on Figure 3.4-1 are:
  - Gila River, runing east-west through Cochran
  - Box Canyon and Walnut Canyon entering from the north and terminating at the Gila River
  - Donnelly Wash, Cottonwood Wash and Box Wash, which run roughly parallel to each other south of Cochran
  - Ninety-Six Hills along the southwest boundary, which include the highest point in the basin at 4,420 feet
  - The lowest point at 1,600 feet at Price where the Gila River exits the basin

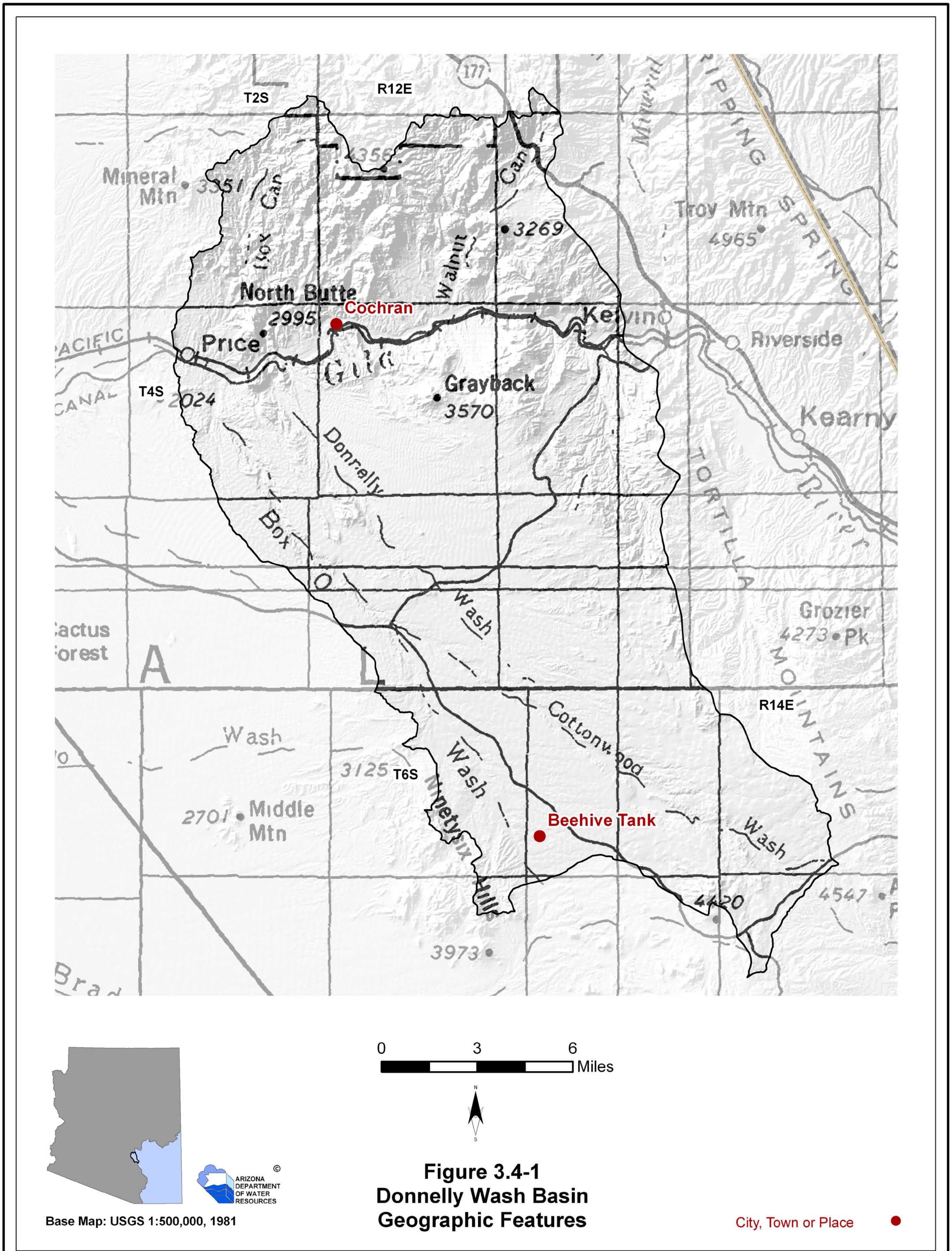


Figure 3.4-1
Donnelly Wash Basin
Geographic Features

3.4.2 Land Ownership in the Donnelly Wash Basin

Land ownership, including the percentage of ownership in each category, is shown for the Donnelly Wash Basin in Figure 3.4-2. Principal features of land ownership in this basin are the significant amount of state trust land, a band of Bureau of Reclamation land and scattered Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

State Trust

- 50.5% of land in this basin is held in trust predominantly for public schools and to a lesser extent the hospital for disabled miners.
- The southern portion of the basin contains a sizeable contiguous portion of state owned land.
- The center and northern portion of the basin contain trust lands that are in more of a checkerboard pattern among Bureau of Land Management and Bureau of Reclamation lands.
- Primary land use is grazing.

U.S. Bureau of Land Management (BLM)

- 30.2% of land is federally owned and managed by the Safford Field Office of the BLM.
- Primary land use is grazing

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

- 11.5% of land is federally owned and managed by the Bureau of Reclamation.
- This land flanks the Gila River and extends south of Cochran.
- Primary land use is for water delivery.

Private

- 6.2% of land is private.
- Private land is scattered in small parcels throughout the basin, with a few in-holdings in BLM lands in the northern portion of the basin.
- Primary land uses are domestic and ranching.

National Forest

- 1.6% of the land is federally owned and managed by the United States Forest Service (USFS).
- The basin includes the Globe Ranger District in the Tonto National Forest.
- Primary land uses are grazing and recreation.

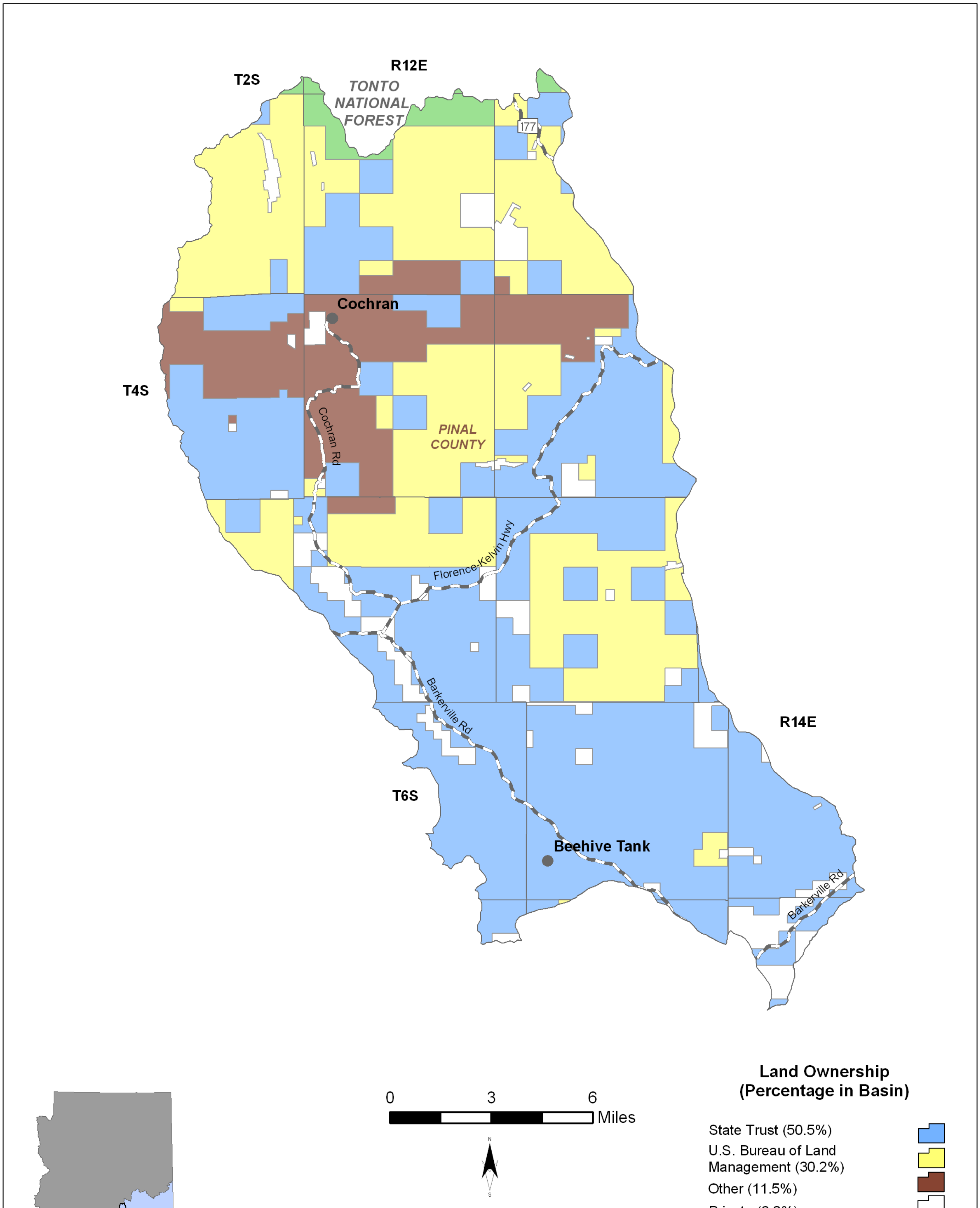


Figure 3.4-2
Donnelly Wash Basin
Land Ownership

Source: ALRIS, 2004

3.4.3 Climate of the Donnelly Wash Basin

The Donnelly Wash Basin does not contain any NOAA/NWS Co-op Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 3.4-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 3.0.3. A description of this and other climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 3.4-3
- Precipitation data shows average annual precipitation as high as 22 inches at the northeastern-most tip of the basin and in the southeast portion of the basin and as low as 10 inches in the vicinity of the Gila River.

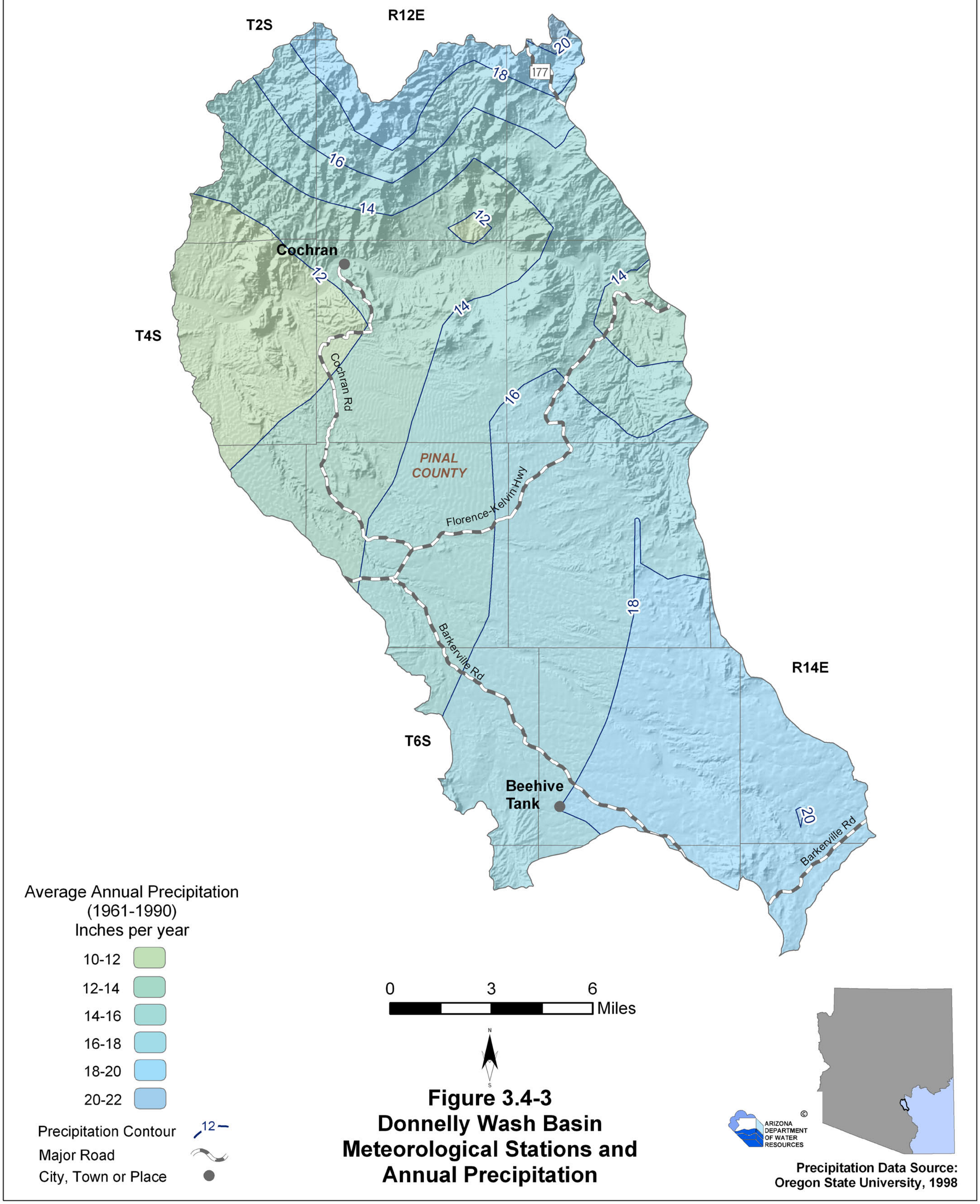


Figure 3.4-3
Donnelly Wash Basin
Meteorological Stations and Annual Precipitation

3.4.4 Surface Water Conditions in the Donnelly Wash Basin

There are no streamflow data or flood ALERT equipment in this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.4-1. The USGS annual runoff contours as well as stream channels are shown on Figure 3.4-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Reservoirs and Stockponds

- Refer to Table 3.4-1.
- Surface water is stored or could be stored in two small reservoirs in the basin.
- There are 89 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.4-4.
- Average annual runoff is 0.5 inches per year, or 26.65 acre-feet per square mile, in this basin.

Table 3.4-1 Reservoirs and Stockponds in the Donnelly Wash Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 0
Total maximum storage: 0 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 2
Total surface area: 10 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 89 (from water right filings)

Notes:
[1]Capacity data not available to ADWR

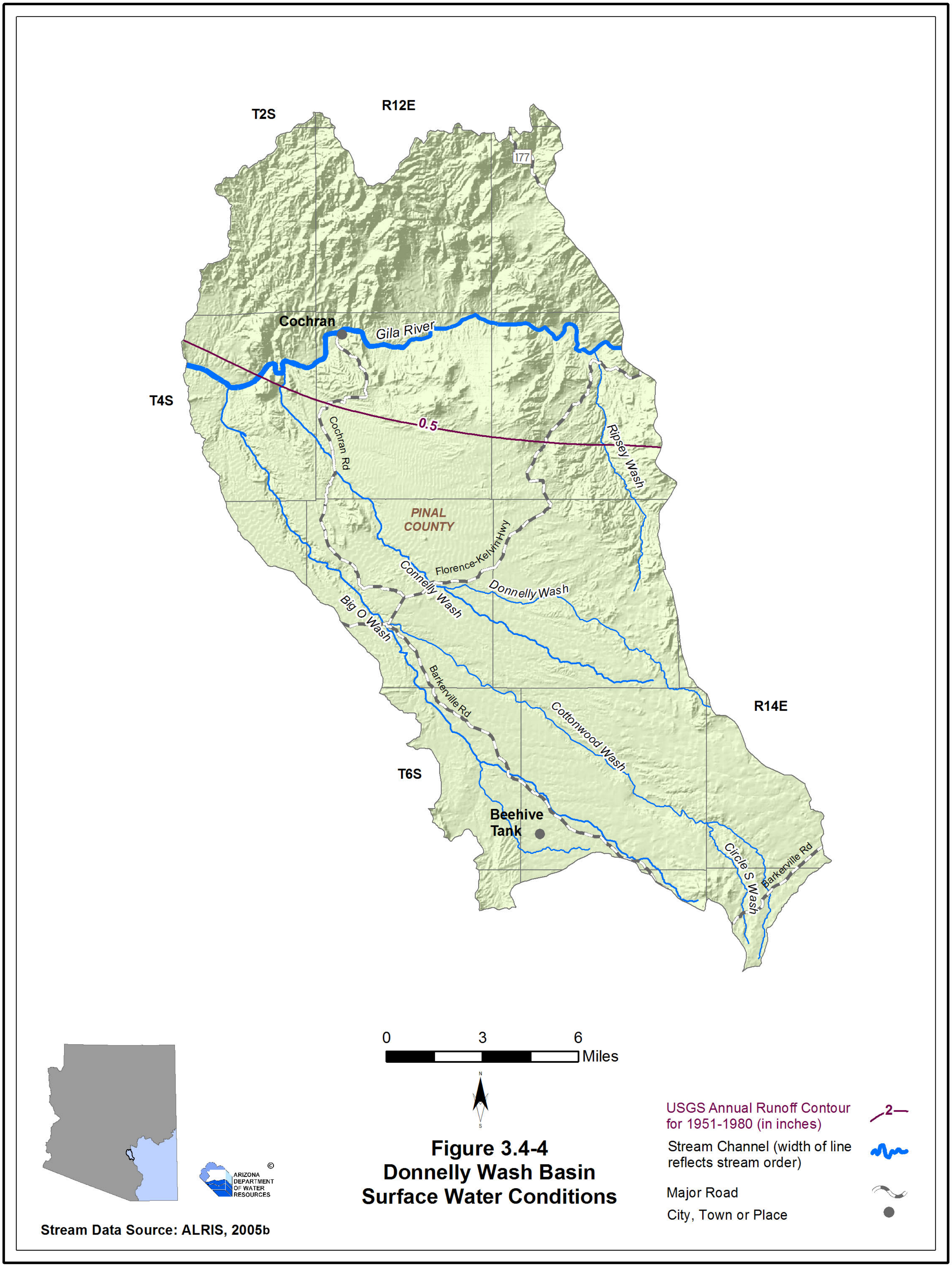


Figure 3.4-4
Donnelly Wash Basin
Surface Water Conditions

3.4.5 Perennial/Intermittent Streams and Major Springs in the Donnelly Wash Basin

The locations of perennial and intermittent streams are shown on Figure 3.4-5. There are no identified major or minor springs in this basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are two perennial streams in this basin, the Gila River and Box Canyon. Flow in the Gila River is controlled by releases from Coolidge Dam to meet legal obligations.
- There are a number of intermittent streams in the northern portion of the basin.
- The total number of springs identified by the USGS varies from 12 to 14, depending on the database reference.

Table 3.4-2 Springs in the Donnelly Wash Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)	Date Discharge Measured
	Latitude	Longitude		
None identified by ADWR at this time				

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 12 to 14

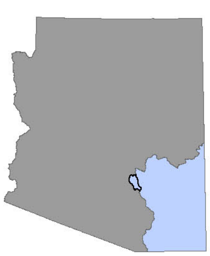


Figure 3.4-5
Donnelly Wash Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

Stream Data Source: AGFD, 1993 & 1997; Brown and Carmony, 1981

3.4.6 Groundwater Conditions of the Donnelly Wash 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 3.4-3. Figure 3.4-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.4-7 contains hydrographs for selected wells shown on Figure 3.4-6. Figure 3.4-8 shows well yields in three 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 3.4-3 and Figure 3.4-6.
- The major aquifer in the basin is a narrow strip of basin fill.
- Flow direction is from the southeast to the northwest.

Well Yields
- Refer to Table 3.4-3 and Figure 3.4-8.
- As shown on Figure 3.4-8 well yields in this basin range from less than 100 gallons per minute (gpm) to 1,000 gpm.
- One source of well yield information, based on four reported wells, indicates that the median well yield in this basin is 62.5 gpm.

Natural Recharge
- Refer to Table 3.4-3.
- The natural recharge estimate for this basin is 3,000 acre-feet per year (AFA).

Water in Storage
- Refer to Table 3.4-3.
- There are three storage estimates for this basin, ranging from 140,000 acre-feet to 2.0 million acre-feet to a depth of 1,200 feet.

Water Level
- Refer to Figure 3.4-6. Water level is shown for a well measured in 2003-2004.
- The only 2003-2004 recorded water level in the basin is 35 feet northwest of Beehive Tank. A hydrograph corresponding to this well is shown in Figure 3.4-7.

Table 3.4-3 Groundwater Data for the Donnelly Wash Basin

Basin Area, in square miles:	293	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
	Range 3 - 2,600 Median 62.5 (4 wells reprted)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 0 - 500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet:	3,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	140,000 (to 1,200 ft)	ADWR (1994b)
	<1,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	2,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	0	
Date of Last Water-level Sweep:	1996 (25 wells measured)	

Notes:
[1]Predevelopment Estimate

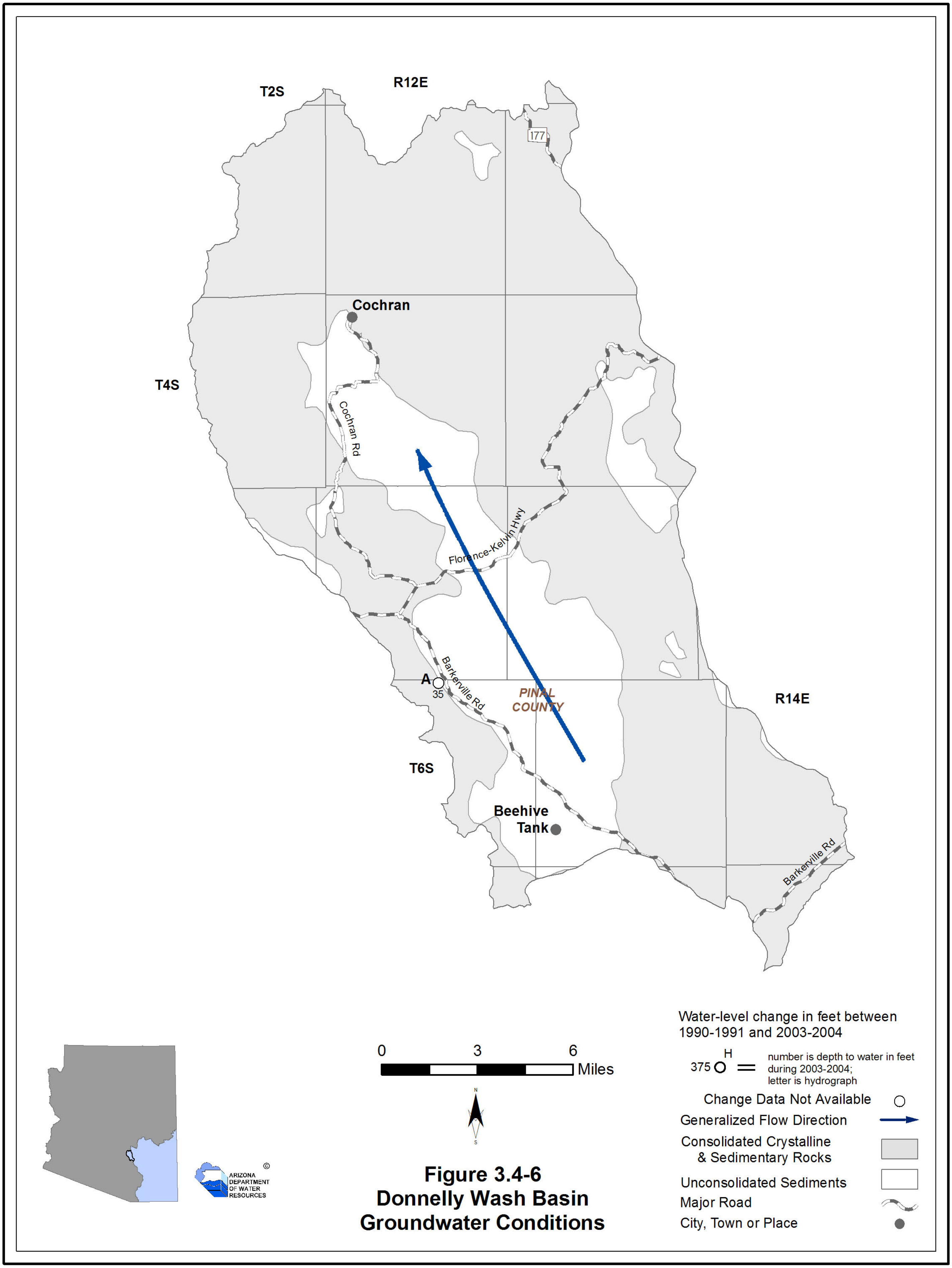
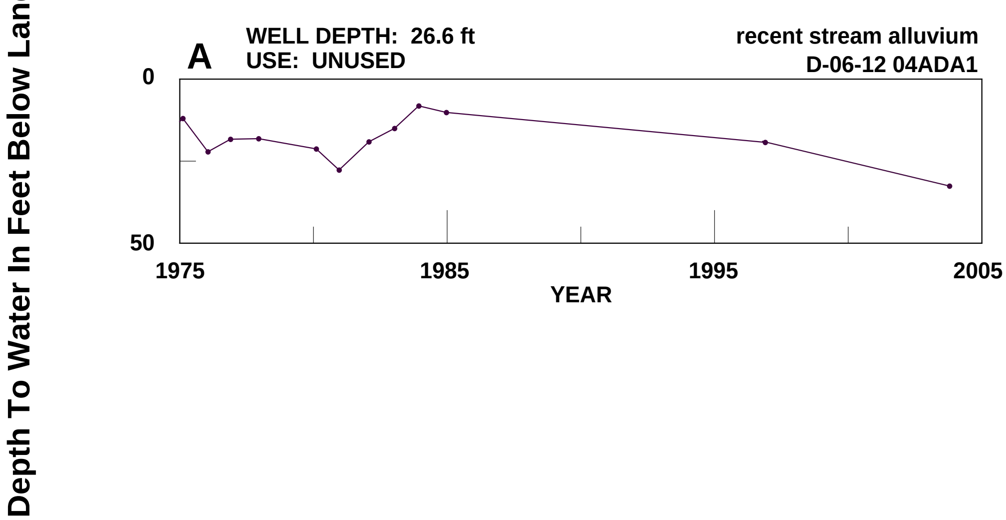


Figure 3.4-6
Donnelly Wash Basin
Groundwater Conditions

Figure 3.4-7
Donnelly Wash Basin
Hydrographs Showing Depth to Water in Selected Wells



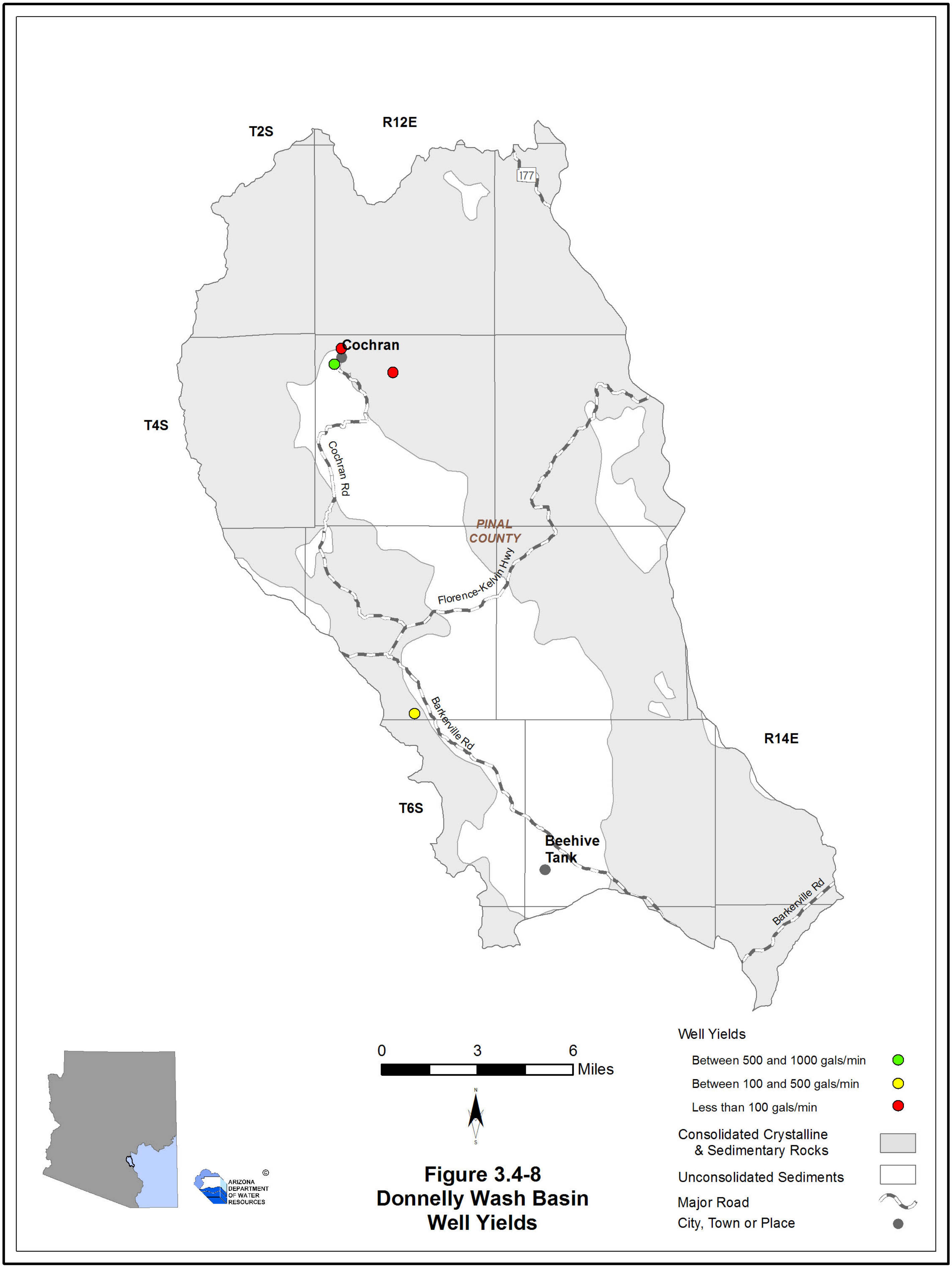


Figure 3.4-8
Donnelly Wash Basin
Well Yields

3.4.7 Water Quality of the Donnelly Wash Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.4-4A. There are no data on impaired lakes and streams in this basin. Figure 3.4-9 shows the location of exceedences keyed to Table 3.4-4A. A description of water quality data sources and methods is found in Volume 1, Appendix A. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.4-4A.
- Five sites have parameter concentrations that have equaled or exceeded DWS.
- Equaled or exceeded parameters include arsenic, fluoride and nitrates.

Table 3.4-4 Water Quality Exceedences in the Donnelly Wash Basin[1]

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	3 South	12 East	24	As
2	Spring	4 South	12 East	31	F
3	Spring	4 South	13 East	9	F
4	Well	5 South	13 East	7	NO3
5	Well	7 South	14 East	5	NO3

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:
Because of map scale feature locations may appear different than the location indicated on the table
[1] Water quality samples collected between 1996 and 2000.
[2] As = Arsenic
F = Fluoride
NO3 = Nitrate

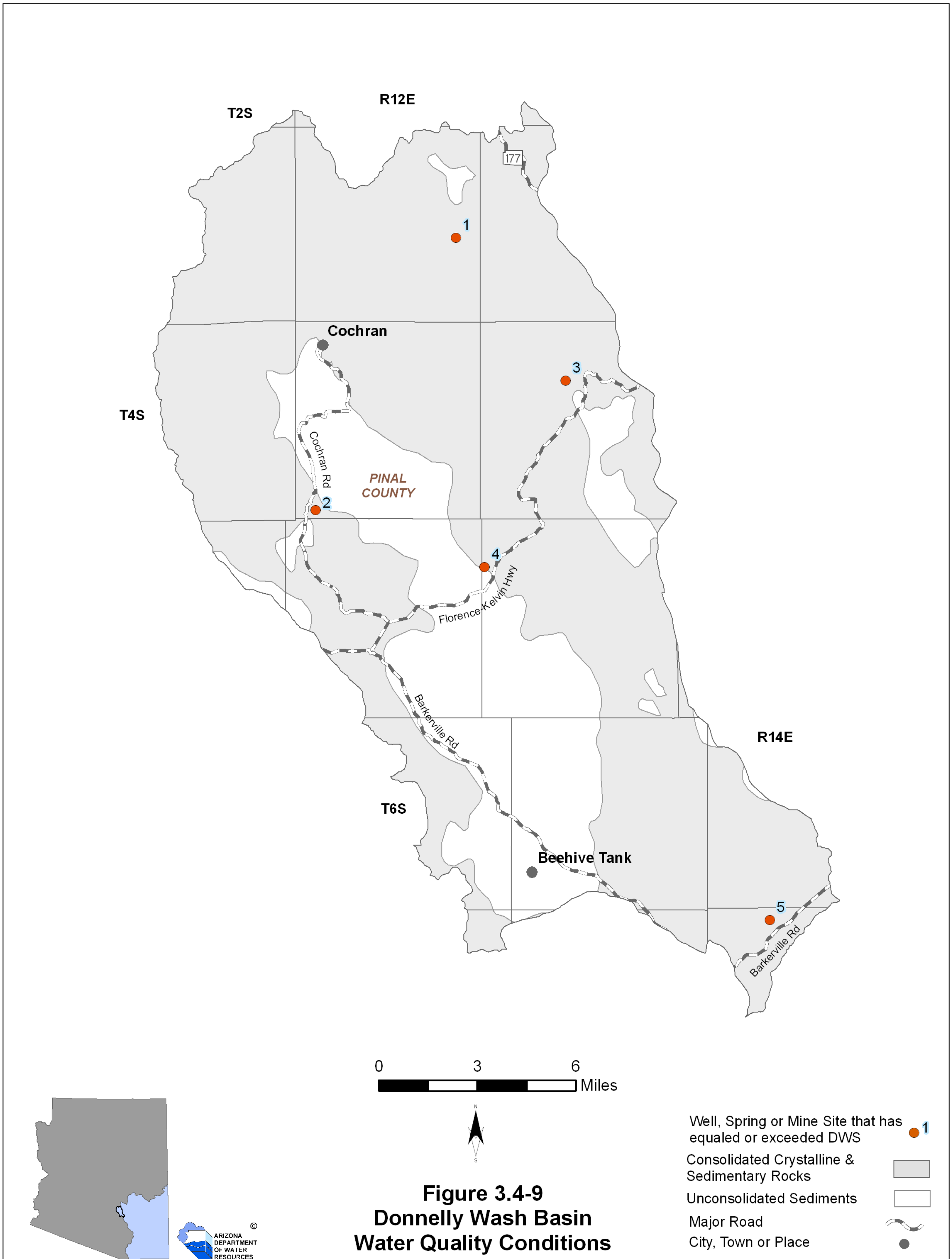


Figure 3.4-9
Donnelly Wash Basin
Water Quality Conditions

3.4.8 Cultural Water Demand in the Donnelly Wash 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 3.4-5. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the source of cultural demand map data, showed no demand centers for this basin. 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.4-5.
- Population in this basin is small, with 165 residents in 2000.
- Groundwater pumping remained constant from 1971 to 2005 with less than 300 AFA.
- All water use in this basin is groundwater, there are no recorded surface-water diversions.
- Municipal demand is the only water demand in this basin.
- As of 2005 there were 140 registered wells with a pumping capacity of less than or equal to 35 gpm and six wells with a pumping capacity of more than 35 gpm.

Table 3.4-5 Cultural Water Demand in the Donnelly Wash Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">85[2]</td><td rowspan="10">3[2]</td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a) USGS (2007)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>27</td></tr>
<tr><td>1981</td><td>35</td><td rowspan="5">13</td><td rowspan="5">2</td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>43</td></tr>
<tr><td>1983</td><td>52</td></tr>
<tr><td>1984</td><td>60</td></tr>
<tr><td>1985</td><td>68</td></tr>
<tr><td>1986</td><td>76</td><td rowspan="5">3</td><td rowspan="5">1</td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>85</td></tr>
<tr><td>1988</td><td>93</td></tr>
<tr><td>1989</td><td>101</td></tr>
<tr><td>1990</td><td>109</td></tr>
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<tr><td>1992</td><td>120</td></tr>
<tr><td>1993</td><td>126</td></tr>
<tr><td>1994</td><td>132</td></tr>
<tr><td>1995</td><td>137</td></tr>
<tr><td>1996</td><td>143</td><td rowspan="5">15</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>148</td></tr>
<tr><td>1998</td><td>154</td></tr>
<tr><td>1999</td><td>159</td></tr>
<tr><td>2000</td><td>165</td></tr>
<tr><td>2001</td><td>169</td><td rowspan="5">16</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>173</td></tr>
<tr><td>2003</td><td>177</td></tr>
<tr><td>2004</td><td>181</td></tr>
<tr><td>2005</td><td>185</td></tr>
<tr><td>2010</td><td>205</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>245</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>285</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>140</td><td>6</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through June 1980.

3.4.9 Water Adequacy Determinations in the Donnelly Wash 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 3.4-6. Figure 3.4-10 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- One water adequacy determination for 59 lots has been made in this basin through December 2008.
- The reason for a determination of inadequacy is unknown at this time because the Department was unable to locate records.

Table 3.4-6 Adequacy Determinations in the Donnelly Wash Basin[1]

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	Western Sky Airpark	Pinal	5 South	13 East	17	59	22-400718	Inadequate	D	07/07/02	Mescal Lakes Water Systems, Inc.

Source: ADWR 2008

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 unavailable; 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

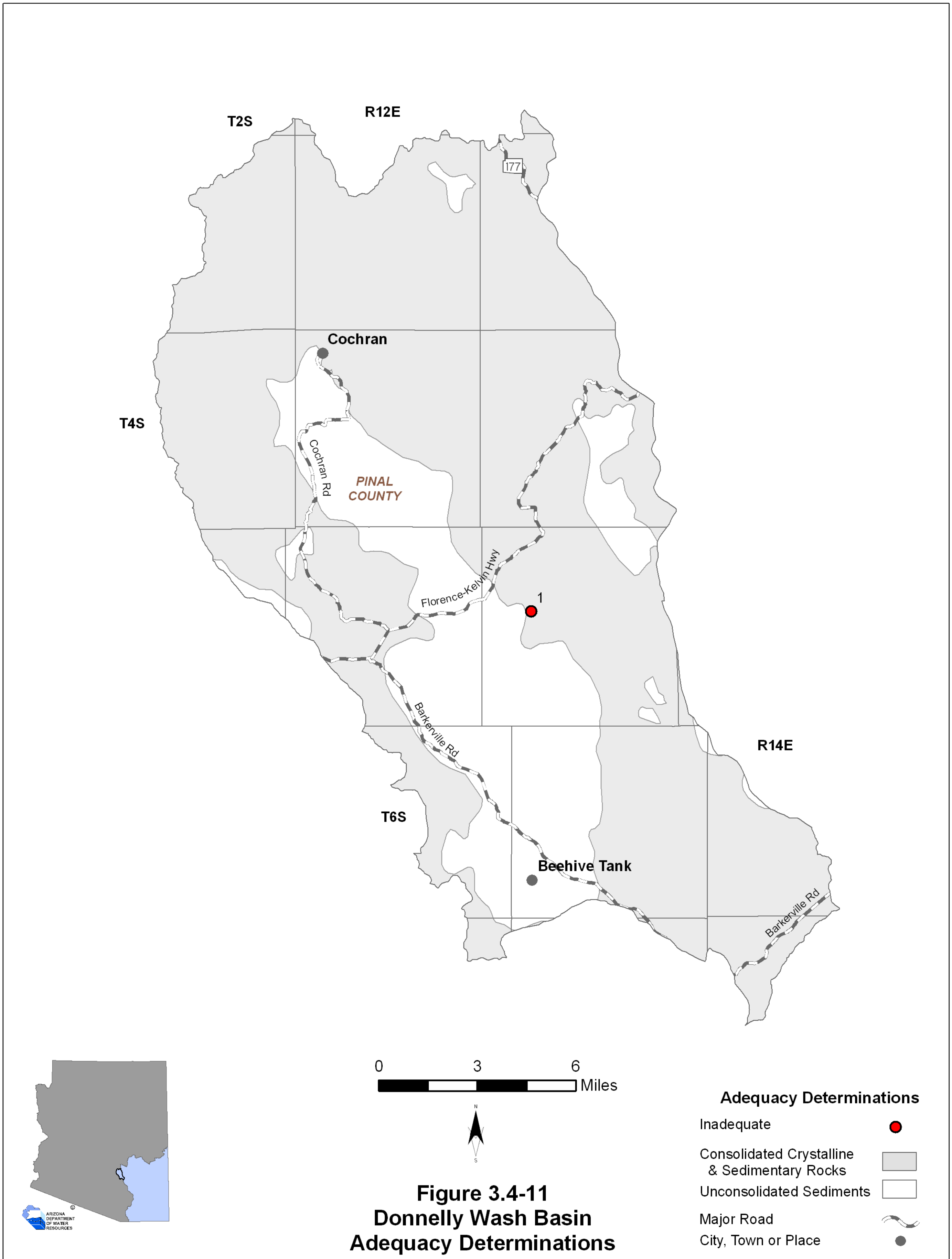

Figure 3.4-11
Donnelly Wash Basin
Adequacy Determinations

DONNELLY WASH BASIN
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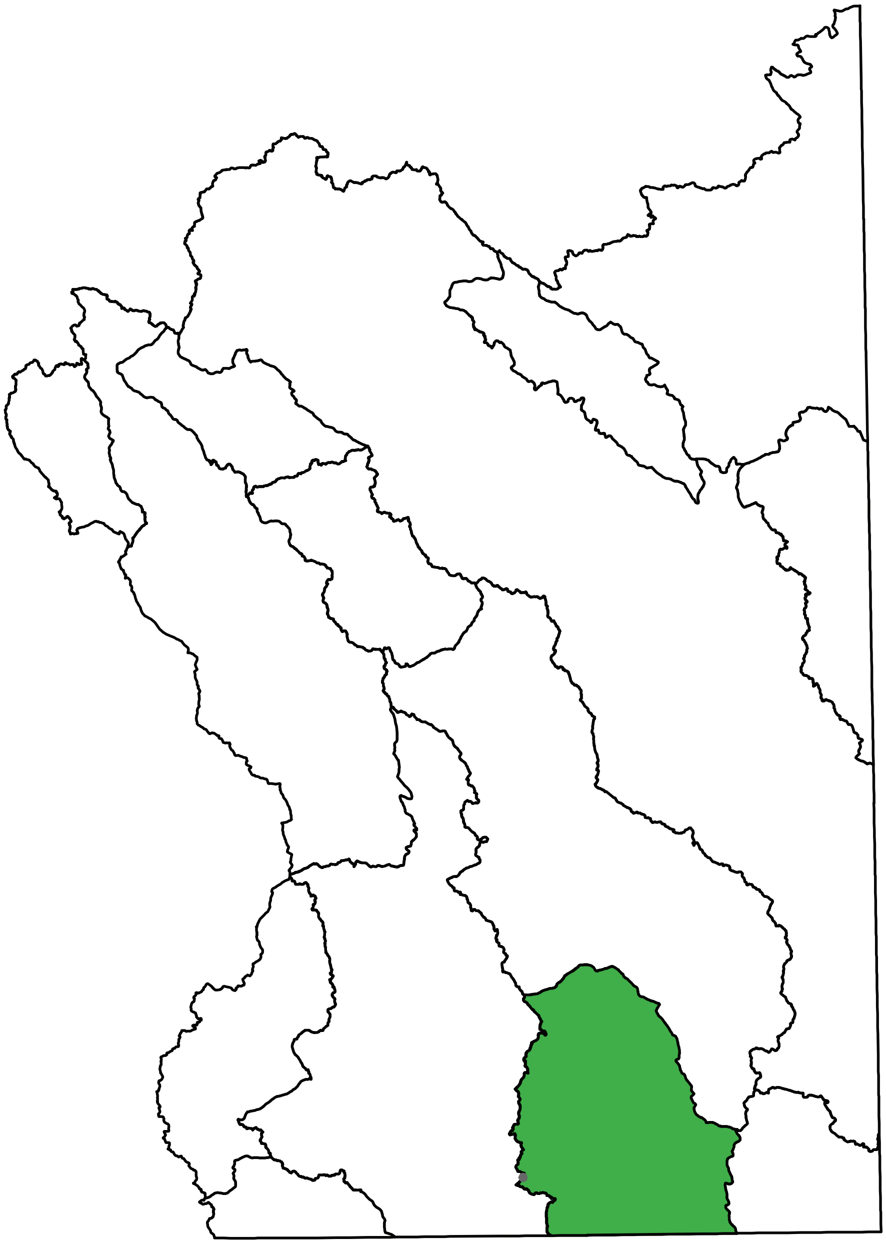
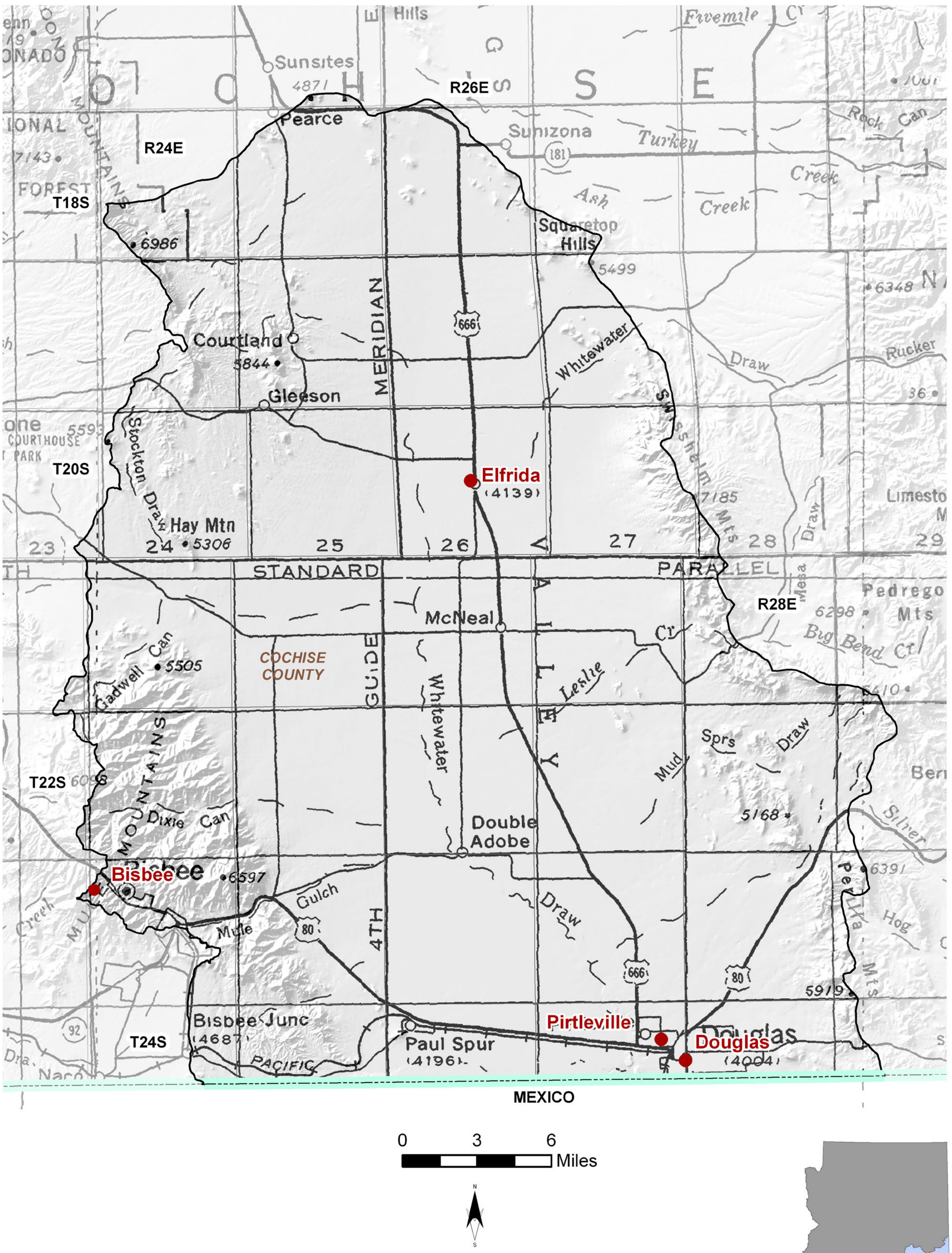
Section 3.5
Douglas Basin



3.5.1 Geography of the Douglas Basin

The Douglas Basin is a medium-size, 949 square mile basin located in the southern portion of the planning area. Geographic features and principal communities are shown on Figure 3.5-1. The basin is characterized by a large valley, the Sulphur Springs Valley, running north-south down the center of the basin. Vegetation is primarily semi-desert grassland with smaller areas of Chihuahuan desertscrub. (see Figure 3.0-9) Riparian vegetation includes cottonwood/willow along Leslie Creek.

- Principal geographic features shown on Figure 3.5-1 are:
  - Whitewater Draw running north-south down the center of the basin to Douglas
  - Mule Mountains along the southwestern basin boundary near Bisbee
  - Perilla Mountains east of Douglas and the Swisshelm Mountains east of Elfrida
  - The southern end of the Dragoon Mountains are northwest of Elfrida, which include the highest point in the basin at 6,986 feet
  - The lowest point in the basin at 4,100 feet in the Sulphur Springs Valley located near Pirtleville.



International Boundary
City, Town or Place

Figure 3.5-1
Douglas Basin
Geographic Features

ARIZONA DEPARTMENT OF WATER RESOURCES

Base Map: USGS 1:500,000, 1981

3.5.2 Land Ownership in the Douglas Basin

Land ownership, including the percentage of ownership in each category, is shown for the Douglas Basin in Figure 3.5-2. Principal features of land ownership in this basin are the significant amount of private land interspersed with state trust lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

Private
- 62.6% of the land is held privately.
- The largest concentration of private land is along Highway 191, the major route through the basin.
- This basin contains the largest percentage of private land ownership of any basin in the planning area.
- Primary land uses are farming, domestic, commercial and mining.

State Trust
- 32.1% of the land in this basin is held in trust for public schools and 13 other beneficiaries under the State Trust Land system.
- State land ownership in this basin is relatively fragmented.
- Primary land use is grazing.

U.S. Bureau of Land Management (BLM)
- 3.8% of land is federally owned and managed by the Safford Office of the BLM.
- BLM lands are interspersed throughout the private and state owned lands in this basin and there is little continuity.
- Primary land use is grazing.

National Forest
- 0.7% of land is federally owned and managed by the United States Forest Service (USFS).
- All forest lands in the basin are in the Douglas Ranger District of the Coronado National Forest.
- Primary land uses are recreation, grazing and timber production.

Wildlife Refuge
- 0.4% of land is federally owned and managed by the U.S. Fish and Wildlife Service (USFWS).
- All USFWS lands are within the Leslie Canyon National Wildlife Refuge. The refuge also includes private and state trust lands.
- Primary land uses are wildlife protection and recreation.

Other
- 0.4% of land is state owned and managed by the Arizona Game and Fish Department.

- All Game and Fish lands are within the Whitewater Draw Wildlife Area.
- Primary land uses are wildlife protection and recreation.

U.S. Military

- 0.1% of the land is federally owned and managed by the U.S. Military.
- Primary land use is for military activities.

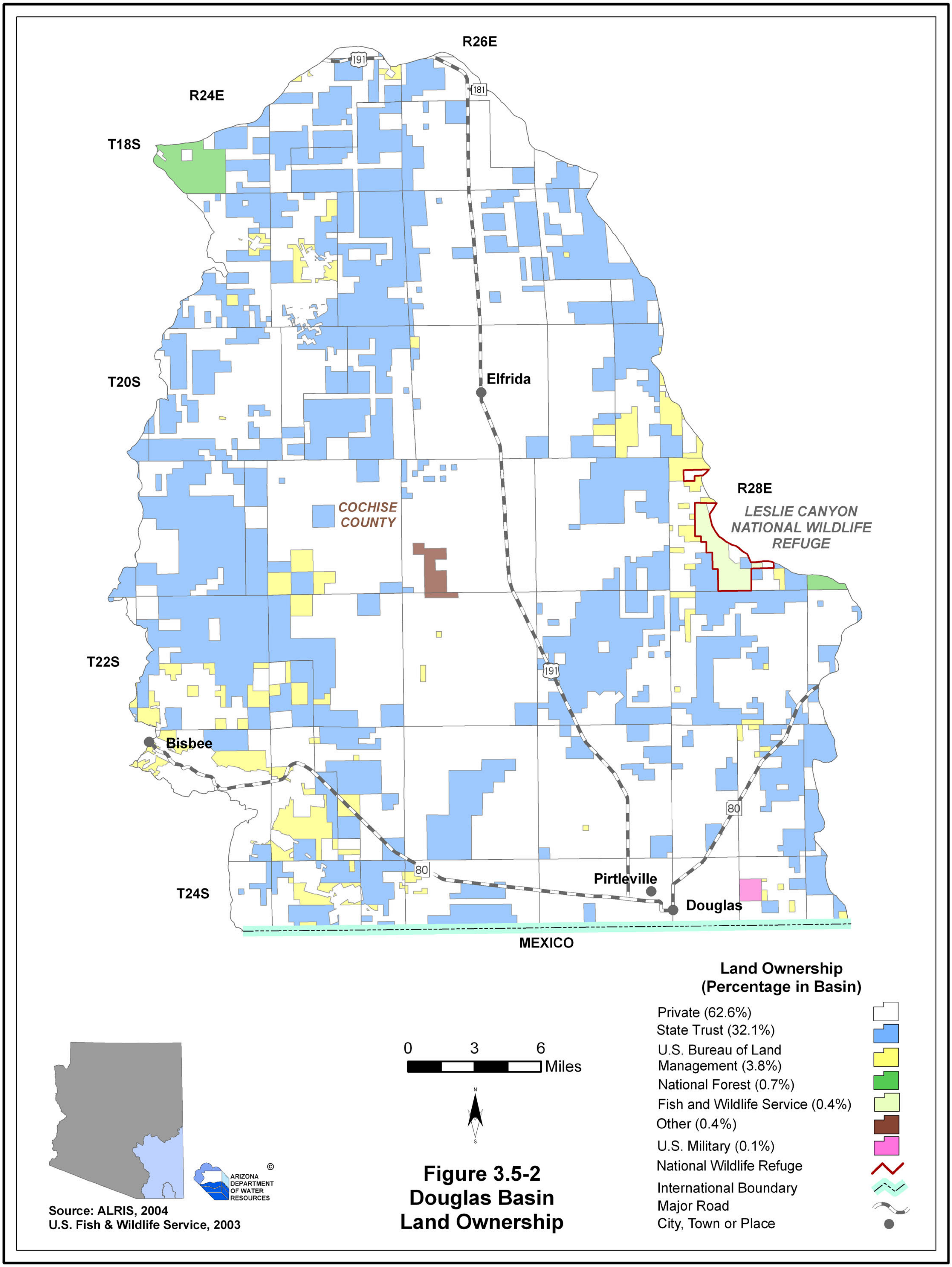


Figure 3.5-2
Douglas Basin
Land Ownership

3.5.3 Climate of the Douglas Basin

Climate data from NOAA/ NWS Co-op Network stations are complied in Table 3.5-1 and their locations are shown on Figure 3.5-3. Figure 3.5-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Douglas Basin does not contain Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.5-1.
- There are four NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July and ranges from 76.5°F at Bisbee to 80.4°F at Douglas Smelter. The average monthly minimum occurs in December and is about 46°F for all four stations.
- Highest average seasonal rainfall occurs in the summer (July - September). For the period of record used, the highest annual rainfall is 22.75 inches at Bisbee and the lowest is 13.76 inches at Douglas FAA AP.

SCAS Precipitation Data

- See Figure 3.5-3
- Additional annual precipitation data shows rainfall as high as 26 inches at the Mule Mountains, north of the town of Bisbee, and as low as 10 inches at the Sulphur Springs Valley in the vicinity of Elfrida.

Table 3.5-1 Climate Data for the Douglas Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Bisbee	5,350	1892-1985[1]	76.5/Jul	45.8/Jan	4.94	1.66	10.54	5.62	22.75
Douglas	4,040	1948-2004[1]	79.3/Jul	45.9/Dec	2.16	1.56	8.51	3.12	15.36
Douglas FAA AP	4,100	1971-2000	79.0/Jul	45.8/Jan	1.85	1.16	7.65	3.10	13.76
Douglas Smelter	3,970	1903-1973[1]	80.4/Jul	45.5/Jan	1.43	1.28	8.09	3.47	14.27

Source: WRCC, 2005

Notes:
FAA AP = Federal Aviation Administration Airport
[1]Average temperature for period of record shown; average precipitation from 1971-2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content (*Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								

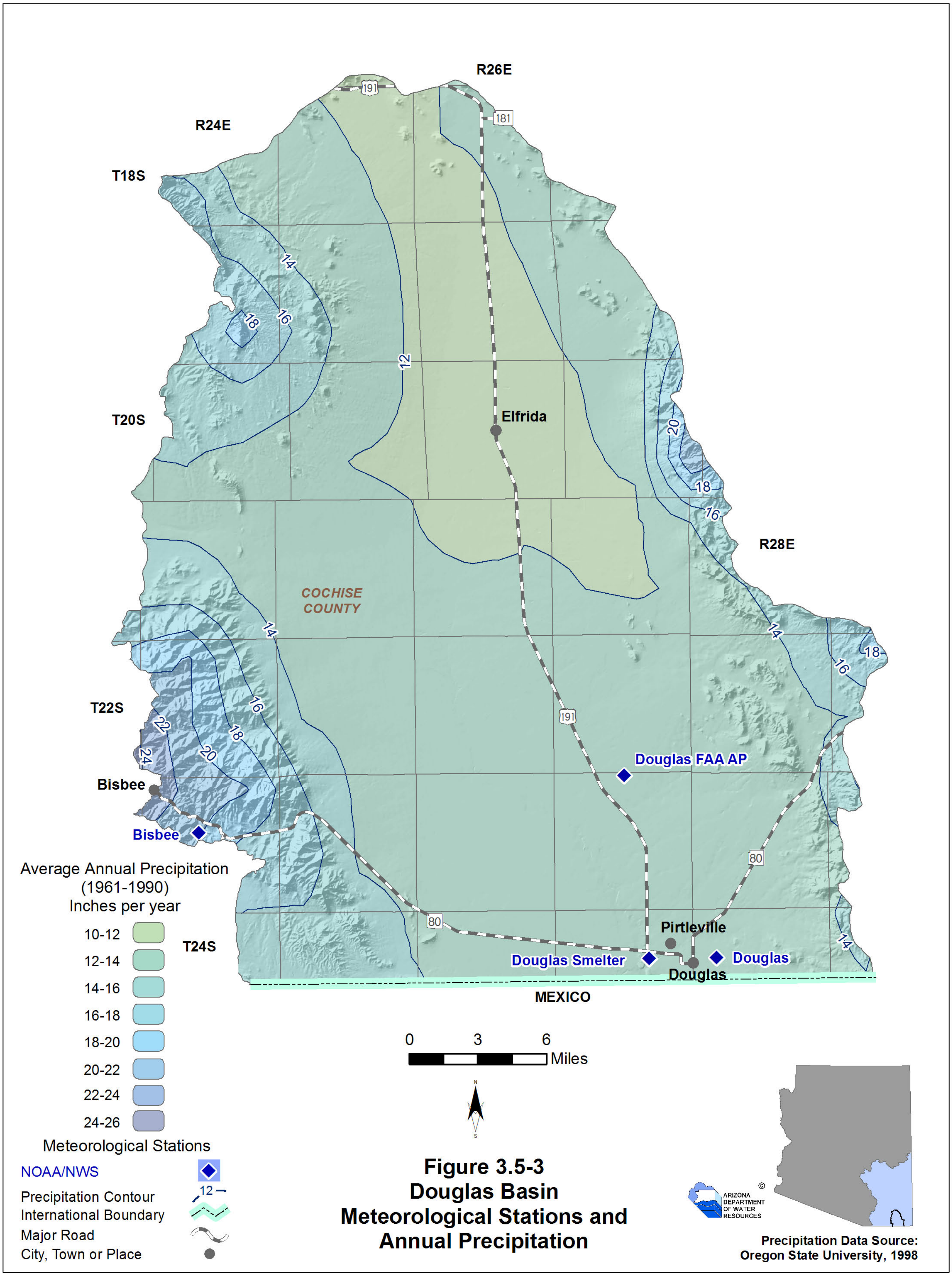


Figure 3.5-3
Douglas Basin
Meteorological Stations and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

3.5.4 Surface Water Conditions in the Douglas Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.5-2. This basin does not contain Flood ALERT equipment. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.5-3. The location of streamflow gages, using the USGS number, and USGS runoff contours are shown on Figure 3.5-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.5-2.
- Data from one real-time station located at Whitewater Draw are shown on the table and on Figure 3.5-4.
- The average seasonal flow is highest in the Summer (July-September) and lowest in the Winter (January-March) and Spring (April-June).
- Maximum annual flow was 22,304 acre-feet in 1955 and minimum annual flow was 232 acre-feet in 1980.

Reservoirs and Stockponds

- Refer to Table 3.5-3.
- Surface water is stored or could be stored in three small reservoirs in the basin.
- There are 254 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.5-4.
- Average annual runoff varies from 0.2 inches per year, or 10.66 acre-feet per square mile, east and north of Whitewater Draw to one inch per year, or 53.3 acre-feet per square mile, west of Whitewater Draw.

Table 3.5-2 Streamflow Data for the Douglas 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/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9537500	Whitewater Draw near Douglas, AZ	1,023	3,909	1/1912-current (real time)	2	2	89	7	232 (1980)	5,960	6,533	22,304 (1955)	46

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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

Table 3.5-3 Reservoirs and Stockponds in the Douglas Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 0
Total maximum storage: 0 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 3
Total surface area: 28 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 254 (from water right filings)

Notes:
[1]Capacity data not available to ADWR

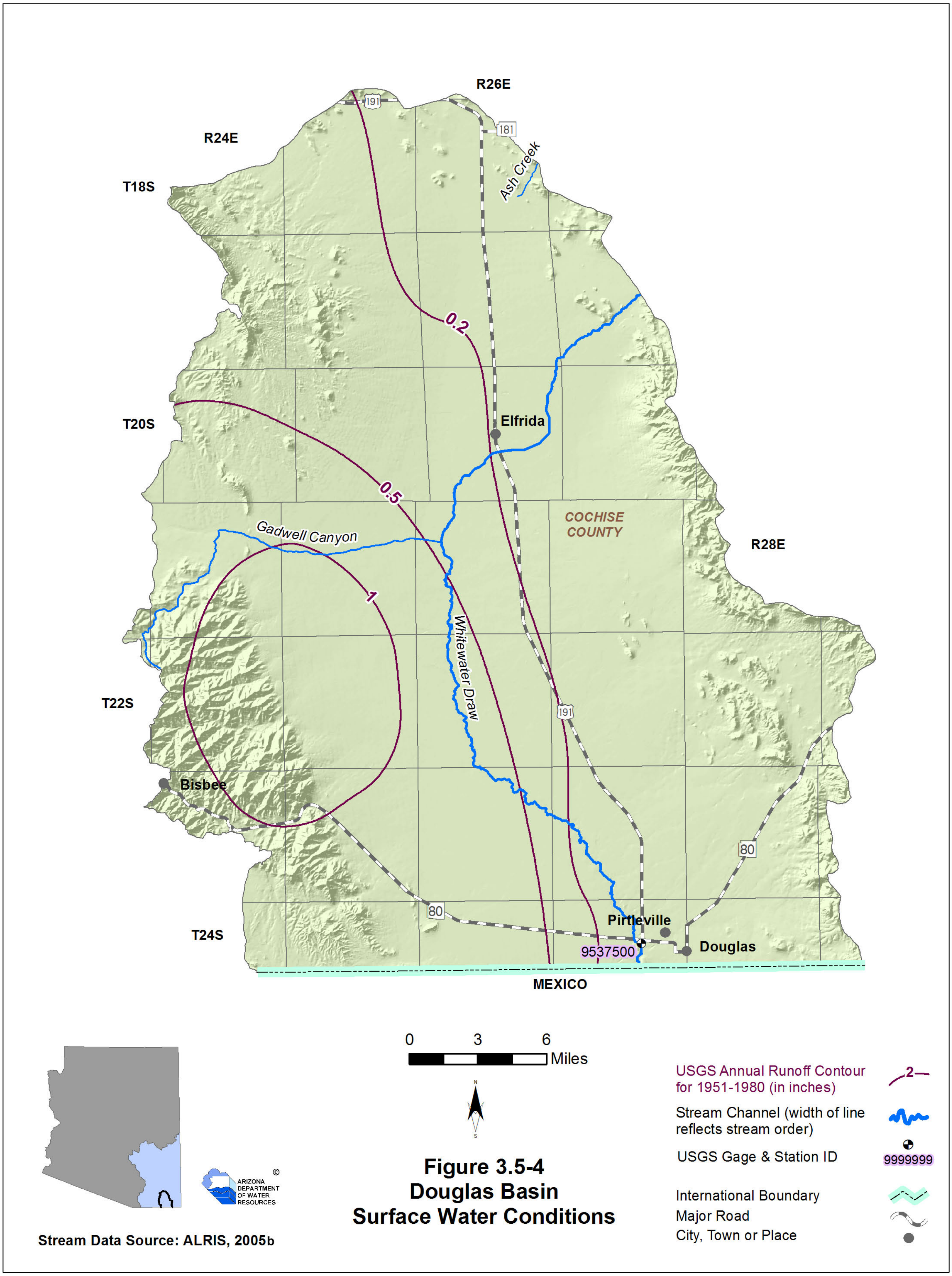


Figure 3.5-4
Douglas Basin
Surface Water Conditions

Stream Data Source: ALRIS, 2005b

3.5.5 Perennial/Intermittent Streams and Major Springs in the Douglas Basin

Minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 3.5-4. There are no major springs in this basin. The locations of perennial and intermittent streams are shown on Figure 3.5-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one perennial stream in this basin, Leslie Creek, located on the eastern boundary of the basin.
- There are six minor springs in the basin.
- Listed discharge rates may not be indicative of current conditions. All of the spring measurements were taken prior to 1982 and most were taken in 1951.
- The total number of springs identified by the USGS varies from six to ten, depending on the database reference. This is the smallest number of springs in a basin in the planning area.

Table 3.5-4 Springs in the Douglas Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed[2]	312923	1095603	4	9/20/1951
Walnut #1	314908	1095343	2	09/1951
Unnamed[2]	313149	1095604	2	9/19/1951
Unnamed[2]	313035	1095438	2	9/20/1951
Unnamed[2]	312940	1095344	2	9/20/1951
Antelope	314025	1095405	1	During or prior to 1982

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 6 to 10

Notes:
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map

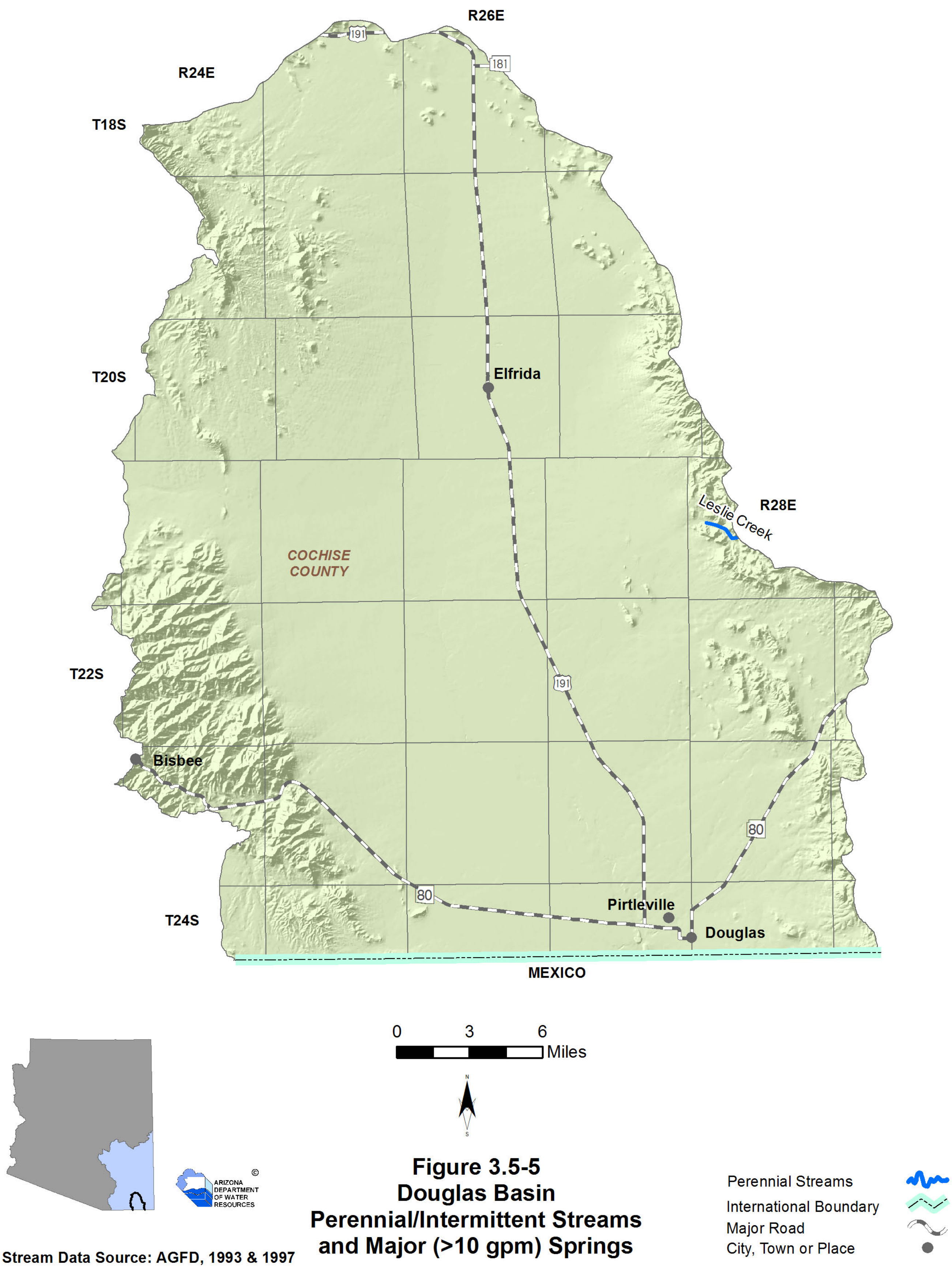


Figure 3.5-5
Douglas Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

3.5.6 Groundwater Conditions of the Douglas 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 3.5-5. Figure 3.5-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.5-7 contains hydrographs for selected wells shown on Figure 3.5-6. Figure 3.5-8 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 3.5-5 and Figure 3.5-6.
- The major aquifers in the basin are basin fill and basin fill with interbedded volcanic rock in the Douglas area.
- As seen on Figure 3.5-6, in the vicinity of Elfrida, groundwater flow directions have been altered due to agricultural pumpage.
- Flow direction is generally from north to south.

Well Yields

- Refer to Table 3.5-5 and Figure 3.5-8.
- As shown on Figure 3.5-8 well yields in this basin range from less than 100 gallons per minute (gpm) to more than 2,000 gpm.
- One source of well yield information, based on 656 reported wells, indicates that the median well yield in this basin is 600 gpm.
- In general, the highest well yields are north of Elfrida and west of Pirtleville. All well yields in the vicinity of Bisbee are less than 100 gpm.

Natural Recharge

- Refer to Table 3.5-5.
- The principal source of recharge for this basin is mountain-front precipitation.
- Natural recharge estimates range from 15,500 acre-feet per year (AFA) to 22,000 AFA.

Water in Storage

- Refer to Table 3.5-5.
- Storage estimates for this basin range from 26 million acre-feet (maf) to 32 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.5-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 27 index wells in this basin. Hydrographs for six index wells are shown in Figure 3.5-7.
- The Department measures water levels four times daily at one automated groundwater monitoring site in the basin.
- The deepest recorded water level in 2003-2004 is 337 feet north of Elfrida and the shallowest is 65 feet northwest of Pirtleville.

Table 3.5-5 Groundwater Data for the Douglas Basin

Basin Area, in square miles:	949	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
	Basin Fill with Interbedded Volcanic Rock (city of Douglas area)	
Well Yields, in gal/min:	Range 144 - 1,068 Median 717.5 (64 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 3 - 2,600 Median 600 (656 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 50 - 2,000	ADWR (1990 and 1994b)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
	Range <1,000-1,600	Rascona, ADWR (1993)
Estimated Natural Recharge, in acre-feet/year:	15,500	Anderson and Freethey (1995)
	22,000	ADWR (1994b)
	20,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	32,000,000 (to 1,200 ft)	ADWR (1994b)
	30,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	26,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	27	
Date of Last Water-level Sweep:	2004 (356 wells measured)	

Notes:
[1]Predevelopment Estimate

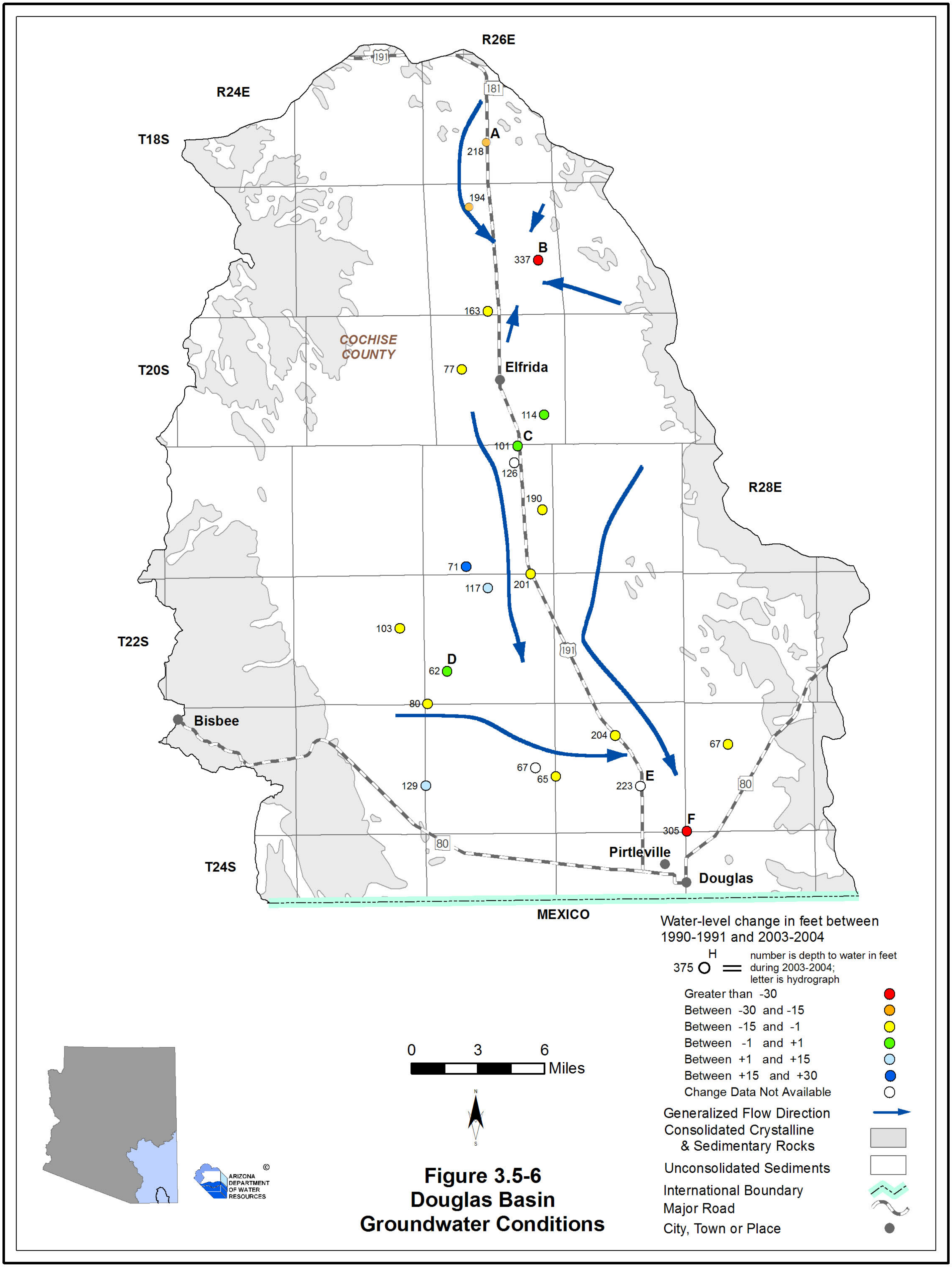


Figure 3.5-6
Douglas Basin
Groundwater Conditions

Figure 3.5-7
Douglas Basin
Hydrographs Showing Depth to Water in Selected Wells

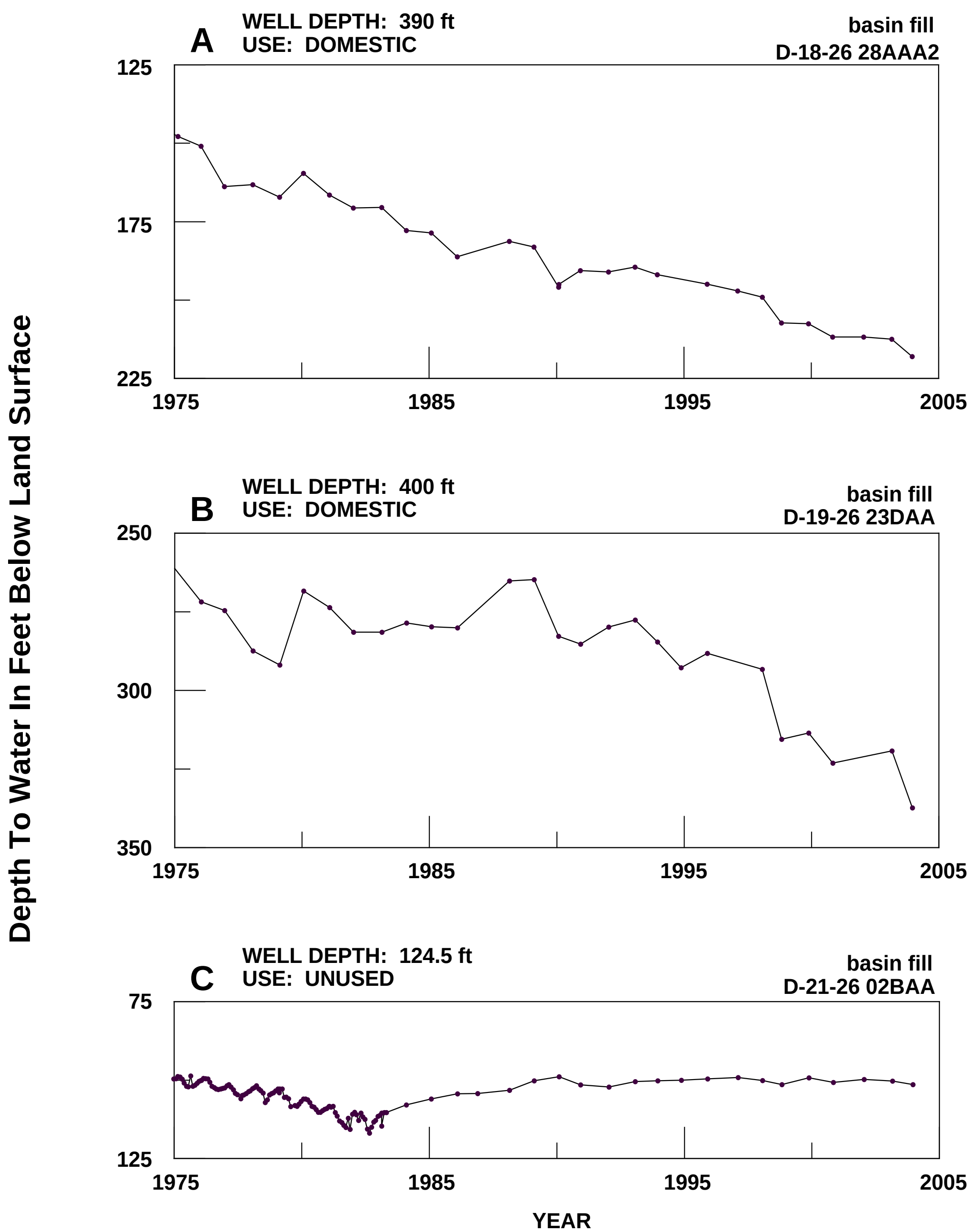
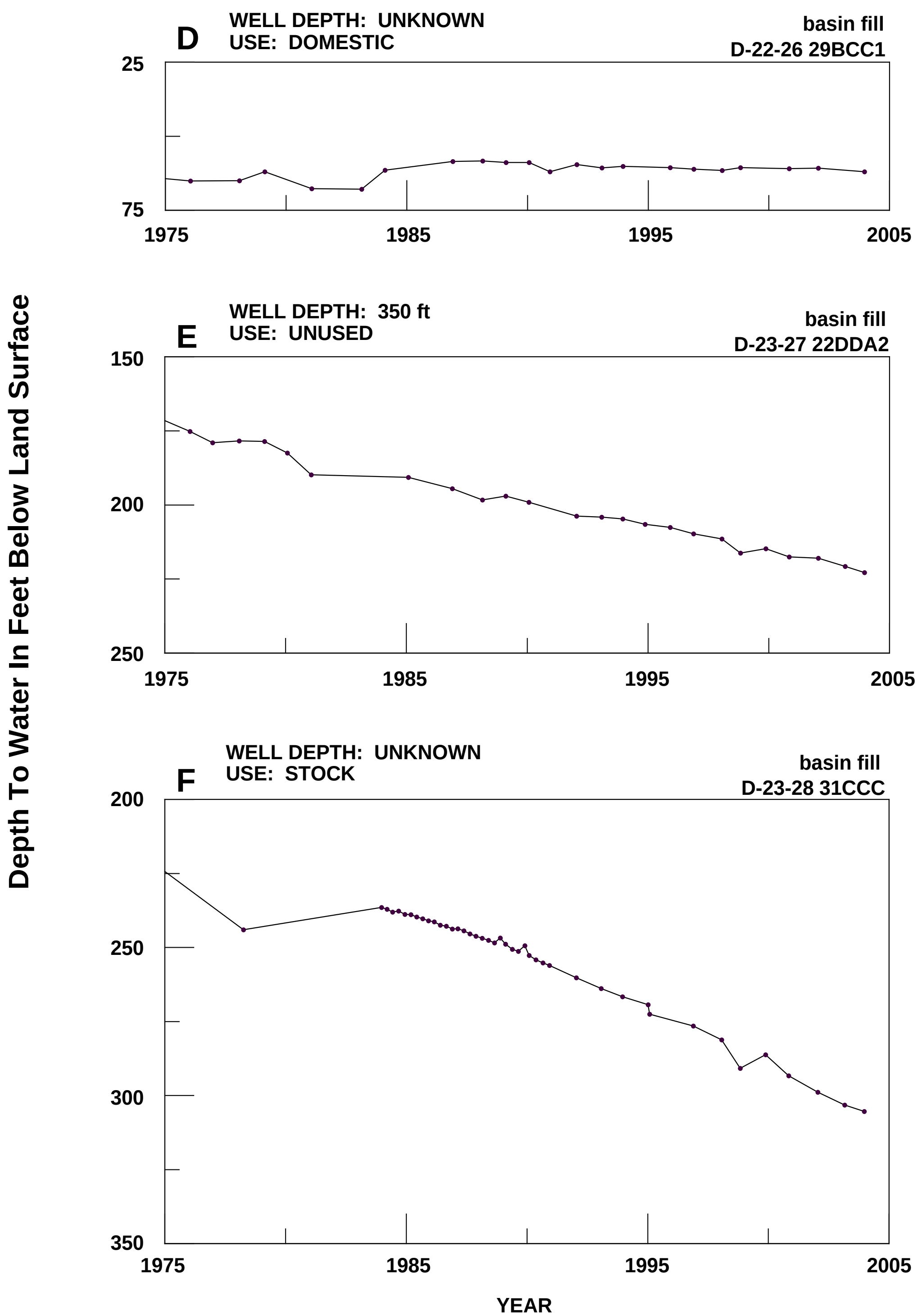


Figure 3.5-7 (Cont)
Douglas Basin
Hydrographs Showing Depth to Water in Selected Wells



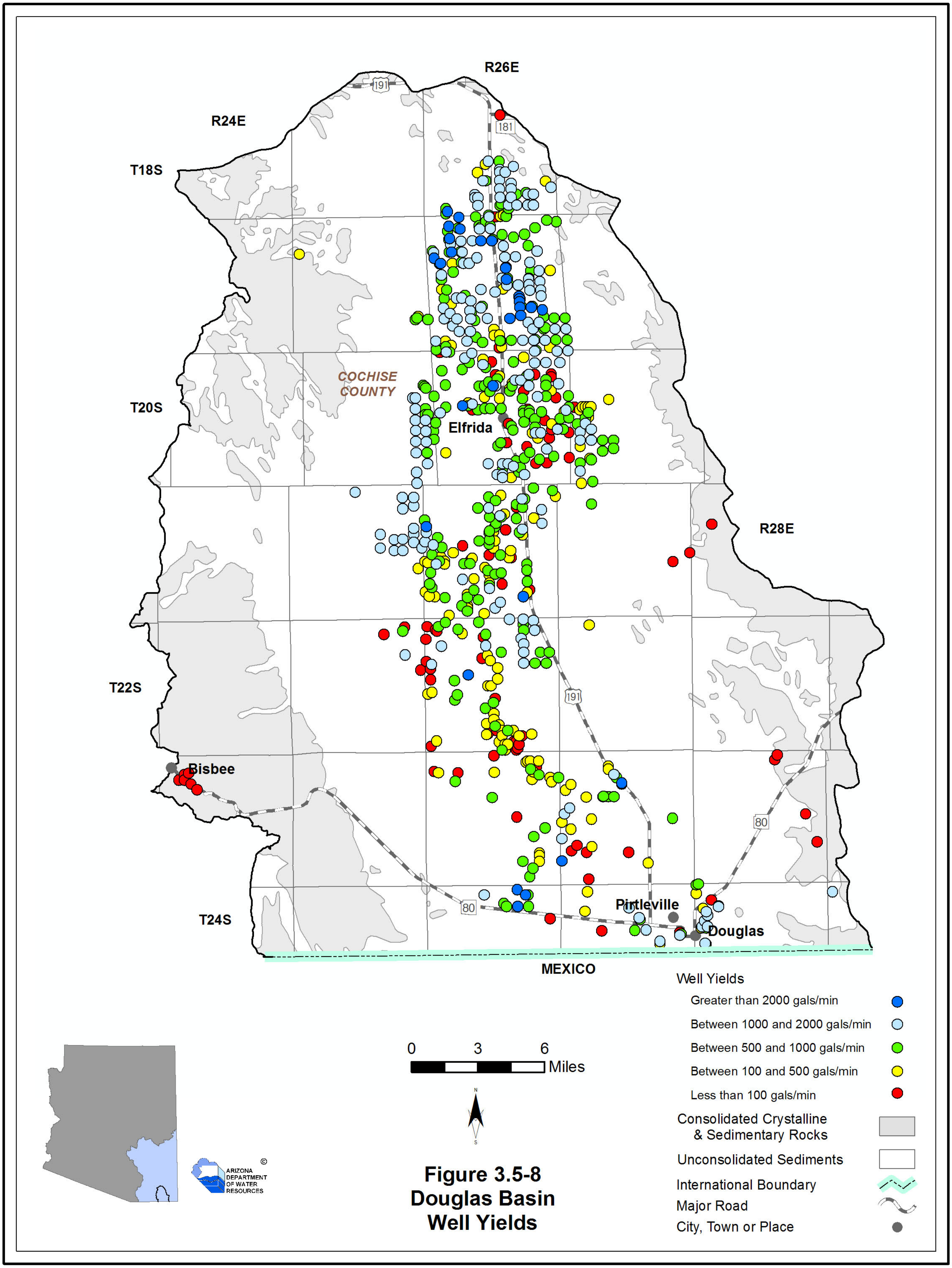


Figure 3.5-8
Douglas Basin
Well Yields

3.5.7 Water Quality of the Douglas Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.5-6A. 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 3.5-6B. Figure 3.5-9 shows the location of exceedences and impairment keyed to Table 3.5-6. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.5-6A.
- Forty-nine sites have parameter concentrations that have equaled or exceeded DWS.
- Frequently equaled or exceeded parameters include fluoride, arsenic and nitrate.

Lakes and Streams with impaired waters

- Refer to Table 3.5-6B.
- Water quality standards were exceeded in three reaches of Mule Gulch and one reach of Brewery Gulch.
- The parameter exceeded in every reach was copper. Other parameters exceeded included cadmium, zinc and pH levels.
- All impaired stream reaches in this basin are part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. In all four stream reaches modeling has been completed, but additional sampling is needed to create the final TMDL report.

Effluent Dependent Reaches

- See Figure 3.5-9
- In 2005 Mule Gulch, in the vicinity of Bisbee was an effluent dependent reach. Currently effluent is treated at the San Jose WWTP and discharged to Greenbrush Draw.

Table 3.5-6 Water Quality Exceedences in the Douglas Basin[1]

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	18 South	25 East	2	As, F
2	Well	18 South	25 East	26	F
3	Well	18 South	26 East	25	F
4	Well	18 South	26 East	32	F
5	Well	18 South	26 East	33	F
6	Well	18 South	26 East	33	F
7	Well	18 South	26 East	34	F
8	Well	18 South	26 East	35	F
9	Well	18 South	26 East	35	F
10	Well	19 South	24 East	25	NO3
11	Well	19 South	26 East	3	NO3
12	Well	19 South	26 East	3	F
13	Well	19 South	26 East	3	F
14	Well	19 South	26 East	4	F
15	Well	19 South	26 East	5	F
16	Well	19 South	26 East	7	F
17	Well	19 South	26 East	7	As, F
18	Well	19 South	26 East	8	F
19	Well	19 South	26 East	8	F
20	Well	19 South	26 East	8	F
21	Well	19 South	26 East	8	F
22	Well	19 South	26 East	18	F
23	Well	19 South	26 East	18	F
24	Well	19 South	26 East	25	F
25	Well	20 South	26 East	6	F
26	Well	20 South	26 East	6	F
27	Well	20 South	26 East	25	NO3
28	Well	20 South	27 East	9	F
29	Well	21 South	26 East	9	As, F
30	Well	21 South	26 East	18	F
31	Well	21 South	26 East	19	As, Be
32	Well	21 South	26 East	19	As
33	Well	21 South	26 East	19	As
34	Well	21 South	26 East	19	F
35	Well	21 South	27 East	29	F
36	Well	22 South	26 East	3	F
37	Well	22 South	26 East	4	F
38	Well	22 South	26 East	8	As
39	Well	22 South	27 East	5	F
40	Well	22 South	27 East	25	As
41	Well	23 South	27 East	34	As
42	Well	24 South	24 East	11	NO3
43	Well	24 South	26 East	3	As
44	Well	24 South	26 East	3	As
45	Well	24 South	26 East	5	NO3
46	Well	24 South	27 East	10	As
47	Well	24 South	27 East	10	As
48	Well	24 South	27 East	13	As
49	Well	24 South	29 East	6	As

Source: Compilation of databases from ADWR & others

Table 3.5-7 Water Quality Exceedences in the Douglas Basin (Cont)[1]

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Brewery Gulch (headwaters to Mule Gulch)	1	NA	A&W	Cu
b	Stream	Mule Gulch (above Lavender Pit to Bisbee WWTP)	1	NA	A&W	Cu, pH
c	Stream	Mule Gulch (Bisbee WWTP to Hwy 80 bridge)	4	NA	A&W	Cd, Cu, pH, Zn
d	Stream	Mule Gulch (headwaters to above Lavender Pit)	4	NA	A&W	Cu

Source: ADEQ 2005e

Notes:
Because of map scale feature locations may appear different than the location indicated on the table
NA = Not applicable
[1] Water quality samples collected between 1978 and 2002.
[2] As = Arsenic
Be = Beryllium
Cd = Cadmium
Cu = Copper
F= Fluoride
NO3 = Nitrate
pH = Measurement of acidity or alkalinity
Zn = Zinc
[3] A&W = Aquatic & Wildlife

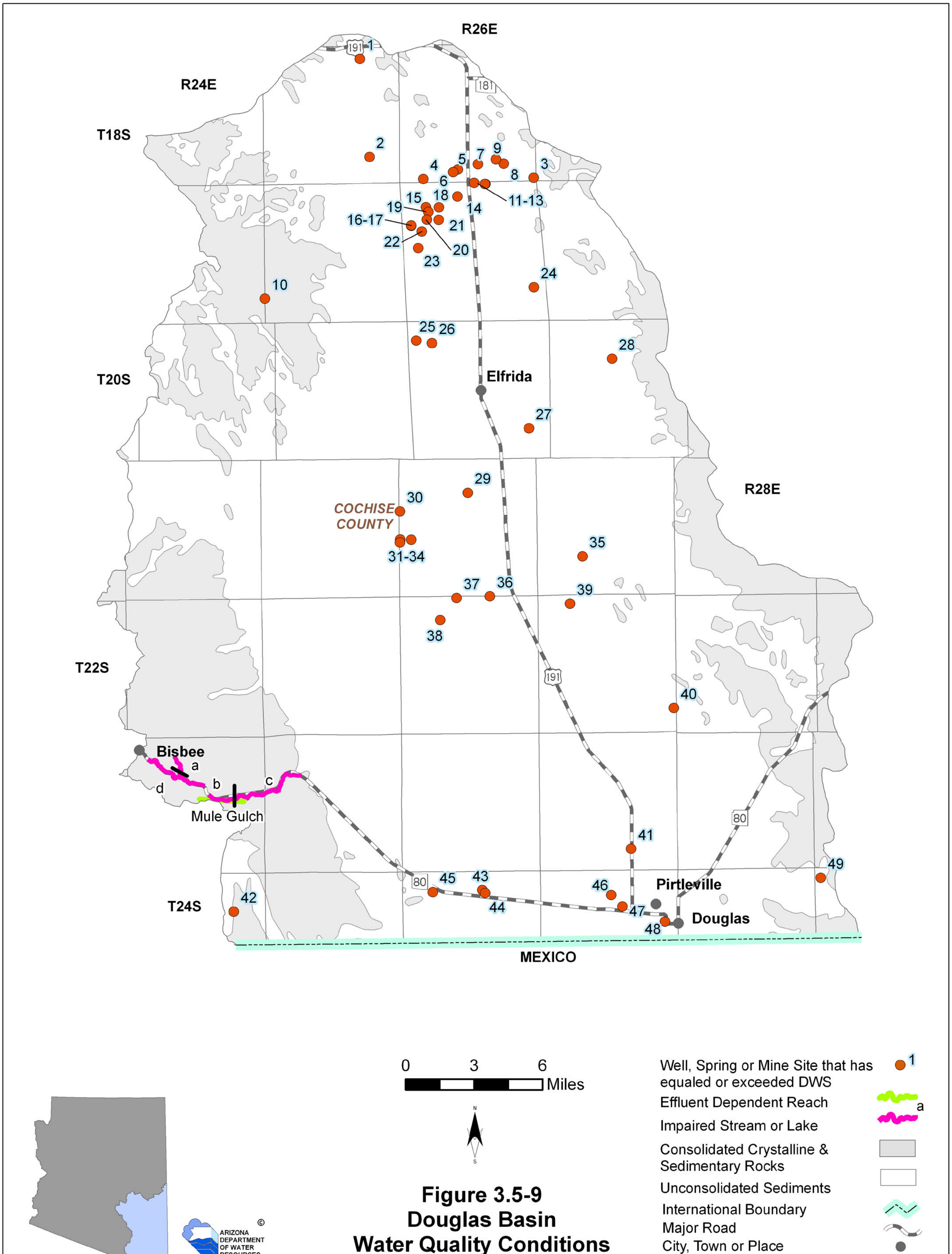


Figure 3.5-9
Douglas Basin
Water Quality Conditions

3.5.8 Cultural Water Demand in the Douglas 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 3.5-7. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.5-8. Figure 3.5-10 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.5-7 and Figure 3.5-10.
- Population increased by an average of 500 people per year between 1980 and 2000.
- All water use in this basin is groundwater and over three-fourths of the water demand in this basin is for agriculture. Total groundwater use decreased significantly in this basin from 1971 to 1990. From 1990 to 2003, however, total groundwater has increased although not to the same level as in 1971.
- The highest concentration of municipal and industrial demand is found near Douglas and Pirtleville with smaller centers north of Pirtleville along Highway 191, north of Elfrida and west of Douglas along Highway 80.
- The majority of the agricultural demand in the basin is in the vicinity of Highway 191 and north of Elfrida.
- There are large mine facilities, including the Copper Queen Mine and the Paul Spur Quarry located along Highway 80. There is, however, no recorded industrial water use in this basin after 1990.
- As of 2005 there were 1,666 registered wells with a pumping capacity of less than or equal to 35 gpm and 899 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.5-8.
- There is one wastewater treatment facility, the Douglas Wastewater Treatment Facility, located at Douglas.
- About 18,000 people are served by this facility. Almost 1,400 acre-feet of effluent per year is generated by the facility and discharged to Mexico where it is used for agricultural irrigation.

Tables 3.5-7 Cultural Water Demand in the Douglas 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		907[2]	795[2]	110,000			NR			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				90,000			NR			
1977										
1978										
1979										
1980	16,600									
1981	17,359	107	42	61,000			NR			
1982	18,119									
1983	18,878									
1984	19,637									
1985	20,397									
1986	21,156	134	22	38,000			NR			
1987	21,915									
1988	22,674									
1989	23,434									
1990	24,193									
1991	24,396	116	17	5,400	NR	32,800	NR			USGS (2007)
1992	24,598									
1993	24,801									
1994	25,004									
1995	25,207									
1996	25,409	187	8	6,200	NR	37,100	NR			
1997	25,612									
1998	25,815									
1999	26,017									
2000	26,220									
2001	26,758	215	15	5,500	NR	47,300	NR			
2002	27,296									
2003	27,834									
2004	28,372									
2005	28,911									
2010	31,609									
2020	37,790									
2030	41,800									
WELL TOTALS:		**1,666**	**899**							

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through June 1980.

Table 3.5-8 Effluent Generation in the Douglas 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	Golf Course/Turf/ Landscape	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other			
Douglas WWTF	Douglas Water & Sewer	Douglas	18,044	1,367	Mexico									Secondary	NA	1996

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: No data currently available to ADWR
WWTF: Wastewater Treatment Facility

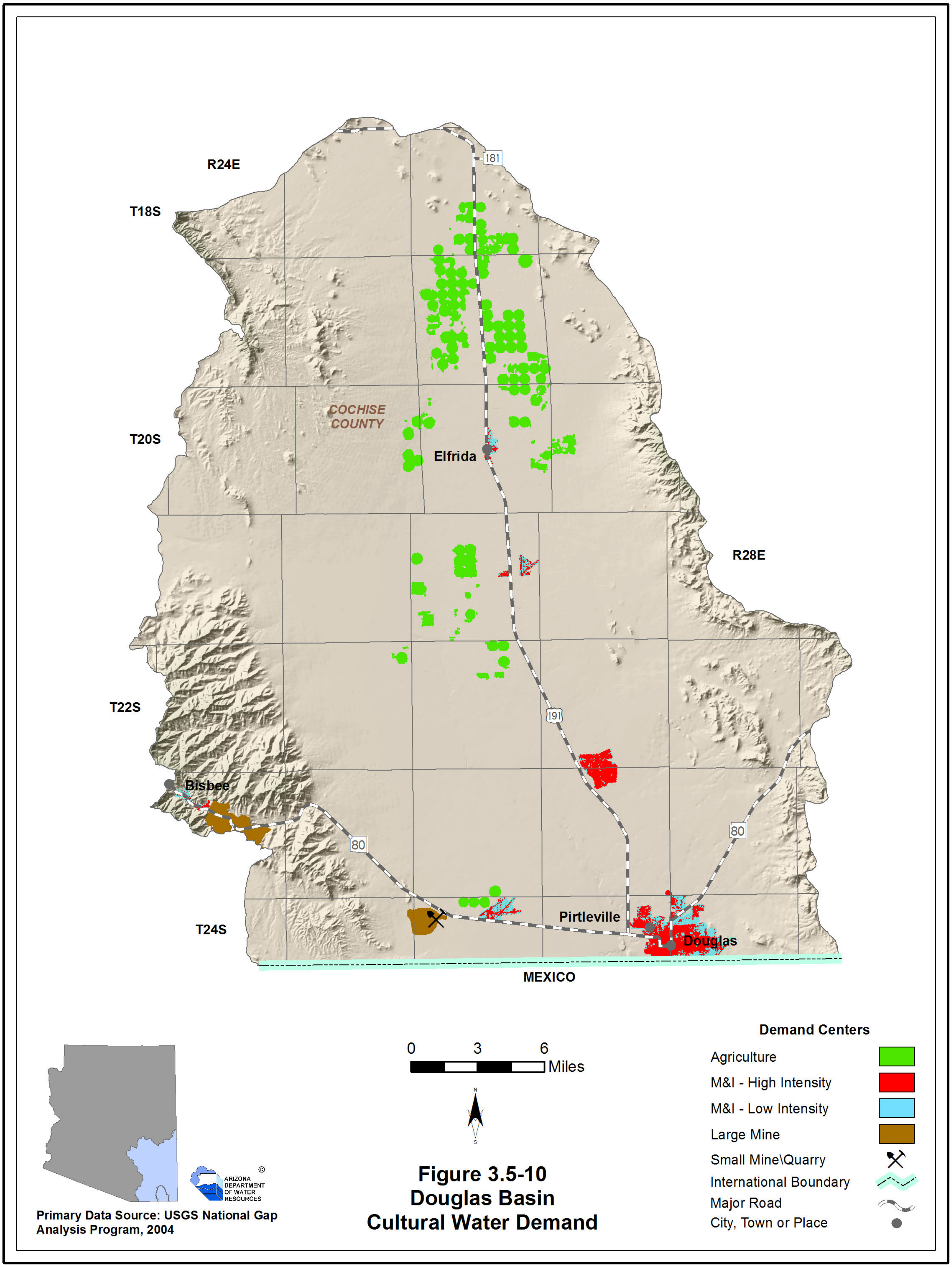


Figure 3.5-10
Douglas Basin
Cultural Water Demand

3.5.9 Water Adequacy Determinations in the Douglas 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 3.5-9A. Designated water provider information is shown in Table 3.5-9B with date of application, date the designation was issued and projected demand. Figure 3.5-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in Cochise County. Eight water adequacy determinations for 433 lots have been made in this basin through December 2008. Eighty-three lots, or 19%, were determined to be adequate.
- All determinations of inadequacy were because the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination.
- There is one designated water provider, City of Douglas, which does not have a total projected or annual estimated demand.

Table 3.5-9 Adequacy Determinations in the Douglas 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	Cochise Industrial Park	Cochise	23 South	27 East	35	22	53-500477	Adequate		8/11/1981	Dry Lot Subdivision
2	El Dorado Suites (A Condominium Project)	Cochise	23 South	24 East	9	12	53-700231	Adequate		3/22/2007	AWC-Bisbee system
3	Harbour Property	Cochise	21 South	26 East	2	33	53-500774	Adequate		2/4/1982	Dry Lot Subdivision
4	Pueblo Court Condominiums	Cochise	23 South	24 East	7	10	53-501214	Inadequate	A1	2/4/1988	AWC-Bisbee system
5	Rancho Alegre Estates, 1-10	Cochise	24 South	28 East	15	10	53-400051	Adequate		4/21/1999	Dry Lot Subdivision
6	Sunsites Ranches	Cochise	18 South	24 East	14, 22, 24	26	53-300037	Inadequate	A1	7/28/1995	Dry Lot Subdivision
7	Sunsites Ranches Unit 4	Cochise	19 South	26 East	1,13,24,25	314	53-300157	Inadequate	A1	2/14/1996	Dry Lot Subdivision
			19 South	27 East	28,29,30,31, 32						
			20 South	27 East	4,5,6,7,9,18, 29						
8	The 400 Club	Cochise	23 South	24 East	8	6	53-700398	Adequate		11/19/2007	AWC-Bisbee system

B. Designated Adequate Water Supply

Map Key	Water Provider Name	County	Designation No.	Projected or Annual Estimated Demand	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	City of Douglas	Cochise	40-900001.0000	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 unavailable; 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

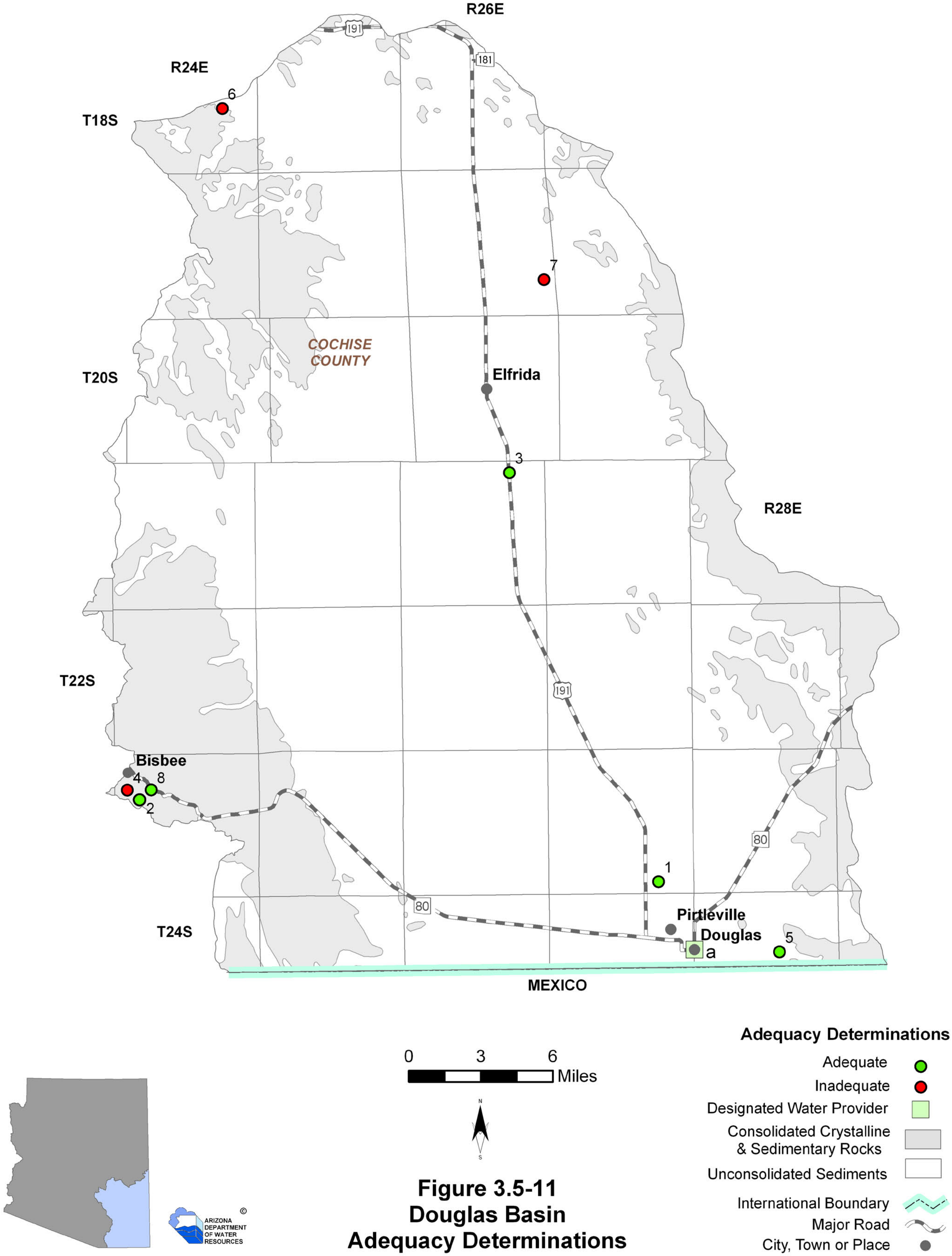


Figure 3.5-11
Douglas Basin
Adequacy Determinations

DOUGLAS BASIN

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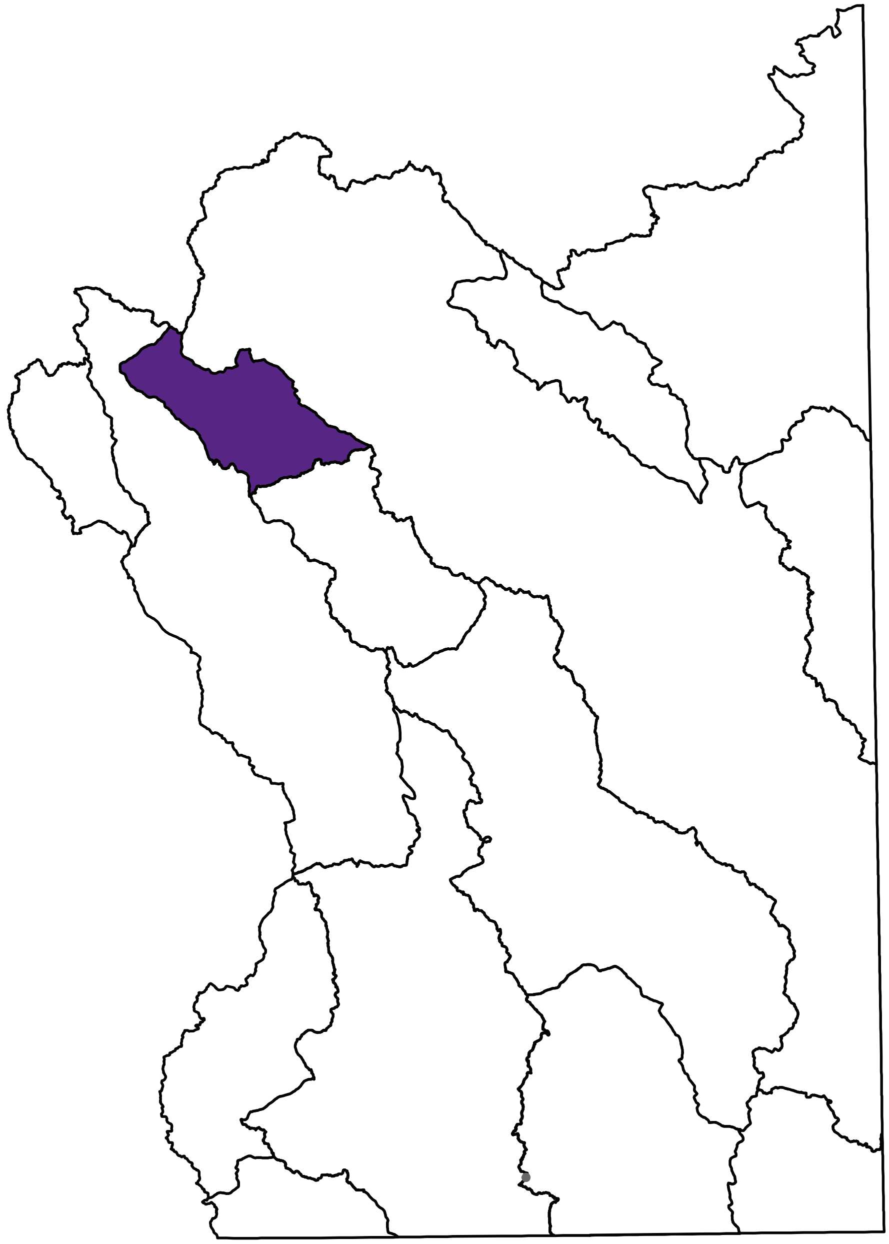
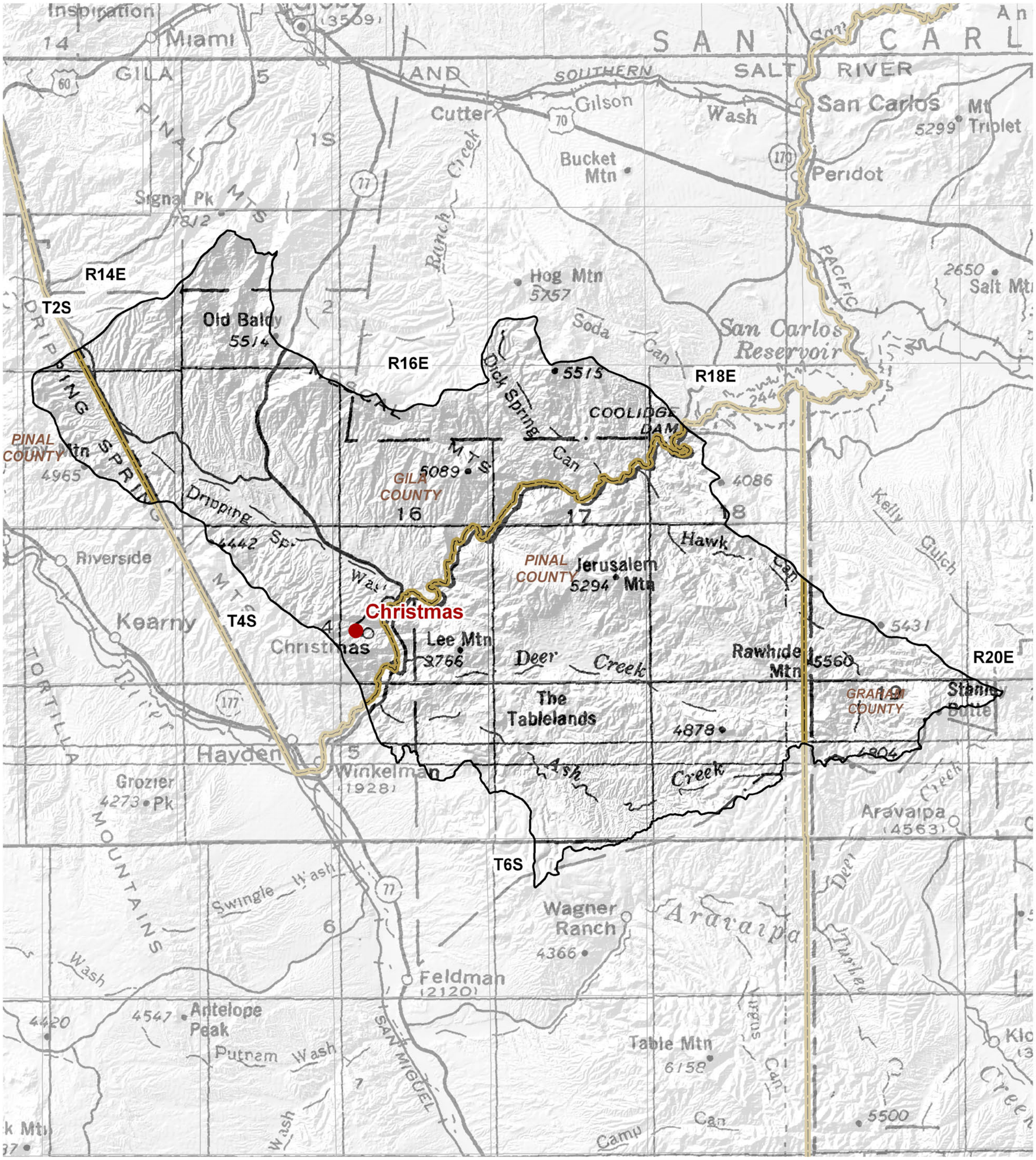
Section 3.6
Dripping Springs Wash Basin



3.6.1 Geography of the Dripping Springs Wash Basin

The Dripping Springs Wash Basin is a small, 378 square mile basin in the northwestern portion of the planning area. Geographic features and principal communities are shown on Figure 3.6-1. The basin is characterized by a mid-elevation mountain range and Arizona uplands Sonoran desertscrub, interior chaparral, semi-desert grassland and madrean evergreen woodland vegetation. (see Figure 3.0-9) Riparian vegetation includes strand and mesquite on the Gila River and cottonwood/willow, strand and mixed broadleaf on Mescal Creek.

- Principal geographic features shown on Figure 3.6-1 include:
    - Deer Creek and Ash Creek running roughly parallel to one another southeast of Christmas
    - Dripping Springs Wash northwest of Christmas, a tributary of the Gila River
    - Gila River, running east-west creating the boundary between Pinal and Gila counties
    - Dripping Springs Mountains to the west, which include the highest point in the basin at 5,515 feet.
    - The lowest point at approximately 1,900 feet where the Gila River exits the basin



0 3 6 Miles

Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES

Figure 3.6-1
Dripping Springs Wash Basin
Geographic Features

COUNTY
City, Town or Place

3.6.2 Land Ownership in the Dripping Springs Wash Basin

Land ownership, including the percentage of ownership in each category, is shown for the Dripping Springs Wash Basin in Figure 3.6-2. Principal features include a significant amount of tribal lands and scattered state owned, Bureau of Land Management and private lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

Indian Reservations

- 57.8% of the land is under ownership of the San Carlos Apache Tribe.
- Primary land use is grazing.

U.S. Bureau of Land Management (BLM)

- 22.0% of land is federally owned and managed by the Safford Field Office of the BLM.
- BLM land is located primarily in the northern portion of the basin and is interspersed with state owned and private lands.
- Primary land uses are grazing and mining.

State Trust

- 11.5% of land in this basin is held in trust for public schools.
- The majority of the state owned land, including a sizable contiguous parcel, is in the northwestern portion of the basin.
- Primary land use is grazing.

Private

- 7.4% of land is private.
- Private land is scattered in small parcels throughout the basin with a number of in-holdings within the San Carlos Apache Indian Reservation.
- Primary land uses are mining, domestic and grazing.

National Forest

- 1.3% of land is federally owned and managed by the United States Forest Service (USFS).
- The portion of national forest in this basin is in the Tonto National Forest, Globe Ranger District.
- Primary land uses are grazing and recreation.

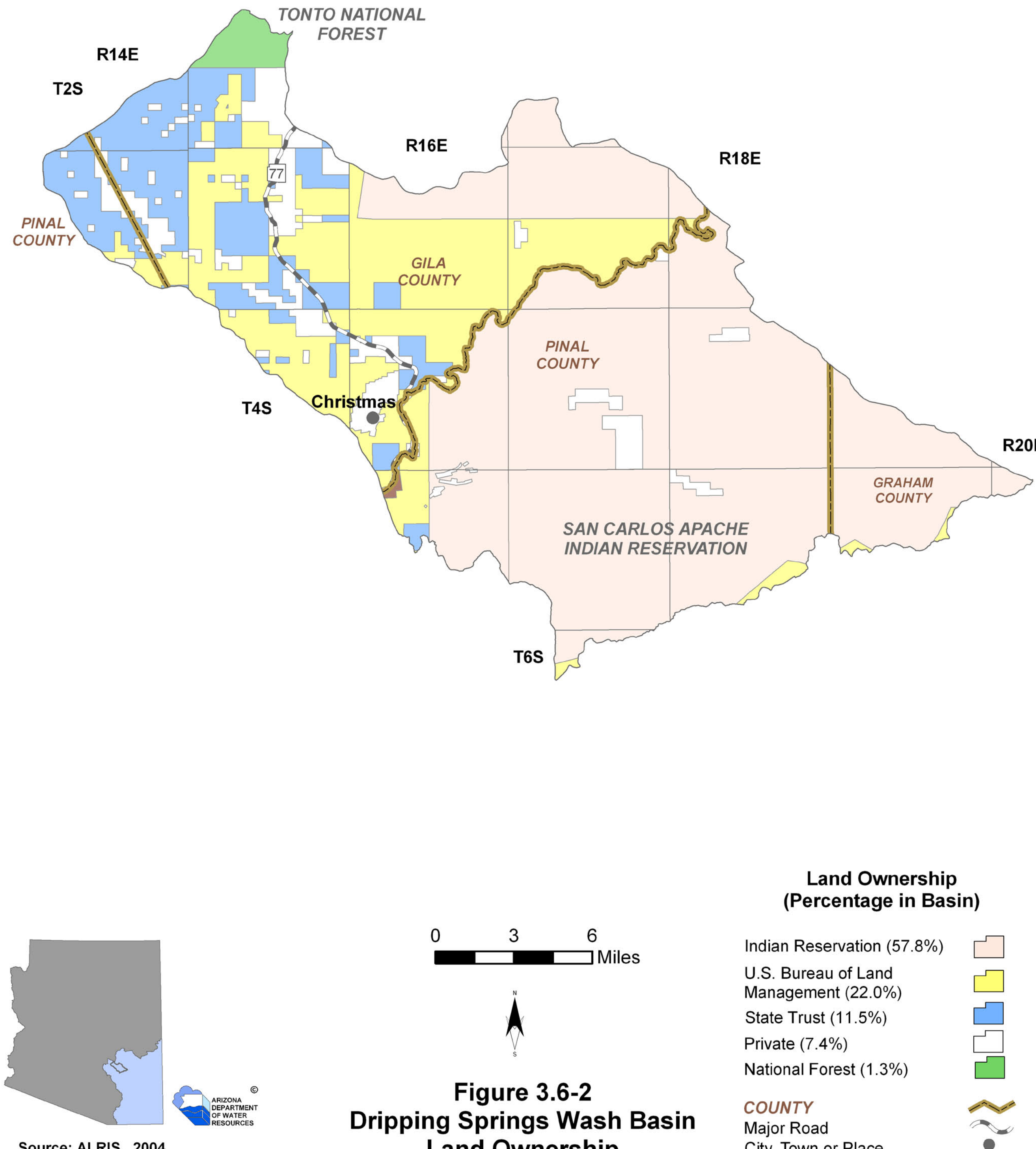


Figure 3.6-2
Dripping Springs Wash Basin
Land Ownership

3.6.3 Climate of the Dripping Springs Wash Basin

Climate data from NOAA/NWS Co-op Network and Evaporation Pan stations are complied in Table 3.6-1 and their locations are shown on Figure 3.6-3. Figure 3.6-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Dripping Springs Wash Basin does not contain AZMET and SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network
- Refer to Table 3.6-1A
- There is one NOAA/NWS Coop network climate station in the basin at San Carlos Reservoir. The average monthly maximum temperature is 86.6°F and average minimum temperature is 46.4°F.
- Winter, summer and fall season precipitation is relatively similar; 5.36 inches, 5.07 inches and 4.36 inches respectively.
- The dry season is in the spring (April-June) when an average of 1.08 inches is recorded.

Evaporation Pan
- Refer to Table 3.6-1B
- There is one site in the basin at San Carlos Reservoir, located at 2,530 feet with an average annual evaporation of 91.45 inches.

SCAS Precipitation Data
- See Figure 3.6-3
- Other precipitation data shows rainfall as high as 30 inches at the northernmost tip of the basin in the Pinal Mountains, and as low as 12 inches in the vicinity of Christmas.

Table 3.6-1 Climate Data for the Dripping Springs Wash Basin

A.NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
San Carlos Reservoir	2,530	1971-2000	86.6/Jul	46.4/Jan	5.36	1.08	5.07	4.36	15.87

Source: WRCC, 2005.

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
San Carlos Reservoir	2,530	1948 - 2002	91.45

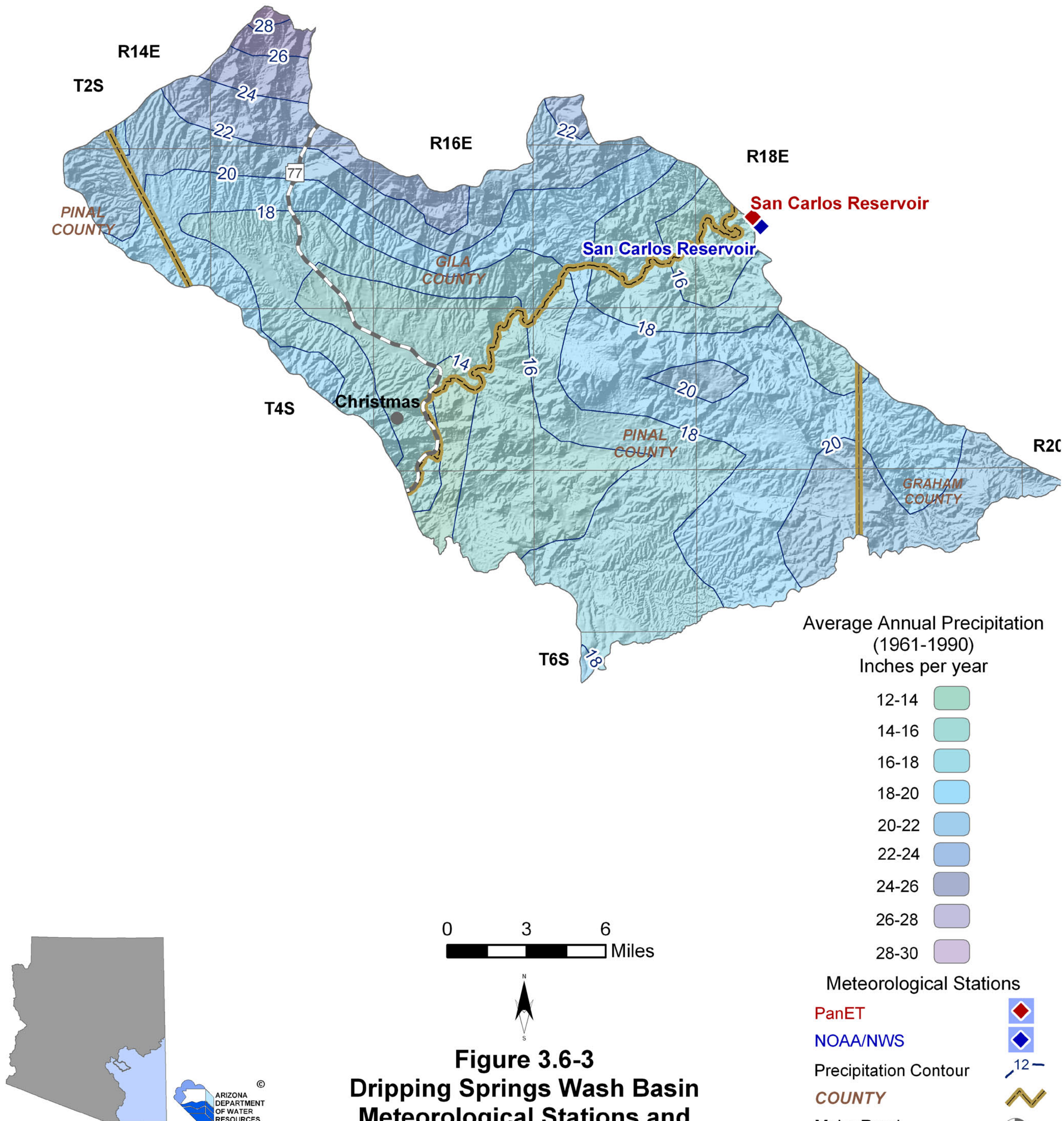
Source: WRCC, 2003.

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								



Precipitation Data Source:
Oregon State University, 1998

Figure 3.6-3
Dripping Springs Wash Basin Meteorological Stations and Annual Precipitation

3.6.4 Surface Water Conditions in the Dripping Springs Wash Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.6-2. Flood ALERT equipment in the basin is shown on Table 3.6-3. Reservoir and stockpond data are shown in Table 3.6-4. The location of streamflow gages identified by USGS number, flood ALERT equipment and USGS runoff contours are shown on Figure 3.6-4. Descriptions of stream, flood ALERT, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.6-2.
- Data from one real-time station located at the Gila River below Coolidge Dam are shown on the table and on Figure 3.6-4.
- The average seasonal flow is similar in most seasons due to controlled releases from Coolidge Dam.
- Maximum annual flow was 1,681,500 acre-feet in 1993 and minimum annual flow was 27,590 acre-feet in 1929.

Flood ALERT Equipment

- Refer to Table 3.6-3.
- There is one station in the basin as of October 2005.

Reservoirs and Stockponds

- Refer to Table 3.6-4.
- There are no reservoirs in this basin.
- There are 79 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.6-4.
- Average annual runoff is 0.5 inches, or 26.65 acre-feet per square mile, in this basin.

Table 3.6-2 Streamflow Data for the Dripping Springs Wash 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	
9469500	Gila River below Coolidge Dam	12,886	2,309	7/1899-current (real time)	29	28	31	12	27,590 (1929)	231,731	270,458	1,681,500 (1993)	90

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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

Table 3.6-3 Flood ALERT Equipment in the Dripping Springs Wash Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
905	Downstream Coolidge Dam, Gila River	Precipitation/Stage	NA	Gila County FCD

Source: ADWR 2005a

Notes:
NA = Not available
FCD = Flood Control District

Table 3.6-4 Reservoirs and Stockponds in the Dripping Springs Wash Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 0
Total maximum storage: 0 acre-feet

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

Total number: 0
Total surface area: 0 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 79 (from water right filings)

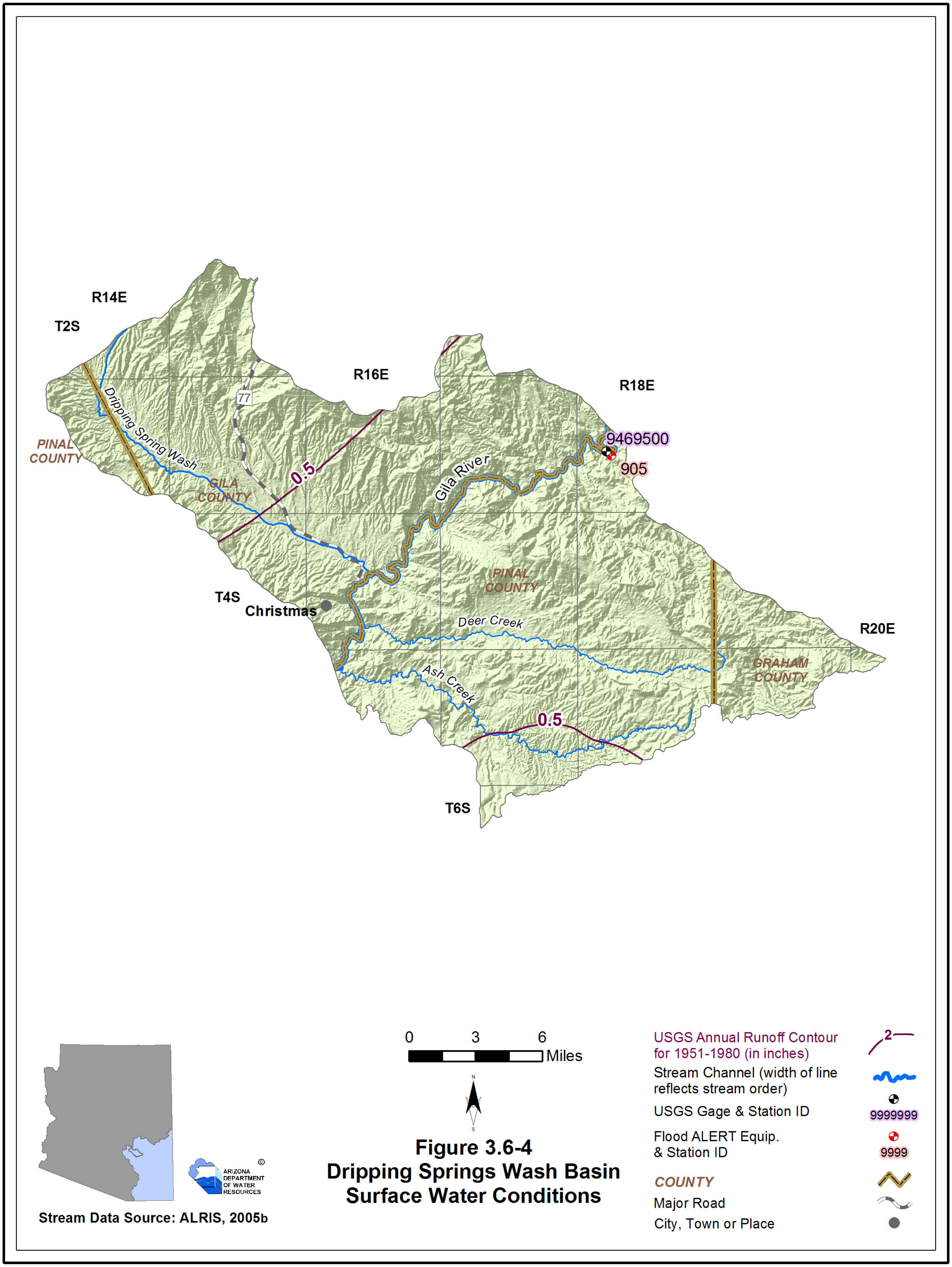


Figure 3.6-4
Dripping Springs Wash Basin
Surface Water Conditions

3.6.5 Perennial/Intermittent Streams and Major Springs in the Dripping Springs Wash Basin

Major springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 3.6-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.6-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are two perennial streams, the Gila River and Mescal Creek. The Gila River is controlled by releases from Coolidge Dam to meet legal obligations.
- There are two major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge is 200 gpm at Mescal Warm spring.
- There are no minor springs identified at this time.
- Listed discharge rates may not be indicative of current conditions. Both of the major spring measurements were taken prior to 1985.
- The total number of springs identified by the USGS varies from 76 to 99, depending on the database reference.

Table 3.6-5 Springs in the Dripping Springs Wash Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Mescal Warm	330918	1103815	200	During or prior to 1982
2	Coolidge Dam Warm	331016	1103139	165	During or prior to 1982

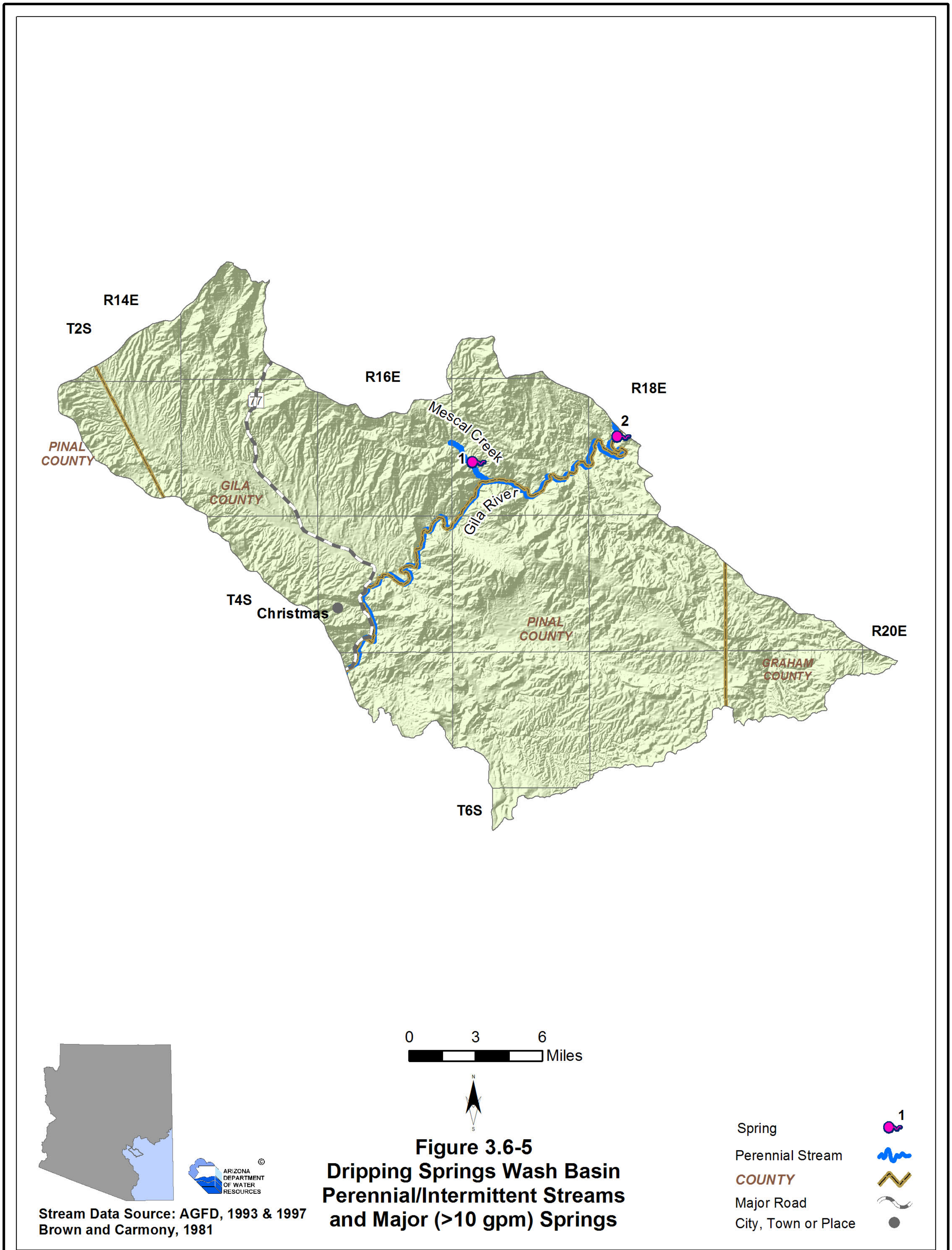
B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)	Date Discharge Measured
	Latitude	Longitude		
None identified by ADWR at this time				

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 76 to 99

Notes:
[1]Most recent measurement identified by ADWR



Stream Data Source: AGFD, 1993 & 1997
Brown and Carmony, 1981

Figure 3.6-5
Dripping Springs Wash Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

3.6.6 Groundwater Conditions of the Dripping Springs Wash 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 3.6-6. Figure 3.6-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.6-7 shows a hydrograph for a selected well shown on Figure 3.6-6. Figure 3.6-8 shows well yields in four 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 3.6-6 and Figure 3.6-6.
- The major aquifers in the basin are recent stream alluvium, consisting of mostly sand and silt, and Gila Conglomerate sedimentary rock. The recent stream alluvium is the principal water-producing unit.
- Flow direction is generally from the northwest to the southeast.

Well Yields
- Refer to Table 3.6-6 and Figure 3.6-8.
- As shown on Figure 3.6-8 well yields in this basin range from less than 100 gpm to 2,000 gpm.
- One source of well yield information, based on 12 reported wells, indicates that the median well yield in this basin is 394.5 gpm.

Natural Recharge
- Refer to Table 3.6-6.
- Natural recharge estimates range from 3,000 acre-feet per year (AFA) to 9,000 AFA.

Water in Storage
- Refer to Table 3.6-6.
- Storage estimates for this basin range from 150,000 acre-feet to less than 1.0 million acre-feet to a depth of 1,200 feet.

Water Level
- Refer to Figure 3.6-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures two index wells in this basin. A hydrograph for one of these wells is shown in Figure 3.6-7.
- There were only two water levels recorded in this basin during 2003-2004. The wells are close to each other and measure 87 feet and 98 feet to water. Water levels in both declined one to 15 feet between 1990-1991 and 2003-2004.

Table 3.6-6 Groundwater Data for the Dripping Springs Wash Basin

Basin Area, in square miles:	378	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Sedimentary Rock (Gila Conglomerate)	
Well Yields, in gal/min:	Range 12 - 1,200 Median 394.5 (12 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	<2	ADWR (1994b)
	Range 0 - 500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	3,000	ADWR (1994b)
	9,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	150,000 (to 1,200 ft)	ADWR (1994b)
	<1,000,000[1]	Freethey and Anderson (1986)
Current Number of Index Wells:	2	
Date of Last Water-level Sweep:	1996 (34 wells measured)	

Notes:
[1]Predevelopment Estimate

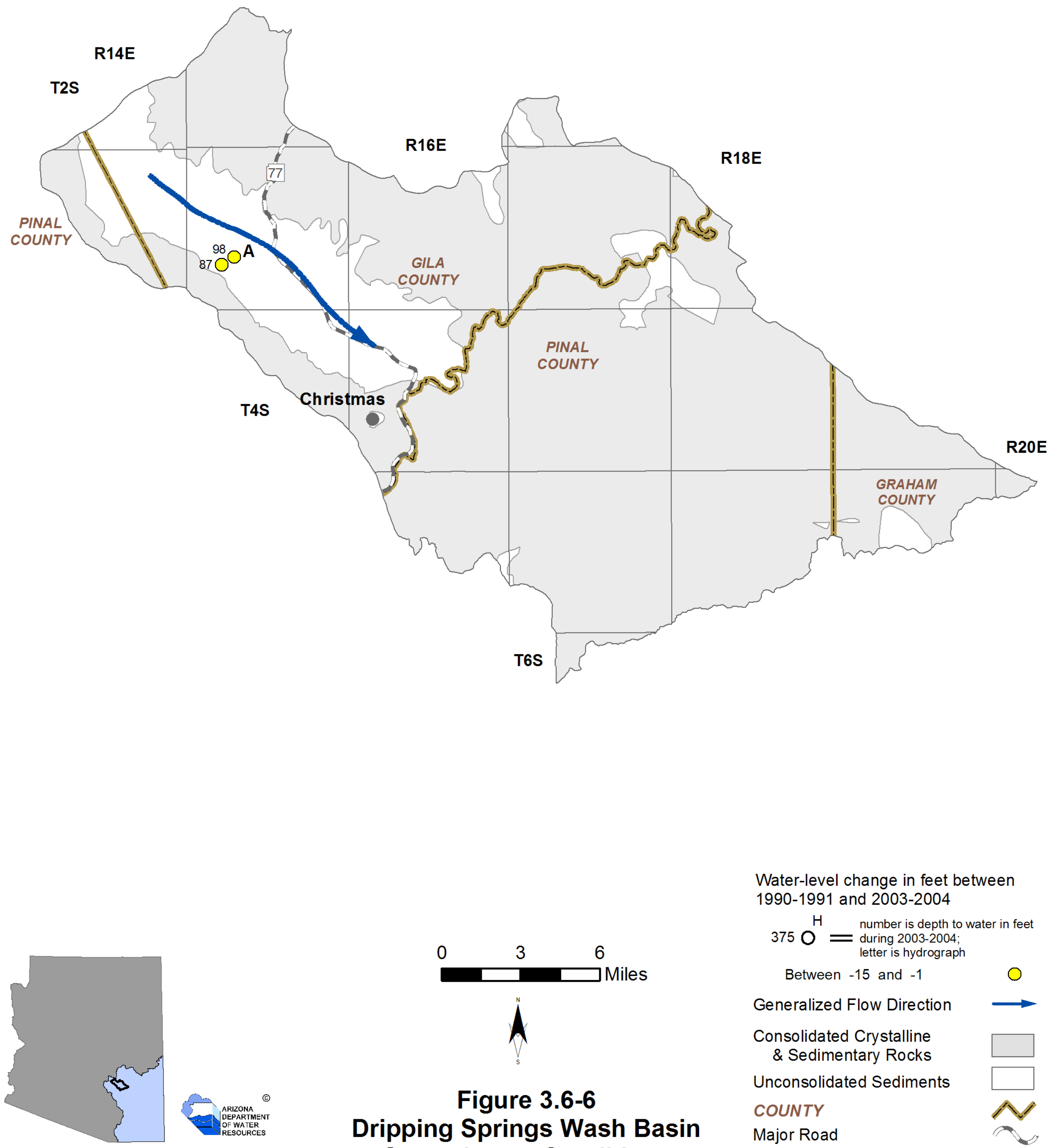
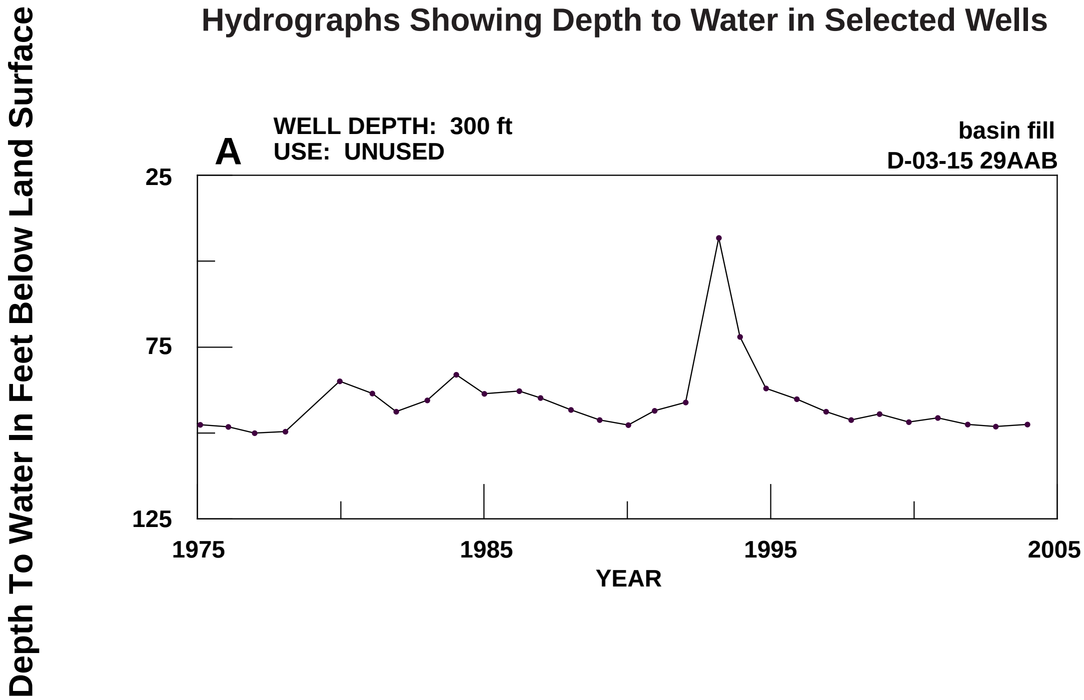


Figure 3.6-6
Dripping Springs Wash Basin Groundwater Conditions

Figure 3.6-7
Dripping Springs Wash Basin
Hydrographs Showing Depth to Water in Selected Wells



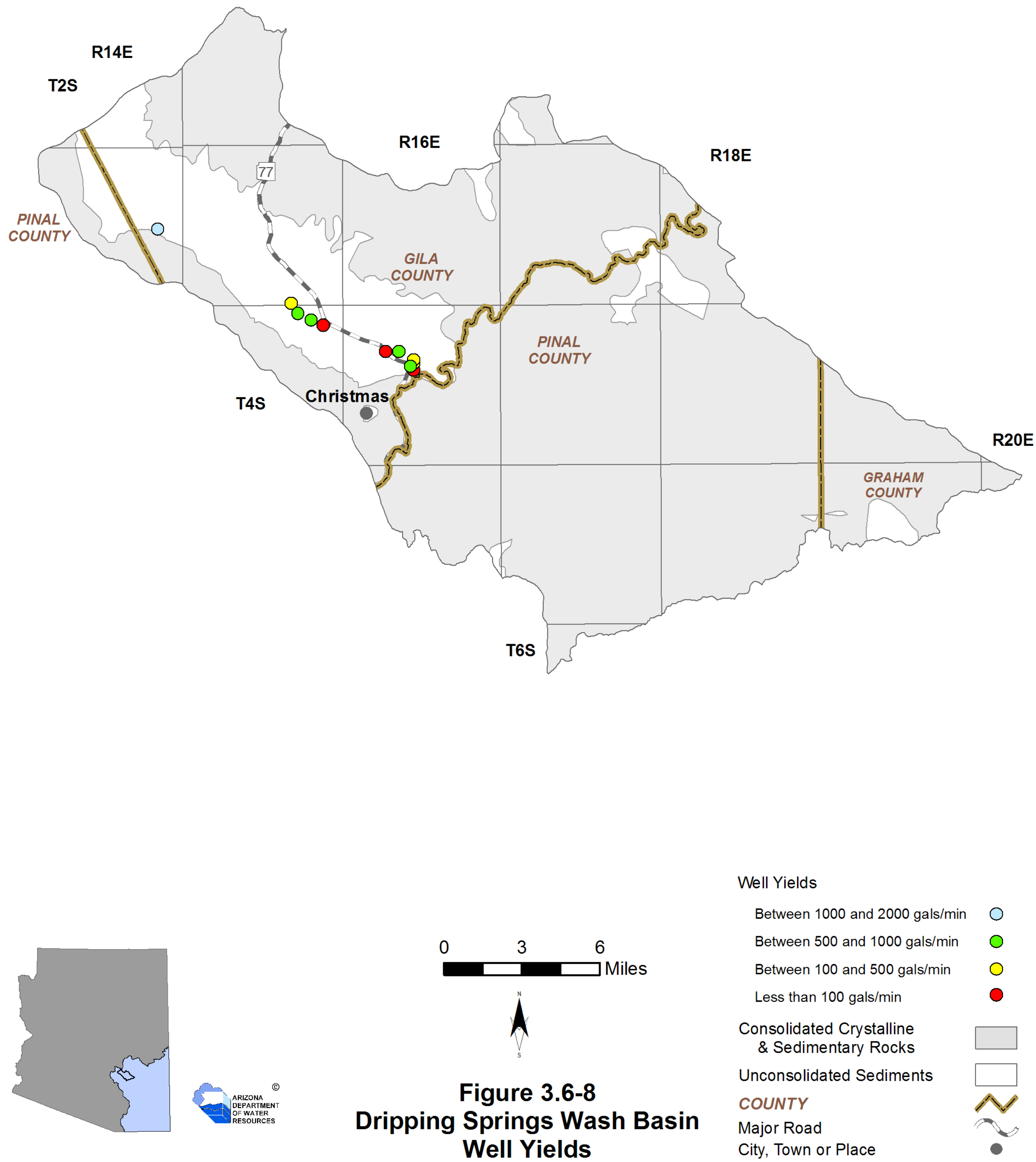


Figure 3.6-8
Dripping Springs Wash Basin
Well Yields

3.6.7 Water Quality of the Dripping Springs Wash Basin

Data on drinking water standard exceedences in wells, springs and mine sites and impaired lakes and streams are not available for this basin. A description of water quality data sources and methods is found in Volume 1, Appendix A.

3.6.8 Cultural Water Demand in the Dripping Springs Wash 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 3.6-7. 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 3.0.7.

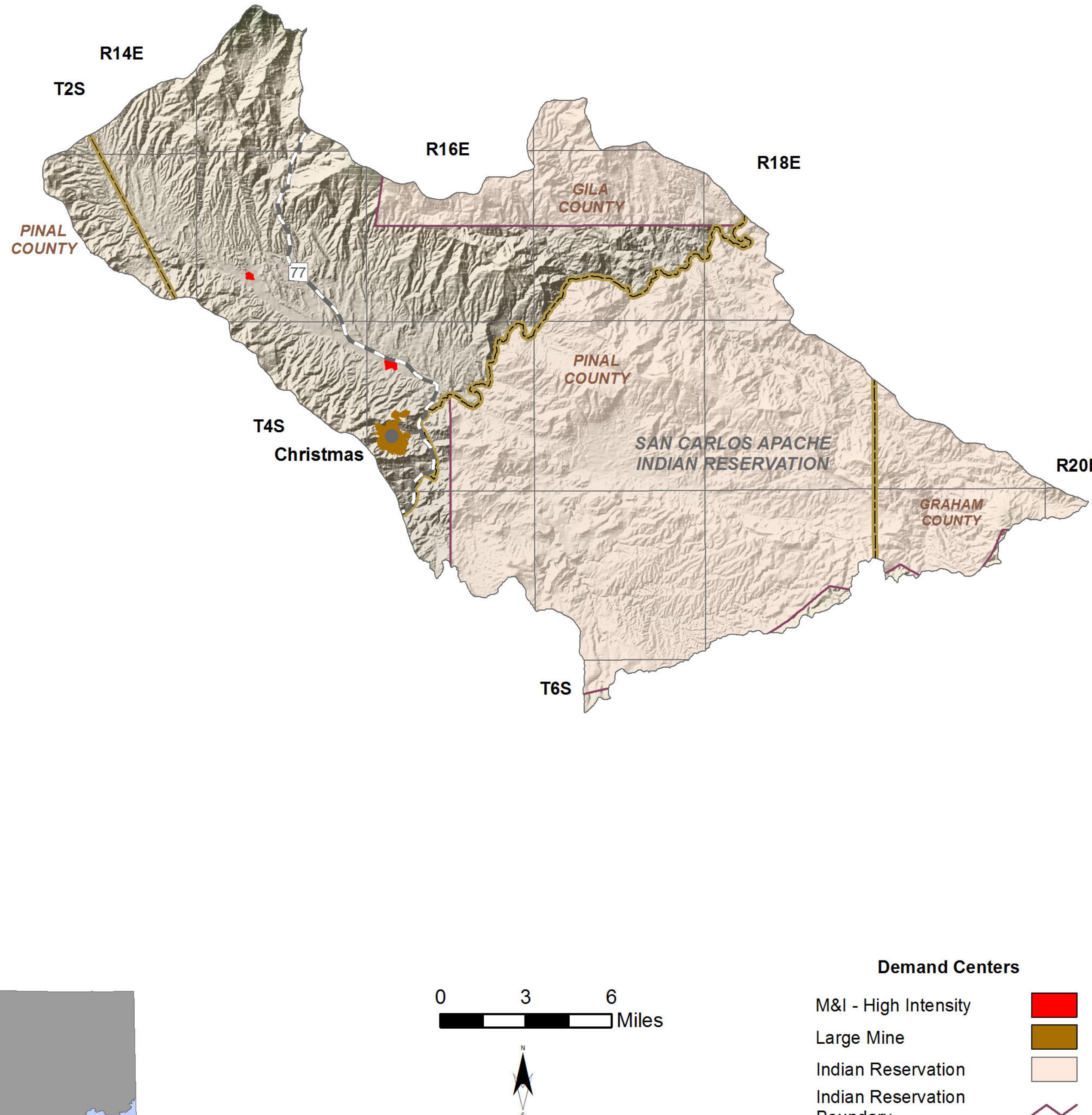
Cultural Water Demand

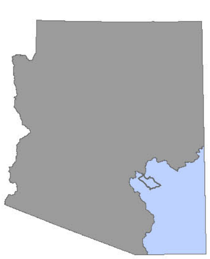
- Refer to Table 3.6-7 and Figure 3.6-9.
- Population decreased between 1980 and 2005.
- All water use in this basin is groundwater and is pumped to meet municipal demand. Groundwater pumping has decreased since 1971 and remained constant from 1990 to 2005, with less than 300 AFA during this time.
- High intensity municipal and industrial demand is found in the vicinity of Highway 77.
- There are several inactive mines including the Christmas Mine, New Year Mine and the San Bernardo Jr. Mine in the vicinity of Christmas.
- As of 2005 there were 119 registered wells with a pumping capacity of less than or equal to 35 gpm and 40 wells with a pumping capacity of more than 35 gpm.

Table 3.6-7 Cultural Water Demand in the Dripping Springs Wash Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="6">Average Annual Demand (in acre-feet)</th><th rowspan="3">Data Source</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agriculture</th><th>Municipal</th><th>Industrial</th><th>Agriculture</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">73[2]</td><td rowspan="10">21[2]</td><td colspan="3" rowspan="5"><1,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5"><1,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>329</td></tr>
<tr><td>1981</td><td>318</td><td rowspan="5">17</td><td rowspan="5">2</td><td colspan="3" rowspan="5"><1,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>307</td></tr>
<tr><td>1983</td><td>295</td></tr>
<tr><td>1984</td><td>284</td></tr>
<tr><td>1985</td><td>273</td></tr>
<tr><td>1986</td><td>262</td><td rowspan="5">3</td><td rowspan="5">2</td><td colspan="3" rowspan="5"><1,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>251</td></tr>
<tr><td>1988</td><td>239</td></tr>
<tr><td>1989</td><td>228</td></tr>
<tr><td>1990</td><td>217</td></tr>
<tr><td>1991</td><td>213</td><td rowspan="5">11</td><td rowspan="5">3</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td><td rowspan="15">USGS (2007)</td></tr>
<tr><td>1992</td><td>208</td></tr>
<tr><td>1993</td><td>204</td></tr>
<tr><td>1994</td><td>200</td></tr>
<tr><td>1995</td><td>196</td></tr>
<tr><td>1996</td><td>192</td><td rowspan="5">10</td><td rowspan="5">3</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>188</td></tr>
<tr><td>1998</td><td>183</td></tr>
<tr><td>1999</td><td>179</td></tr>
<tr><td>2000</td><td>175</td></tr>
<tr><td>2001</td><td>177</td><td rowspan="5">5</td><td rowspan="5">7</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>179</td></tr>
<tr><td>2003</td><td>182</td></tr>
<tr><td>2004</td><td>184</td></tr>
<tr><td>2005</td><td>186</td></tr>
<tr><td>2010</td><td>197</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>220</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>288</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>119</td><td>40</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs or effluent.
[2] Includes all wells through June 1980.





Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 3.6-9
Dripping Springs Wash Basin
Cultural Water Demand

3.6.9 Water Adequacy Determinations in the Dripping Springs Wash Basin

There are no water adequacy applications on file with the Department as of December 2008 for the Dripping Springs Wash Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

DRIPPING SPRINGS BASIN
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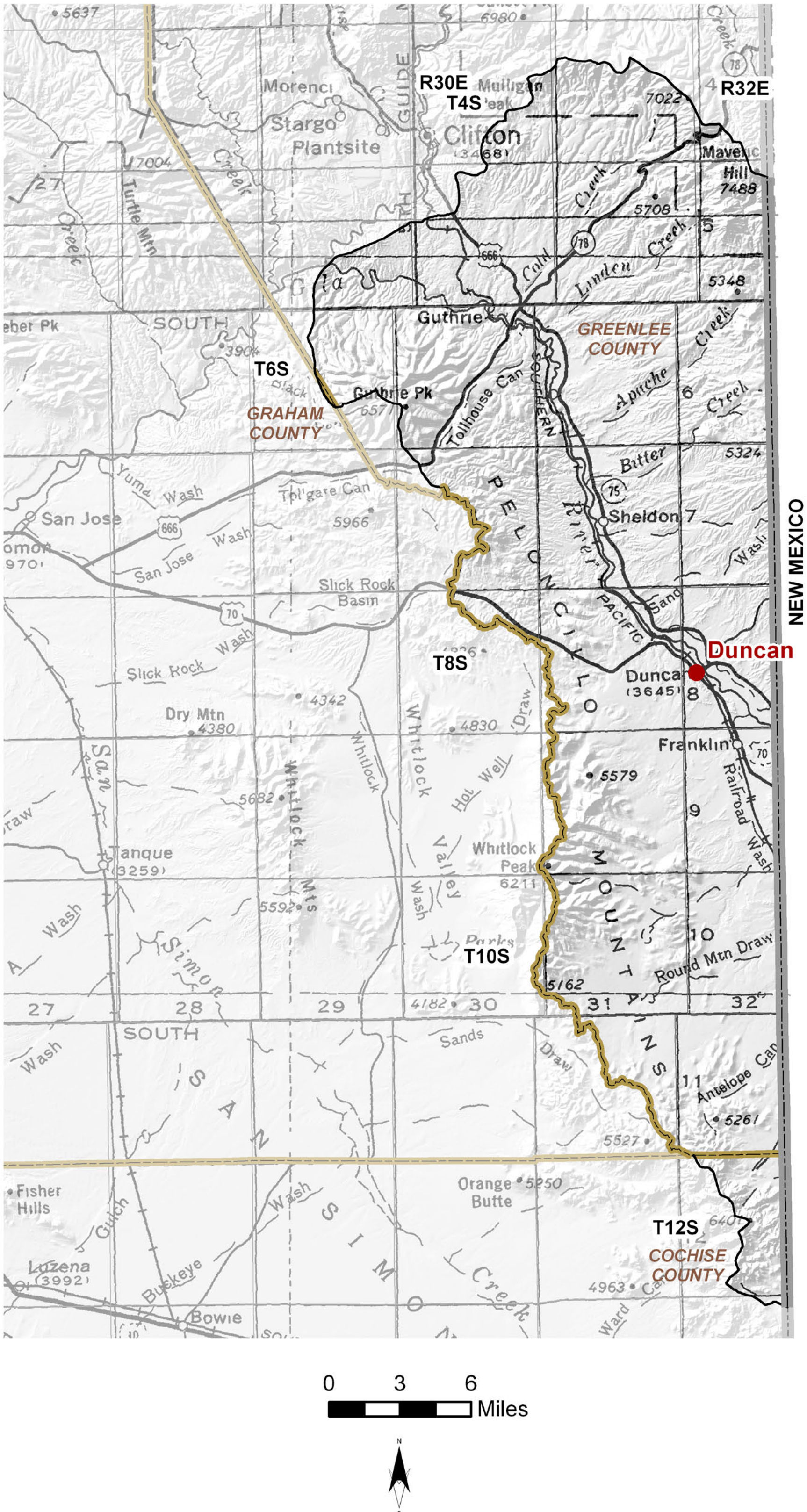
Section 3.7
Duncan Valley Basin

3.7.1 Geography of the Duncan Valley Basin

The Duncan Valley Basin is a relatively small, 550 square mile basin on the eastern edge of the planning area. Geographic features and principal communities are shown on Figure 3.7-1. The basin is characterized by mid-elevation mountain ranges and Chihuahuan desertscrub, semi-desert grassland and madrean evergreen woodland vegetation. (see Figure 3.0-9) Riparian vegetation includes tamarisk and mesquite on the Gila River.

- Principal geographic features shown on Figure 3.7-1 are:
    - Gila River, flowing north from New Mexico in the vicinity of Duncan and exiting the basin west of Guthrie
    - Cold Creek, Linden Creek, Apache Creek and Bitter Creek northeast of Duncan
    - The Peloncillo Mountains west of Duncan along the basin boundary
    - Big Lue Mountains along the northern boundary, which include the highest point in the basin, Maverick Hill 7,488 feet
    - The lowest point at approximately 3,400 feet where the Gila River exits the basin



Base Map: USGS 1:500,000, 1981

Figure 3.7-1
Duncan Valley Basin
Geographic Features

New Mexico State Boundary
COUNTY
City, Town or Place

3.7.2 Land Ownership in the Duncan Valley Basin

Land ownership, including the percentage of ownership in each category, is shown for the Duncan Valley Basin in Figure 3.7-2. Principal features of land ownership in this basin are the two contiguous sections of State Trust Lands and a significant amount of Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

State Trust

- 44.5% of land in this basin is held in trust for public schools and to a lesser extent the University of Arizona and the hospital for disabled miners.
- State land ownership in this basin consists of two largely contiguous parcels, north and south of Duncan.
- Primary land use is grazing.

U.S. Bureau of Land Management (BLM)

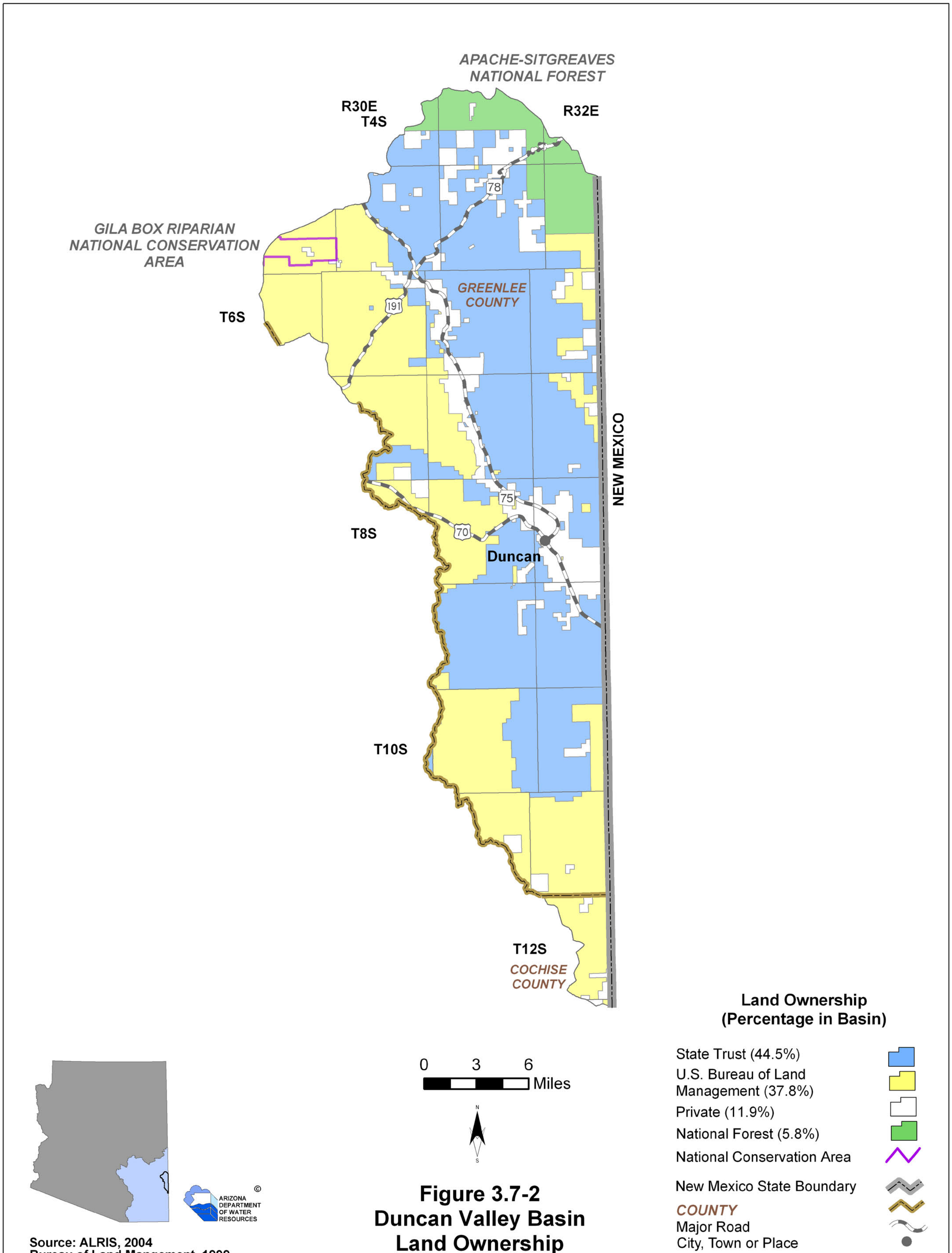
- 37.8% of land is federally owned and managed by the Safford Office of the BLM.
- There are two protected areas in the basin; the Gila Box National Conservation Area in the northwest corner of the basin and the Peloncillo Mountains Wilderness area in T12S, R32E. (See Figure 3.0-12)
- Primary land uses are grazing and recreation.

Private

- 11.9% of land ownership is private.
- The majority of private land in this basin is around the town of Duncan and along State Highway 75.
- There are a few private land in-holdings within BLM and national forest lands.
- Primary land uses are domestic, commercial and ranching.

National Forest

- 5.8% of land is federally owned and managed by the United States Forest Service (USFS).
- All national forest land in this basin is in the Apache-Sitgreaves National Forest, Clifton Ranger District.
- Primary land uses are timber production and recreation.



Source: ALRIS, 2004
Bureau of Land Mangement, 1999

Figure 3.7-2
Duncan Valley Basin
Land Ownership

3.7.3 Climate of the Duncan Valley Basin

Climate data from a NOAA/NWS Co-op Network station is complied in Table 3.7-1 and the location is shown on Figure 3.7-3. Figure 3.7-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Duncan Valley Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. More detailed information on climate is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.7-1A.
- There is one NOAA/NWS Co-op network station in the basin at Duncan located at 3,660 feet. The average maximum temperature at the station is 80.2°F and average minimum temperature is 41.3°F.
- The highest seasonal precipitation at this station, 5.50 inches, occurs in the summer (July-September) and the lowest, 1.00 inches, occurs in the spring (April-June).

SCAS Precipitation Data

- See Figure 3.7-3
- Other precipitation data shows rainfall as high as 20 inches in the Peloncillo Mountains and as low as 10 inches in the vicinity of Duncan.
- This basin contains the smallest variation in precipitation in the planning area, only 10 inches separates the areas of highest average annual precipitation from the lowest.

Table 3.7-1 Climate Data for the Duncan Valley Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Duncan	3,660	1971-2000	80.2/Jul	41.3/Dec	2.52	1.00	5.50	3.26	12.28

Source: WRCC, 2005.

B. Evaporation Pan:

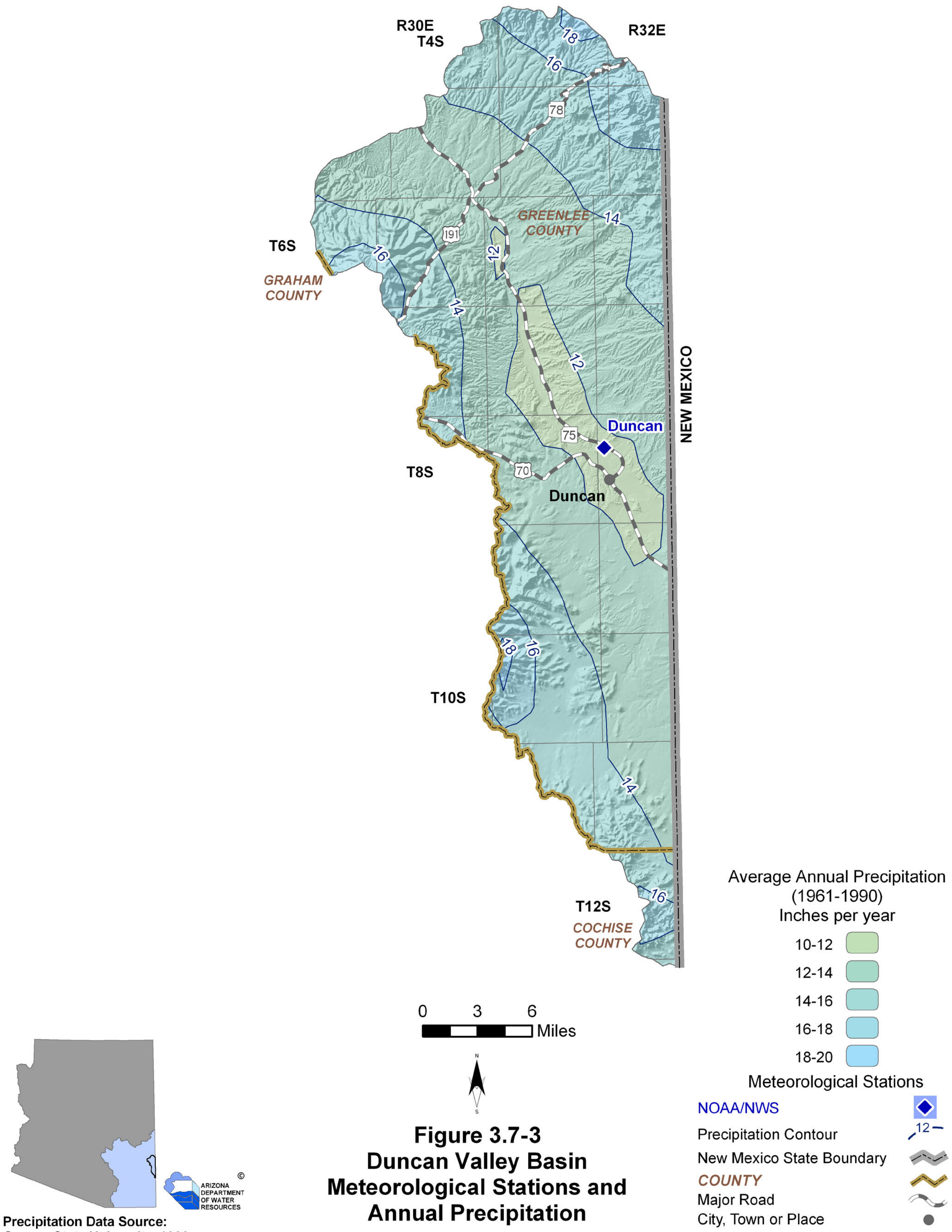
Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								



Precipitation Data Source:
Oregon State University, 1998

Figure 3.7-3
Duncan Valley Basin
Meteorological Stations and
Annual Precipitation

3.7.4 Surface Water Conditions in the Duncan Valley Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.7-2. Flood ALERT equipment in the basin is shown on Table 3.7-3. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.7-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 3.7-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.7-2.
- Data from two real-time stations located at the Gila River are shown on the table and on Figure 3.7-4.
- As of 2005 only the Gila River near Clifton station had more than three years of annual flow record. At this station, maximum annual flow was 480,118 acre-feet in 1915 and minimum annual flow was 17,670 acre-feet in 1956. Average seasonal flow is highest in the Winter (January-March) and lowest in the Spring (April-June).

Flood ALERT Equipment

- Refer to Table 3.7-3.
- There is one station in the basin as of October 2005.

Reservoirs and Stockponds

- Refer to Table 3.7-4.
- There is one large reservoir and two small reservoirs in this basin.
- The large reservoir has a maximum surface area of 124 acres. This reservoir is used for fire protection or is a stock/farm pond.
- There are 373 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.7-4.
- Average annual runoff varies from 0.5 inches, or 26.65 acre-feet per square mile, at the northern tip of the basin to 0.2 inches, or 10.66 acre-feet per square mile, in the southern portion of the basin.

Table 3.7-2 Streamflow Data for the Duncan Valley 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	
9439000	Gila River at Duncan	NA	3,663	11/2002-current (real time)	No statistics run, less than 3 years data								1[1]
9442000	Gila River near Clifton	4,010	3,336	11/1910-current (real time)	39	16	23	22	17,670 (1956)	114,417	147,837	480,118 (1915)	69

Source: USGS (NWIS) 2005 & 2008

Notes:
NA=Not available
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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]Year 2003 was the only year with 12 months of data

Table 3.7-3 Flood ALERT Equipment in the Duncan Valley Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
595	Duncan City Hall	Precipitation	12/3/1996	Town of Clifton

Source: ADWR 2005a

Table 3.7-4 Reservoirs and Stockponds in the Duncan Valley Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

B. Other Large Reservoirs (50 acre surface area or greater)[1]

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[2]	JURISDICTION
1	Lost	AZ Land Dept.	124	P	Landowner

Source: Compilation of databases from ADWR & others

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

Total number: 0
Total maximum storage: 0 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 2
Total surface area: 38 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 373 (from water right filings)

Notes:
[1]Capacity data not available to ADWR
[2]P=fire protection, stock or farm pond

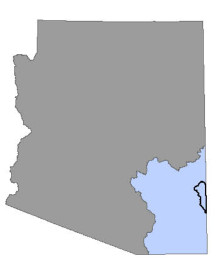


Figure 3.7-4
Duncan Valley Basin
Surface Water Conditions

Stream Data Source: ALRIS, 2005b

3.7.5 Perennial/Intermittent Streams and Major Springs in the Duncan Valley 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 3.7-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.7-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one perennial stream, the Gila River, in the northern portion of the basin.
- Several intermittent streams are located in the northeastern portion and along the western boundary of the basin. The Gila River is also an intermittent stream through a portion of the basin.
- There are two major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge rate was 30 gpm at Gillard Hot Spring.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.7-5. There is one minor spring identified in this basin.
- Listed discharge rates may not be indicative of current conditions. Most of the measurements were taken prior to 1982.
- The total number of springs identified by the USGS varies from 30 to 36, depending on the database reference.

Table 3.7-5 Springs in the Duncan Valley Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Gillard Hot	325823	1092059	30	03/1981
2	Bert's Shack	325654	1090347	15	04/1981

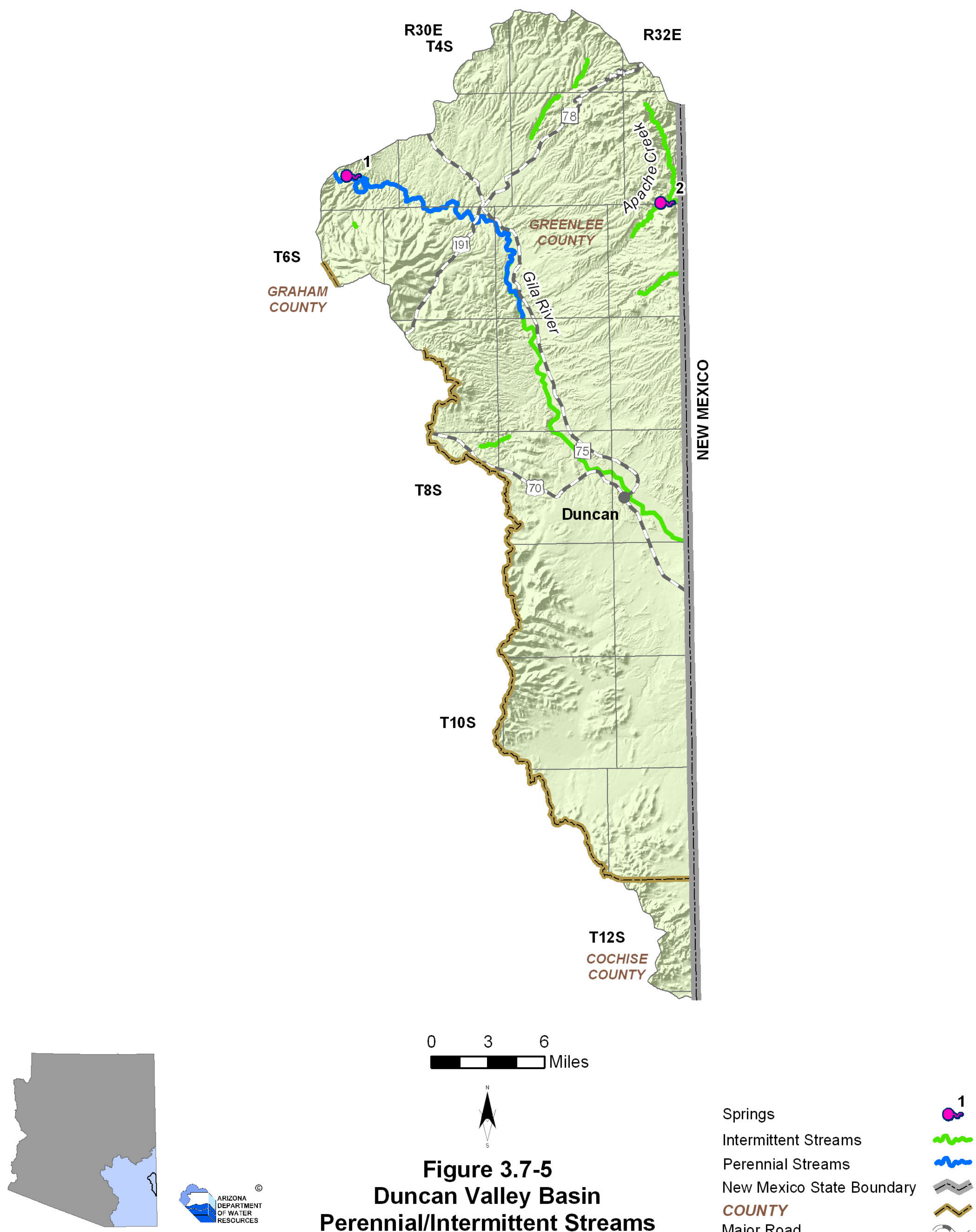
B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Zwan[2]	325708	1091655	6	07/1992

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 30 to 36

Notes:
[1]Most recent measurement identified by ADWR
[2]Location approximated by ADWR



Stream Data Source: AGFD, 1993 & 1997; Brown and Carmony, 1981

Figure 3.7-5
Duncan Valley Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

3.7.6 Groundwater Conditions of the Duncan Valley 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 3.7-6. Figure 3.7-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.7-7 contains hydrographs for selected wells shown on Figure 3.7-6. Figure 3.7-8 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 3.7-6 and Figure 3.7-6.
- The major aquifers in the basin are recent stream alluvium, consisting of gravel and sand underlain by clay, and Gila Formation sedimentary rock, consisting of poorly consolidated sand, silt and gravel.
- The principal source of groundwater is the recent stream alluvium.
- Flow direction is generally from the south to the northwest.

Well Yields

- Refer to Table 3.7-6 and Figure 3.7-8.
- As shown on Figure 3.7-8 well yields in this basin range from less than 100 gpm to more than 2,000 gpm.
- One source of well yield information, based on 160 reported wells, indicates that the median well yield in this basin is 850 gpm.

Natural Recharge

- Refer to Table 3.7-6.
- Natural recharge estimates range from 6,000 acre-feet per year (AFA) to 14,200 AFA.

Water in Storage

- Refer to Table 3.7-6.
- Storage estimates for this basin range from 9.0 million acre-feet (maf) to 19 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.7-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 11 index wells in this basin. Hydrographs for three of these wells are shown in Figure 3.7-7.
- Depth to water varies in this basin, with the deepest recorded water level measured during 2003-2004 at 503 feet at the northwestern basin boundary and the shallowest at 19 feet in the vicinity of Duncan.
- All recorded wells in this basin have declined between one and 15 feet between 1990-1991 and 2003-2004.

Table 3.7-6 Groundwater Data for the Duncan Valley Basin

Basin Area, in square miles:	550	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Sedimentary Rock (Gila Formation)	
Well Yields, in gal/min:	Range 4 - 4,000 Median 850 (165 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range few - 2,350	ADWR (1994b)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	14,200	ADWR (1994b)
	6,000	Freethey and Anderson (1986)
	8,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	19,000,000 (to 1,200 ft)	ADWR (1994b)
	9,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	19,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	11	
Date of Last Water-level Sweep:	1987 (182 wells measured)	

Notes:
[1]Predevelopment Estimate

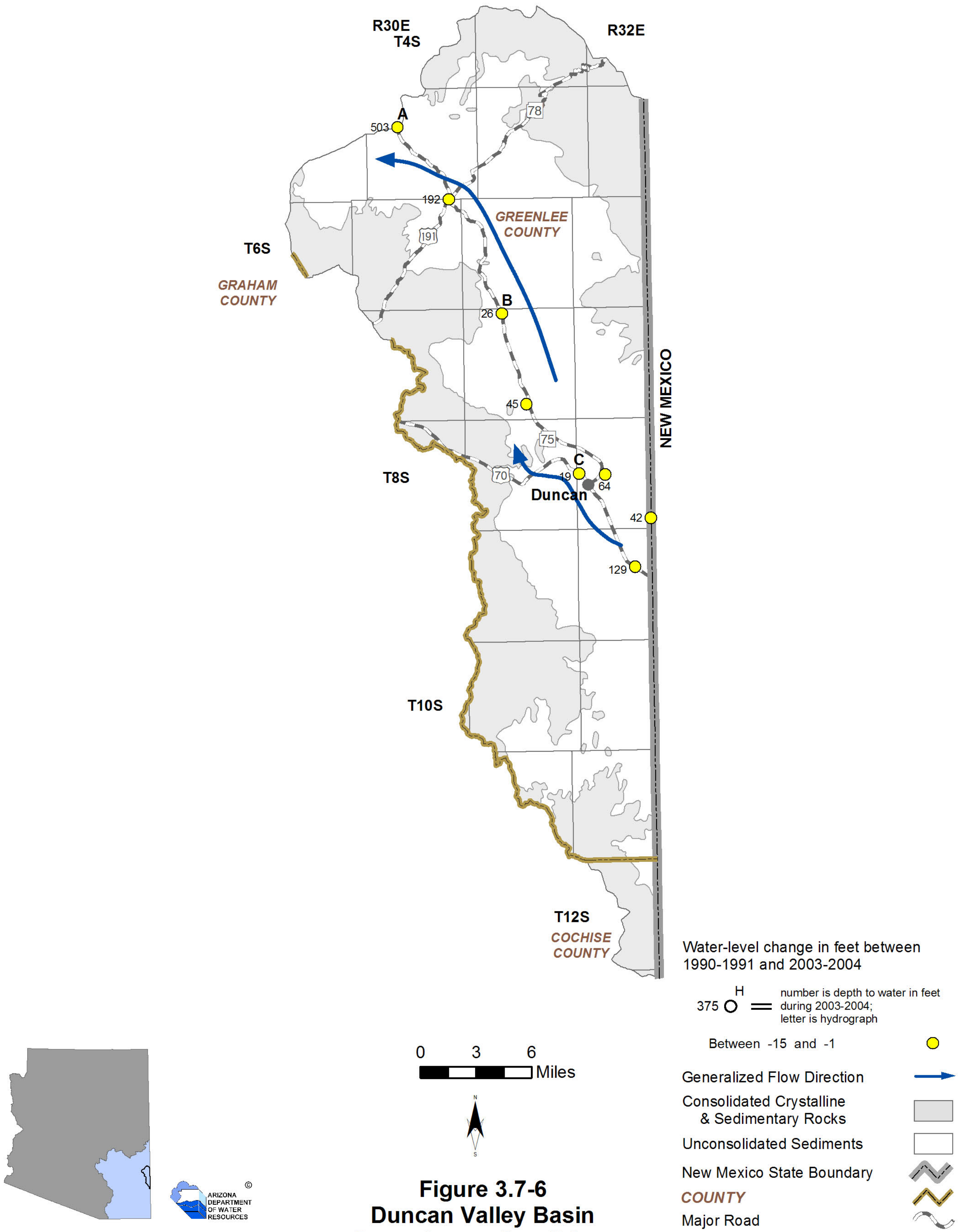
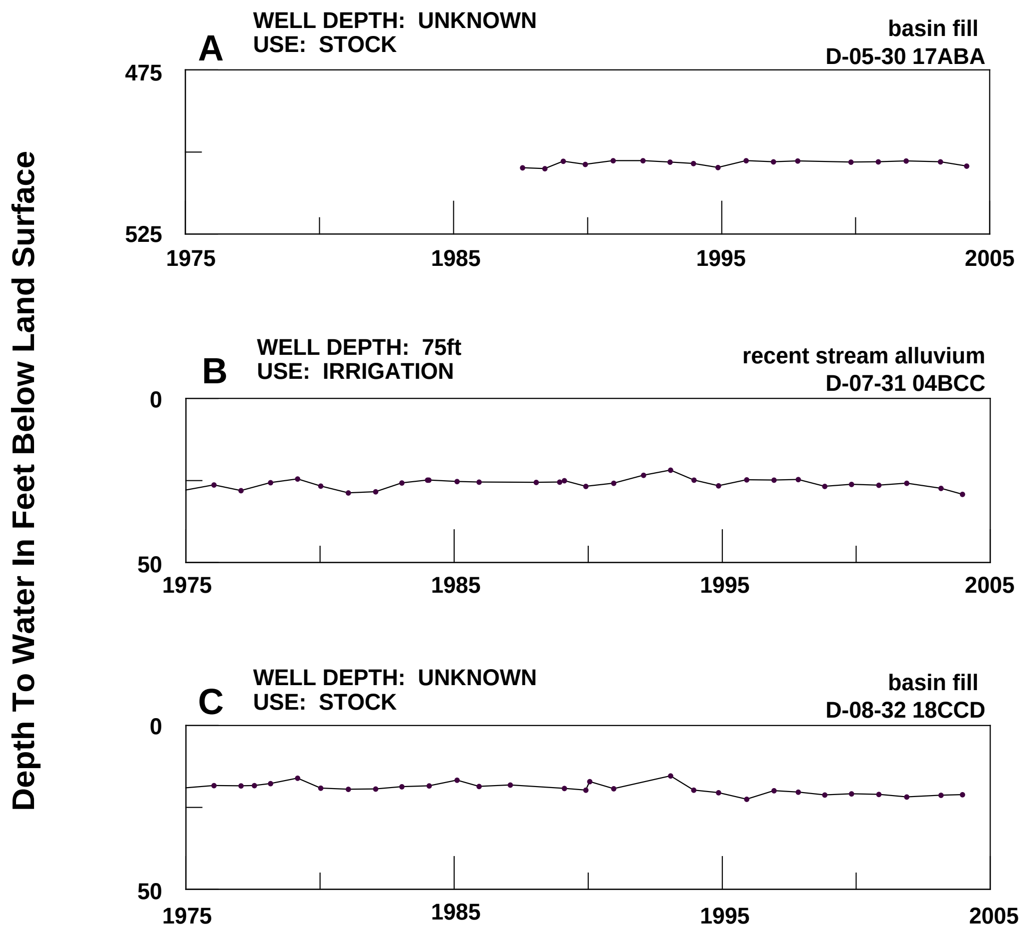


Figure 3.7-6
Duncan Valley Basin
Groundwater Conditions

Figure 3.7-7
Duncan Valley Basin
Hydrographs Showing Depth to Water in Selected Wells



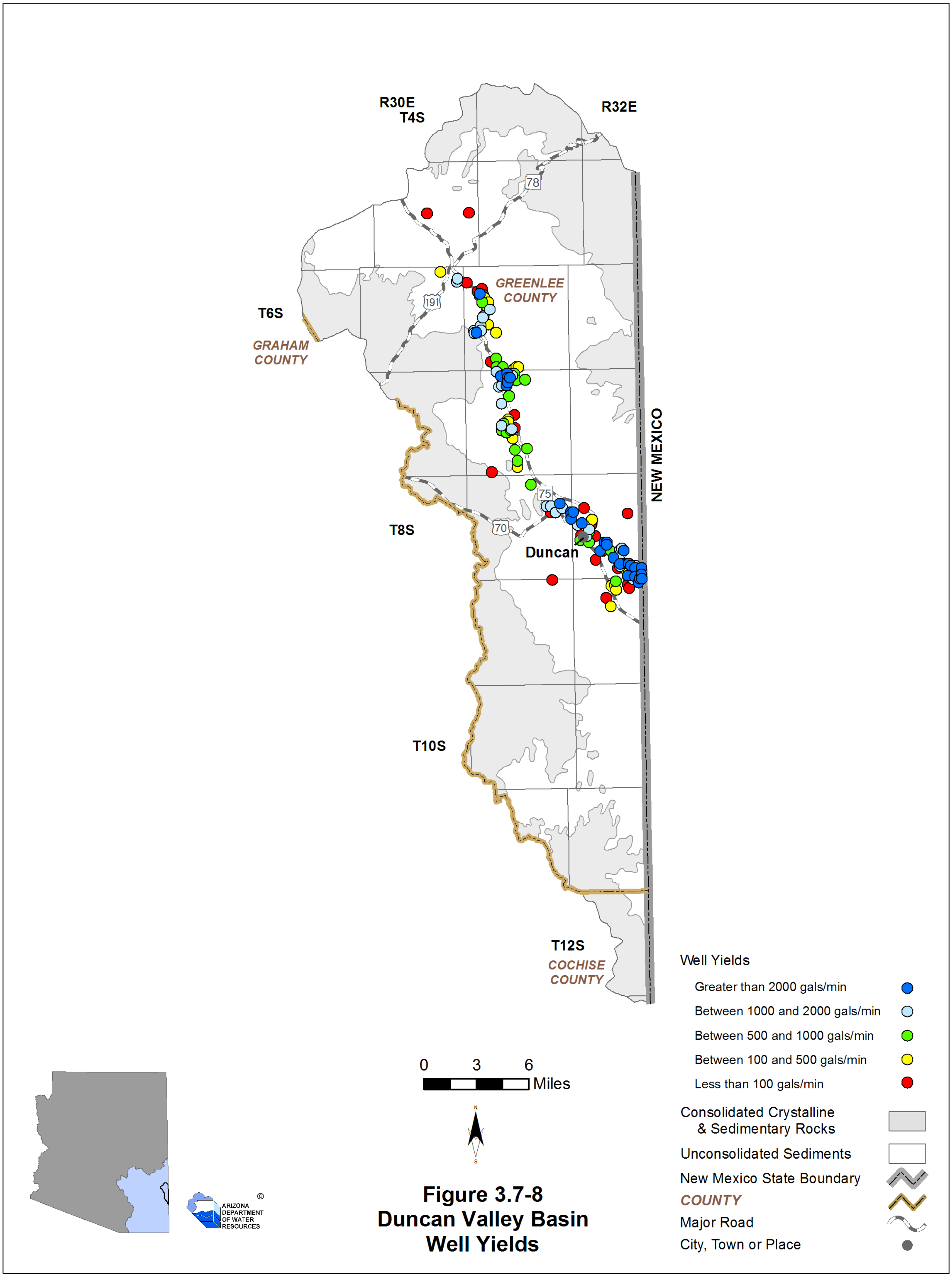


Figure 3.7-8
Duncan Valley Basin
Well Yields

3.7.7 Water Quality of the Duncan Valley Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.7-7A. 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 3.7-7B. Figure 3.7-9 shows the location of exceedences and impairment keyed to Table 3.7-7. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.7-7A.
- Thirty-seven sites have parameter concentrations that have equaled or exceeded DWS.
- The most frequently equaled or exceeded parameter was arsenic.
- Other parameters commonly equaled or exceeded in the sites measured in this basin were nitrate, total dissolved solids, mercury, cadmium and radionuclides.

Lakes and Streams with impaired waters

- Refer to Table 3.7-7B.
- Water quality standards were exceeded in one 15 mile reach of the Gila River.
- The parameter exceeded in this reach was selenium.
- This reach is part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. The draft TMDL report is underway.

Table 3.7-7 Water Quality Exceedences in the Duncan Valley Basin[1]

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	5 South	29 East	27	F
2	Well	5 South	30 East	10	As
3	Well	5 South	30 East	10	As
4	Well	5 South	30 East	10	As
5	Well	5 South	30 East	10	As
6	Well	5 South	30 East	24	Hg
7	Well	6 South	30 East	1	As
8	Well	6 South	30 East	2	F
9	Well	6 South	31 East	19	As
10	Well	6 South	32 East	8	As
11	Well	7 South	31 East	28	Cd
12	Well	8 South	32 East	8	As
13	Well	8 South	32 East	17	As
14	Well	8 South	32 East	17	As
15	Well	8 South	32 East	18	F
16	Well	8 South	32 East	19	As
17	Well	8 South	32 East	19	As
18	Well	8 South	32 East	21	As, NO3
19	Well	8 South	32 East	29	F
20	Well	9 South	31 East	2	As, F
21	Well	9 South	32 East	3	As, TDS
22	Well	9 South	32 East	4	As
23	Well	9 South	32 East	4	As, F
24	Well	9 South	32 East	5	As, F
25	Well	9 South	32 East	8	F
26	Well	9 South	32 East	9	F
27	Well	9 South	32 East	9	F
28	Well	9 South	32 East	9	As, F
29	Well	9 South	32 East	15	As, F
30	Well	9 South	32 East	19	F
31	Well	9 South	32 East	28	F
32	Well	9 South	32 East	28	F
33	Well	9 South	32 East	34	F
34	Well	10 South	31 East	35	As, NO3
35	Well	10 South	32 East	21	F
36	Well	10 South	32 East	21	As, F
37	Well	12 South	32 East	14	Rad

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Gila River (Skully Creek-San Francisco River)	15	NA	A&W	Se

Source: ADEQ 2005d

Notes:
Because of map scale feature locations may appear different than the location indicated on the table
NA = Not applicable
[1] Water quality samples collected between 1986 and 2004.
[2] As = Arsenic
Cd = Cadmium
F= Fluoride
Pb = Lead
Hg = Mercury
NO3 = Nitrate
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
Se = Selenium

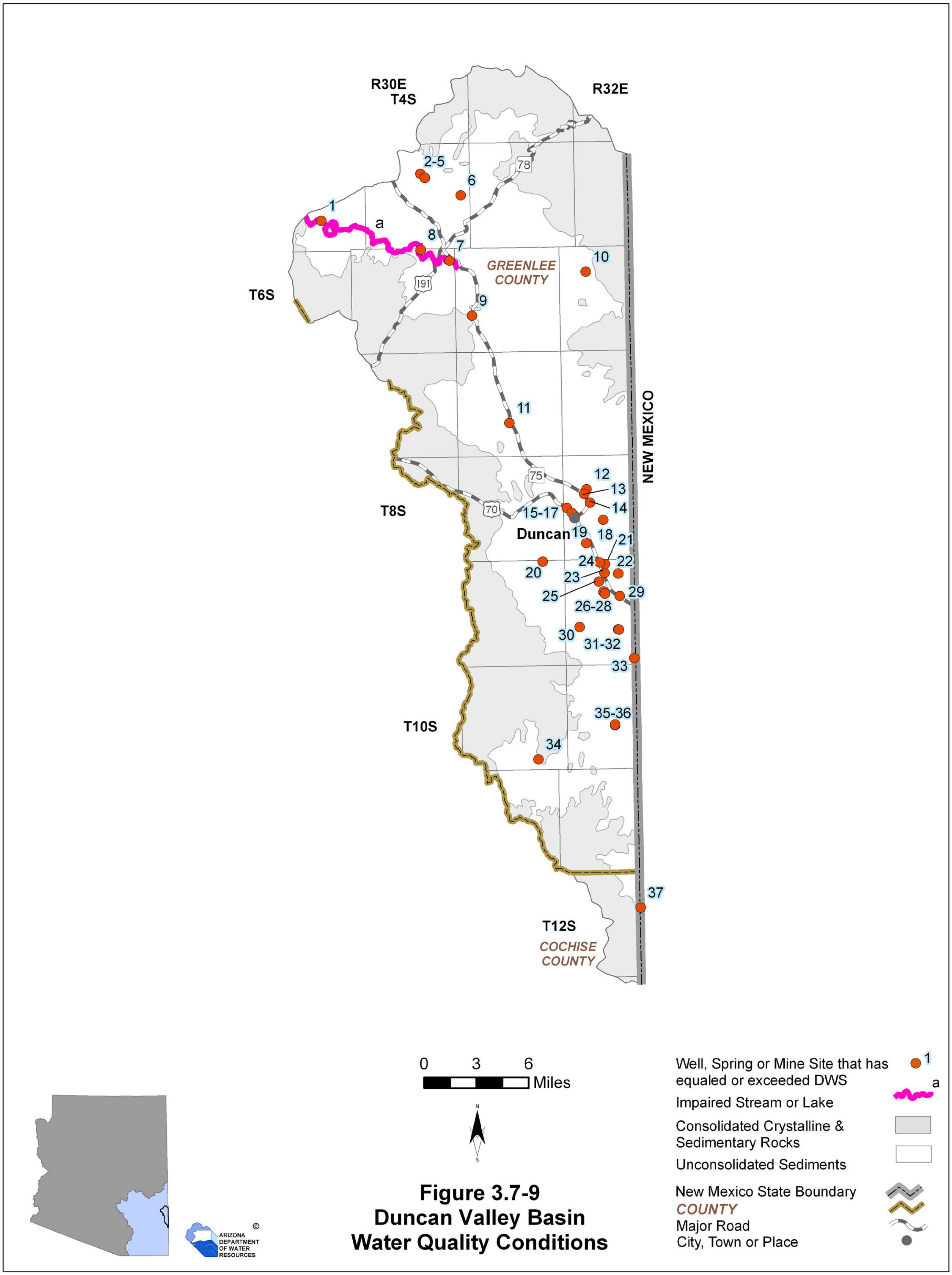


Figure 3.7-9
Duncan Valley Basin
Water Quality Conditions

3.7.8 Cultural Water Demand in the Duncan Valley 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 3.7-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.7-9. Figure 3.7-10 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.7-8 and Figure 3.7-10.
- Population increased only minimally between 1980 and 2000.
- Total groundwater use has fluctuated between 1971 and 2005. The highest average annual groundwater use in this basin was from 1976 to 1980 at 24,000 AFA.
- Surface water diversions have also fluctuated between 1971 and 2005. The highest average annual surface water diversions were from 1981 to 1985 at 22,000 AFA.
- Years with lower surface water diversions coincide with years of increased groundwater use.
- All surface water demand between 1991 and 2005 has been for agriculture.
- The majority of agricultural demand is in the vicinity of Duncan with other small blocks of agricultural demand along Highway 75.
- The highest concentration of municipal and industrial demand, including a golf course, is along Highway 75 near the small town of York.
- Industrial demand in this basin is comparable to historic levels with an average of 300 AFA for the period from 1991-2005.
- Municipal demand has remained relatively constant as well, with an average of 600 AFA for the period from 2001-2005.
- As of 2005 there were 866 registered wells with a pumping capacity of less than or equal to 35 gpm and 325 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.7-9.
- There is one wastewater treatment facility, the Duncan Wastewater Treatment Facility, located at Duncan.
- 600 people are served by the facility, which generates 45 acre-feet of effluent per year and disposes it in as overland flow.

Table 3.7-8 Cultural Water Demand in the Duncan Valley 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		635[2]	276[2]	21,000			13,000			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				24,000			16,000			
1977										
1978										
1979										
1980	3,225									
1981	3,210	53	11	12,000			22,000			
1982	3,195									
1983	3,181									
1984	3,166									
1985	3,151									
1986	3,136	33	10	7,000			20,000			
1987	3,122									
1988	3,107									
1989	3,092									
1990	3,077									
1991	3,145	49	7	650	300	5,900	NR	NR	21,500	USGS (2007) Gila Water Commis-sioner (2006) ADWR (2008b)
1992	3,213									
1993	3,281									
1994	3,349									
1995	3,417									
1996	3,458	47	12	800	300	8,300	NR	NR	18,500	
1997	3,553									
1998	3,621									
1999	3,689									
2000	3,757									
2001	3,742	3683	9	600	300	10,000	NR	NR	9,900	
2002	3,727									
2003	3,713									
2004	3,698									
2005	3,683									
2010	3,609									
2020	3,610									
2030	3,655									
	WELL TOTALS:	**866**	**325**							

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoirs or effluent.
[2] Includes all wells through June 1980.

Table 3.7-9 Effluent Generation in the Duncan Valley 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	Golf Course/Turf/ Landscape	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other			
Duncan WWTF	Town of Duncan	Duncan	600	45									X	Secondary	NA	2000

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
WWTF: Wastewater Treatment Facility

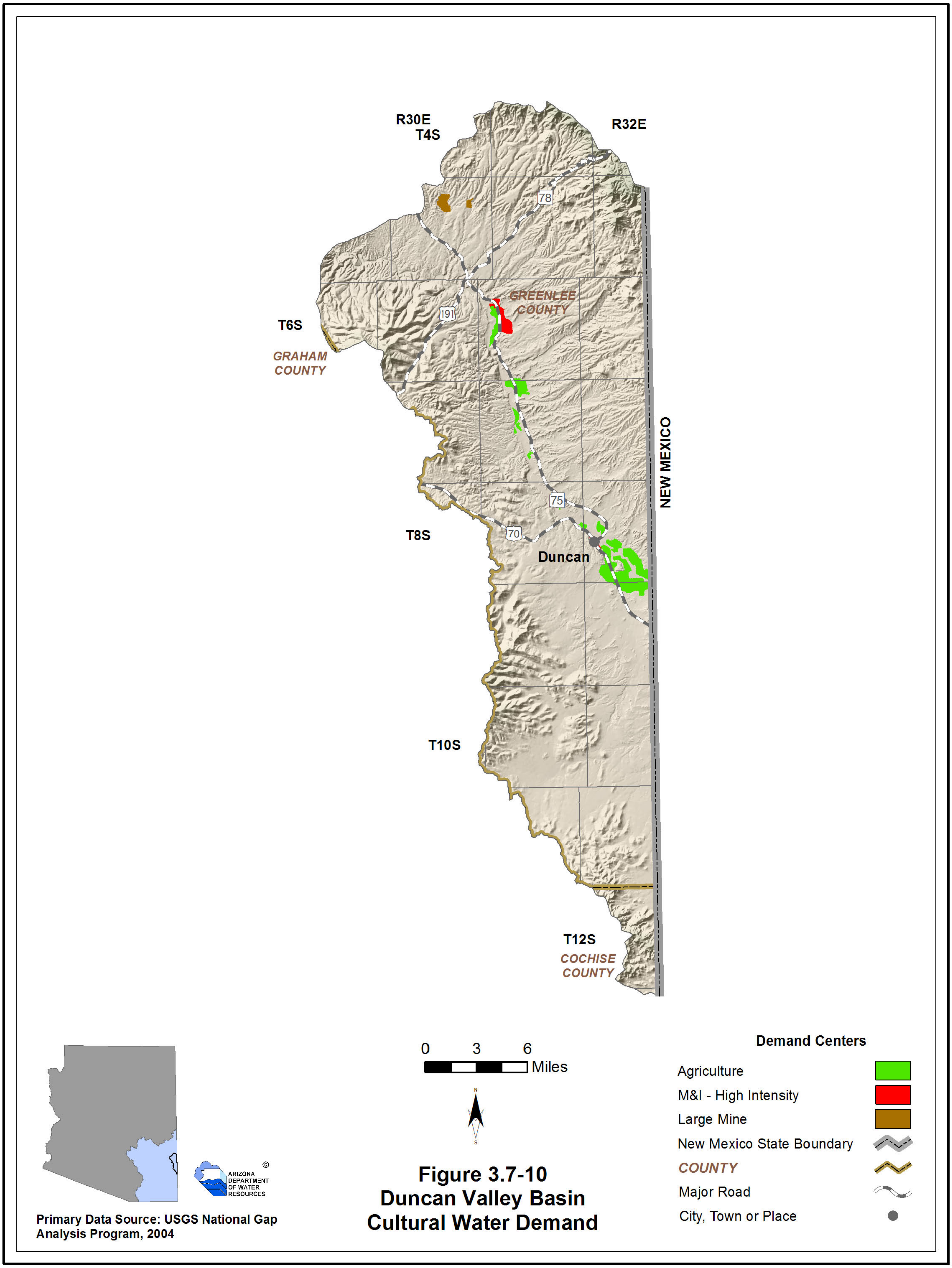


Figure 3.7-10
Duncan Valley Basin
Cultural Water Demand

3.7.9 Water Adequacy Determinations in the Duncan Valley 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 3.7-10. Figure 3.7-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in Greenlee County. Three water adequacy determinations for 263 lots have been made in this basin through December 2008. Sixty-one lots, or 23%, were determined to be adequate.
- The one determination of inadequacy was made because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination.

Table 3.7-10 Adequacy Determinations in the Duncan Valley Basin[1]

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	Gila Vista # 1	Greenlee	8 South	32 East	8	29		Adequate		11/07/79	Dry Lot Subdivision
2	Greenlee Mountain Ranchettes	Greenlee	5 South	31 East	6	NA		Inadequate	A1	05/10/84	Dry Lot Subdivision
			4 South	31 East	29, 31	207					
3	Hunter Estates # 2	Greenlee	8 South	32 East	8	32		Adequate		07/18/80	Dry Lot Subdivision

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 unavailable; 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= Data not currently available to ADWR

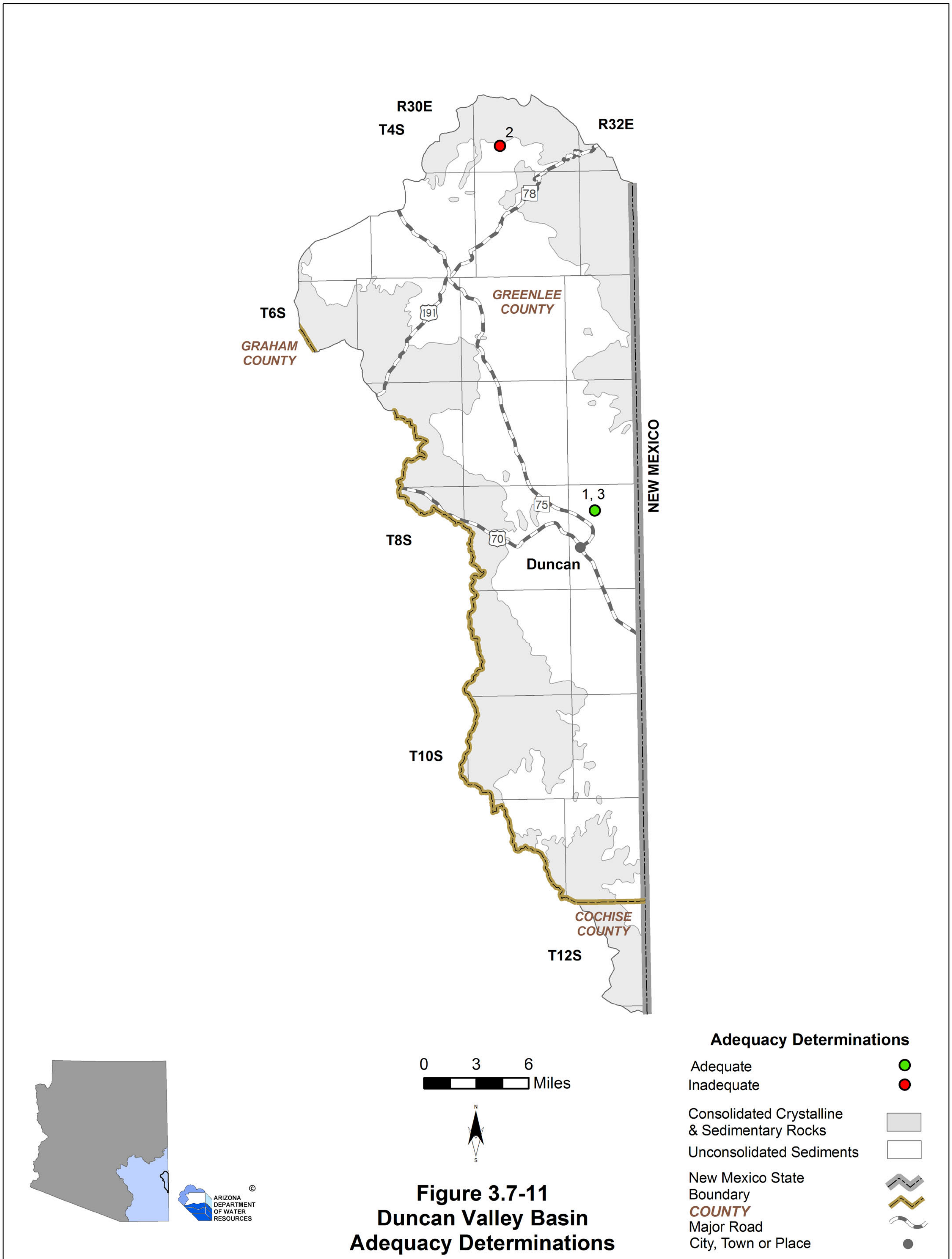


Figure 3.7-11
Duncan Valley Basin
Adequacy Determinations

DUNCAN VALLEY BASIN

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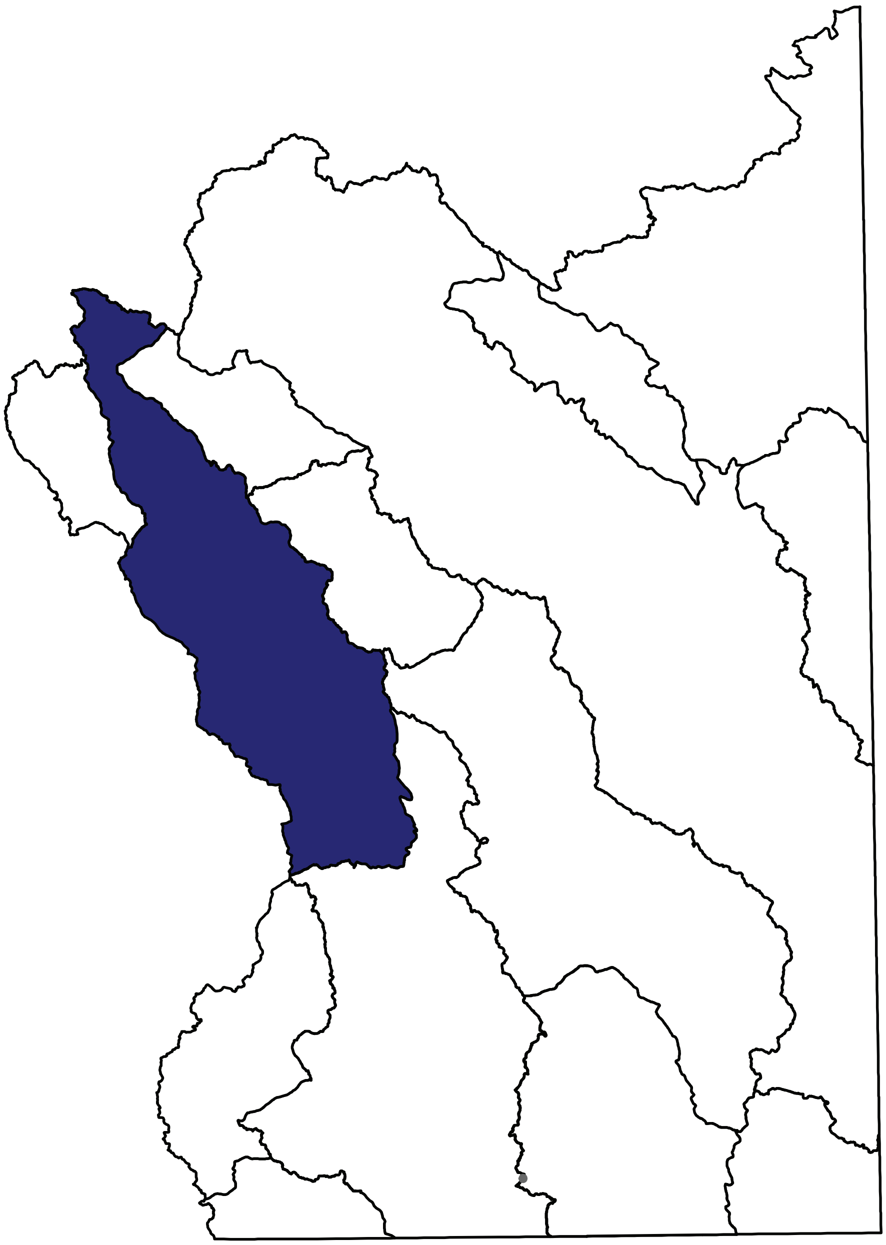
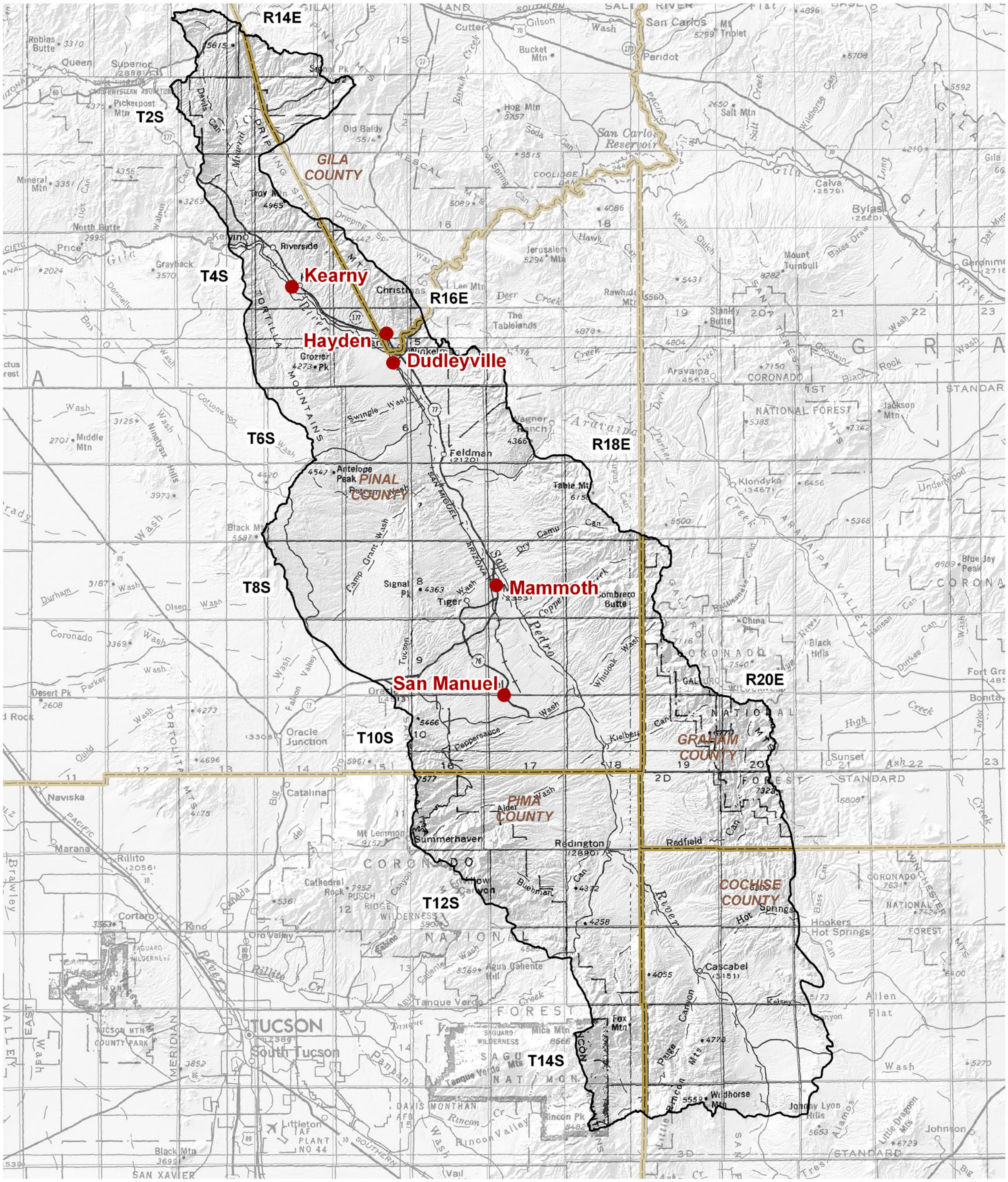
Section 3.8
Lower San Pedro Basin



3.8.1 Geography of the Lower San Pedro Basin

The Lower San Pedro Basin is a medium-size, 1,624 square mile basin on the western side of the planning area. Geographic features and principal communities are shown on Figure 3.8-1. The basin is characterized by high-elevation mountain ranges and washes. Vegetation is primarily Arizona uplands Sonoran desertscrub and semi-desert grassland with smaller areas of Chihuahuan desertscrub, madrean evergreen woodland, Rocky Mountain and madrean montane conifer forest and interior chaparral. (see Figure 3.0-9) Riparian vegetation includes strand and mesquite on the San Pedro River and Aravaipa Creek.

- Principal geographic features shown on Figure 3.8-1 are:
    - San Pedro River running northward from south of Cascabel to Winkleman where it joins the Gila River
    - Gila River in the vicinity of Kearny and Hayden
    - Peppersauce, Hot Springs, Buehman, Redfield and Kielberg Canyons south of San Manuel
    - Tortilla Mountains to the west of Kearny and Hayden
    - Santa Catalina Mountains to the west and southwest of San Manuel
    - Dripping Springs Mountains to the northeast, Galiuro Mountains to the southeast and the Rincon Mountains along the southwestern boundary, which include the highest point in the basin at 7,960 feet
    - The lowest point at approximately 1,800 feet where the Gila River exits the basin



0 3 6
Miles

Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 3.8-1
Lower San Pedro Basin
Geographic Features

COUNTY
City, Town or Place

3.8.2 Land Ownership in the Lower San Pedro Basin

Land ownership, including the percentage of ownership in each category, is shown for the Lower San Pedro in Figure 3.8-2. Principal features of land ownership in this basin include the large variety of land ownership types, seven total, and the high proportion of state trust lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

State Trust

- 51.9% of land in this basin is held in trust for public schools and 13 other beneficiaries under the State Trust Land system.
- The majority of the land in state ownership is contiguous and located throughout the basin.
- Primary land use is grazing.

Private

- 20.9% of land ownership is private.
- Private land is largely fragmented in this basin with one nearly continuous strip running along the two highways in the region, 177 and 77, and the San Pedro River. A sizable portion of private land ownership also exists around the town of San Manuel.
- There are a few private land in-holdings in the Coronado National Forest and U.S. Bureau of Land Management lands.
- Primary land uses are farming, mining, domestic and commercial.

National Forest

- 15.3% of the land is federally owned and managed by the United States Forest Service (USFS).
- The basin contains two forest districts and three ranger districts, the Tonto National Forest, Globe Ranger District and the Coronado National Forest, Santa Catalina Ranger District in the west and the Safford Ranger District in the east.
- The basin contains portions of two wilderness areas, the Rincon Mountain Wilderness area, which surrounds Saguaro National Park and the Galiuro Wilderness area in the Safford Ranger District. (see Figure 3.0-12)
- Primary land uses are recreation, grazing and timber production.

U.S. Bureau of Land Management (BLM)

- 9.3% of land is federally owned and managed by the Safford Field Office of the BLM.
- BLM ownership is dispersed in small parcels throughout most of the basin.
- The Redfield Canyon Wilderness area, managed by the BLM, is located in T11S, R20E. (see Figure 3.0-12)
- Primary land uses are grazing and recreation.

Indian Reservations

- 1.6% of land is under ownership of the San Carlos Apache Tribe, located east of

Dudleyville.
- Primary land use is grazing.

National Park Service (NPS)
- 0.8% of land is federally owned and managed by the NPS.
- A small portion of Saguaro National Park is in the southwestern corner of the basin.
- Primary land uses are resource protection and recreation.

Other (Game and Fish, County and Bureau of Reclamation Lands)
- 0.2% of land is owned by the Bureau of Reclamation
- This land is not visible on the map but is located in T4S, R14E.
- Primary land use is for water delivery.

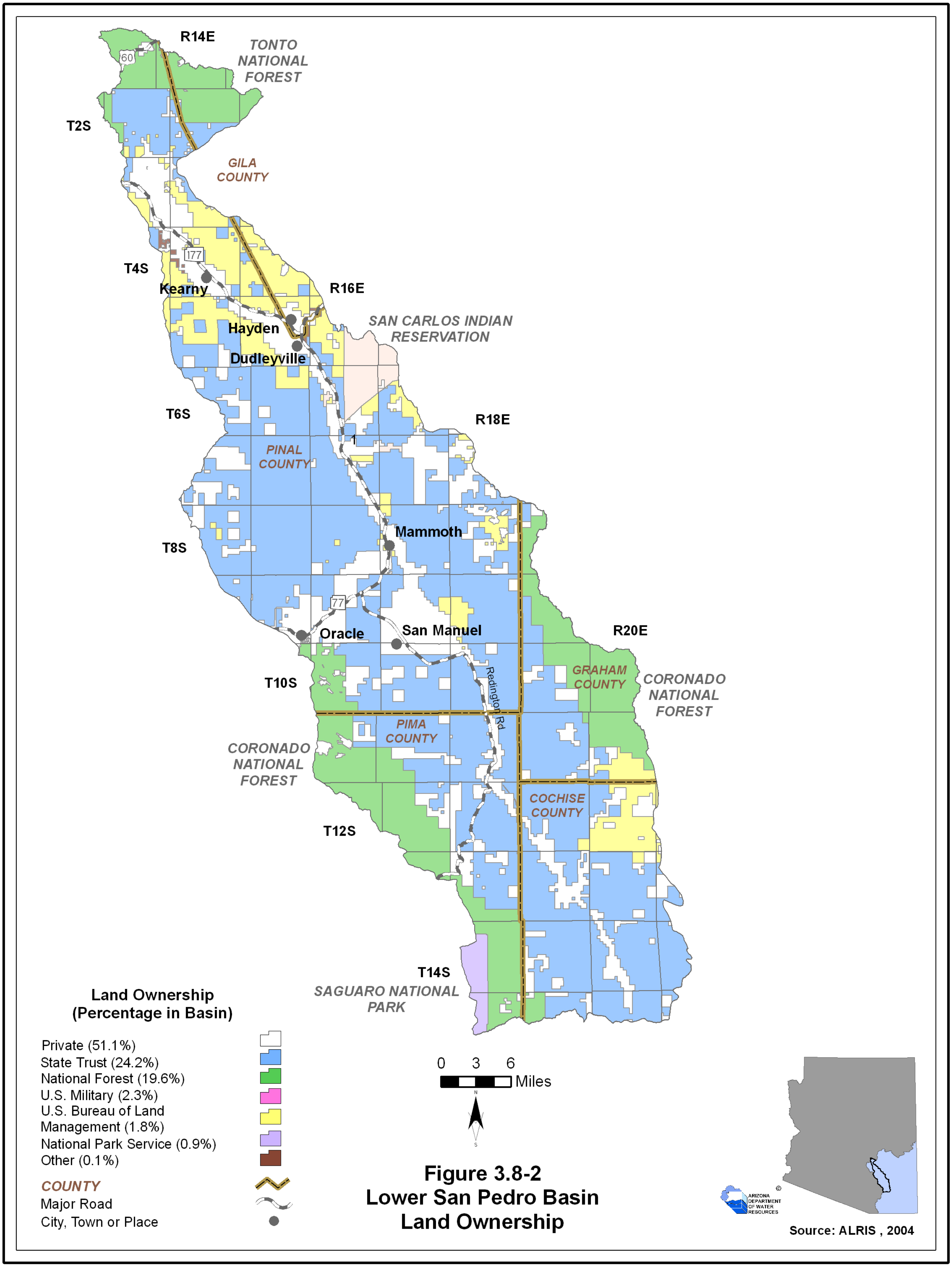


Figure 3.8-2
Lower San Pedro Basin
Land Ownership

3.8.3 Climate of the Lower San Pedro Basin

Climate data from NOAA/ NWS Co-op Network stations are complied in Table 3.8-1 and their locations are shown on Figure 3.8-3. Figure 3.8-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Lower San Pedro Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.4. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.8-1A
- There are six NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July and ranges from 64.9°F at Palisade Ranger Station to 86.4°F at Winkleman 6 S. The average monthly minimum temperature occurs in January and December and ranges from 34.5°F at Palisade Ranger Station to 47.6°F at Cascabel.
- Highest average seasonal rainfall occurs in the summer (July-September). For the period of record used, highest annual rainfall is 32.24 inches at Palisade Ranger Station and the lowest is 14.33 inches at Cascabel.

SCAS Precipitation Data

- See Figure 3.8-3
- Additional precipitation data shows rainfall as high as 38 inches at the Santa Catalina Mountains southwest of San Manuel and as low as 12 inches at the San Pedro River Valley in the vicinity of Dudleyville.

Table 3.8-1 Climate Data for the Lower San Pedro Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Cascabel	3,140	1971-2000	82.5/Jul	47.6/Dec	3.41	1.08	6.56	3.28	14.33
Oracle 2 SE	4,510	1971-2000	79.5/Jul	45.5/Dec	7.59	1.93	9.31	6.09	24.92
Palisade Ranger Station	7,960	1965-1981[1]	64.9/Jul	34.5/Jan	9.26	2.80	12.31	7.88	32.24
San Manuel	3,460	1954-2004[1]	83.3/Jul	47.3/Jan	3.76	1.56	6.51	3.25	14.75
Willow Springs Ranch	3,690	1949-1978[1]	81.2/Jul	45.2/Jan	2.86	1.67	5.79	5.46	15.77
Winkelman 6 S	2,080	1942-1980[1]	86.4/Jul	46.9/Dec	4.48	1.54	5.43	4.76	16.22

Source: WRCC, 2005

Notes:
[1]Average temperature for period of record shown; average precipitation from 1971-2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								

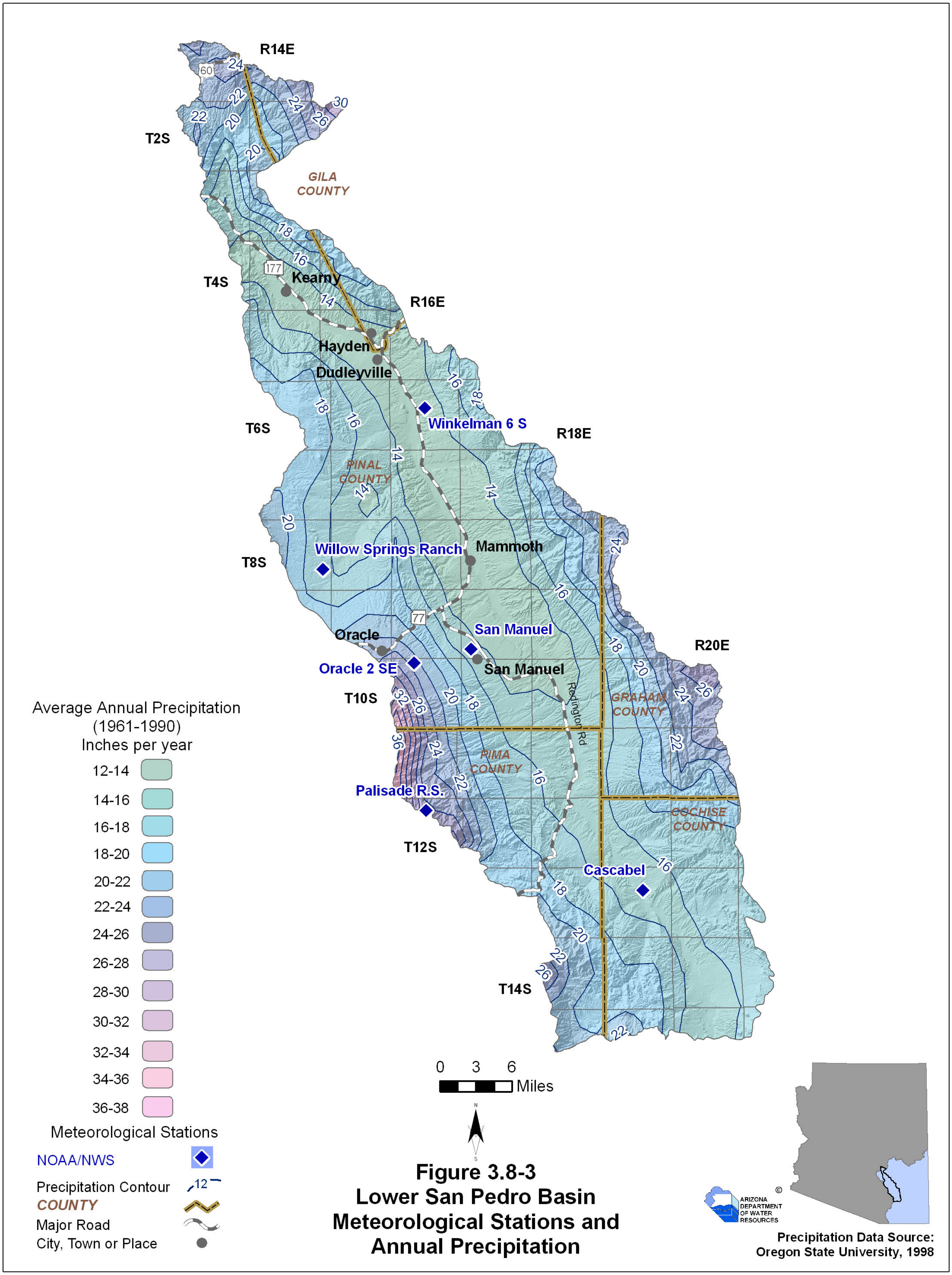


**Figure 3.8-3
Lower San Pedro Basin
Meteorological Stations and
Annual Precipitation**

3.8.4 Surface Water Conditions in the Lower San Pedro Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.8-2. Flood ALERT equipment in the basin is shown on Table 3.8-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.8-4. The location of streamflow gages identified by USGS number, flood ALERT equipment and USGS runoff contours are shown on Figure 3.8-5. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.8-2.
- Data from 11 stations on four watercourses are shown on the table and on Figure 3.8-5. Eight stations have been discontinued and the remaining three are real-time stations.
- The average seasonal flow for most stations is highest in the Summer (July-September) and lowest in the Spring (April-June).
- Maximum annual flow in this basin was 2,375,969 acre-feet in 1993 on the Gila River and minimum annual flow was 17 acre-feet in 1969 on the Peck Canyon tributary.
- Figure 3.8-4 is a stream hydrograph showing long-term flow at Aravaipa Creek near Mammoth.

Flood ALERT Equipment

- Refer to Table 3.8-3.
- There are four stations in the basin as of October 2005.

Reservoirs and Stockponds

- Refer to Table 3.8-4.
- There are seven small reservoirs in this basin.
- There are 648 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.8-5.
- Average annual runoff varies from 0.5 inches per year, or 26.65 acre-feet per square mile, in the vicinity of the San Pedro River to one inch per year, or 53.3 acre-feet per square mile, on the eastern and western boundaries of the basin.

Figure 3.8-4 Annual Flows (in acre-feet) at Aravaipa Creek near Mammoth (Station # 9473000) Water Years 1932 - 2007

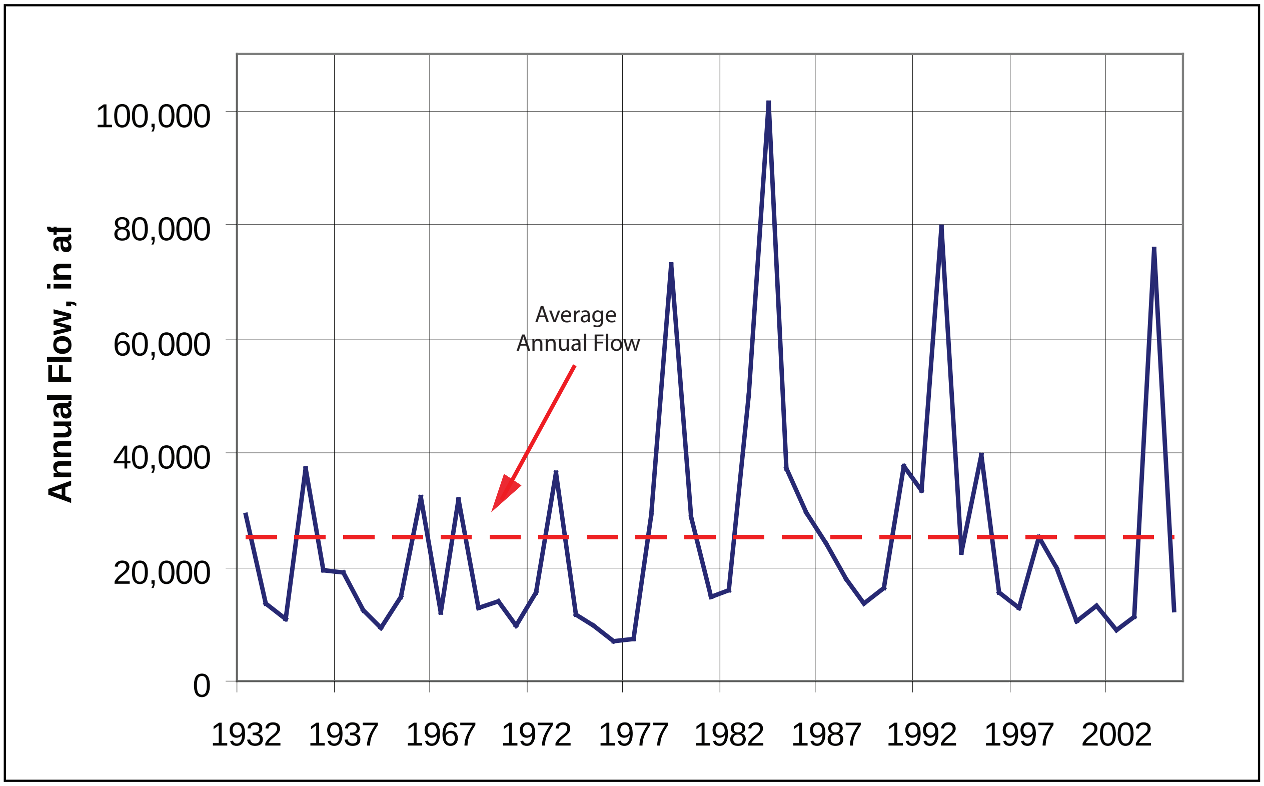


Table 3.8-2 Streamflow Data for the Lower San Pedro Basin

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/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9470000	Gila River at Winkelman	13,268	1,922	9/1917-7/2004 (discontinued)	30	31	32	7	43,522 (1953)	237,525	282,922	2,203,619 (1993)	47
9472000	San Pedro River near Redington	2,927	2,940	6/1943-9/1995 (discontinued)	19	2	64	16	297 (1997)	21,399	31,033	131,073 (1955)	50
9472050	San Pedro River at Redington Bridge near Redington	3,096	2,820	7/1998-current (real time)	2	0	57	41	2,325 (2002)	13,451	19,491	48,736 (2000)	4
9472100	Peck Canyon Tributary near Redington	8	2,850	10/1967-9/1972 (discontinued)	0	3	90	8	17 (1969)	71	78	152 (1971)	4
9472500	San Pedro River near Mammoth	3,583	2,307	5/1931-6/1941 (discontinued)	12	1	78	9	17,520 (1933)	43,149	43,406	73,846 (1940)	9
9473000	Avavaipa Creek near Mammoth	537	2,345	5/1931-current (real time)	42	11	19	28	6,756 (1976)	18,901	24,768	120,211 (1983)	46
9473020	Avavaipa Creek near Fieldman	557	NA	5/1919-9/1921 (discontinued)	No statistics run, less than 3 years of data								2
9473100	San Pedro River below Aravaipa Creek near Mammoth	4,343	2,125	10/1979-9/1983 (discontinued)	60	6	28	6	17,086 (1981)	18,679	20,706	26,352 (1980)	3
9473400	San Pedro River near Winkelman	4,430	NA	4/1962-12/1965 (discontinued)	13	2	50	35	43,294 (1963)	66,099	62,045	76,742 (1965)	3
9473500	San Pedro River at Winkelman	4,453	1,925	1/1966-12/1978 (discontinued)	22	2	41	35	8,615 (1975)	35,764	37,803	109,321 (1978)	13
9474000	Gila River at Kelvin	18,011	1,745	1/1911-current (real time)	31	23	23	14	56,398 (1961)	324,351	370,675	2,375,969 (1993)	93

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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
NA= Not available

Table 3.8-3 Flood ALERT Equipment in the Lower San Pedro Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
700	Alder Canyon Wash	Precipitation/Stage	NA	ADWR
1030	Oracle Ridge	Precipitation	3/1/1983	Pima County FCD
1140	Dan Saddle	Precipitation	NA	Pima County FCD
6760	Signal Peak Repeater	Repeater/Precipitation	5/18/1993	ADWR

Source: ADWR 2005a

Notes:
NA = Not available
ADWR = Arizona Department of Water Resources
FCD = Flood Control District

Table 3.8-4 Reservoirs and Stockponds in the Lower San Pedro Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 4
Total maximum storage: 360 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 3
Total surface area: 33 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 648 (from water right filings)

Notes:
[1]Capacity data not available to ADWR

Figure 3.8-5
Lower San Pedro Basin
Surface Water Conditions

3.8.5 Perennial/Intermittent Streams and Major Springs in the Lower San Pedro 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 3.8-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.8-6. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- A number of perennial and intermittent streams are located throughout the basin.
- The San Pedro River is perennial south of Dudleyville and in its southern reach in the planning area.
- There are 13 major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge is 1,000 gpm at Cooks Lake spring.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.8-5. There are 30 minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. Most of the measurements were taken prior to 1990 and many of the major spring measurements were taken in the 1950s. Only four minor spring measurements post-date 1990.
- The total number of springs identified by the USGS varies from 203 to 209, depending on the database reference.

Table 3.8-5 Springs in the Lower San Pedro Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Cooks Lake	325144	1104301	1,000	2/9/1951
2	Bingham[2]	322724	1102910	494	4/18/1968
3	V S[2]	324847	1104206	150	2/15/1951
4	Putnam	324931	1104510	112	6/16/1978
5	Unnamed	321548	1101623	40	03/1946
6	Unnamed[2]	322026	1101438	35	11/1950
7	Unnamed[2]	321535	1101739	25	03/1936
8	Unnamed[2]	321527	1101508	20	2/24/1951
9	Unnamed[2]	322019	1102507	15	10/1950
10	Unnamed[2]	322000	1101956	15	11/17/1950
11	Piper	325901	1104333	15	2/14/1951
12	Upper Walnut[2]	322537	1102027	11	1/18/1989
13	Swamp Spring Canyon[2,3]	322609	1101709	10[4]	06/1984

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Horse Camp	324154	1102631	8	NA
Unnamed	324319	1103000	7	03/1950
Copper Creek	324522	1102844	6	10/2002
Unnamed	324416	1103104	5	11/27/1972
Unnamed	322722	1103824	5	7/10/1952
Red	325328	1103746	4	04/1951
Carrizo[2]	325326	1103631	4	2/13/1951
Peasley	322913	1104017	4	10/1949
Unnamed[2]	322558	1102251	4	01/1951
Barrel Hoop[2,3]	322624	1101542	4	04/1986
Stratton	322757	1104439	3	10/1949
Unnamed[2]	322807	1104337	3	NA
Alder Box	322748	1104211	3	10/1949
Lost Trail[2,3]	322604	1101732	3	11/2002

Table 3.8-5 Springs in the Lower San Pedro Basin (Cont)

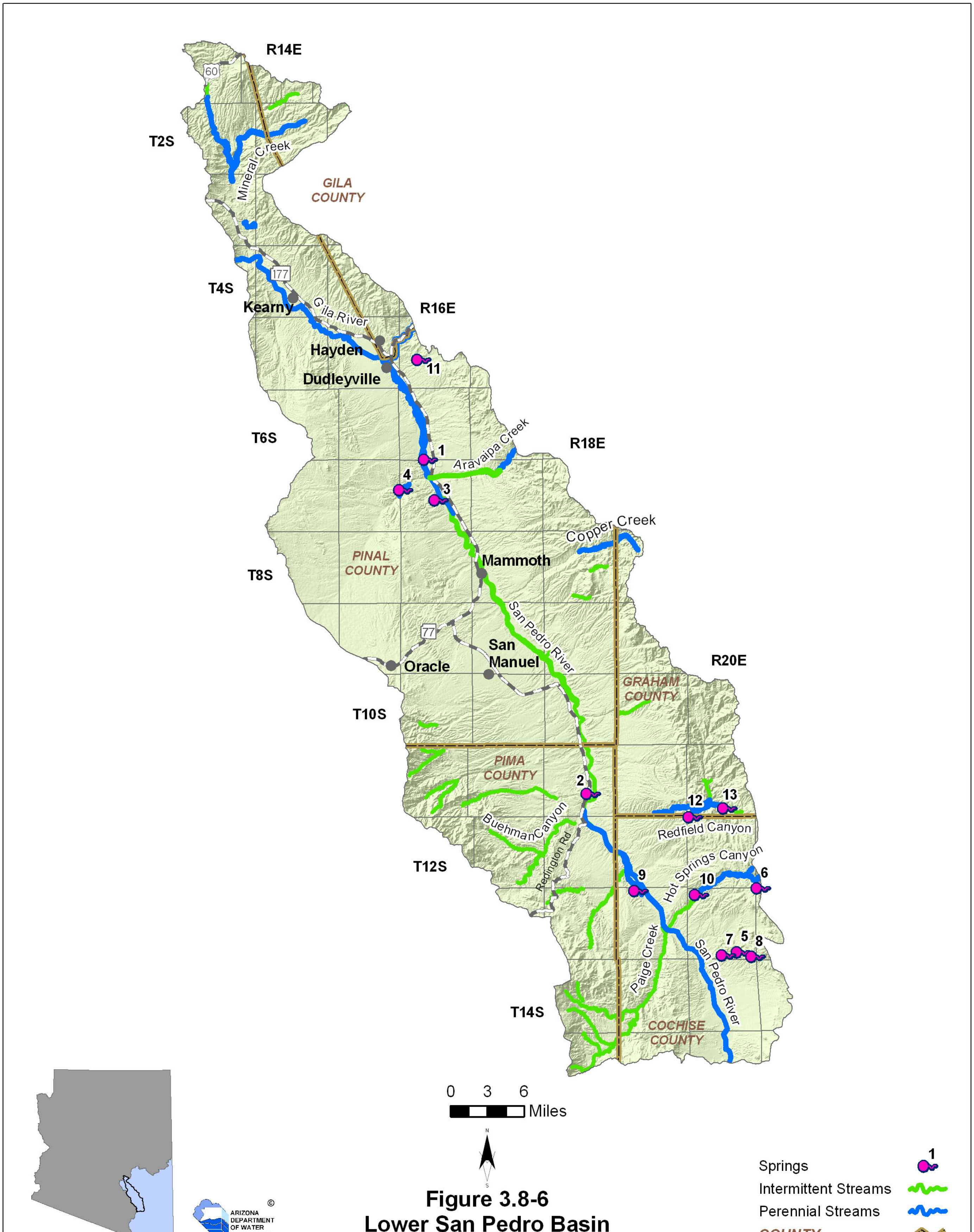
B. Minor Springs:

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed	325745	1103935	2	06/1950
Carrico	325334	1103723	2	02/1951
Oak	325029	1103158	2	04/1951
Red Horse	322951	1104047	2	08/1951
Tio Cruz	322457	1101527	2[5]	08/1986
Miller[2,3]	322737	1101708	2	09/1993
Buddy Opic	322809	1104005	2	10/1949
Old Ranch[2,3]	322750	1101721	2	01/1993
Norton	324344	1102640	2	NA
Rock Wall	322951	1104225	1	11/1949
Juan	322821	1104017	1	10/1949
Addington	324338	1103114	1	04/1951
Unnamed[2]	324724	1103211	1	04/1950
Walnut[2,3]	322552	1102018	1	01/1989
Rim Slope[3]	322549	1101541	1	NA
Roble	321610	1102655	1[5]	01/1951

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 203 to 209

Notes:
NA = Not Available
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Location approximated by ADWR
[4]Discharge measurements vary. Shown is greatest measured discharge; most recent measurement is < 10 gpm
[5]Discharge measurements vary. Shown is greatest measured discharge; most recent measurement is < 1 gpm



Stream Data Source: AGFD, 1993 & 1997; Brown and Carmony, 1981; Pima County DOT, 2000 & 2005

Figure 3.8-6
Lower San Pedro Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

3.8.6 Groundwater Conditions of the Lower San Pedro 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 3.8-6. Figure 3.8-7 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.8-8 contains hydrographs for selected wells shown on Figure 3.8-7. Figure 3.8-9 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 3.8-6 and Figure 3.8-7.
- The major aquifers in the basin are basin fill and recent stream alluvium.
- Artesian conditions exist about five miles north to ten miles south of Mammoth in wells drilled deeper than 500 feet.
- Flow direction is generally from southeast to northwest.
- There are two groundwater sub-basins; Camp Grant Wash and Mammoth.

Well Yields

- Refer to Table 3.8-6 and Figure 3.8-9.
- As shown on Figure 3.8-9 well yields in this basin range from less than 100 gpm to more than 2,000 gpm.
- One source of well yield information, based on 181 reported wells, indicates that the median well yield in this basin is 1,000 gpm.

Natural Recharge

- Refer to Table 3.8-6.
- Principal sources of recharge in this basin are mountain-front recharge and streambed infiltration.
- Natural recharge estimates range from 24,000 acre-feet per year (AFA) to 29,000 AFA.

Water in Storage

- Refer to Table 3.8-6. Water levels are shown for wells measured in 2003-2004.
- Storage estimates for this basin range from 11 million acre-feet (maf) to more than 27 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.8-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 19 index wells in this basin. Hydrographs for six of these wells are shown in Figure 3.8-8.
- Depth to water varies in this basin with the deepest recorded water level in 2003-2004 at 503 feet south of Mammoth and the shallowest at 17 feet north of Mammoth.

Table 3.8-6 Groundwater Data for the Lower San Pedro Basin

Basin Area, in square miles:	1,624	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 628 - 1,910 Median 1,295 (10 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 1 - 4,000 Median 1,000 (181 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 70 - 2,700	ADWR (1994b)
	Range 0 - 2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	29,000	Anderson and Freethey (1995)
	25,000	ADWR (1994b)
	24,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	12,000,000 - 25,600,000 (to 1,200 ft/not given)	ADWR (1990 and 1994b)
	11,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	>27,000,000	Arizona Water Commission (1975)
Current Number of Index Wells:	19	
Date of Last Water-level Sweep:	2006 (205 wells measured)	

[1]Predevelopment Estimate

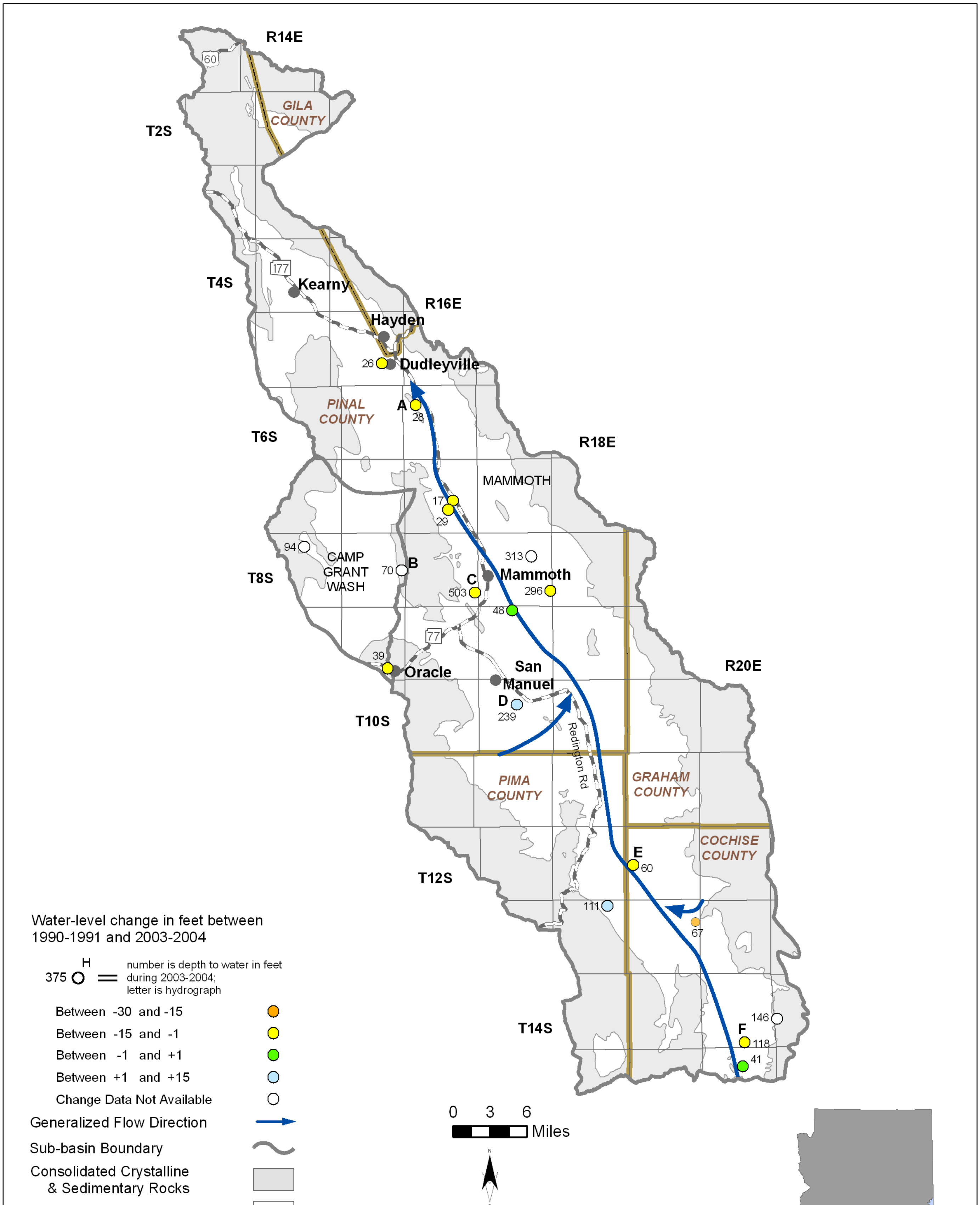


Figure 3.8-7
Lower San Pedro Basin
Groundwater Conditions

Figure 3.8-8
Lower San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

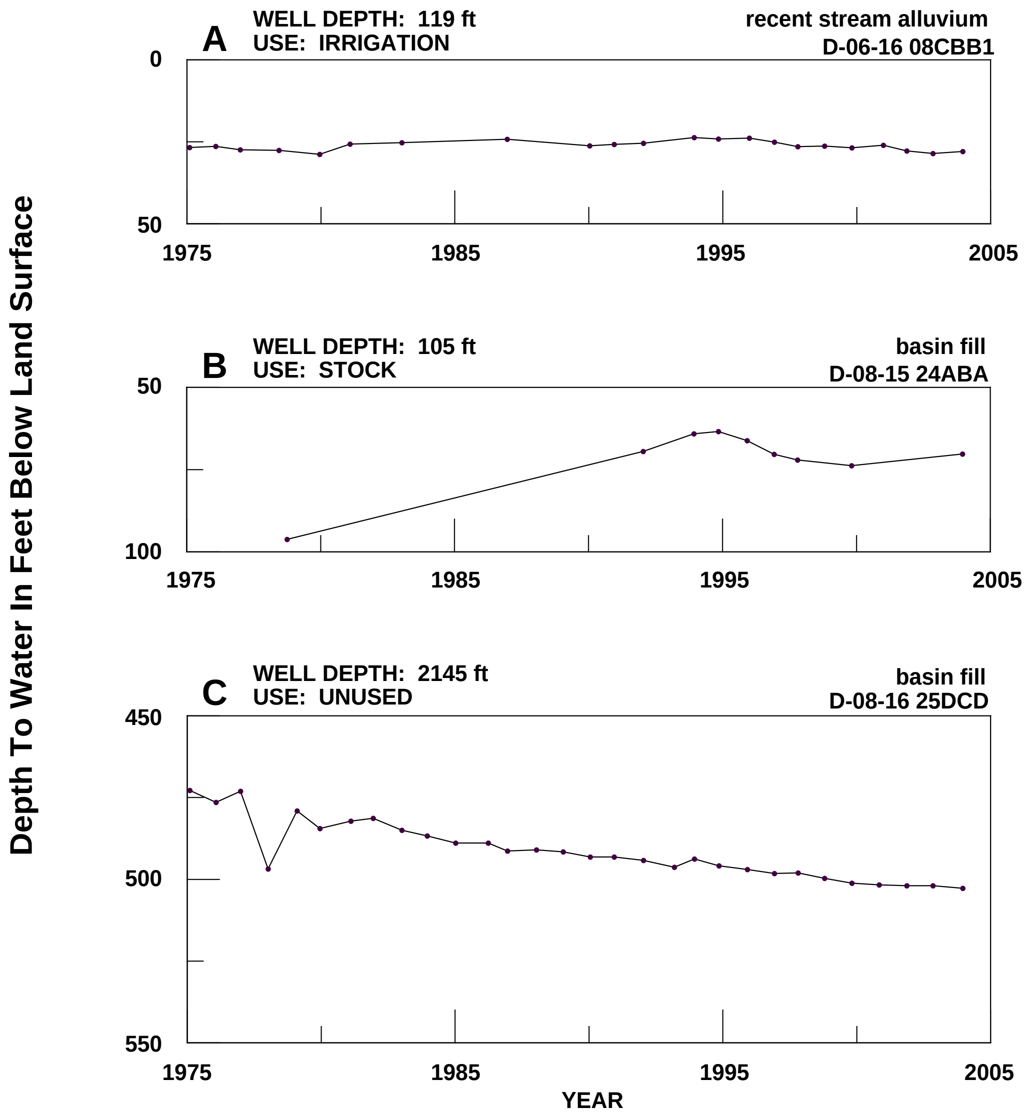
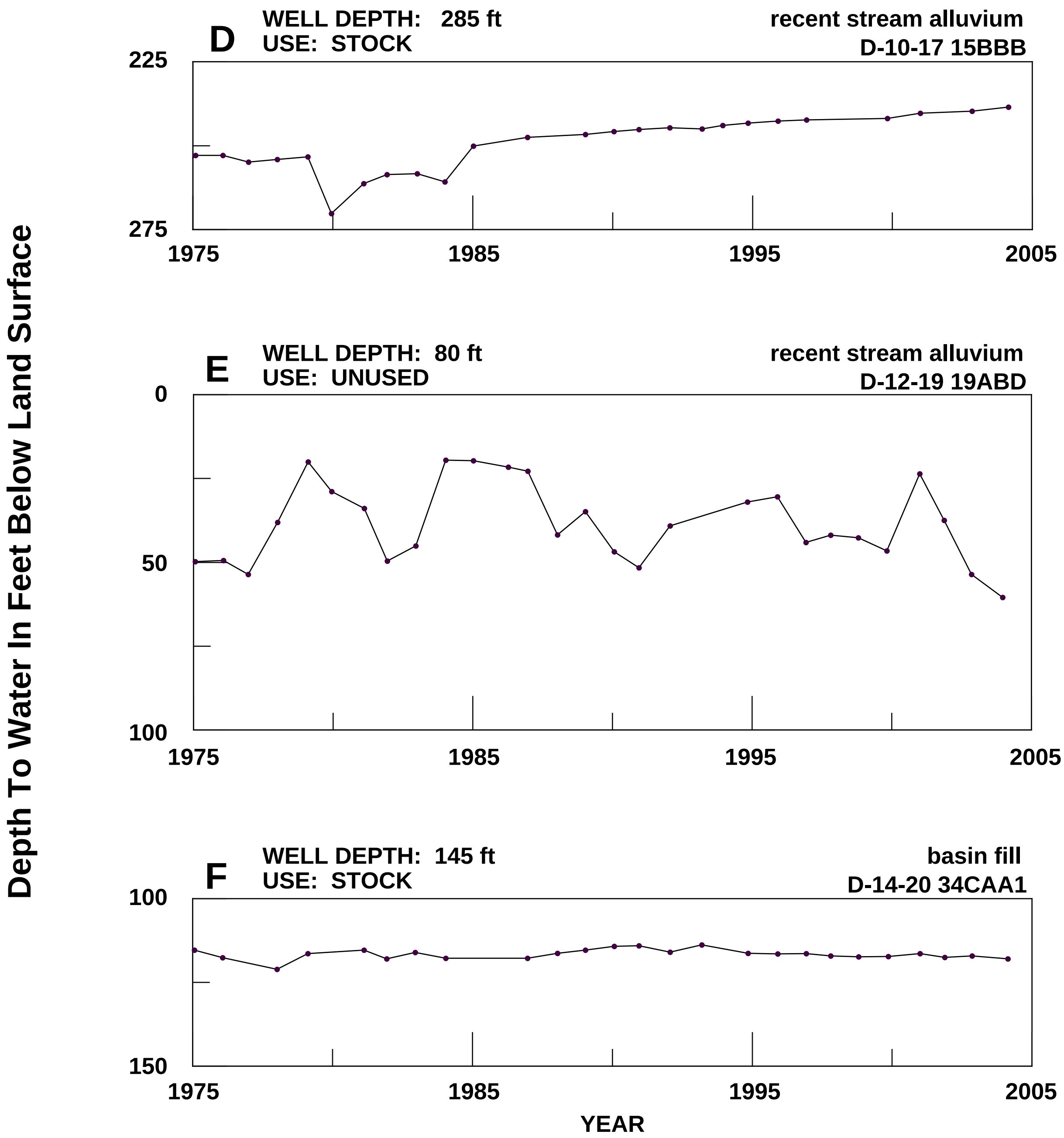


Figure 3.8-8 (Cont)
Lower San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells



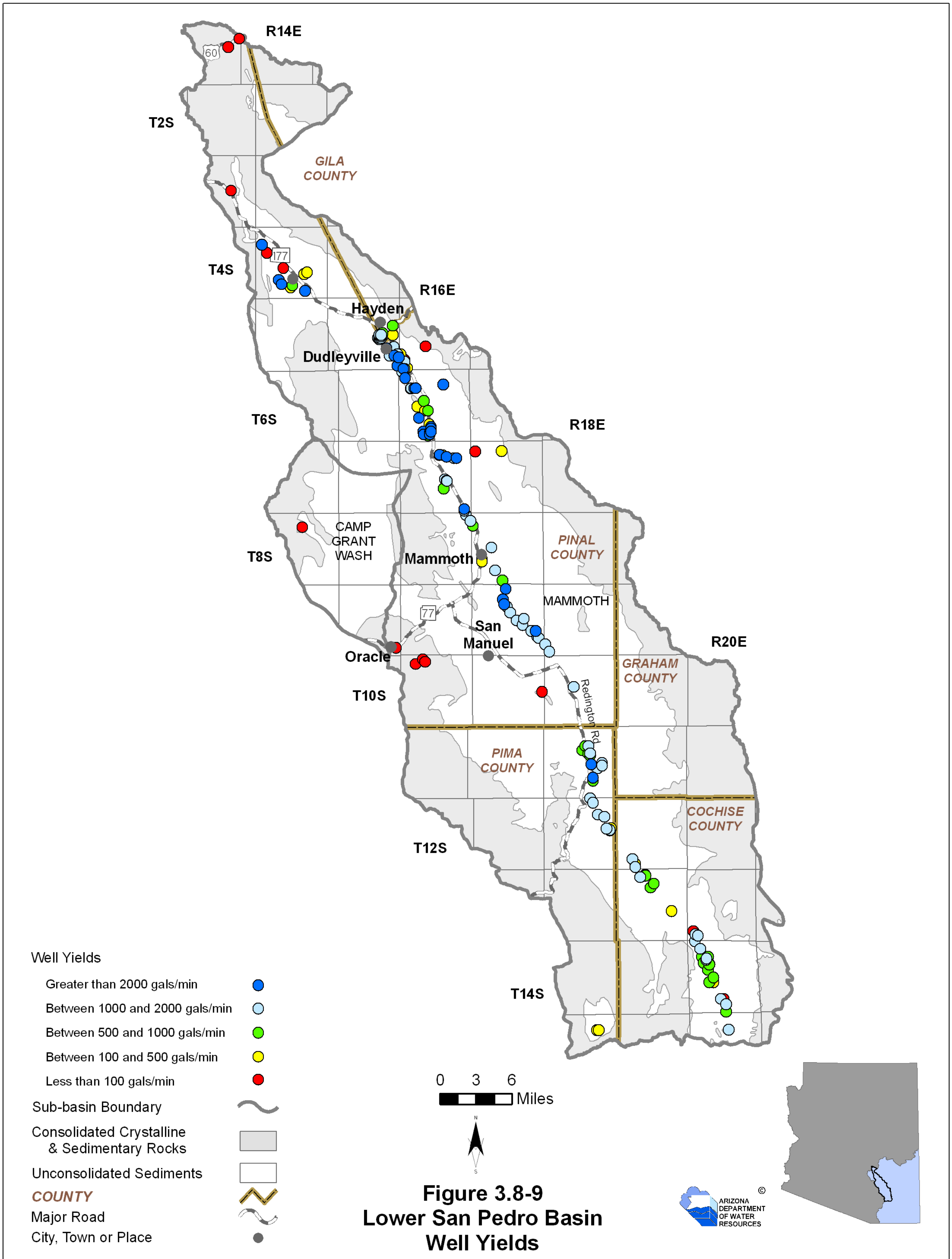


Figure 3.8-9
Lower San Pedro Basin
Well Yields

3.8.7 Water Quality of the Lower San Pedro Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.8-7A. 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 3.8-7B. Figure 3.8-10 shows the location of exceedences and impairment keyed to Table 3.8-7. 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. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.8-7A.
- Fifty-six sites have parameter concentrations that have equaled or exceeded DWS.
- The parameter most frequently equaled or exceeded was fluoride.
- Other parameters commonly equaled or exceeded in the sites measured in this basin were cadmium, arsenic, nitrates, total dissolved solids, lead, antimony, beryllium and radionuclides.

Lakes and Streams with impaired waters

- Refer to Table 3.8-7B.
- Water quality standards were exceeded in one reach of Mineral Creek and in one reach of the San Pedro River.
- The parameters exceeded in Mineral Creek included copper and selenium.
- The parameters exceeded in the San Pedro River were E. coli and selenium.
- Both reaches are part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. The TMDL report for Mineral Creek is not yet complete, however, cleanup by the mining company ASARCO is ongoing. Investigation is underway for the impaired portion of the San Pedro River in this basin.

Effluent Dependent Reaches

- Refer to Figure 3.8-10
- There is one small portion of an unnamed tributary to Alder Creek that is effluent dependent. The source of the effluent is from the Summerhaven wastewater treatment facility located in the Tucson AMA.

Table 3.8-7 Water Quality Exceedences in the Lower San Pedro Basin[1]

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	1 South	13 East	12	NO3
2	Well	1 South	13 East	12	NO3
3	Well	1 South	13 East	14	NO3
4	Well	1 South	14 East	21	Cu
5	Well	4 South	14 East	6	NO3
6	Well	4 South	14 East	11	Cd
7	Well	4 South	14 East	11	Cd
8	Well	4 South	14 East	11	As, Cd
9	Well	4 South	14 East	23	Cd
10	Well	4 South	14 East	23	Cd
11	Well	4 South	14 East	27	Cd
12	Well	4 South	14 East	35	NO3
13	Well	5 South	14 East	2	F
14	Well	5 South	15 East	23	As, F
15	Well	5 South	15 East	25	Hg
16	Well	5 South	15 East	25	Hg
17	Well	6 South	16 East	6	F
18	Well	6 South	16 East	8	F
19	Well	6 South	16 East	29	F
20	Well	6 South	16 East	33	F
21	Well	6 South	16 East	34	TDS
22	Well	7 South	16 East	10	Sb
23	Well	7 South	16 East	22	F
24	Well	7 South	16 East	22	As, F
25	Well	7 South	16 East	22	As, F
26	Well	7 South	16 East	36	F
27	Well	7 South	17 East	6	Pb
28	Well	8 South	17 East	18	Be
29	Well	8 South	17 East	18	Be
30	Well	8 South	17 East	19	As, F
31	Well	8 South	17 East	30	As, Be, F
32	Well	8 South	17 East	30	F
33	Well	8 South	17 East	31	As, F
34	Well	8 South	17 East	32	As, F
35	Well	8 South	17 East	32	As, F, Pb
36	Well	8 South	18 East	14	As
37	Well	8 South	18 East	23	As
38	Well	9 South	15 East	35	NO3
39	Well	9 South	16 East	31	F, Rad
40	Well	9 South	17 East	4	As, F
41	Well	9 South	17 East	14	F
42	Well	9 South	17 East	24	As, F, Pb
43	Well	9 South	17 East	24	As, F, Pb
44	Well	9 South	18 East	31	As
45	Well	9 South	18 East	32	As, F
46	Well	9 South	18 East	32	As
47	Well	10 South	18 East	3	F
48	Well	10 South	18 East	8	Sb, F
49	Well	10 South	18 East	8	As, F
50	Well	11 South	18 East	26	As
51	Well	13 South	18 East	6	Rad, TDS
52	Well	13 South	19 East	30	As
53	Well	13 South	20 East	21	As
54	Well	13 South	20 East	31	As
55	Well	14 South	21 East	19	F
56	Well	15 South	18 East	11	TDS

Source: Compilation of databases from ADWR & others

Table 3.8-7 Water Quality Exceedences in the Lower San Pedro Basin (Cont)[1]

B. Lakes, Rivers and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Mineral Creek (Devil's Canyon - Gila River)	10	NA	A&W	Cu, Se
b	Stream	San Pedro (Aravaipa Creek - Gila River)	15	NA	A&W	E.coli, Se

Source: ADEQ 2005e

Notes:
Because of map scale, feature locations may appear different than the location indicated on the table
NA = Not applicable
[1] Water quality samples collected between 1980 and 2004.
[2] Sb = Antimony
As = Arsenic
Be = Beryllium
Cd = Cadmium
Cu = Copper
F= Fluoride
Pb = Lead
Hg = Mercury
NO3 = Nitrate
Se = Selenium
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
TDS = Total Dissolved Solids
[3] A&W = Aquatic and Wildlife

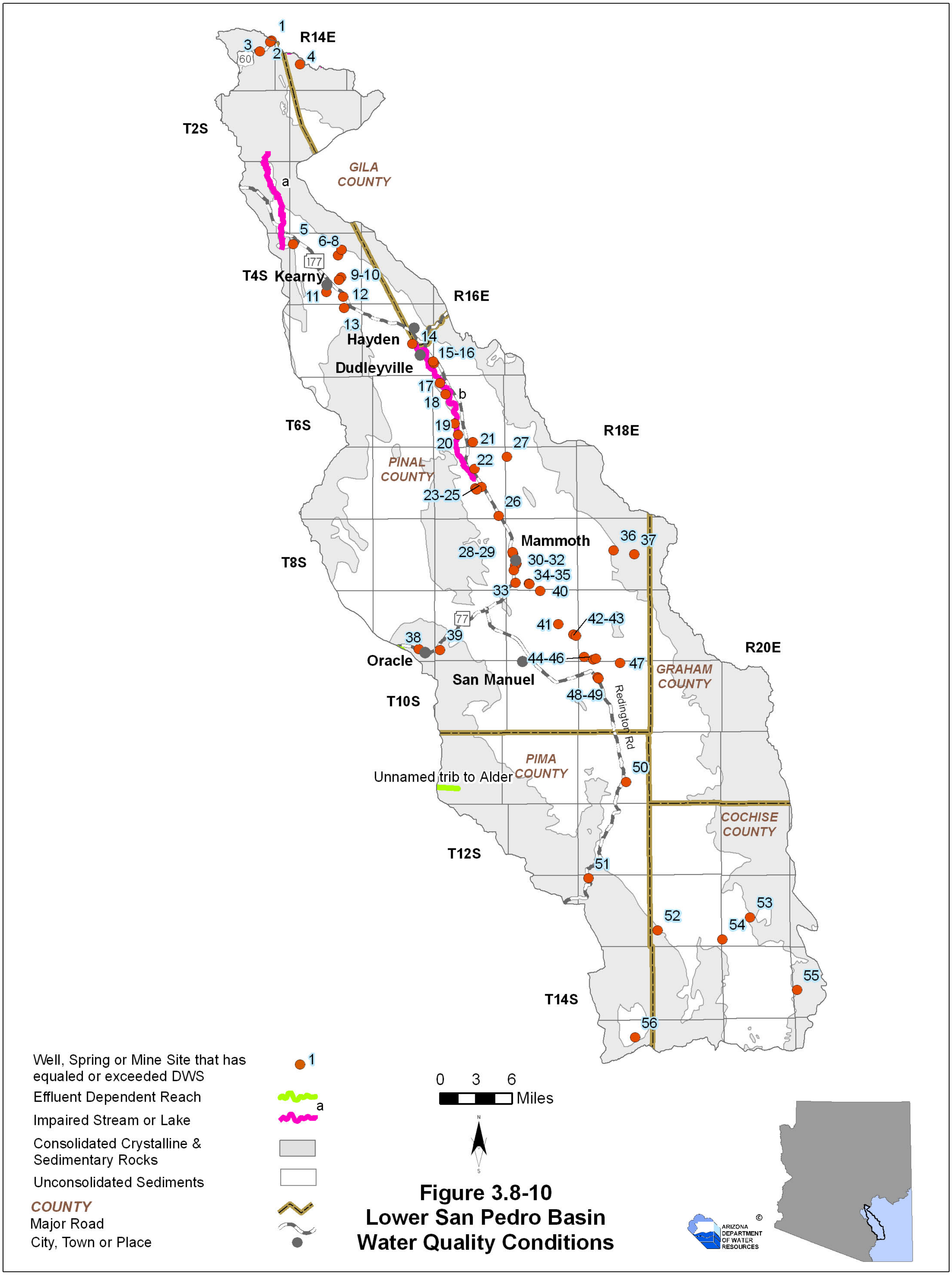


Figure 3.8-10
Lower San Pedro Basin
Water Quality Conditions

3.8.8 Cultural Water Demand in the Lower San Pedro 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 3.8-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.8-9. Figure 3.8-11 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.8-8 and Figure 3.8-11.
- Population decreased in this basin 1980 to 2000. Projections suggest a minimal growth through 2030.
- Total groundwater demand has decreased from 1971 to 2005 with an average of 25,700 AFA pumped in the period from 2001-2005.
- Surface water diversions have also decreased from 1971 to 2005 with approximately 1,000 AFA diverted in the period from 1991 – 2005 for agricultural and municipal uses.
- The majority of agricultural demand is along Highway 177, Highway 77 in Pinal County and along the San Pedro River in Pima and Cochise Counties.
- The largest single demand for groundwater is industrial with an average of 15,900 AFA pumped in the period from 2001-2005.
- There are numerous mines in the basin. The active Ray Mine north of Kearny, a small inactive mine in the vicinity of Hayden and numerous inactive mines including the Mammoth Mine and San Manuel Mine in the vicinity of Mammoth.
- Municipal demand has remained relatively constant with an average of 2,300 AFA pumped in the period from 2001-2005. The town of Oracle is located at the western boundary of the basin. Wells associated with this town are in the Tucson Active Management Area at Oracle Junction.
- As of 2005 there were 1,630 registered wells with a pumping capacity of less than or equal to 35 gpm and 398 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.8-9.
- There are six known wastewater treatment facilities in the basin.
- Over 12,000 people are served by these facilities.
- 708 acre-feet of effluent per year are generated in this basin.
- One facility, the Kearny Wastewater Treatment Facility, discharges wastewater to a golf course and two facilities recharge the aquifer through an unlined impoundment. These facilities are not permitted by the Department as Underground Storage Facilities.

Table 3.8-8 Cultural Water Demand in the Lower San Pedro Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th rowspan="2" colspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">1,028[2]</td><td rowspan="10">297[2]</td><td rowspan="5" colspan="3">56,000</td><td rowspan="5" colspan="3">6,000</td><td rowspan="20">ADWR (1994a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td rowspan="5" colspan="3">56,000</td><td rowspan="5" colspan="3">6,000</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>19,300</td></tr>
<tr><td>1981</td><td>18,960</td><td rowspan="5">92</td><td rowspan="5">21</td><td rowspan="5" colspan="3">47,000</td><td rowspan="5" colspan="3">6,000</td></tr>
<tr><td>1982</td><td>18,620</td></tr>
<tr><td>1983</td><td>18,279</td></tr>
<tr><td>1984</td><td>17,939</td></tr>
<tr><td>1985</td><td>17,599</td></tr>
<tr><td>1986</td><td>17,259</td><td rowspan="5">118</td><td rowspan="5">28</td><td rowspan="5" colspan="3">40,000</td><td rowspan="5" colspan="3">6,000</td></tr>
<tr><td>1987</td><td>16,919</td></tr>
<tr><td>1988</td><td>16,578</td></tr>
<tr><td>1989</td><td>16,238</td></tr>
<tr><td>1990</td><td>15,898</td></tr>
<tr><td>1991</td><td>15,860</td><td rowspan="5">147</td><td rowspan="5">25</td><td rowspan="5">2,500</td><td rowspan="5">31,000</td><td rowspan="5">12,800</td><td rowspan="5">500</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td><td rowspan="15">USGS (2007) ADWR (2008b) Gila Water Commissioner Annual Reports (1991-2005)</td></tr>
<tr><td>1992</td><td>15,821</td></tr>
<tr><td>1993</td><td>15,783</td></tr>
<tr><td>1994</td><td>15,745</td></tr>
<tr><td>1995</td><td>15,707</td></tr>
<tr><td>1996</td><td>15,668</td><td rowspan="5">100</td><td rowspan="5">8</td><td rowspan="5">2,500</td><td rowspan="5">26,300</td><td rowspan="5">11,100</td><td rowspan="5">400</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td></tr>
<tr><td>1997</td><td>15,630</td></tr>
<tr><td>1998</td><td>15,592</td></tr>
<tr><td>1999</td><td>15,553</td></tr>
<tr><td>2000</td><td>15,515</td></tr>
<tr><td>2001</td><td>16,154</td><td rowspan="5">145</td><td rowspan="5">19</td><td rowspan="5">2,300</td><td rowspan="5">15,900</td><td rowspan="5">7,500</td><td rowspan="5">300</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td></tr>
<tr><td>2002</td><td>16,793</td></tr>
<tr><td>2003</td><td>17,432</td></tr>
<tr><td>2004</td><td>18,071</td></tr>
<tr><td>2005</td><td>18,710</td></tr>
<tr><td>2010</td><td>21,905</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>29,180</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>34,736</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>1,630</td><td>398</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoirs or effluent
[2] Includes all wells through June 1980.

Table 3.8-9 Effluent Generation in the Lower San Pedro 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	Golf Course/Turf/ Landscape	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other			
Coronado Utilities WWTP	Santec Corp.	San Manuel	4,100	291								X		Tertiery	NA	2008
Hayden Collection Systems	Town of Hayden	Hayden	910	NA							Winkleman WWTP			NA		2003
Kearny STP	Town of Kearny	Kearny	2,550	190	X			X	X				X	Adv. Trt. II & Nutrient Removal	NA	2007
Mammoth WWTF	Town of Mammoth	Mammoth	1,700	99		X						X		Secondary	NA	2004
Oracle WWTF	Oracle SD	Oracle	1,551	90		X								Secondary	NA	2004
Winkleman WWTP	Town of Winkleman	Winkleman	1,210	38	Gila River									Secondary	NA	2004
Total			**12,021**	**708**												

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data currently not available to ADWR
WWTF: Wastewater Treatment Facility
WWTP: Wastewater Treatment Plant
SD: Sanitation District
STP: Sewage Treatment Plant
Adv. Tr. ll: Advance treatment level ll

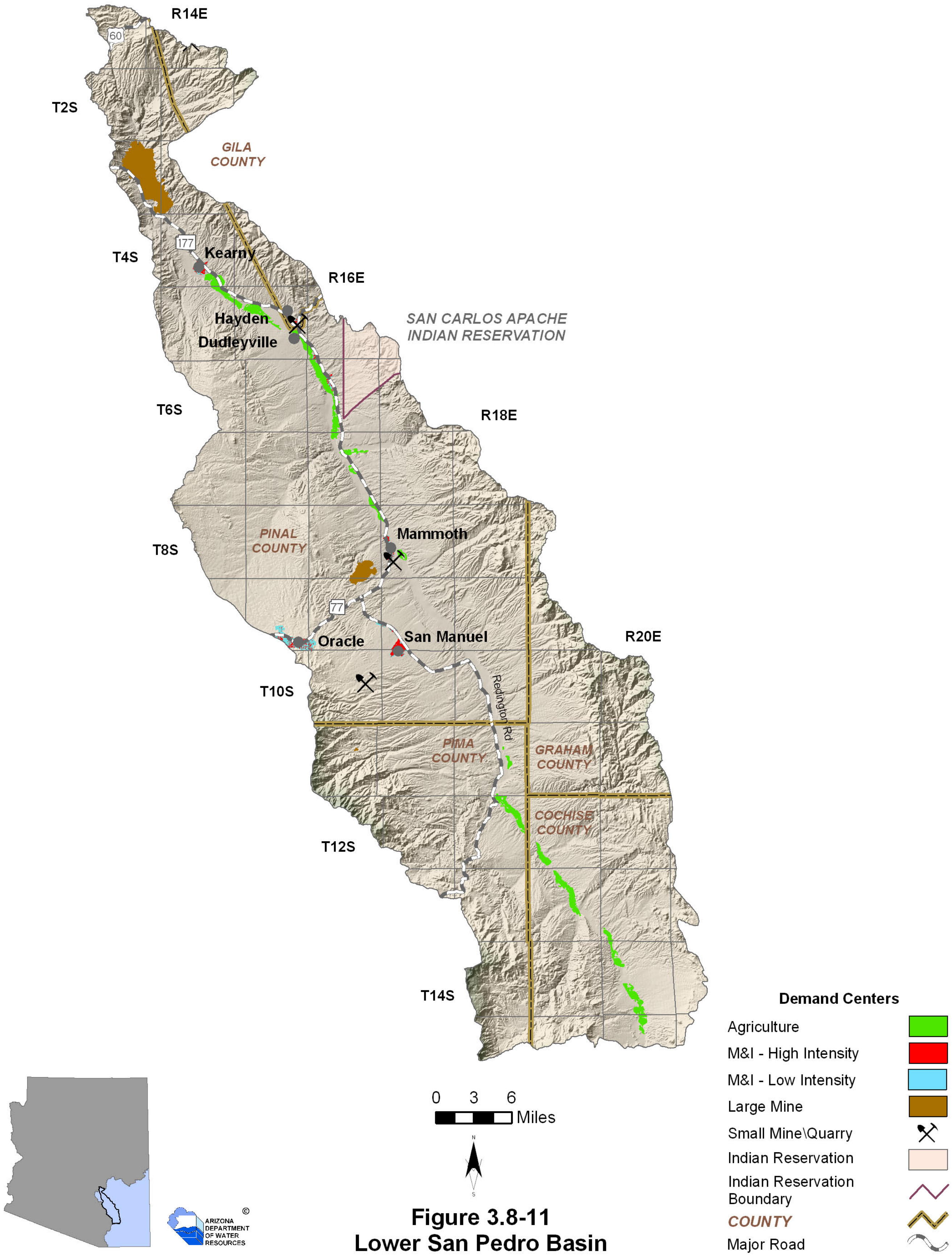


Figure 3.8-11
Lower San Pedro Basin
Cultural Water Demand

Primary Data Source: USGS National Gap Analysis Program, 2004

3.8.9 Water Adequacy Determinations in the Lower San Pedro 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 3.8-10A and B for water reports and analysis of adequate water supply. Figure 3.8-12 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- Eleven water adequacy determinations have been made in this basin through December 2008.
- Three determinations of inadequacy have been made. These determinations are scattered throughout the basin.
- All determinations of inadequacy were because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination.
- One analysis of adequate water supply for 2,948 lots has been issued in this basin.
- The number of lots receiving a water adequacy determination, by county, are:

County	Number of Subdivision Lots	Number of Lots Determined to be Adequate	Percent Adequate
Cochise	0	0	NA
Gila	7	7	100%
Graham	0	0	NA
Pima	0	0	NA
Pinal	>1,204	1,188	~98%

Table 3.8-10 Adequacy Determinations in the Lower San Pedro 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	Aravaipa #1	Pinal	7 South	16 West	9, 10	24	53-500282	Adequate		1/27/1975	Aravaipa Water Company
2	Cherry Valley	Pinal	10 South	16 West	6	26	53-500452	Adequate		10/24/1977	Arizona Water Company - Oracle System
4	Kearney Subdivision #12	Pinal	4 South	14 West	22	13	53-500838	Adequate		6/19/1979	John W. Galbreath Development Corp.
5	Mammoth, Town of	Pinal	8 South	17 West	19	16	53-500933	Inadequate	A1	4/11/1988	Town of Mammoth
6	Mountain Valley	Pinal	1 South	13 West	13	NA	53-501025	Inadequate	A1	3/30/1981	Dry Lot Subdivision
7	Oracle Mountain View Estates	Pinal	9 South	15 West	36	NA	53-501076	Inadequate	A1	1/2/1982	Arizona Water Company - Oracle System
8	Oracle Ranch Estates #2	Pinal	9 South	15 West	26, 27	38	53-501077	Adequate		8/16/1979	Arizona Water Company - Oracle System
9	Rancho Robles	Pinal	9 South	15 West	35	17	53-501269	Adequate		8/9/1979	Arizona Water Company - Oracle System
10	San Manuel, Townsite	Pinal	9 South	17 West	31,32	1,050	53-500201	Adequate		7/7/1988	Arizona Water Company
11	Two O'Clock Hill	Pinal	9 South	15 West	35	20	53-501587	Adequate		10/15/1974	Arizona Water Company - Oracle System
12	Winkelman Terrace	Gila	5 South	15 West	13	7	53-300508	Adequate		8/25/1998	Arizona Water Company & Community Wells

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
3	Cielo	Pinal	9 South	15 West	12, 13, 24, 25	2,948	43-401716	6/27/2005	Town of Mammoth

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 unavailable; 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= Data not currently available to ADWR

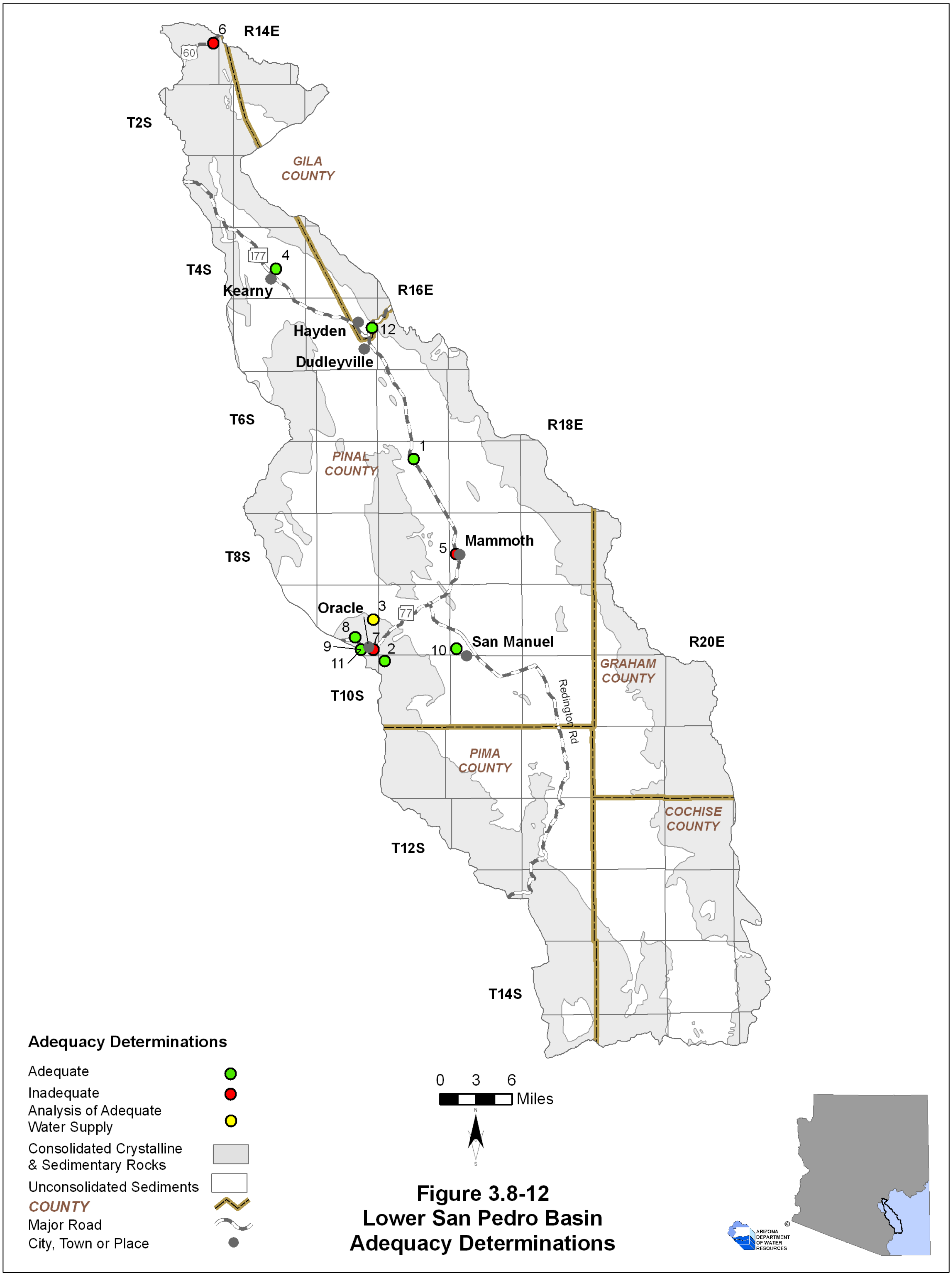


Figure 3.8-12
Lower San Pedro Basin
Adequacy Determinations

LOWER SAN PEDRO BASIN

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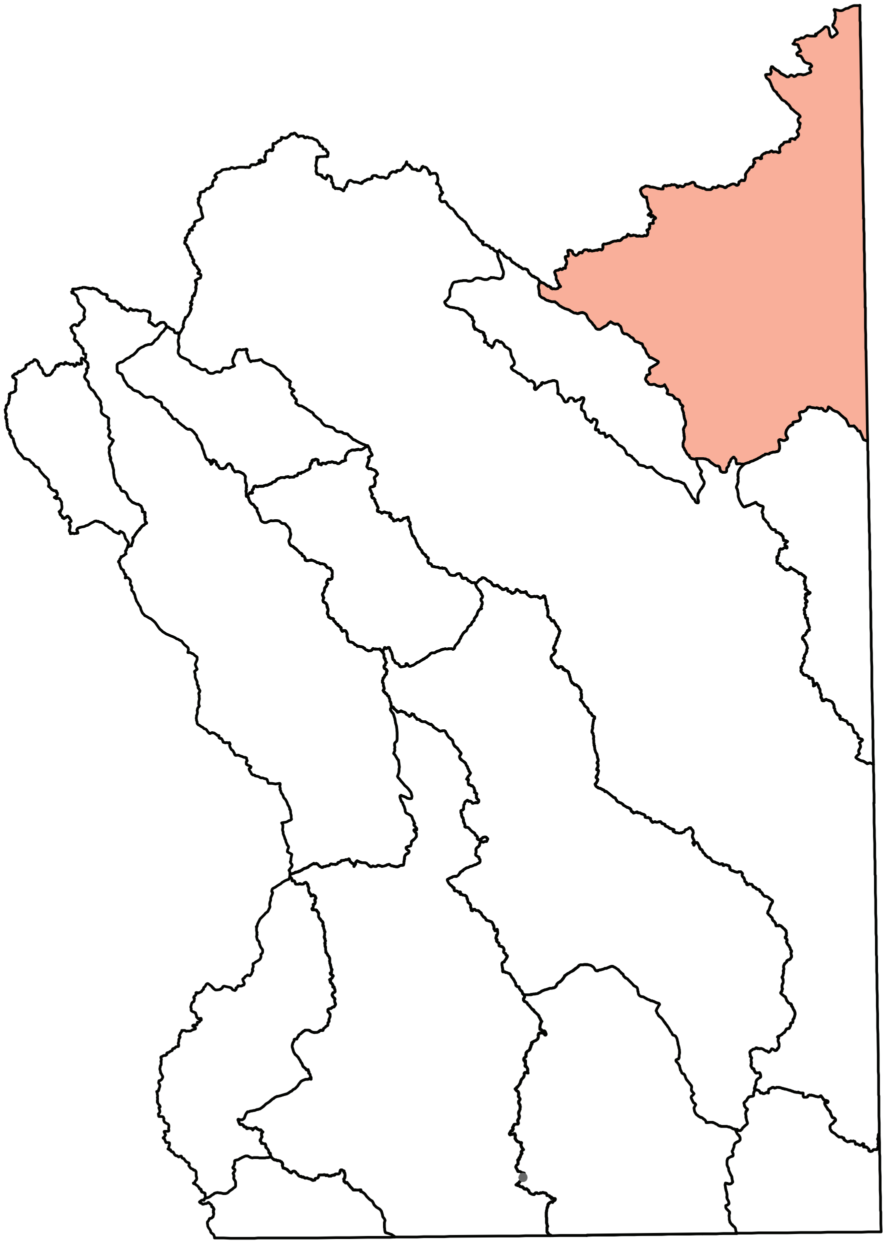
Section 3.9
Morenci Basin



3.9.1 Geography of the Morenci Basin

The Morenci Basin is a medium-size, 1,599 square mile basin in the northeast portion of the planning area. Geographic features and principal communities are shown on Figure 3.9-1. The basin is characterized by high-elevation mountain ranges and a diversity of biotic communities including Rocky Mountain and madrean montane conifer forest, Great Basin conifer forest, madrean evergreen woodland, Plains and Great Basin grassland, interior chaparral, Chihuahuan desertscrub and semi-desert grassland vegetation. (see Figure 3.0-9) Riparian vegetation includes: wet meadow and mountain scrub on the San Francisco River near Alpine; mixed broadleaf and cottonwood/willow on the Campbell Blue Creek; cottonwood/willow, mixed broadleaf and mesquite on the Blue River; mixed broadleaf on Cienega and Willow Creeks; and mesquite and mixed broadleaf on Eagle Creek and the San Francisco River north of Clifton.

- Principal geographic features shown on Figure 3.9-1 are:
  - San Francisco River running from west to east in Apache County and from east to south near Clifton
  - Blue River south of the Apache County line, which flows south through the basin and joins the San Francisco River
  - Eagle Creek in the vicinity of the boundary between Graham and Greenlee counties
  - The lowest point at approximately 3,600 feet where the San Francisco River exits the basin
  - The Mogollon Rim, which includes the highest point in the basin at 9,346 feet

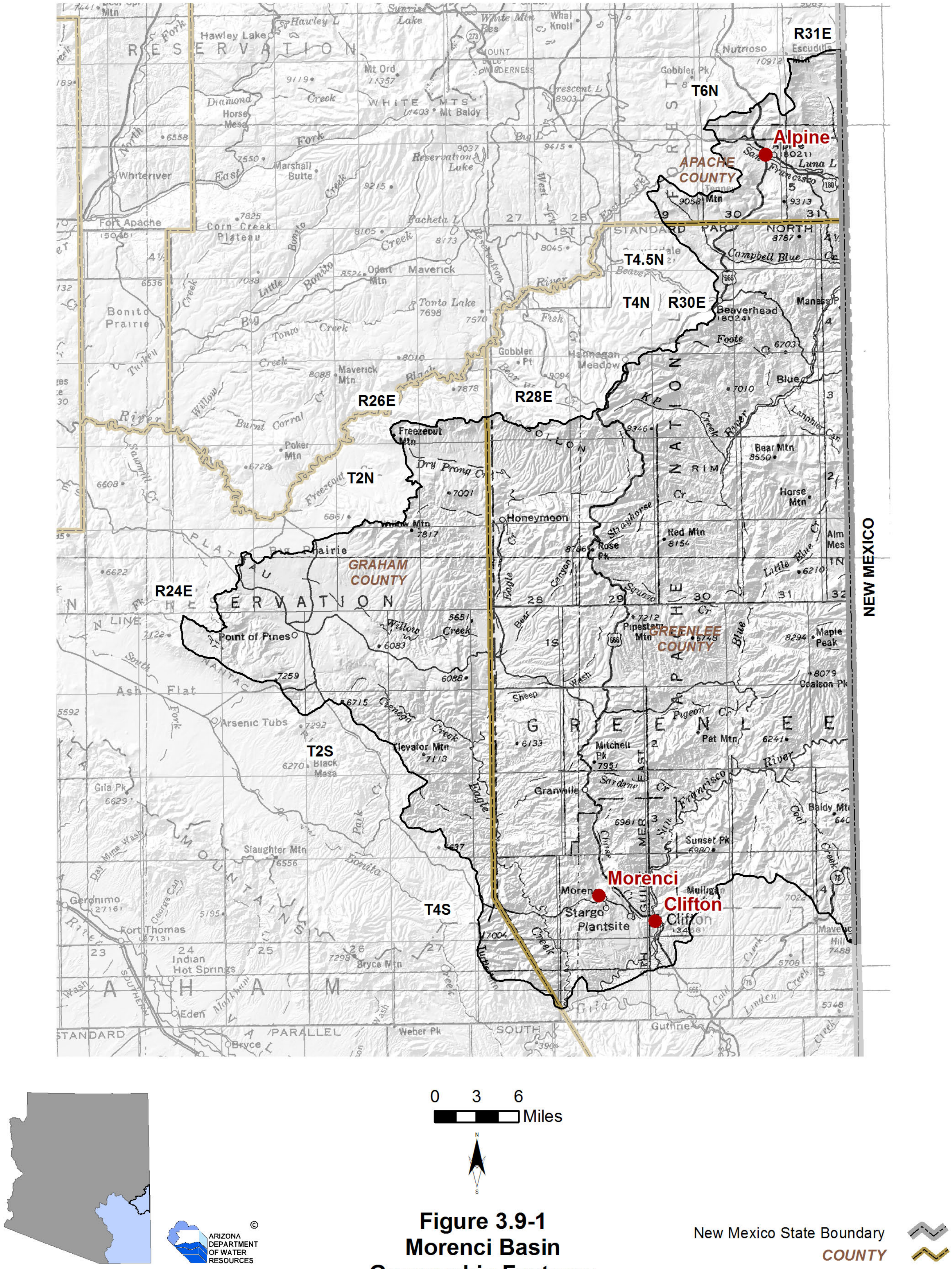


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Figure 3.9-1
Morenci Basin
Geographic Features

3.9.2 Land Ownership in the Morenci Basin

Land ownership, including the percentage of ownership in each category, is shown for the Morenci Basin in Figure 3.9-2. Primary land ownership features are the large block of national forest land, a significant amount of tribal land and the relatively large contiguous portion of private land around Morenci used predominantly for mining activities. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

National Forest

- 67.6% of the land is federally owned and managed by the United States Forest Service (USFS).
- All national forest land in the basin is in the Apache-Sitgreaves National Forest in two ranger districts, the Alpine Ranger District in the northern portion of the basin and the Clifton Ranger District in the southern portion of the basin.
- A portion of the Escudilla Wilderness is located at the northernmost tip of the basin. (see Figure 3.0-12)
- Primary land uses are recreation, wildlife protection and timber production.

Indian Reservations

- 21.7% of the land is under ownership of the San Carlos Apache Tribe.
- Primary land use is grazing.

Private

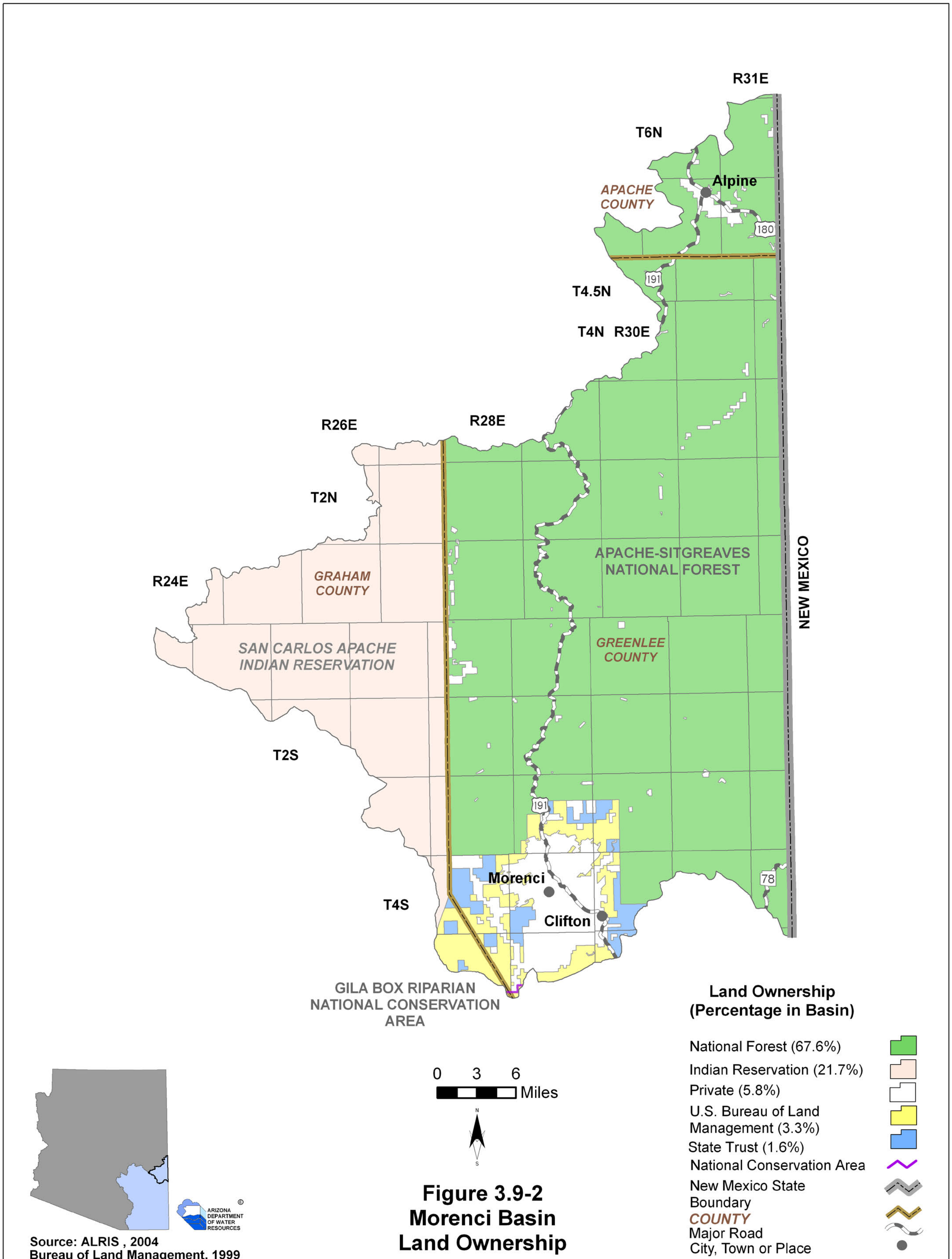
- 5.8% of land is private.
- The majority of private land is surrounding Morenci.
- Private in-holdings are scattered throughout the National Forest lands.
- Primary land uses are mining, domestic and commercial.

U.S. Bureau of Land Management (BLM)

- 3.3% of land is federally owned and managed by the Safford Field Office of the BLM.
- The basin contains a small portion of the Gila Box Riparian National Conservation Area in T5S, R29E.
- All BLM land is in the southern-most tip of the basin and is interspersed with private and state trust lands.
- Primary land use is grazing.

State Trust

- 1.6% of land in this basin is held in trust for public schools and to a lesser extent the University of Arizona, hospital for disabled miners and the Arizona Hospital.
- All state owned land is in the southernmost-tip of the basin and is interspersed with BLM and private lands.
- Primary land use is grazing.



Source: ALRIS , 2004
Bureau of Land Management, 1999

Figure 3.9-2
Morenci Basin
Land Ownership

3.9.3 Climate of the Morenci Basin

Climate data from NOAA/NWS Co-op Network and SNOTEL/Snowcourse stations are complied in Table 3.9-1 and the locations are shown on Figure 3.9-3. Figure 3.9-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Morenci Basin does not contain Evaporation Pan and AZMET stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.9-1A.
- There are four NOAA/NWS Co-op Network stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges from 61.6°F in Alpine to 84.7°F in Clifton. The average monthly minimum temperature occurs in December or January and ranges from 29.1°F in Alpine to 45.8°F in Clifton.
- Highest average seasonal rainfall occurs primarily in the summer (July-September) or in the fall (October – December). For the period of record used, the highest annual rainfall is 21.66 inches at Alpine and the lowest is 13.29 inches at Morenci.

SNOTEL/Snowcourse

- Refer to Table 3.9-1D.
- The Morenci Basin is the only basin in the planning area with SNOTEL/Snowcourse data.
- There are five SNOTEL/Snowcourse stations in the basin; from are currently active.
- The highest average monthly snowpack at most stations is in March.

SCAS Precipitation Data

- See Figure 3.9-3
- Additional precipitation information shows rainfall as high as 32 inches along the Mogollon Rim near Highway 191 and as low as 12 inches in the vicinity of Clifton.

Table 3.9-1 Climate Data for the Morenci Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Alpine	8050	1971-2000	61.6/Jul	29.1/Jan	3.94	2.24	10.31	5.17	21.66
Blue	5420	1971-2000	70.5/Jul	36.0/Dec	4.37	1.86	9.82	5.09	21.14
Granville	6800	1955-1975[1]	70.2/Jul	34.7/Jan	3.03	3.25	5.73	6.47	17.19
Clifton	3480	1971-2000	84.7/Jul	45.8/Dec	3.00	1.10	5.77	3.42	13.29

Source: WRCC, 2005

Notes:
[1]Average temperature for period of record shown; average precipitation from 1971-2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
Beaverhead	8,000	1938 - current	1.4 *(27)*	2.7 *(67)*	2.8 *(68)*	1.1 *(64)*	0.4 *(1)*	0 *(0)*
Coronado Trail	8,350	1938 - current	1.3 *(29)*	2.8 *(69)*	*2.9 (69)*	1.0 *(65)*	0 *(1)*	0 *(0)*
Coronado Trail SNOTEL	8,400	1983 - current	1.8 *(24)*	3.2 *(24)*	3.1 *(24)*	0.4 *(23)*	0 *(24)*	0 *(24)*
Hannagen Meadows	9,090	1964 - 2000 (discontinued)	4.5 (23)	7.3 *(36)*	9.8 *(36)*	9.3 *(36)*	8.1 *(2)*	0 *(0)*
Nutrioso	8,500	1938 - current	0.9 *(29)*	1.8 *(69)*	1.78 *(69)*	0.5 *(69)*	0 *(1)*	0 *(0)*

Source: Natural Resources Conservation Service, 2006

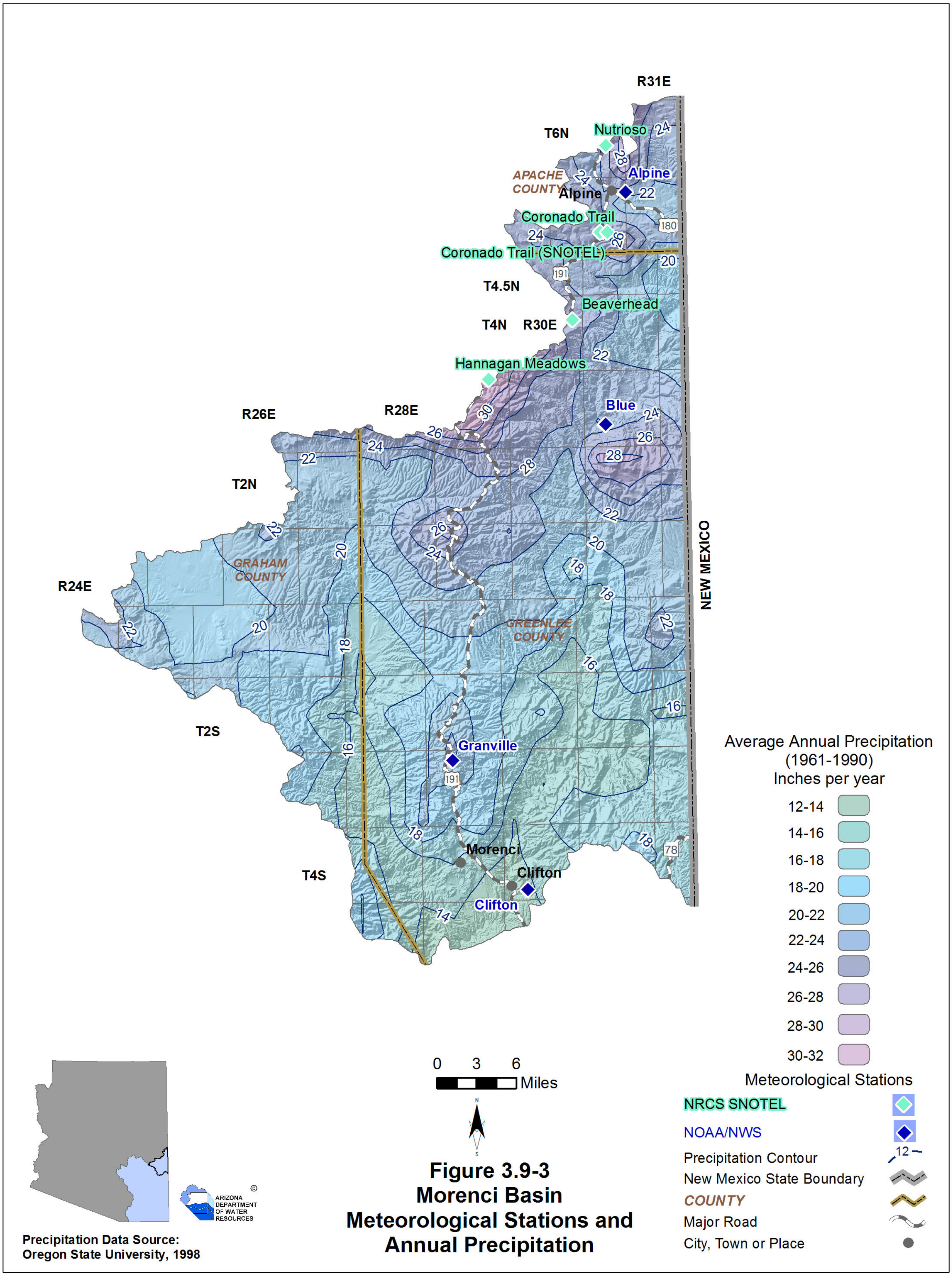


Figure 3.9-3
Morenci Basin
Meteorological Stations and Annual Precipitation

3.9.4 Surface Water Conditions in the Morenci Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.9-2. Flood ALERT equipment in the basin is shown on Table 3.9-3. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.9-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 3.9-5. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.9-2.
- Data from six stations on four watercourses are shown on the table and on Figure 3.9-5. Three stations have been discontinued; those remaining are real-time stations.
- The average seasonal flow at most stations is highest in the Winter (January-March) and lowest in the Spring (April-June) or Summer (July-September).
- Maximum annual flow in this basin was 678,755 acre-feet in 1915 on the San Francisco River, see Figure 3.9-4, and minimum annual flow was 724 acre-feet in 1964 on Willow Creek.

Flood ALERT Equipment

- Refer to Table 3.9-3.
- There are seven stations in the basin as of October 2005.

Reservoirs and Stockponds

- Refer to Table 3.9-4
- There are four large and 16 small reservoirs in this basin.
- The largest reservoir, the Silver Basin, has a maximum storage capacity of 5,200 acre-feet.
- The reservoirs are used for irrigation, recreation and other purposes.
- There are 673 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.9-5.
- Average annual runoff increases from 0.5 inches, or 26.65 acre-feet per square mile, in the vicinity of Clifton and Morenci to two inches, or 106.6 acre-feet per square mile toward the Mogollon Rim.

Figure 3.9-4 Annual Flows (in acre-feet) at San Francisco River at Clifton (Station # 9444500) Water Years 1914-2007

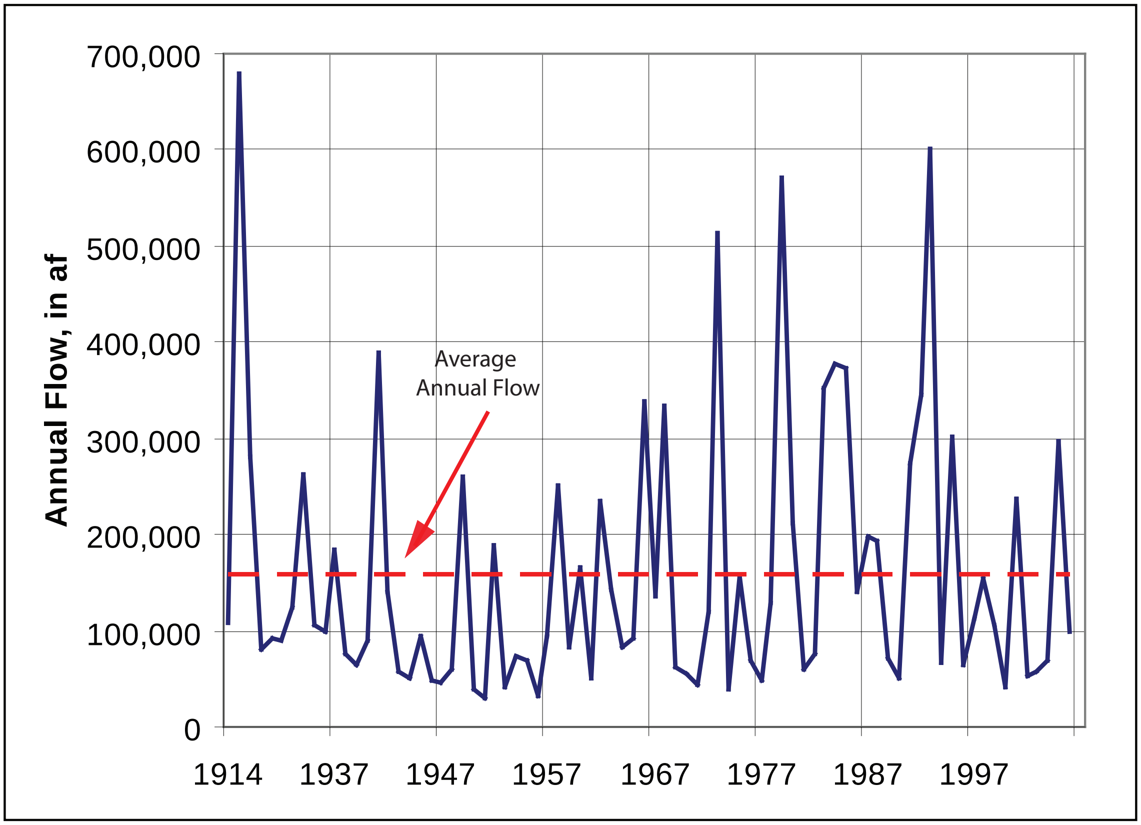


Table 3.9-2 Streamflow Data for the Morenci Basin

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	
9444200	Blue River near Clifton	506	4,160	11/1967-current (real time)	39	22	14	25	9,487 (2002)	38,091	50,373	176,695 (1983)	30
9444500	San Francisco River at Clifton	2,766	3,436	10/1910-current (real time)	41	20	16	22	30,415 (1951)	91,606	146,532	678,755 (1915)	79
9445500	Willow Creek near Point of Pines near Morenci	102	5,804	8/1944-9/1967 (discontinued)	26	27	27	20	724 (1964)	7,855	8,433	19,403 (1965)	22
9446000	Willow Creek near Double Circle Ranch near Morenci	149	4,969	8/1944-9/1967 (discontinued)	27	22	29	22	2,013 (1964)	8,688	9,929	28,018 (1965)	22
9446500	Eagle Creek near Double Circle Ranch near Morenci	377	4,722	8/1944-9/1967 (discontinued)	33	19	26	22	8,181 (1953)	14,914	18,906	48,579 (1965)	22
9447000	Eagle Creek above Pumping Plant near Morenci	622	3,673	4/1944-current (real time)	49	14	15	22	12,311 (1953)	34,398	48,850	405,530 (1993)	58

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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

Table 3.9-3 Flood ALERT Equipment in the Morenci Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
510	Sardine Saddle	Precipitation	11/15/1993	Town of Clifton
515	Maverick Hill	Precipitation	NA	Town of Clifton
525	Blue River	Precipitation/Stage	1/1/1993	Town of Clifton
560	Clifton	Precipitation/Stage	NA	Town of Clifton
575	Blue Vista	Precipitation	1/1/1996	Town of Clifton
580	Escudilla Mountain	Precipitation	10/23/1996	Town of Clifton
610	Clifton ADOT Weather Station	Weather Station	8/31/2001	ADWR

Source: ADWR 2005a

Notes:
NA = Not available
ADOT = Arizona Department of Transportation
ADWR = Arizona Department of Water Resources

Table 3.9-4 Reservoirs and Stockponds in the Morenci Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE[1]	JURISDICTION
1	Silver Basin	Phelps Dodge-Morenci	5,200	O	State
2	Luna	Luna Irrigation	1,800	I	State
3	Columbine	Phelps Dodge-Morenci	522[2]	O	State

B. Other Large Reservoirs (50 acre surface area or greater)[3]

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[1]	JURISDICTION
4	Dry	San Carlos Apache Tribe	229	R	Tribal

Source: Compilation of databases from ADWR & others

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

Total number: 4
Total maximum storage: 1,327 acre-feet

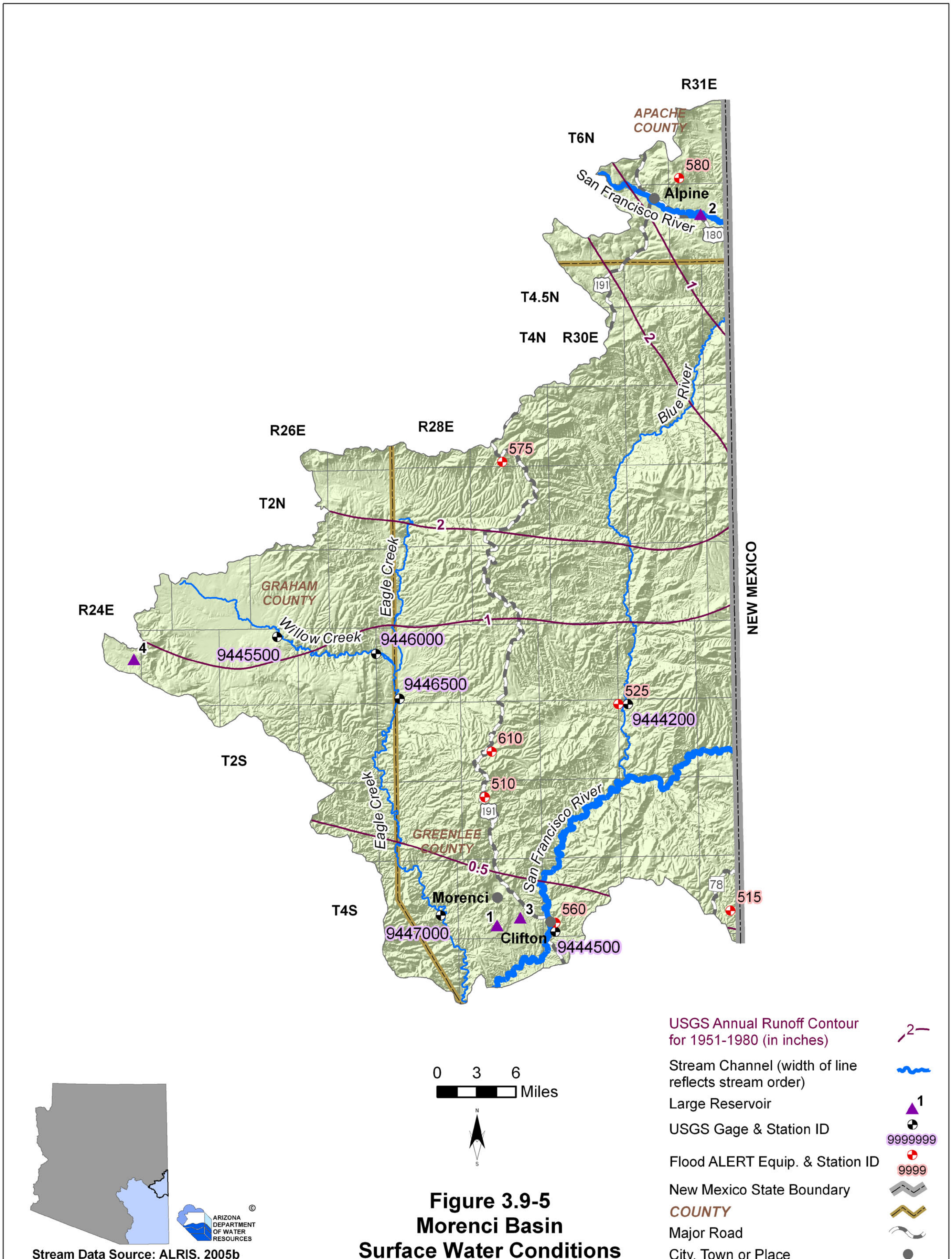
D. Other Small Reservoirs (between 5 and 50 acres surface area)[3]

Total number: 12
Total surface area: 138 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 673 (from water right filings)

Notes:
[1]I=irrigation; O=other; R=recreation
[2]Normal capacity < 500acre-feet
[3]Capacity data not available to ADWR



Stream Data Source: ALRIS, 2005b

Figure 3.9-5
Morenci Basin
Surface Water Conditions

3.9.5 Perennial/Intermittent Streams and Major Springs in the Morenci 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 3.9-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.9-6. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are many perennial stream reaches located throughout the basin. Some of these streams are the San Francisco River, Blue River, Grant Creek, Strayhorse Creek, KP Creek, Willow Creek, Cienega Creek and Eagle Creek.
- Numerous intermittent streams are also located throughout the basin.
- There are nine major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge rate was 200 gpm at an unnamed spring along the San Francisco River.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.9-5. There are eight minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. The most recent measurement was in 1992; seven springs were measured before 1982 and one has no date.
- The total number of springs identified by the USGS varies from 308 to 358, depending on the database reference.

Table 3.9-5 Springs in the Morenci Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Unnamed[2]	331603	1091053	200	6/16/1978
2	Unnamed[2]	331922	1091123	100	NA
3	Unnamed	331735	1091603	100	6/16/1978
4	Eagle Creek Hot	330249	1092623	50	During or prior to 1982
5	Hannah	332401	1090907	50	During or prior to 1982
6	KP Cienega (multiple)	333428	1092116	50	6/26/1973
7	Rock Basin	331302	1090748	20	During or prior to 1982
8	Smuggler[2]	325653	1092041	20	07/1992
9	Unnamed[2]	334448	1090404	10	6/14/1978

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Coronado	331002	1092202	5	6/17/1978
Gulch[2,3]	331000	1092109	3	04/1980
Sycamore Gulch[2,3]	330854	1091837	3	12/1981
Metcalf [2,3]	331047	1092050	2	04/1980
Judges[2,3]	330919	1092249	2	12/1991
Strayhorse	332638	1092131	2	6/26/1978
Sycamore[2,3]	330026	1091857	1	04/1980
Burnt Corral	333124	1091808	1	6/26/1978

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 308 to 358

Notes:
NA = Not Available
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Location approximated by ADWR

Stream Data Source: AGFD, 1993 & 1997

Figure 3.9-6
Morenci Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

3.9.6 Groundwater Conditions of the Morenci 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 3.9-6. Figure 3.9-7 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.9-8 contains hydrographs for selected wells shown on Figure 3.9-7. Figure 3.9-9 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 3.9-6 and Figure 3.9-7.
- The major aquifers in this basin are recent stream alluvium and volcanic rock.
- Flow direction is generally from north to south.

Well Yields

- Refer to Table 3.9-6 and Figure 3.9-9.
- As shown on Figure 3.9-9 well yields in this basin range from less than 100 gpm to more than 2,000 gpm.
- One source of well yield information, based on 53 reported wells, indicates that the median well yield in this basin is 600 gpm.

Natural Recharge

- Refer to Table 3.9-6.
- The only natural recharge estimate in this basin is 15,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 3.9-6.
- The only storage estimate is 3.0 million acre-feet to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.9-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures four index wells in this basin. A hydrograph for one of these four wells is shown in Figure 3.9-8.
- The deepest recorded water level in the basin in 2003-2004 is 78 feet and the shallowest is eight feet. All recorded water level changes are in the vicinity of Alpine.

Table 3.9-6 Groundwater Data for the Morenci Basin

Basin Area, in square miles:	1,599	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Volcanic Rock	
Well Yields, in gal/min:	Range 2 - 5,900 Median 600 (53 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 0 - 2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	15,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	3,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
Current Number of Index Wells:	4	
Date of Last Water-level Sweep:	1978 (6 wells measured)	

[1]Predevelopment Estimate

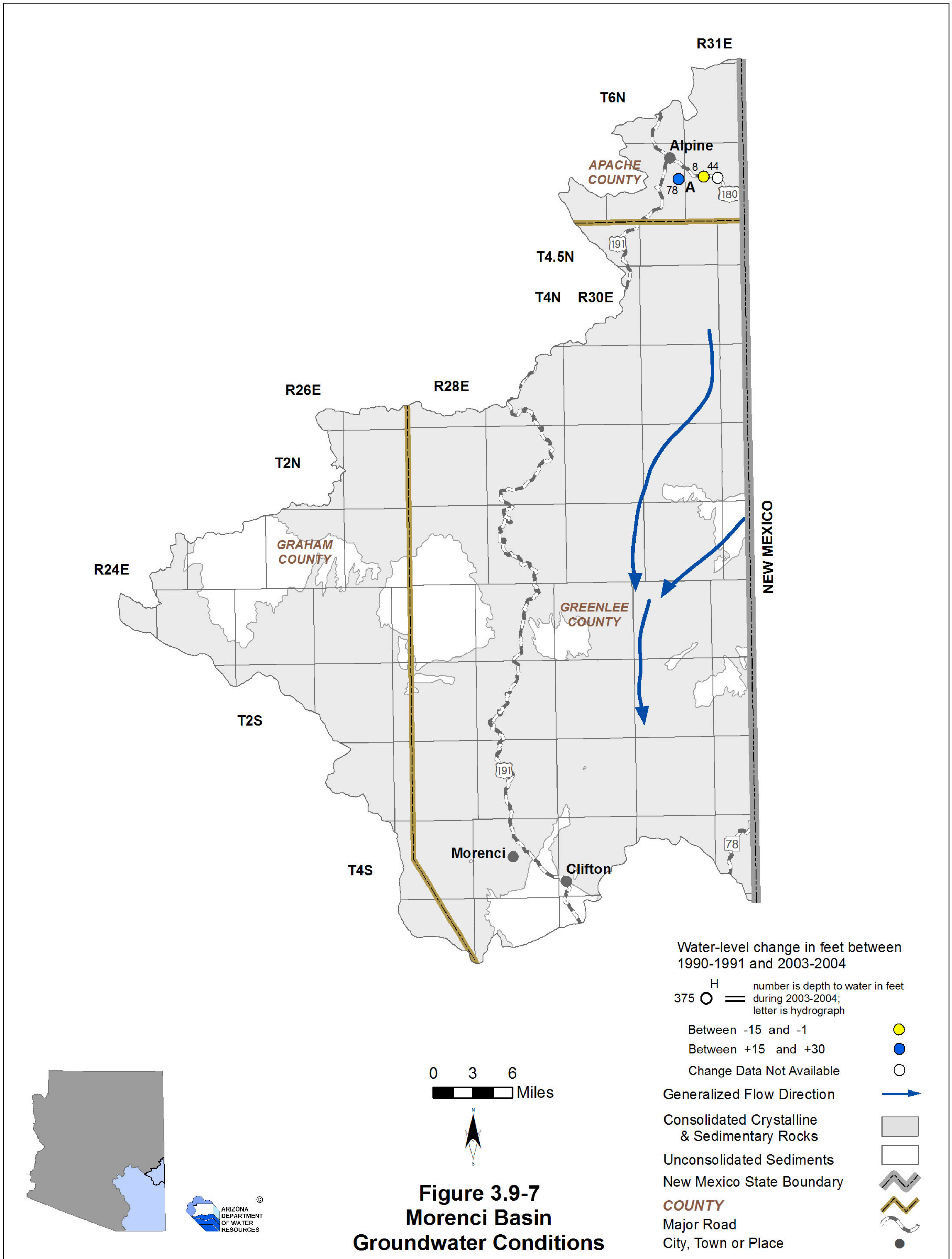
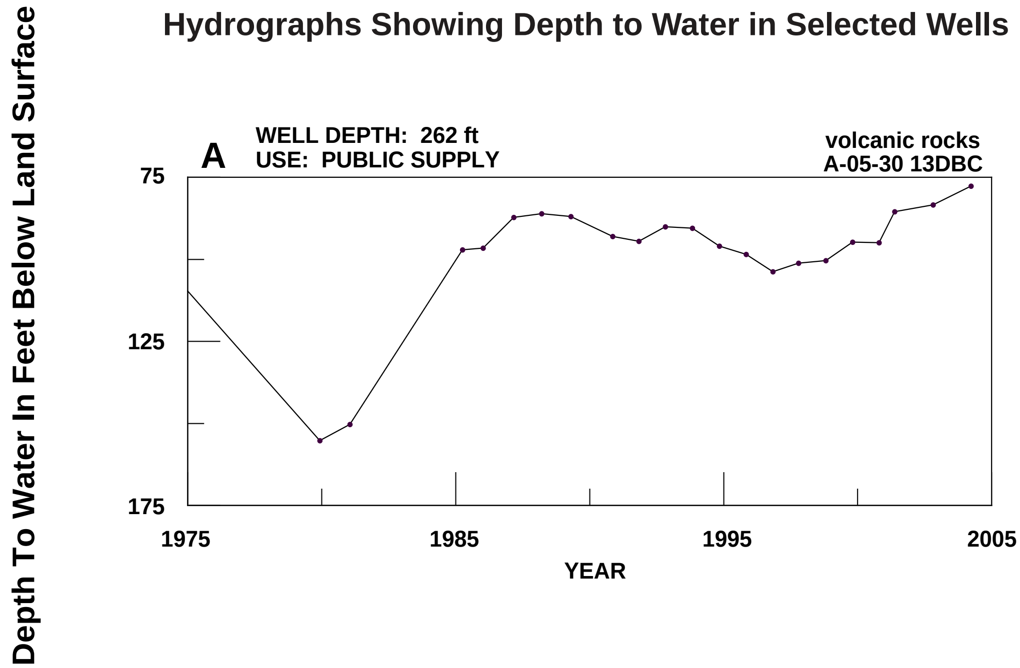


Figure 3.9-7
Morenci Basin
Groundwater Conditions

Figure 3.9-8
Morenci Basin
Hydrographs Showing Depth to Water in Selected Wells



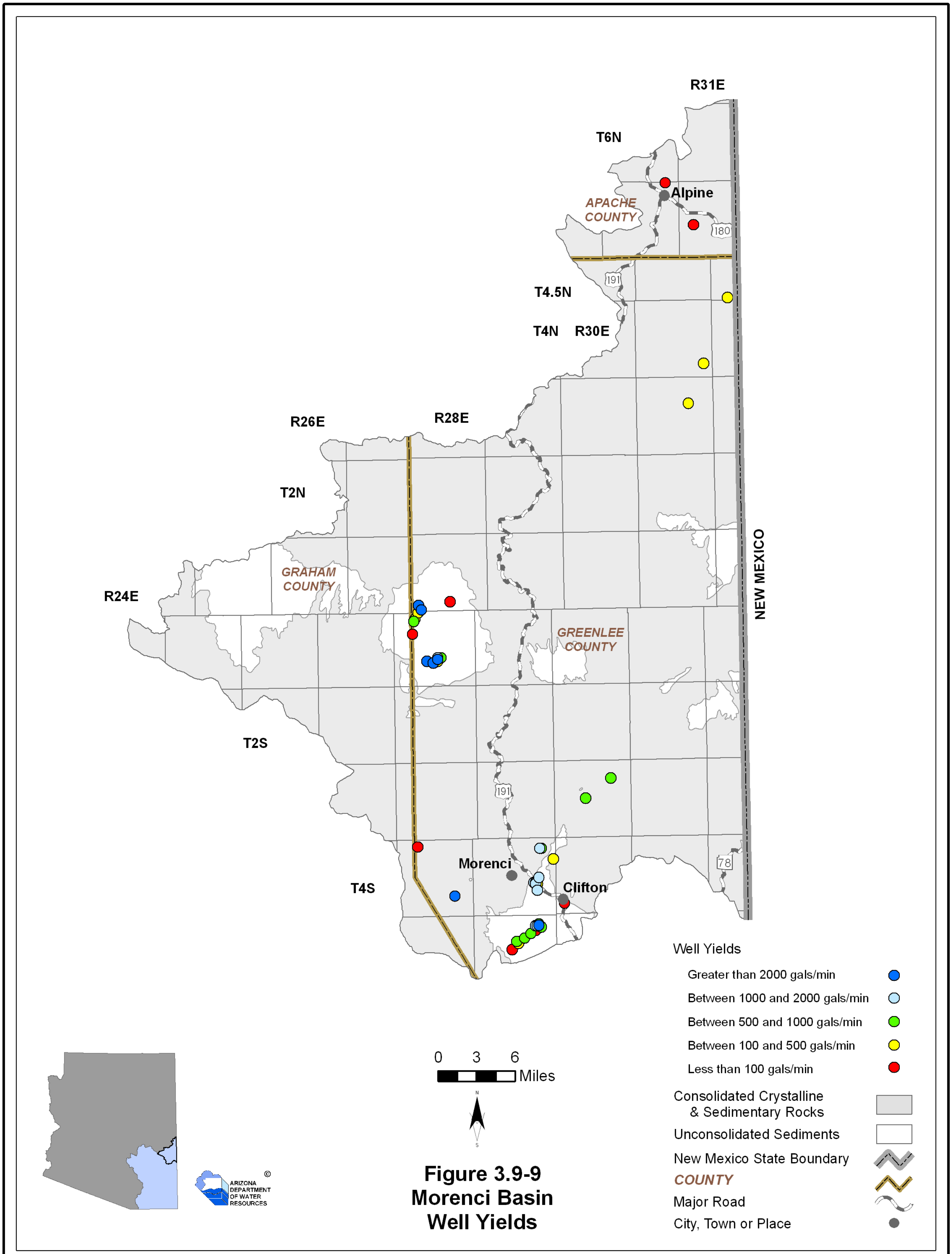


Figure 3.9-9
Morenci Basin
Well Yields

3.9.7 Water Quality of the Morenci Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.9-7A. 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 3.9-7B. Figure 3.9-10 shows the location of exceedences and impairment keyed to Table 3.9-7. 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. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.9-7A.
- Three sites have parameter concentrations that have equaled or exceeded DWS.
- Parameters equaled or exceeded include beryllium, cadmium, copper, fluoride, arsenic, lead and nitrates

Lakes and Streams with impaired waters

- Refer to Table 3.9-7B.
- Water quality standards were exceeded in one lake, Luna Lake, and one reach of the San Francisco River.
- The parameters exceeded in Luna Lake included dissolved oxygen and pH levels.
- The parameter exceeded in the San Francisco River was sediment.
- Luna Lake has been evaluated under the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. The TMDL report for Luna Lake was accepted by the EPA in 2000 and implementation of the water quality improvement plan is underway. There are no TMDL reports for the impaired reach of the San Francisco River.

Table 3.9-7 Water Quality Exceedences in the Morenci Basin[1]

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	4 South	29 East	2	Be, Cd, Cu, F
2	Well	4 South	29 East	20	As, Pb
3	Well	4 South	32 East	18	NO3

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Lake	Luna	NA	120	A&W, AgL, FBC	DO, pH
b	Stream	San Francisco River (headwaters to New Mexico border)	13	NA	A&W	Sediment

Source: ADEQ 2005d

Notes:
Because of map scale, feature locations may appear different than the location indicated on the table
NA = Not applicable
[1] Water quality samples collected between 1996 and 2004.
[2] As = Arsenic
Be = Beryllium
Cd = Cadmium
Cu = Copper
DO = Dissolved oxygen
F= Fluoride
Pb = Lead
NO3 = Nitrate
pH = Measurement of acidity or alkalinity
[3] A&W = Aquatic and Wildlife
AgL = Agricultural Livestock Watering
FBC = Full Body Contact

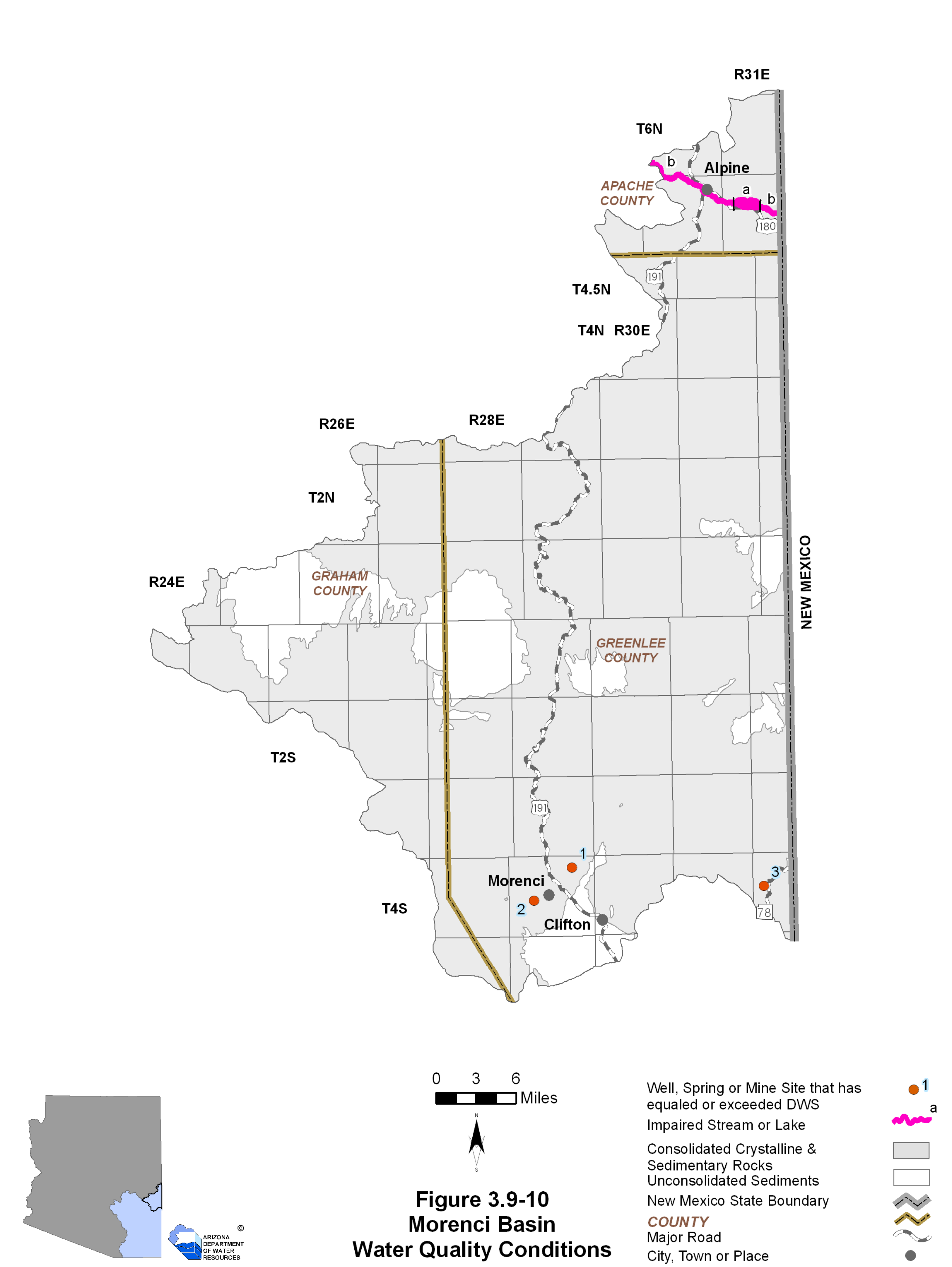


Figure 3.9-10
Morenci Basin
Water Quality Conditions

3.9.8 Cultural Water Demand in the Morenci 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 3.9-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.9-9. Figure 3.9-11 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.9-8 and Figure 3.9-11.
- Population decreased from 1980 to 2000.
- Total groundwater use has increased from 1991 to 2005 with an average of 9,600 AFA in the period from 2001-2005.
- Pre-1991 surface-water diversions are not available for this basin however, surface water diversions have decreased from 1991 to 2005 with 1,700 AFA in the period from 2001 – 2005. All surface-water diversions between 1991 and 2005 were for municipal and industrial uses
- Almost all municipal and industrial demand is in the vicinity of Clifton and Morenci, including the Morenci and Clifton area is the active Morenci Mine.
- There is no agricultural demand reported in this basin.
- As of 2005, there were 505 registered wells with a pumping capacity of less than or equal to 35 gpm and 145 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.9-9.
- There are three wastewater treatment facilities in the basin.
- Two of these facilities serve communities, effluent at the third facility is generated by the copper mining process and used for industrial purposes.
- Over 3,500 people are served by the two municipal facilities.
- 186 acre-feet of effluent per year is generated by municipal facilities in this basin and discharged into either an evaporation pond or a watercourse.

Table 3.9-8 Cultural Water Demand in the Morenci Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">239[2]</td><td rowspan="10">59[2]</td><td colspan="3" rowspan="5">3,900</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a) ADWR (2005f)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5">4,700</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>8,620</td></tr>
<tr><td>1981</td><td>8,284</td><td rowspan="5">66</td><td rowspan="5">16</td><td colspan="3" rowspan="5">5,100</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>7,948</td></tr>
<tr><td>1983</td><td>7,612</td></tr>
<tr><td>1984</td><td>7,276</td></tr>
<tr><td>1985</td><td>6,940</td></tr>
<tr><td>1986</td><td>6,604</td><td rowspan="5">47</td><td rowspan="5">24</td><td colspan="3" rowspan="5">6,400</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>6,268</td></tr>
<tr><td>1988</td><td>5,932</td></tr>
<tr><td>1989</td><td>5,596</td></tr>
<tr><td>1990</td><td>5,260</td></tr>
<tr><td>1991</td><td>5,248</td><td rowspan="5">35</td><td rowspan="5">13</td><td rowspan="5">1,000</td><td rowspan="5">13,700</td><td rowspan="5">NR</td><td rowspan="5">600</td><td rowspan="5">2,400</td><td rowspan="5">NR</td><td rowspan="15">USGS (2007) ADWR (2008b) ADWR (2008c)</td></tr>
<tr><td>1992</td><td>5,236</td></tr>
<tr><td>1993</td><td>5,224</td></tr>
<tr><td>1994</td><td>5,212</td></tr>
<tr><td>1995</td><td>5,200</td></tr>
<tr><td>1996</td><td>5,186</td><td rowspan="5">46</td><td rowspan="5">24</td><td rowspan="5">1,000</td><td rowspan="5">17,900</td><td rowspan="5">NR</td><td rowspan="5">600</td><td rowspan="5">2,100</td><td rowspan="5">NR</td></tr>
<tr><td>1997</td><td>5,177</td></tr>
<tr><td>1998</td><td>5,165</td></tr>
<tr><td>1999</td><td>5,153</td></tr>
<tr><td>2000</td><td>5,141</td></tr>
<tr><td>2001</td><td>5,126</td><td rowspan="5">72</td><td rowspan="5">9</td><td rowspan="5">1,400</td><td rowspan="5">8,200</td><td rowspan="5">NR</td><td rowspan="5">600</td><td rowspan="5">1,100</td><td rowspan="5">NR</td></tr>
<tr><td>2002</td><td>5,111</td></tr>
<tr><td>2003</td><td>5,096</td></tr>
<tr><td>2004</td><td>5,081</td></tr>
<tr><td>2005</td><td>5,066</td></tr>
<tr><td>2010</td><td>4,990</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>5,021</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>5,113</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">***WELL TOTALS:***</td><td>**505**</td><td>**145**</td><td colspan="7"></td></tr>
</table>

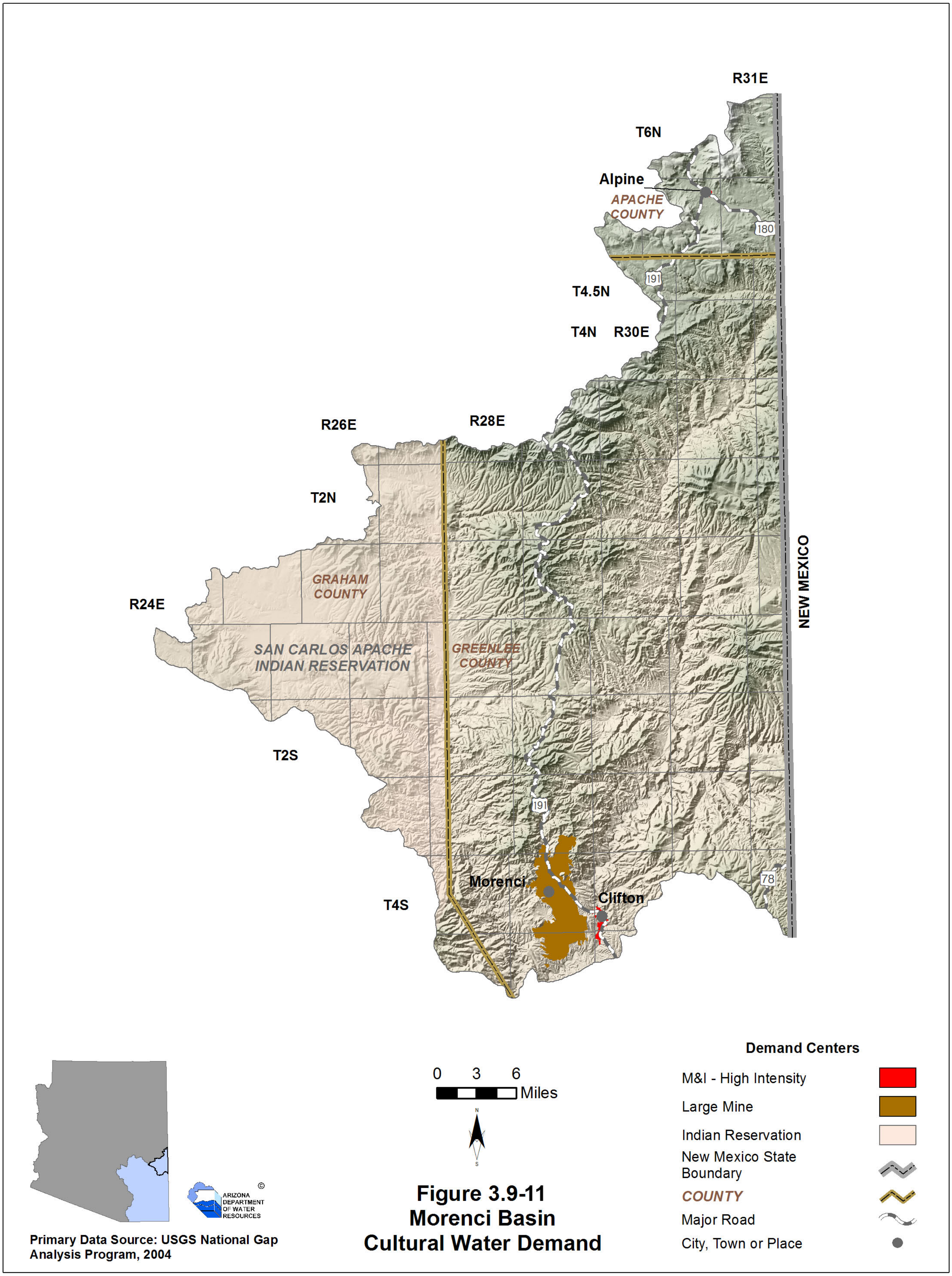
Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through June 1980.

Table 3.9-9 Effluent Generation in the Morenci 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	Golf Course/Turf/ Landscape	Industrial Use	Wildlife Area	Discharge to Another Facility	Infiltration Basins	Other			
Alpine WWTF	Alpine SD	Alpine	570	46		X								Secondary	70	2000
Clifton WWTF	Town of Clifton	Clifton	3,010	140									X	Secondary	25	1999
Morenci WWTF	Phelps Dodge-Morenci Water & Electric Co.	Morenci	NA						X					NA		
Total			**3,580**	**186**												

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
WWTF: Wastewater Treatment Facility
SD: Sanitation District



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 3.9-11
Morenci Basin
Cultural Water Demand

3.9.9 Water Adequacy Determinations in the Morenci 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 3.9-10. Figure 3.9-12 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in Apache County in the vicinity of Alpine. Eleven water adequacy determinations have been made in this basin through December 2008.
- One determination of water inadequacy has been made because the applicant failed to demonstrate the legal right to use the water or failed to demonstrate the provider's legal authority.
- Of the 1,859 lots in 10 subdivisions for which lot information was available, approximately 1,825 lots, or 98%, were determined to be adequate.

Table 3.9-10 Adequacy Determinations in the Morenci Basin[1]

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	Alpine Country Club	Apache	5 North	31 East	19, 20	8	53-500257	Adequate		7/18/1984	Alpine Country Club HOA
2	Alpine Forest Estates	Apache	5 North	30 East	11	75	53-402277	Adequate		10/17/2006	Turner Ranches Water Co.
3	Alpine Highlands	Apache	5 North	30 East	13	47	53-500259	Adequate		2/28/1978	Alpine Highlands Water Company
4	Alpine Village Acres	Apache	5 North	30 East	11, 14	1505	NA	Adequate		3/16/1988	Mountain Springs Water Company
5	Alpine Village Acres 2	Apache	6 North	31 East	11, 15	66	53-500262	Adequate		12/16/1993	Mountain Springs Water Company
6	Alpine Village East	Apache	5 North	30 East	14	NA	53-500263	Adequate		7/16/1985	Mountain Springs Water Company
7	Becker Estates	Apache	5 North	31 East	19	29	53-500313	Adequate		3/29/1982	Becker Estates HOA
8	Blue Spruce	Apache	5 North	30 East	12	24	53-500344	Adequate		7/11/1989	Alpine Water System
9	Jackson Spring Estates	Apache	5 North	31 East	18	34	53-500819	Inadequate	B	1/7/1987	Jackson Spring Estates HOA
10	Pine Ridge Estates	Apache	5 North	31 East	18	36	53-501153	Adequate		8/3/1983	Pine Ridge Estates HOA
11	The Ranch at Alpine, Amended	Apache	5 North	31 East	7, 18	35	53-700372	Adequate		8/20/2007	Alpine Domestic Water Improvemnt District

Source: ADWR 2008a

Notes:

NA = Not Available

[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 unavailable; 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

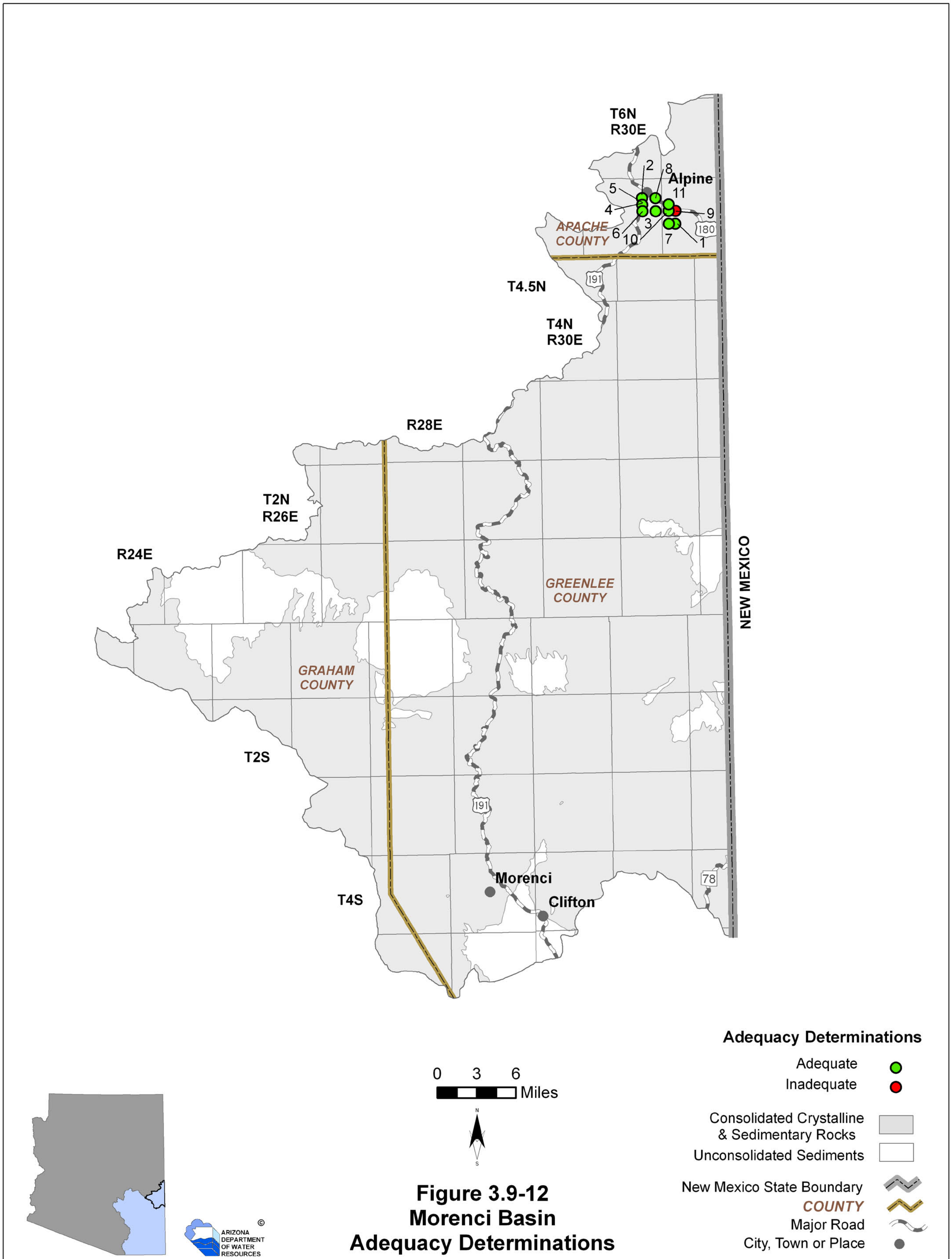


Figure 3.9-12
Morenci Basin
Adequacy Determinations

MORENCI BASIN
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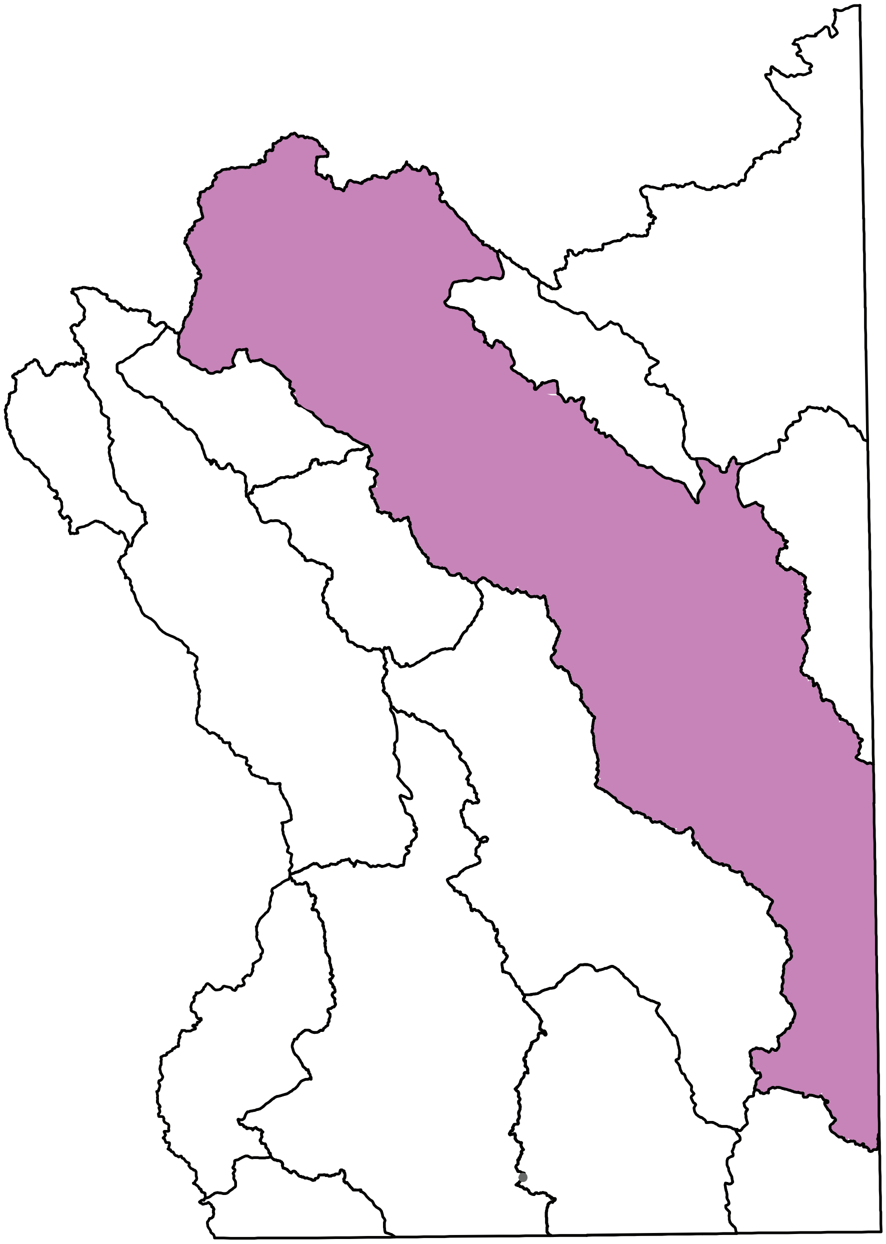
Section 3.10
Safford Basin



3.10.1 Geography of the Safford Basin

The Safford Basin is the largest basin in the planning area at 4,747 square miles. Geographic features and principal communities are shown on Figure 3.10-1. The basin is characterized by valleys, high-elevation mountain ranges and a variety of vegetation types including: Arizona uplands Sonoran and Chihuahuan desertscrub, semi-desert grassland, interior chaparral, Rocky Mountain and montane conifer forest, Great Basin conifer woodland, madrean evergreen woodland and a small portion of Rocky Mountain subalpine forest atop Mt. Graham. (see Figure 3.0-9) Riparian vegetation includes: mesquite and tamarisk on the Gila River; conifer oak, mixed broadleaf and mesquite on Ash Creek; conifer oak and mesquite on Frye Canyon; and conifer oak and mixed broadleaf on Deadman Canyon and Cave Creek and its tributaries.

- Principal geographic features shown on Figure 3.10-1 are:
    - Gila River running northwest from Greenlee County to the San Carlos Reservoir
    - San Simon Creek running through the San Simon Valley south of Safford
    - Gila Mountains northeast of Pima, Dos Cabezas Mountains on the southeastern basin boundary and Chiricahua Mountains along the southeastern and southern basin boundary
    - Pinaleño Mountains west of Swift Trail Junction, which include the highest point in the basin and planning area, Mt. Graham at 10,712 feet
    - The lowest point at approximately 2,500 feet where the Gila River exits the basin

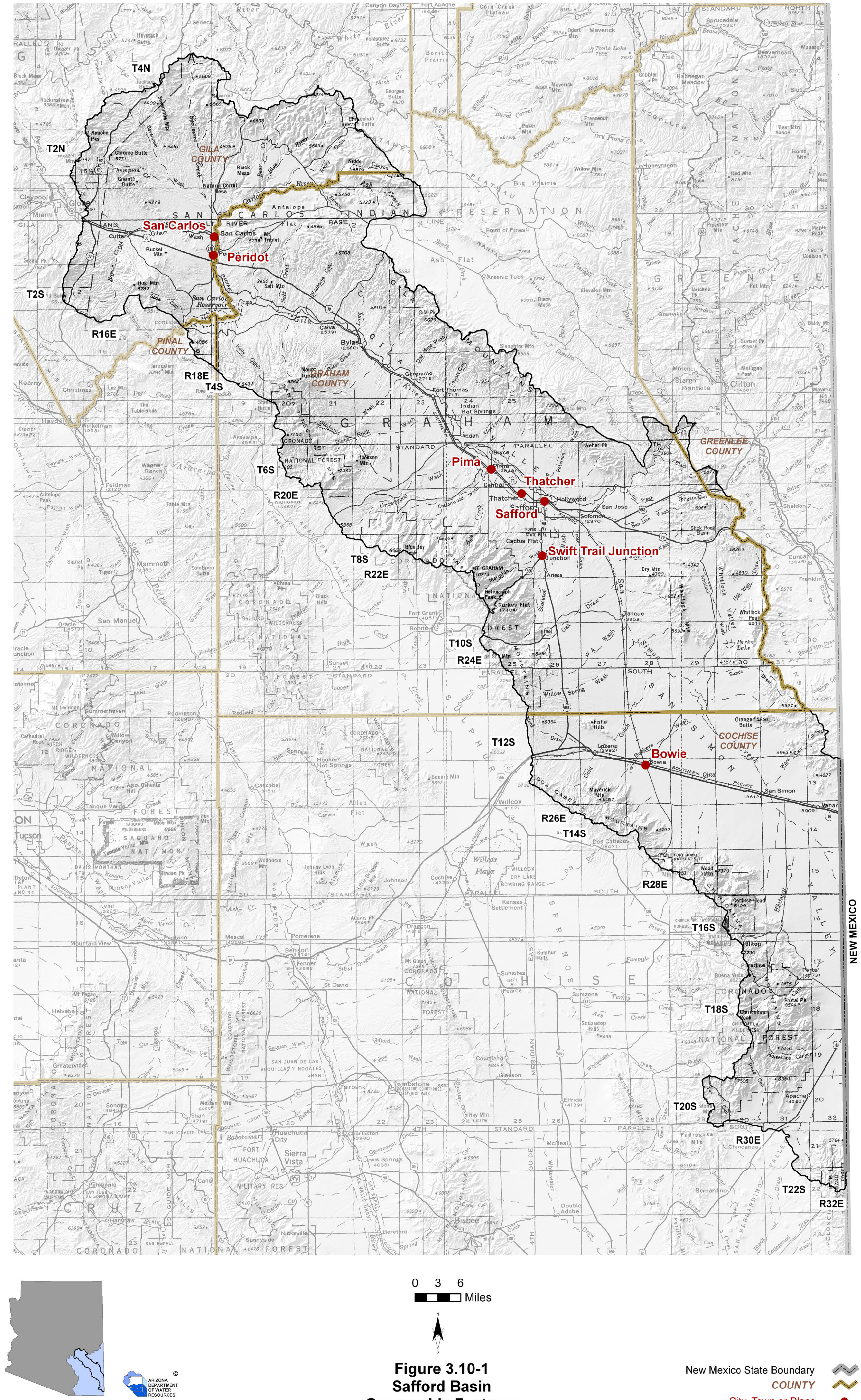


Figure 3.10-1
Safford Basin
Geographic Features

3.10.2 Land Ownership in the Safford Basin

Land ownership, including the percentage of ownership in each category, for the Safford Basin is shown in Figure 3.10-2. A principal feature of land ownership is the diversity of land ownership types, eight total. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

Indian Reservations
- 29.5% of land is under ownership of the San Carlos Apache Tribe.
- Tribal lands are located in the northern quarter of the basin.
- The basin contains the San Carlos Apache tribal headquarters in San Carlos and the San Carlos Apache cultural center in Peridot.
- Primary land uses are domestic, commercial, farming, grazing and mining.

U.S. Bureau of Land Management (BLM)
- 29.0% of land is federally owned and managed by the Safford Field Office of the BLM.
- Most of the BLM land occurs in a wide band along the eastern portion of the basin.
- The basin contains the entire Dos Cabezas Mountain Wilderness, North Santa Teresa, and Fishooks Wilderness areas. (see Figure 3.0-12)
- Portions of the Peloncillo Wilderness Area and Gila Box National Conservation Area are also in the basin.
- Primary land uses are grazing and recreation.

State Trust Land
- 16.3% of land in this basin is held in trust for public schools and 13 other beneficiaries under the State Trust Lands system.
- Many of the state owned lands in this basin are fragmented, however, significant contiguous portions exist east of Swift Trail Junction, in a band surrounding the Coronado National Forest west of Safford, and north and south of Interstate 10.
- Primary land use is grazing.

National Forest
- 12.6% of land is federally owned and managed by the United States Forest Service (USFS).
- The basin includes two national forests and three ranger districts: the Tonto National Forest, Globe Ranger District in the north; and the Coronado National Forest, Safford Ranger District east of Safford, and the Douglas Ranger District in the south.
- Two wilderness areas are located within national forest lands. Most of the Santa Teresa Wilderness is located in the northern portion of the Safford Ranger District and a portion of the Chiricahua Wilderness is located in the Douglas Ranger District. (see Figure 3.0-12)
- Primary land uses are grazing, recreation and timber production.

Private

- 12.0% of land is private.
- Small parcels of private land are scattered throughout the basin.
- The largest continuous blocks of private land are along Highway 70 in the vicinity of Safford, along Interstate 10 and around Highway 80 in the southern portion of the basin.
- Primary land uses are farming, domestic, commercial and mining.

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

- 0.3% of land is state owned and managed by the Arizona Game and Fish Department.
- The basin contains two wildlife areas, the May Memorial Wildlife Area in T17S, R31E and the Cluff Ranch Wildlife Area T7S, R24E.
- Primary land uses are wildlife protection and recreation.

U.S. Military

- 0.2% of the land is federally owned and managed by the U.S. Military.
- A U.S. Military Reserve is located near Swift Trail Junction in T7S, R25E.
- Primary land use is military activities.

National Park Service (NPS)

- 0.1% of the land is federally owned and managed by the National Park Service (NPS).
- The basin contains two NPS units, the Fort Bowie National Historic Site in T15S, R28E and a very small portion of the Chiricahua National Monument in T16S, R30E.
- Primary land uses are recreation and resource protection.

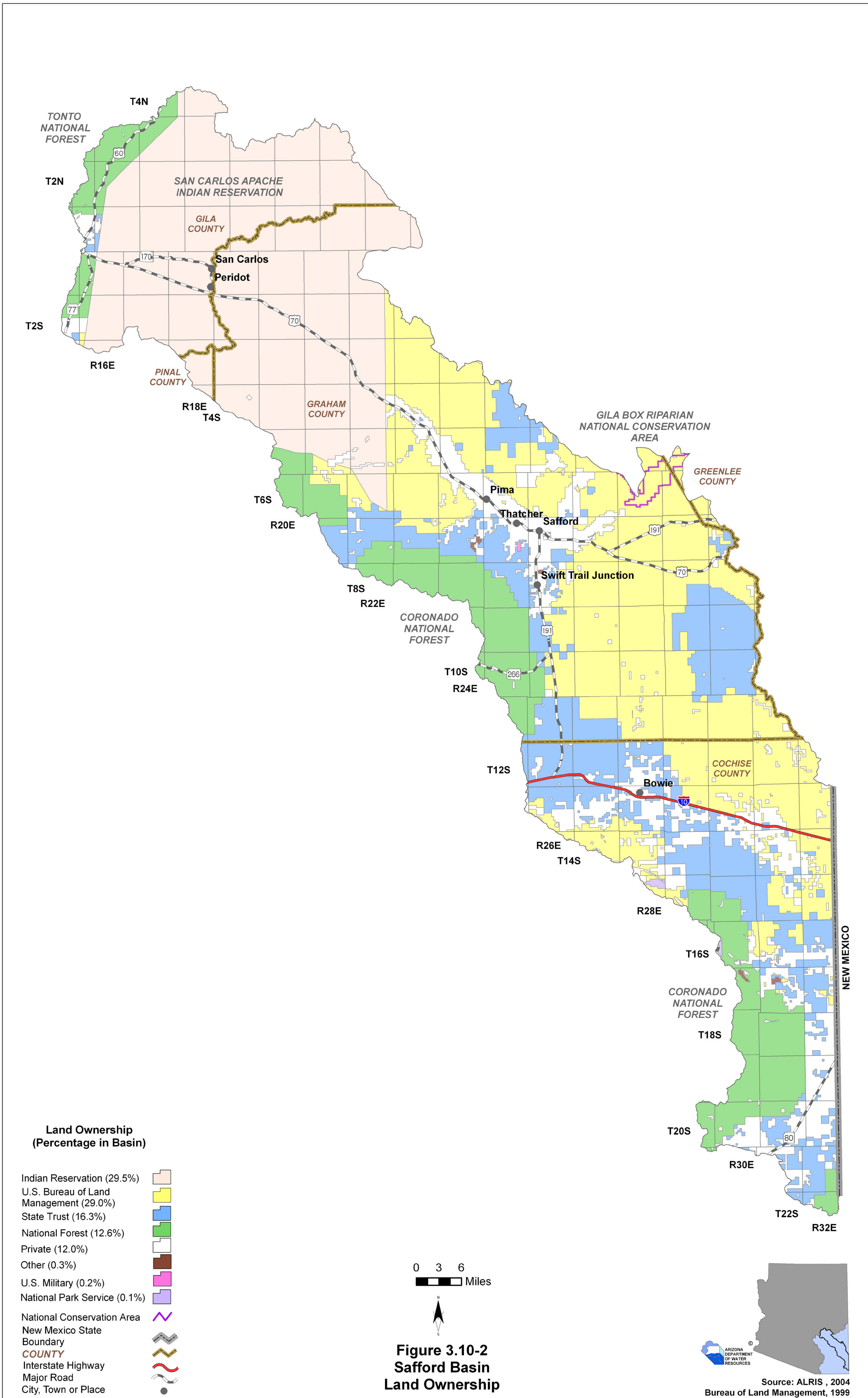


Figure 3.10-2
Safford Basin
Land Ownership

3.10.3 Climate of the Safford Basin

Climate data from NOAA/NWS Co-op Network, Evaporation Pan and AZMET stations are complied in Table 3.10-1 and the locations are shown on Figure 3.10-3. Figure 3.10-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Safford Basin does not contain SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.10-1A.
- There are nine NOAA/NWS Co-op Network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 70.4°F at Portal 4 SW to 84.4°F at San Carlos. The average monthly minimum temperature occurs in December or January and ranges between 37.8°F at Paradise to 46.0°F at Bowie.
- Highest average seasonal rainfall occurs in the summer (July – September). For the period of record used, the highest annual rainfall is 21.56 inches at Portal 4 SW and the lowest is 9.34 inches at San Carlos.

Evaporation Pan

- Refer to Table 3.10-1B.
- There is one site at the Safford Agricultural Center.
- This site, at 2,950 feet, has an annual pan evaporation rate of 98.05 inches.

AZMET

- Refer to Table 3.10-1C.
- There are two AZMET stations in the basin at Safford and Bowie.
- Average annual evaporation at the Bowie site, located at 4,416 feet, is 60.64 inches.
- Average annual evaporation at the Safford site, located at 2,956 feet, is 76.50 inches.

SCAS Precipitation Data

- See Figure 3.10-3
- Additional precipitation data shows rainfall as high as 44 inches near Chiricahua Peak, elevation 9,760 feet, and as low as 8 inches in the areas surrounding San Simon and Safford.

Table 3.10-1 Climate Data for the Safford Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Bowie	3,770	1971-2000	82.6/Jul	46.0/Dec	2.52	1.17	5.28	3.37	12.34
Paradise	5,430	1906-1937	72.6/Jul	37.8/Dec	3.59	1.58	9.88	3.97	19.04
Portal	5,000	1914-1955	75.1/Jul	41.2/Jan	3.08	1.57	9.08	3.64	17.38
Portal 4 SW	5,390	1971-2000	70.4/Jul	38.2/Jan	3.64	2.14	10.43	5.35	21.56
Safford	2,900	1898-1973[1]	84.2/Jul	45.0/Jan	1.34	0.65	4.75	3.23	9.95
Safford Ag. Ctr.	2,950	1971-2000	83.2/Jul	44.4/Dec	2.13	0.80	4.29	2.57	9.79
San Carlos	2,640	1948-1977[1]	84.4/Jul	44.2/Jan	1.98	0.79	3.63	2.95	9.34
San Simon	3,610	1971-2000	80.5/Jul	42.7/Jan	1.94	0.65	4.98	3.09	10.66
San Simon 9 ESE	3,880	1962-1986[1]	81.9/Jul	44.4/Jan	1.96	0.81	5.59	2.50	10.85

Source: WRCC, 2005

Notes:
[1]Average temperature for period of record shown; average precipitation from 1971-2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
Safford Agricultural Center	2,950	1948 - 2002	98.05

Source: WRCC, 2005

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Bowie	4,416	2004 - current	60.64 *(4)*
Safford	2,956	1999 - current	76.50 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								

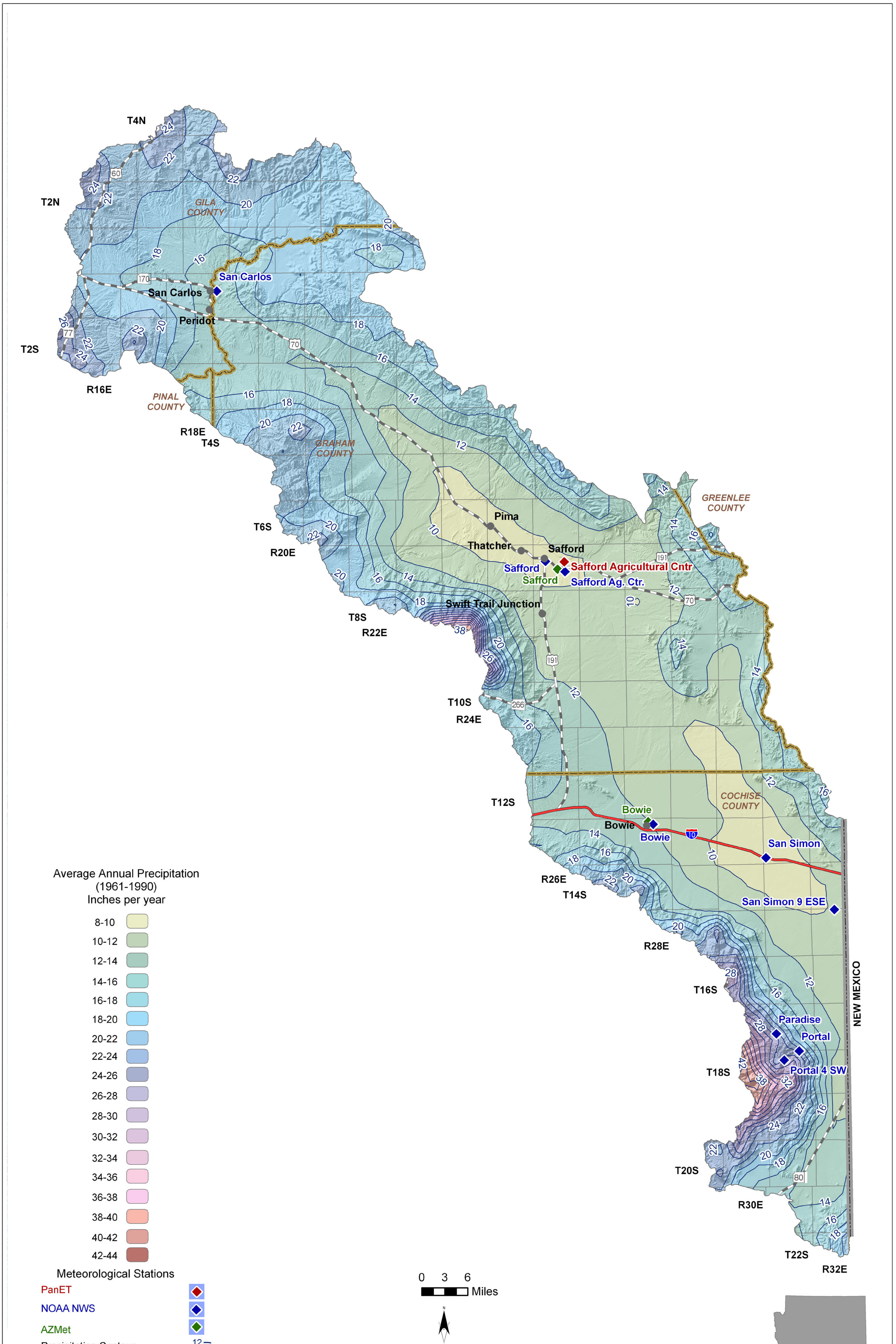


Figure 3.10-3
Safford Basin
Meteorological Stations and
Annual Precipitation

3.10.4 Surface Water Conditions in the Safford Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.10-2. Flood ALERT equipment in the basin is shown on Table 3.10-3. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.10-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 3.10-5. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.10-2.
- Data from 18 stations on eight water courses are shown on the table and on Figure 3.10-4. Fourteen stations have been discontinued and the remaining four are real-time stations.
- The average seasonal flow for many of the stations is highest in the Winter (January-March) and lowest in the Spring (April-June).
- Maximum annual flow in this basin was 1,732,915 acre-feet in 1993 on the Gila River at Calva, see Figure 3.10-4, and minimum annual flow was 56 acre-feet in 1969 on Frye Creek.

Flood ALERT Equipment

- Refer to Table 3.10-3.
- There are eight stations in the basin as of October 2005.

Reservoirs and Stockponds

- Refer to Table 3.10-4
- Surface water is stored or could be stored in 12 large and 57 small reservoirs in this basin.
- The largest reservoir, San Carlos Lake, has a maximum storage capacity of 1,073,000 acre-feet. San Carlos Lake is created by Coolidge Dam, built in 1929. This is the largest reservoir in the planning area and the only large storage dam on the Gila River. Its uses are for hydroelectric generation, irrigation and recreation.
- Other large reservoirs and used for irrigation, water supply, flood control and recreation.
- There are 1,429 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.10-5
- Average annual runoff increases from 0.2 inches, or 10.6 acre-feet per square mile, in the vicinity of Safford and Thatcher along the Gila River and in the southeastern part of the basin, to five inches, or 266.6 acre-feet per square mile, in the Chiricahua Mountains along the southwestern boundary.

Figure 3.10-4 Annual Flows (in acre-feet) at Gila River River at Calva (Station # 9466500) Water Years 1930-2007

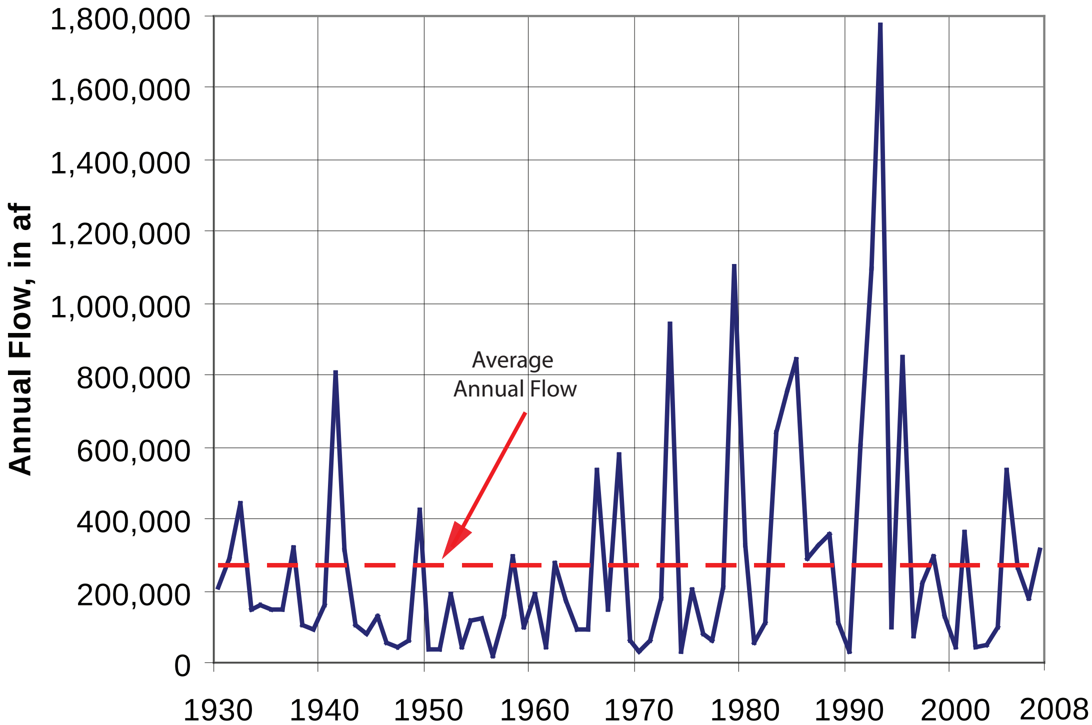


Table 3.10-2 Streamflow Data for the Safford Basin

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/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9448500	Gila River at head of Safford Valley near Solomon	7,896	3,060	10/1920-current (real time)	41	18	20	22	48,953 (1956)	273,008	337,069	1,559,116 (1993)	77
9451000	Gila River near Solomon	7,950	NA	4/1914-9/1951 (discontinued)	40	18	23	18	18,461 (1956)	162,170	198,406	58,780 (1941)	34
9454500	Cave Creek near Paradise	39	4,950	8/1919-9/1925 (discontinued)	17	11	32	40	1,028 (1922)	4,720	4,842	9,122 (1923)	5
9455000	Cave Creek near Paradise	39	NA	10/1919-9/1925 (discontinued)	17	35	26	23	586 (1922)	767	898	1,361 (1923)	5
9455500	East Turkey Creek at Paradise	8	NA	8/1919-9/1925 (discontinued)	22	13	42	23	80 (1922)	1,071	835	1,433 (1921)	5
9456000	San Simon River near San Simon	814	NA	8/1919-6/1941 (discontinued)	1	6	86	8	335 (1937)	2,621	3,943	14,842 (1921)	13
9456200	San Simon River below Fandrop Detention Dam near Bowie	1,400	NA	11/1955-6/1959 (discontinued)	1	2	96	1	710 (1956)	13,104	9,214	13,828 (1957)	3
9456800	San Simon River near Tanque	1,953	NA	7/1957-6/1959 (discontinued)	No statistics run, less than 3 years of data								2
9457000	San Simon River near Solomon	2,192	2,960	6/1931-9/1982 (discontinued)	1	2	90	7	1,275 (1980)	5,648	8,411	27,953 (1954)	46
9458050	Marijilda Wash near Safford	11	NA	5/1971-9/1978 (discontinued)	35	40	10	16	586 (1977)	1,951	2,687	6,610 (1973)	6
9458200	Deadman Creek near Safford	5	NA	11/1966-4/1995 (discontinued)	36	40	9	15	232 (1989)	800	1,124	2,730 (1991)	14
9458500	Gila River at Safford	10,459	2,880	6/1940-9/1965 (discontinued)	45	14	24	17	69,719 (1946)	133,574	206,504	847,778 (1941)	14
9460150	Frye Creek near Thatcher	4	5,850	10/1989-current (real time)	26	44	14	16	59 (2002)	927	1,031	1,890 (1991)	8
9460200	Frye Creek at Thatcher	24	NA	2/1963-2/1973 (discontinued)	2	3	81	14	56 (1969)	159	286	1,231 (1967)	10
9466300	Gila River near Bylas	11,380	NA	10/1965-9/1970 (discontinued)	53	13	14	20	54,733 (1969)	284,161	288,433	53,068 (1968)	4
9466500	Gila River at Calva	11,470	2,517	10/1929-current (real time)	48	15	14	23	7,386 (1956)	165,833	271,929	1,732,915 (1993)	73
9467100	Gila River near Calva	11,550	NA	10/1964-9/1970 (discontinued)	33	5	43	19	28,163 (1970)	86,877	98,244	179,691 (1967)	3
9468500	San Carlos River near Peridot	1,026	2,542	4/1914-current (real time)	61	5	13	21	4,070 (2002)	28,677	43,480	296,181 (1993)	73

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding.
Period of record may not equal Year of 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
NA=Not available

Table 3.10-3 Flood ALERT Equipment in the Safford Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
591	Heliograph Peak Repeater	Repeater/Precipitation	10/1/2001	ADWR
620	Portal Fire/Rescue Station	Precipitation	10/1/2001	ADWR
630	Jacobson Canyon	Precipitation	10/1/2001	ADWR
631	Emerald Park	Precipitation	7/29/2004	ADWR
632	Pinaleno Park	Precipitation	7/29/2004	ADWR
640	Marijilda Canyon	Precipitation/Stage	7/25/2004	ADWR
647	Noon Creek	Precipitation/Stage	7/30/2004	ADWR
900	Upstream Coolidge Dam, Gila River	Precipitation/Stage	NA	Gila County FCD

Source: ADWR 2005c

Notes:
ADWR = Arizona Department of Water Resources
FCD = Flood Control District
NA = Not available

Table 3.10-4 Reservoirs and Stockponds in the Safford Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE[1]	JURISDICTION
1	San Carlos (Coolidge Dam)	Bureau of Reclamation	1,073,000	H,I,R	Federal
2	Talkalai (Elgo)	San Carlos Apache Tribe	13,000	R,S	Tribal
3	Foote Wash	Graham County	5,500	C	State
4	Graveyard Wash	City of Safford	2,360	C	State
5	Billingsley	Graham Canal Co.	2,175	C	State
6	Cheslkey-Wamslee	Graham Canal Co.	2,160	C	State
7	San Jose	Private	1,734	C	Landowner
8	Freeman Wash	Graham County	960[2]	C	State
9	Tufa Stone	San Carlos Apache Tribe	850[2]	I	Tribal
10	No Name Wash	Graham County	646	C	State

B. Other Large Reservoirs (50 acre surface area or greater)[3]

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[1]	JURISDICTION
11	Parks	Private	426	U	Landowner
12	Dry[4]	Private	75	P	Landowner

Source: Compilation of databases from ADWR & others

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

Total number: 25
Total maximum storage: 3,862 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[3]

Total number: 32
Total surface area: 328 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 1429 (from water right filings)

Notes:
[1]C=flood control; H=hydroelectric; I=irrigation; P=fire protection, stock or farm pond
R=recreation; S=water supply; U=unknown
[2]Normal capacity < 500 acre-feet
[3]Capacity data not available to ADWR
[4]Dry Lake

Figure 3.10-5
Safford Basin
Surface Water Conditions

3.10.5 Perennial/Intermittent Streams and Major Springs in the Safford 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 3.10-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.10-6. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are numerous perennial stream reaches located primarily along the western boundary of the basin, as well as the San Carlos River and the Blue River in the northern part of the basin.
- Numerous intermittent streams occur primarily along the western boundary of the basin.
- The Gila River is predominantly an intermittent stream through the basin, with perennial reaches shown on Figure 3.10-6.
- There are 24 major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge rate is 3,398 gpm at Warm Spring. This is the largest recorded discharge in the planning area.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.10-5. There are 30 minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. Most of the measurements were taken prior to 1990 and many measurements date from the 1940's and 1950's. Three major and two minor spring measurements post-date 1990.
- The total number of springs identified by the USGS varies from 379 to 387, depending on the database reference.

Table 3.10-5 Springs in the Safford Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Warm	332623	1101244	3,398	During or prior to 1982
2	Cold #1	330024	1095409	449	5/10/1940
3	Cold #2	330024	1095409	449	5/10/1940
4	Indian Hot	325954	1095351	150	5/10/1940
5	Unnamed	330007	1095359	75	5/10/1940
6	Unnamed[2]	325432	1094910	50	9/1/1941
7	Unnamed[2]	330116	1095534	44	09/1941
8	Unnamed[2]	325631	1095350	40	NA
9	Unnamed[2]	315916	1091543	35	8/1/1946
10	Cassadore	333043	1102400	35	3/13/1951
11	Cold #3	330023	1095409	30	5/10/1940
12	Unnamed[2]	325625	1094833	30	9/15/1960
13	Unnamed[2]	325205	1094525	30	NA
14	Ash Creek	324910	1095024	20	During or prior to 1982
15	Unnamed[2]	324747	1094709	20	3/10/1940
16	Spring Canyon[2,3]	325046	1093120	15[4]	07/2000
17	Simon Springs	325515	1095332	13	04/2002
18	Upper Fishook	331341	1095817	11	04/2002
19	Unnamed[2]	325654	1095353	10	09/1941
20	Unnamed[2]	325526	1095107	10	9/12/1941
21	Unnamed[2]	325110	1095739	10	1/8/1941
22	Unnamed[2]	324625	1094510	10	7/31/1940
23	Unnamed[2]	323535	1092031	10	7/31/1940
24	Unnamed	330420	1095914	10	During or prior to 1982

Table 3.10-5 Springs in the Safford Basin (Cont)

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed[2,3]	331349	1100225	6	05/1980
Unnamed[2]	325546	1095107	5	9/12/1941
Tom Niece	330410	1095840	5	During or prior to 1982
Big	325619	1094818	5	07/1981
Lower Sam Canyon[2,3]	331523	1100233	3	05/1981
Apache	320843	1092624	3	11/20/2002
Indian Hot	325954	1095352	3	4/20/1942
Bigler[2]	330017	1095312	2	04/1995
Unnamed[2]	330226	1095659	2	9/12/1941
Eden	325832	1095237	2	NA
Unnamed[2]	325226	1094828	2	11/15/1940
Unnamed[2]	325222	1094828	2	11/15/1940
George Hill[2,3]	325525	1092550	2	12/1981
Delia[2,3]	325258	1092902	2	09/1982
Bill[2,3]	325607	1092654	2	08/1984
Ward[2]	322138	1090633	2	04/1990
Spring Branch-Ranch Creek[2,3]	331539	1104123	2	5/8/1951
Cold at Warm Springs[2,3]	332625	1101241	2	3/2/1951
Unnamed[2]	325945	1095352	2	4/20/1942
#13[2,3]	320839	1092328	2	04/1989
Fisher[2,3]	325601	1101343	1	09/1981
Unnamed	330009	1095401	1	05/1940

Table 3.10-5 Springs in the Safford Basin (Cont)

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Turkey	321238	1093418	1	05/1984
Unnamed[2]	325425	1095109	1	11/1940
Unnamed[2]	324711	1094605	1	7/20/1941
Upper Bear	321510	1093250	1	11/1989
Elefante	321437	1093019	1	07/1985
Indian	321337	1092954	1	07/1985
Alamo	321312	1093034	1	07/1985
Cowboy Swimming Hole	321631	1093242	1	04/1990

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 379 to 387

Notes:
NA = Not Available
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Location approximated by ADWR
[4]Discharge measurements vary. Shown is greatest measured discharge;
most recent measurement < 10 gpm

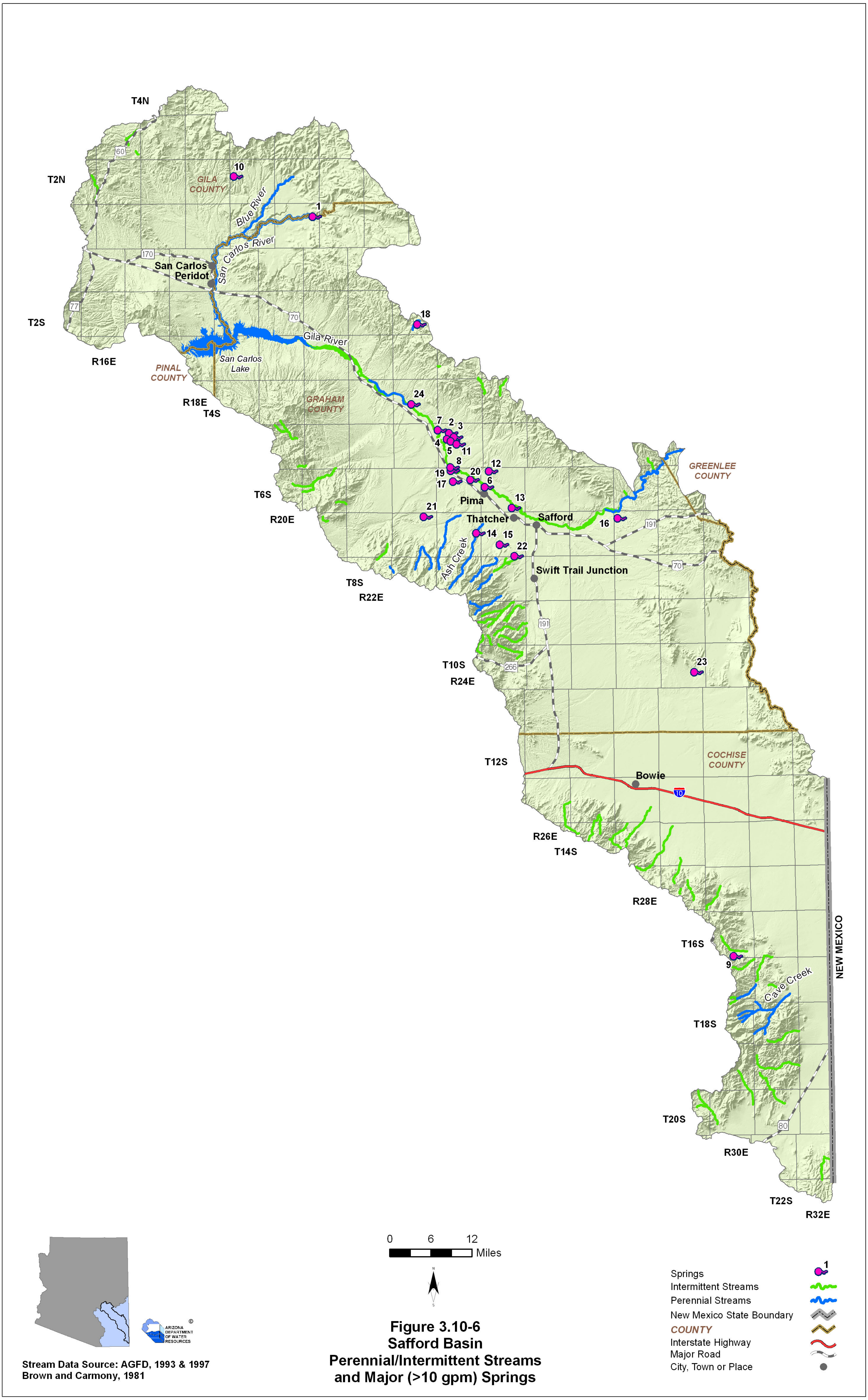


Figure 3.10-6
Safford Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

3.10.6 Groundwater Conditions of the Safford 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 3.10-6. Figure 3.10-7 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.10-8 contains hydrographs for selected wells shown on Figure 3.10-7. Figure 3.10-9 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 3.10-6 and Figure 3.10-7.
- The basin is composed of three sub-basins
- The southernmost sub-basin, the San Simon Valley sub-basin, consists of recent stream alluvium and contains artesian conditions in the lower aquifer.
- The middle sub-basin, the Gila Valley sub-basin, contains older and younger basin fill. The principal aquifer is the younger basin fill.
- The northern sub-basin, the San Carlos Valley sub-basin, consists of younger stream alluvium and basin fill. The principal water-bearing unit is the younger stream alluvium.
- Flow direction is generally from south to north, however, the flow is from north to south in the vicinity of San Carlos. Flow directions have been altered due to pumping south of Interstate 10.

Well Yields

- Refer to Table 3.10-6 and Figure 3.10-9.
- As shown on Figure 3.10-9, well yields in this basin range from less than 100 gpm to more than 2,000 gpm.
- One source of well yield information, based on 1,494 reported wells, indicates that the median well yield in this basin is 600 gpm.

Natural Recharge

- Refer to Table 3.10-6.
- The only estimate for natural recharge in this basin is 105,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 3.10-6.
- Storage estimates for this basin range from more than 27 million acre-feet (maf) to 69 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.10-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 50 index wells in this basin. Hydrographs for thirteen wells are shown in Figure 3.10-8.
- The Department measures water levels daily at two automated groundwater monitoring site in the basin.
- Water levels are as deep as 517 feet in the vicinity of Interstate 10 and as shallow as 21 feet in the Safford, Pima and Thatcher area.

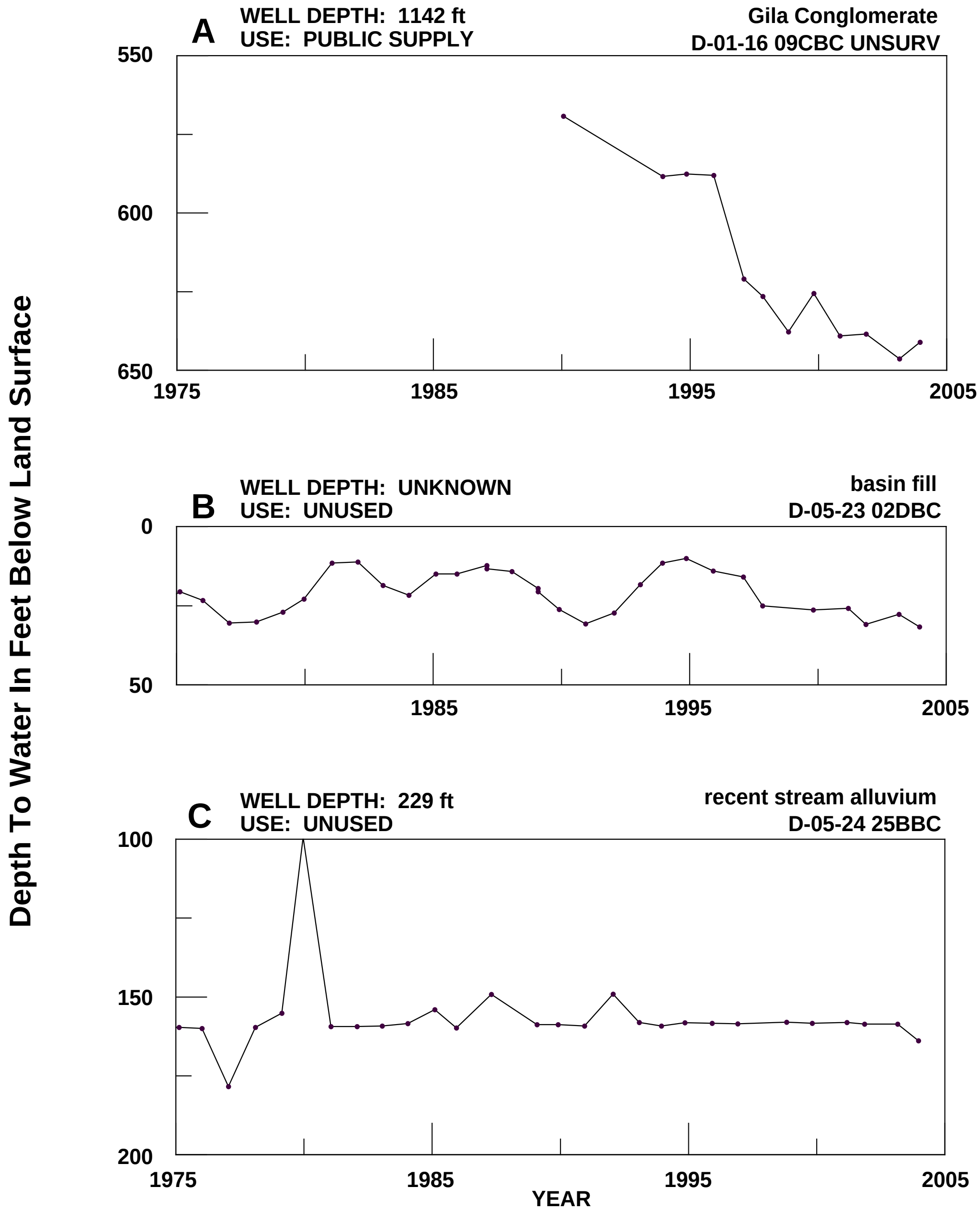
Table 3.10-6 Groundwater Data for the Safford Basin

Basin Area, in square miles:	4,747	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 70 - 1,683 Median 771.5 (52 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 1 - 7,000 Median 600 (1,494 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 50 - 2,500	ADWR (1990 and 1994b)
	Range 0 - 2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	105,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	66,000,000 (to 1,200 ft)	ADWR (1990)
	69,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	>27,000,000	Arizona Water Commission (1975)
Current Number of Index Wells:	50	
Date of Last Water-level Sweep:	1997 (559 wells measured); 2007 (338 wells measured in San Simon Valley Sub-basin	

[1] Predevelopment Estimate

Figure 3.10-7
Safford Basin
Groundwater Conditions

Figure 3.10-8
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells



In Hydrograph A UNSURV indicates there is no land survey for the area the well is in, and the coordinates are projected based on latitude and longitude.

Figure 3.10-8 (Cont)
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells

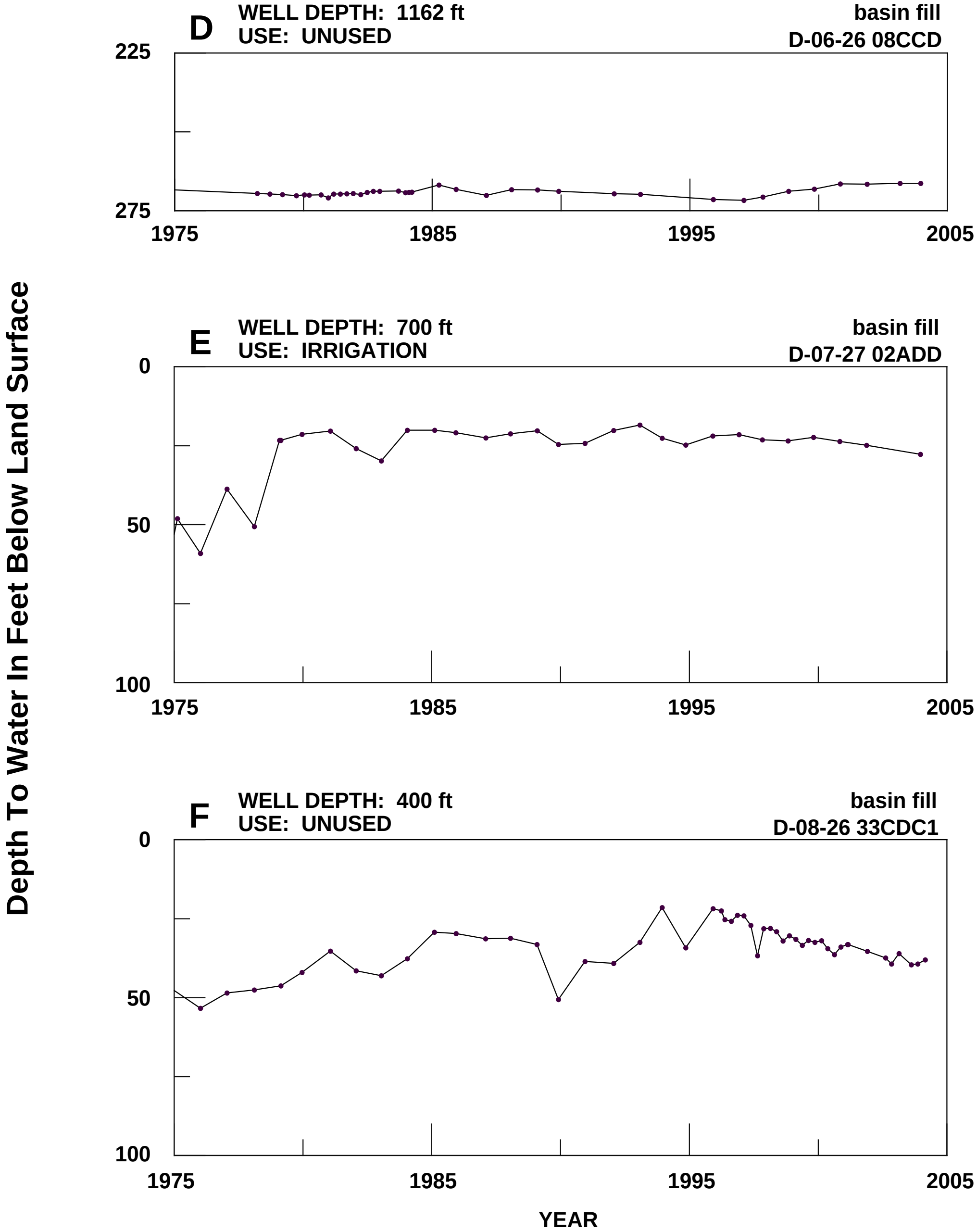


Figure 3.10-8 (Cont)
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells

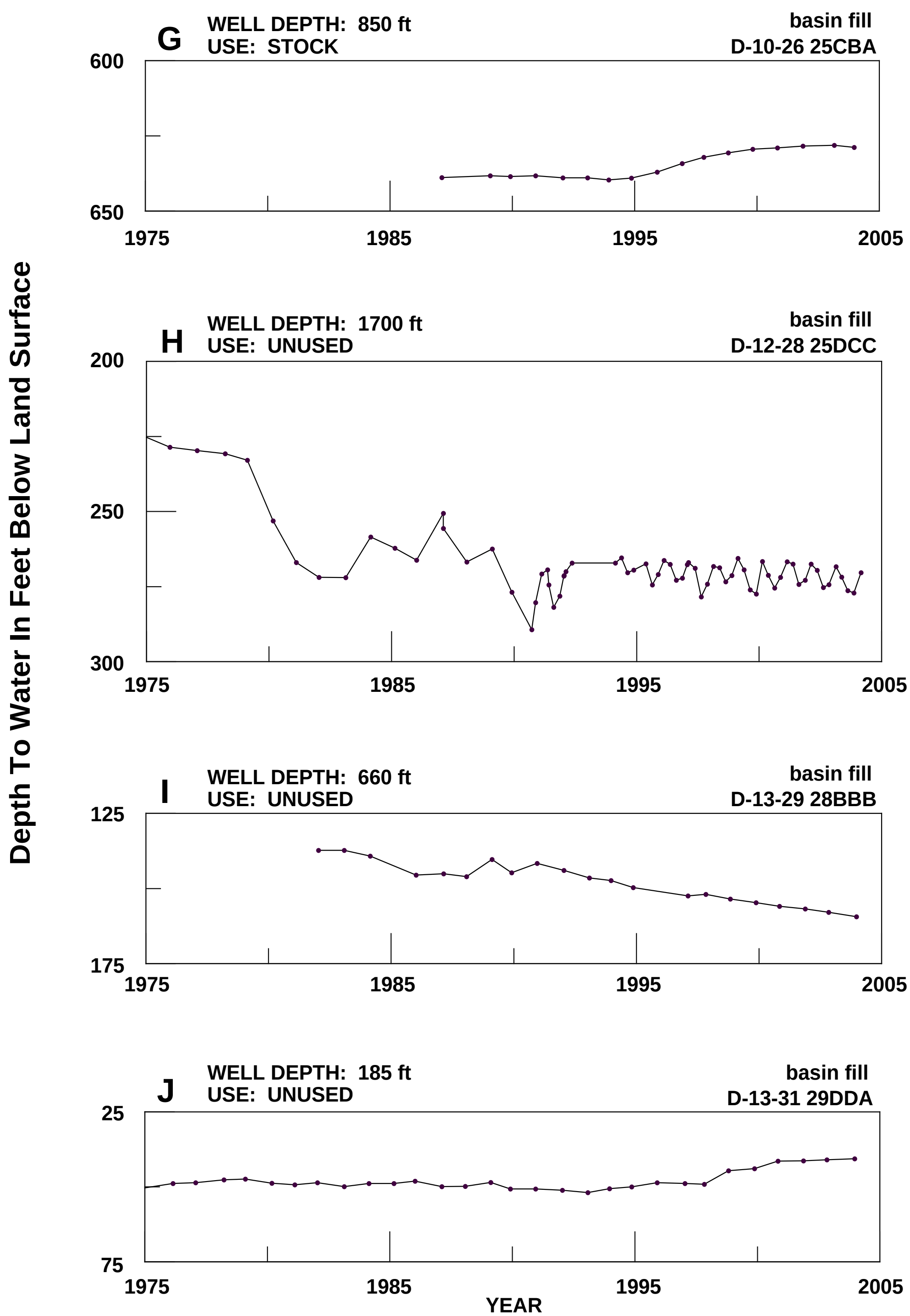
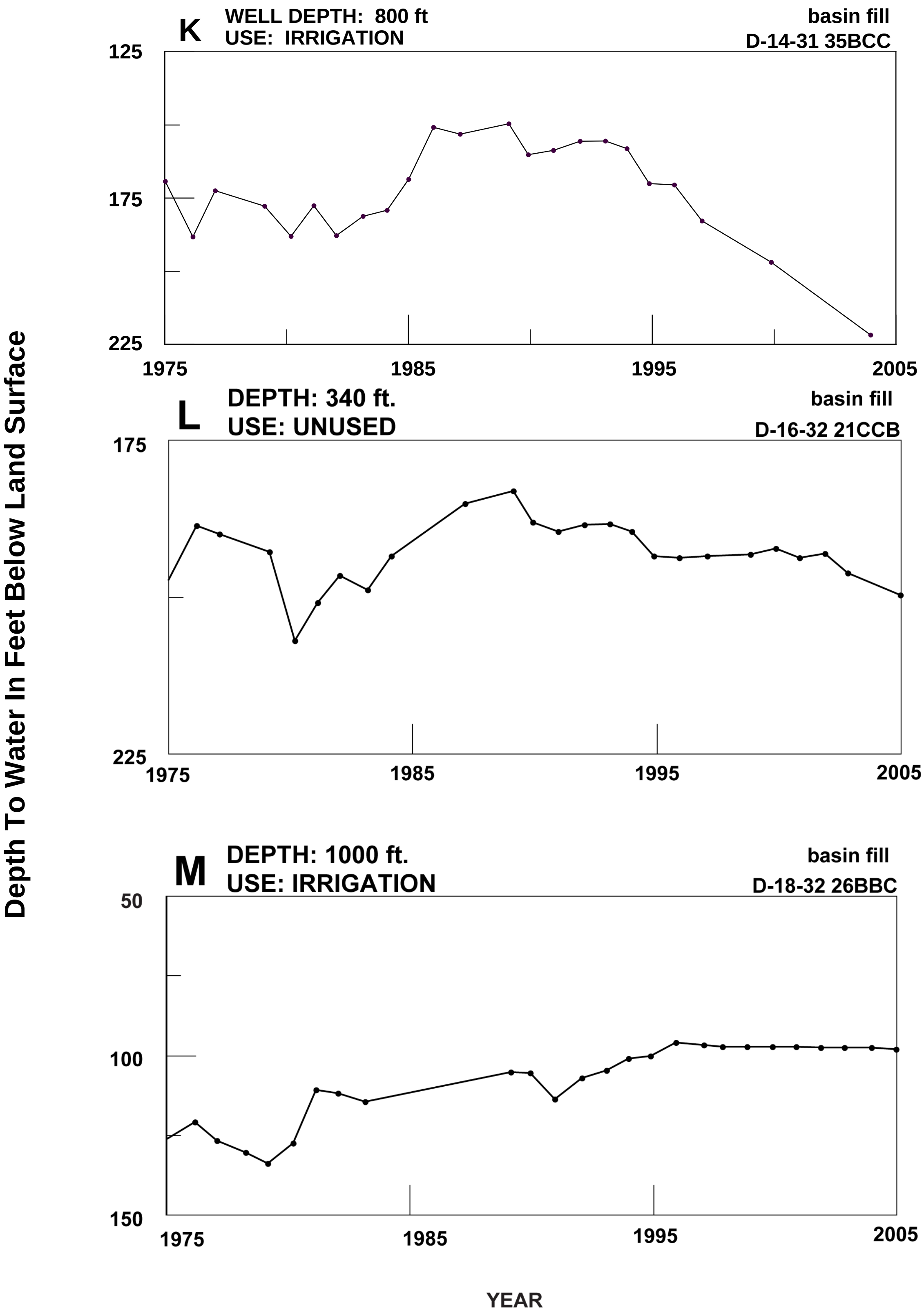


Figure 3.10-8 (Cont)
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells



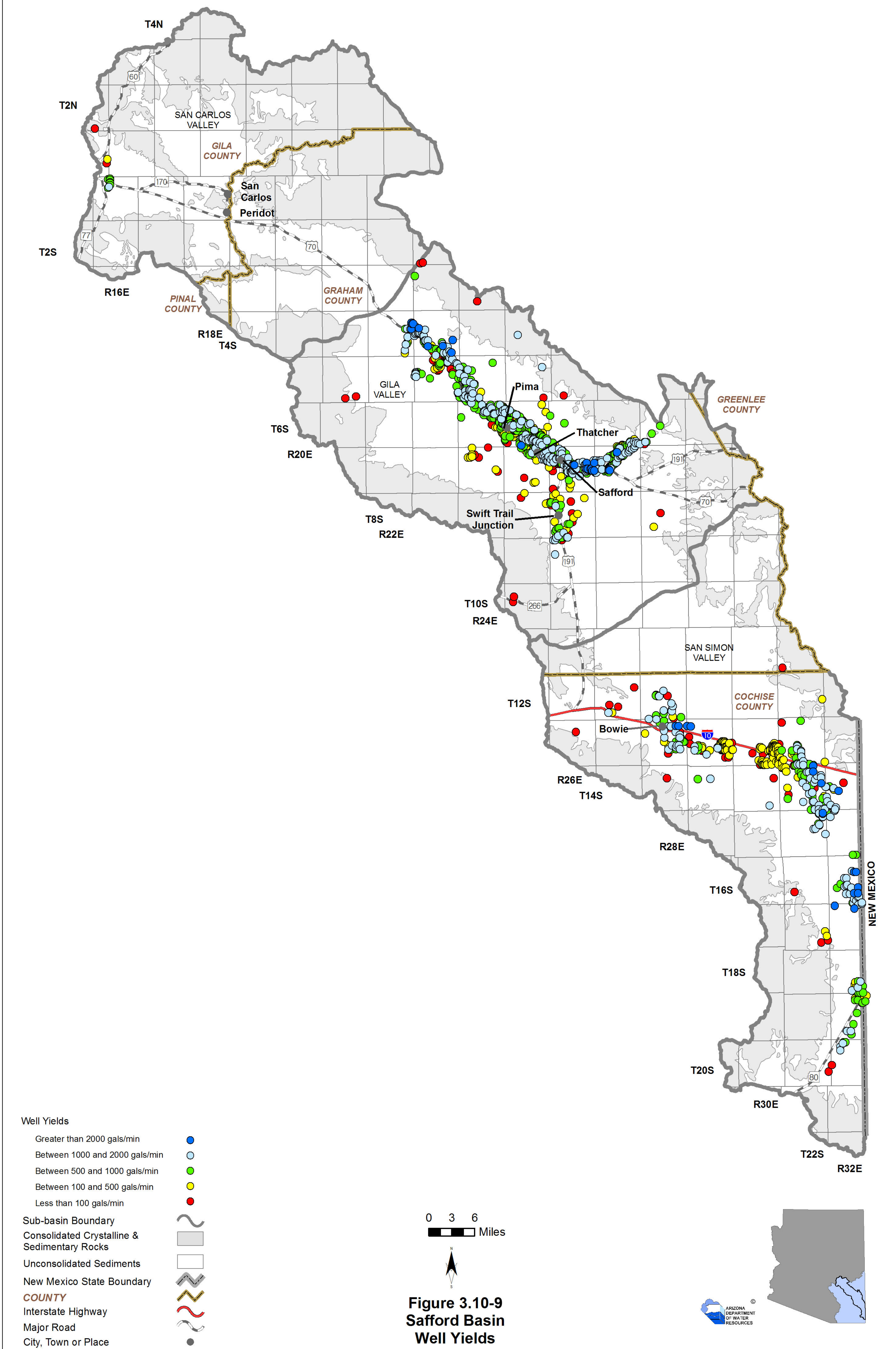


Figure 3.10-9
Safford Basin
Well Yields

3.10.7 Water Quality of the Safford Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.10-7A. 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 3.10-7B. Figure 3.10-10 shows the location of exceedences and impairment keyed to Table 3.10-7. 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. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.10-7A.
- One hundred and thirty-five sites have parameter concentrations that have equaled or exceeded DWS.
- Frequently equaled or exceeded parameters include fluoride and arsenic.
- Other parameters commonly equaled or exceeded in the sites measured in this basin were total dissolved solids, nitrates and lead.

Lakes and Streams with impaired waters

- Refer to Table 3.10-7B.
- Water quality standards were exceeded in one reach of Cave Creek and one reach of the Gila River.
- The parameter exceeded at Cave Creek was selenium.
- The parameters exceeded at the Gila River included E. coli and sediment load.
- The impaired portion of the Gila River in this basin is part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. A draft TMDL report is underway.

Effluent Dependent Reaches

- Refer to Figure 3.10-10.
- This basin contains two effluent dependent reaches, Bennett Wash in the vicinity of Safford and an unnamed wash in the vicinity of Highway 60. Bennett Wash receives effluent from the Arizona Department of Corrections Safford WWTF and the unnamed wash near Highway 60 receives effluent from the Arizona Department of Corrections Globe WWTF.

Table 3.10-7 Water Quality Exceedences in the Safford Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section		
1	Well	1 North	18 East	17	1	As
2	Well	1 South	18 East	12	1	As
3	Well	3 South	19 East	11	1	As
4	Well	3 South	22 East	18	1	TDS
5	Well	3 South	22 East	30	1	TDS
6	Spring	4 South	23 East	7	1	TDS
7	Well	4 South	23 East	18	1	As
8	Well	4 South	23 East	20	1	NO3
9	Spring	4 South	23 East	36	1	As, F
10	Well	5 South	21 East	36	1	F
11	Spring	5 South	24 East	17	2	F
	Spring	5 South	24 East	17	1	As, Cd, F, TDS
12	Well	5 South	24 East	29	2	NO3
13	Well	5 South	24 East	31	1	As, Pb, TDS
14	Well	6 South	23 East	3	2	As, F
15	Well	6 South	24 East	5	1	Pb
16	Well	6 South	24 East	12	1	NO3, TDS
17	Spring	6 South	25 East	5	1	F
18	Well	6 South	25 East	16	1	F
19	Well	6 South	25 East	17	1	As, F, TDS
20	Well	6 South	25 East	19	1	As, F
21	Well	6 South	25 East	23	1	As, F, TDS
22	Well	6 South	25 East	26	2	As, F
	Well	6 South	25 East	26	1	F
23	Well	6 South	25 East	28	1	NO3
24	Well	6 South	25 East	30	2	As
25	Well	6 South	25 East	33	1	NO3
26	Well	6 South	25 East	34	1	NO3
27	Well	6 South	25 East	35	1	NO3
28	Well	6 South	25 East	36	1	As, F, TDS
29	Well	6 South	26 East	35	1	F
30	Well	6 South	27 East	34	2	As
31	Well	7 South	23 East	1	1	As
	Well	7 South	23 East	1	1	F, Pb
	Well	7 South	23 East	1	9	F
32	Well	7 South	23 East	5	1	As
33	Well	7 South	24 East	8	1	As, F
	Well	7 South	24 East	8	3	As
34	Well	7 South	24 East	14	2	As
35	Well	7 South	25 East	2	1	As
	Well	7 South	25 East	2	2	NO3
36	Well	7 South	25 East	7	1	As, Cd, F, Pb, TDS
37	Well	7 South	25 East	11	1	NO3
38	Well	7 South	25 East	27	1	As, F, TDS
39	Well	7 South	26 East	4	1	As, F, TDS
40	Well	7 South	26 East	15	1	As, F, TDS
41	Well	7 South	26 East	21	1	As
42	Well	7 South	26 East	23	1	As
43	Well	7 South	26 East	24	4	As
44	Well	7 South	26 East	28	1	TDS
45	Well	7 South	27 East	2	3	As, F
	Well	7 South	27 East	2	2	F
	Well	7 South	27 East	2	1	As
46	Well	7 South	27 East	3	1	As, F

Table 3.10-7 Water Quality Exceedences in the Safford Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section		
47	Well	7 South	27 East	8	1	As
48	Well	7 South	27 East	11	1	As, F
49	Well	7 South	27 East	16	2	F
	Well	7 South	27 East	16	1	As
50	Well	7 South	27 East	18	1	As
51	Well	7 South	27 East	20	1	As
	Well	7 South	27 East	20	1	As, F
52	Well	8 South	26 East	6	1	As, F
53	Well	8 South	26 East	7	1	As, F, TDS
	Well	8 South	26 East	7	1	Pb
	Well	8 South	26 East	7	1	As
	Well	8 South	26 East	7	2	F
54	Well	8 South	26 East	8	2	F
55	Well	8 South	26 East	15	1	F
56	Well	8 South	26 East	17	2	F
57	Well	8 South	26 East	18	4	F
58	Well	8 South	26 East	20	1	F
59	Well	8 South	26 East	28	1	As, F
60	Well	8 South	26 East	32	1	F
61	Well	8 South	27 East	23	1	As, F
62	Well	8 South	28 East	22	1	F
63	Well	8 South	28 East	29	1	As, F
64	Well	8 South	29 East	22	1	Pb
65	Well	9 South	26 East	5	1	F
66	Well	9 South	26 East	6	1	As
66	Well	9 South	26 East	6	1	As, F
67	Well	9 South	28 East	31	1	As, F
68	Well	9 South	30 East	33	1	As
69	Well	10 South	27 East	28	1	F
70	Well	10 South	28 East	7	1	Se
71	Well	10 South	28 East	36	1	As, F
72	Well	11 South	26 East	23	1	F
73	Well	11 South	28 East	28	1	As, NO3
74	Well	11 South	28 East	31	1	NO3
75	Well	11 South	29 East	1	2	F
	Well	11 South	29 East	1	1	As, F
76	Well	11 South	29 East	10	1	F
77	Well	11 South	29 East	14	1	As, F
78	Well	11 South	29 East	36	2	F
79	Well	11 South	30 East	1	1	F
80	Well	11 South	30 East	31	1	As, F
81	Well	12 South	28 East	14	1	NO3
82	Well	12 South	28 East	34	1	NO3
83	Well	12 South	29 East	1	1	F
84	Well	12 South	29 East	16	1	As, F
85	Well	12 South	30 East	28	1	F
86	Well	13 South	26 East	10	1	Rad
87	Well	13 South	29 East	18	1	F
88	Well	13 South	29 East	21	1	F
89	Well	13 South	29 East	25	2	As
	Well	13 South	29 East	25	1	NO3
90	Well	13 South	30 East	3	1	F

Table 3.10-7 Water Quality Exceedences in the Safford Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section		
91	Well	13 South	30 East	15	1	F
	Well	13 South	30 East	15	1	As
92	Well	13 South	30 East	24	1	F
93	Well	13 South	30 East	25	2	F
94	Well	13 South	31 East	6	2	F
95	Well	13 South	31 East	17	1	F
96	Well	13 South	31 East	18	1	F
97	Well	13 South	31 East	20	1	F
98	Well	13 South	31 East	22	1	F
99	Well	13 South	31 East	28	1	F
100	Well	13 South	31 East	30	1	F
101	Well	13 South	31 East	31	1	F
102	Well	13 South	31 East	34	1	F
103	Well	14 South	31 East	3	1	NO3,TDS
104	Well	14 South	31 East	6	1	F
105	Well	14 South	31 East	9	1	Pb, NO3
	Well	14 South	31 East	9	1	F, NO3, TDS
	Well	14 South	31 East	9	1	NO3, TDS
	Well	14 South	31 East	9	2	F
106	Well	14 South	31 East	10	2	F, NO3
106	Well	14 South	31 East	10	1	NO3, TDS
107	Well	14 South	31 East	16	1	As, F
108	Well	14 South	31 East	19	1	As, F
109	Well	14 South	31 East	23	1	Pb
110	Well	14 South	31 East	35	1	F
111	Well	14 South	32 East	20	1	NO3
112	Well	15 South	29 East	4	1	F
113	Well	15 South	32 East	34	1	Pb
114	Well	18 South	32 East	26	1	F

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Cave Creek (headwaters to South Fork of Cave Creek)	8	NA	A&W	Se
b	Stream	Gila River (Bonita Creek to Yuma Wash)	6	NA	A&W, FBC	E. coli, sediment

Source: ADEQ 2005e

Notes:

Because of map scale, feature locations may appear different than the location indicated on the table

NA = Not applicable

[1] Water quality samples collected between 1975 and 2004.

[2] As = Arsenic
Cd = Cadmium
F= Fluoride
Pb = Lead
NO3 = Nitrate
Se = Selenium
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
TDS = Total Dissolved Solids

[3] A&W = Aquatic and Wildlife
FBC = Full Body Contact

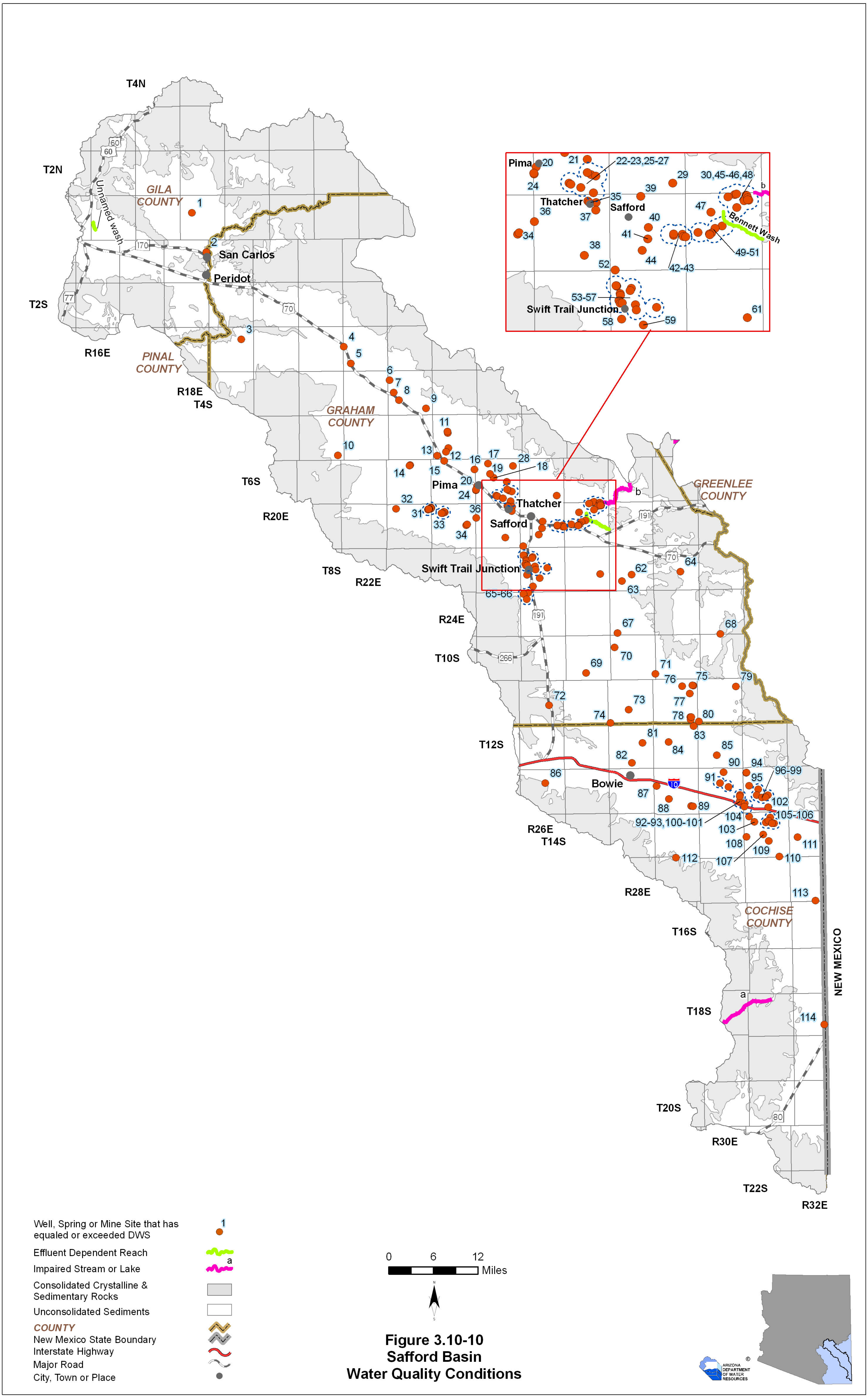


Figure 3.10-10
Safford Basin
Water Quality Conditions

3.10.8 Cultural Water Demand in the Safford 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 3.10-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.10-9. Figure 3.10-11 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.10-8 and Figure 3.10-11.
- Population has increased by about 600 people a year on average from 1980 to 2000.
- Total groundwater use decreased from 1971 to 1990 and then increased again from 1991 to 2005. An average of 124,500 AFA in the period from 2001-2005.
- Surface water diversions increased from 1971 to 1985 and have decreased from 1986 to 2005, with 61,300 AFA diverted on average in the period from 1991 – 2005. All surface water diversions between 1991 and 2003 were for agriculture.
- Approximately 98% of the total water demand in this basin is for agriculture.
- Large tracks of agricultural lands are located along Highway 70 and the Gila River in the vicinity of Pima, Thatcher and Safford and in Cochise County south of Interstate 10.
- Current municipal and industrial demand is comparable to historic use with 3,300 AFA of municipal water demand and 800 AFA of industrial water demand in the period from 2000-2005.
- As of 2005 there were 2,698 registered wells with a pumping capacity of less than or equal to 35 gpm and 2,278 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.10-9.
- There are 13 wastewater treatment facilities in the basin.
- Almost 29,000 people are served by these facilities.
- More than 2,500 acre-feet of effluent per year are generated in this basin.
- Three facilities discharge wastewater for irrigation.
- Discharge from one facility, the Peridot Heights Wastewater Treatment Facility, recharges the aquifer through an unlined impoundment. This facility is not permitted by the Department as an Underground Storage Facility.
- One facility, the Safford Wastewater Treatment Facility, discharges water for golf course irrigation.

Table 3.10-8 Cultural Water Demand in the Safford Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971										
1972										
1973				180,000			84,000			
1974										
1975										
1976		1,473[2]	1,854[2]							
1977										
1978				184,000			86,000			
1979										
1980	27,638									ADWR (1994a)
1981	27,969									
1982	28,300									
1983	28,631	244	111	113,000			125,000			
1984	28,962									
1985	29,293									
1986	29,624									
1987	29,955									
1988	30,286	222	99	71,500			118,000			
1989	30,617									
1990	30,948									
1991	32,081									
1992	33,214									
1993	34,348	192	64	3,200	700	86,000	NR	NR	117,000	
1994	35,481									
1995	36,614									
1996	37,748									USGS (2007) Gila Water Commis - sioner Annual Reports ADWR (2008b)
1997	38,881									
1998	40,014	299	60	3,400	700	91,500	NR	NR	99,500	
1999	41,148									
2000	42,281									
2001	42,847									
2002	43,412									
2003	43,978	268	90	3,300	800	120,400	NR	NR	61,300	
2004	44,544									
2005	45,110									
2010	47,938									
2020	52,282									
2030	56,570									
WELL TOTALS:		**2,698**	**2,278**							

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoir, or effluent
[2] Includes all wells through June 1980.
Note: Groundwater withdrawn in the Bonita Creek Basin is delivered to the Safford Basin for municipal use. These withdrawals are not included in the table

Table 3.10-9 Effluent Generation in the Safford 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	Golf Course/Turf Irrigation	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other			
AZ St. Industrial School	Arizona Department of Corrections	Prison	673	90	NA									Secondary	NA	2001
Bylas	San Carlos Apache Tribe	Bylas	1,480	79	NA											2001
Daley Estates	Private	Thatcher	NA													
Gilson Wash	San Carlos Apache Tribe	San Carlos	3,002	258	NA									Secondary	NA	2001
Peridot Heights	San Carlos Apache Tribe	Peridot Heights	625	22								X		Secondary	700	2000
Pima WWTF	Town of Pima	Pima	1,918	119		X								Secondary	NA	2000
Safford WWTF	Gila Resources	Safford	10,500	963			X	Mt. Graham						Secondary	NA	2000
Safford WWTF #1	Arizona Department of Corrections	Ft. Grant	286	34	Bennett Wash		X							Secondary	NA	2001
San Carlos Regional Sewer	San Carlos Apache Tribe	San Carlos	5,500	560		X								Secondary	NA	2000
Skill Center	San Carlos Apache Tribe	NA	111	11									X	Secondary	NA	2000
Soda Canyon	San Carlos Apache Tribe	Soda Canyon	106	11	NA									Secondary	NA	2000
Thatcher WWTF	Town of Thatcher	Thatcher	4,429	411			X							Adv. Trt. I	400	2000
Upper Seven Mile	San Carlos Apache Tribe	San Carlos	254	11	NA									Secondary	NA	2000
Total			**28,884**	**2,569**												

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
WWTF: Wastewater Treatment Facility
Adv. Tr. I: Advance treatment level I

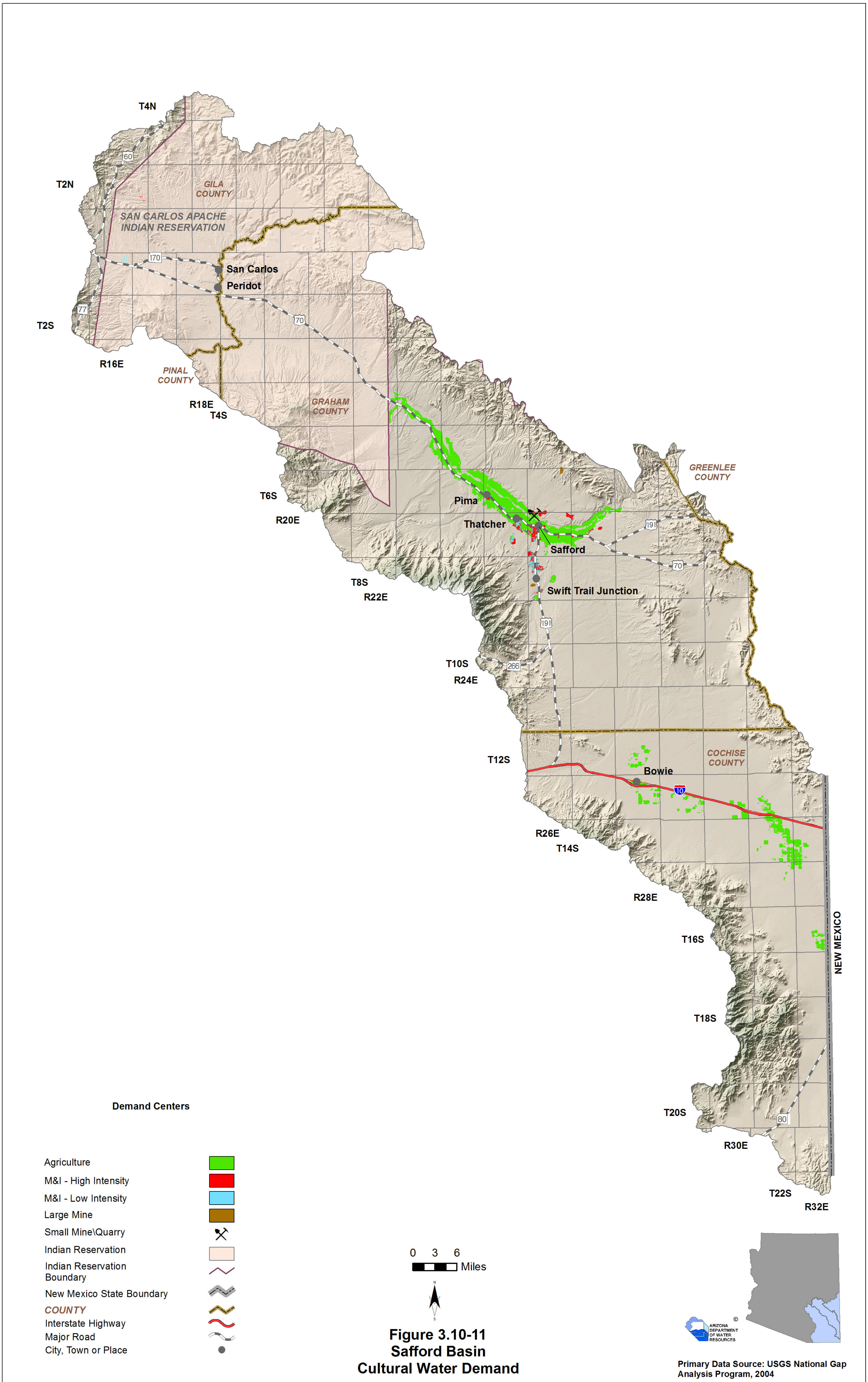


Figure 3.10-11
Safford Basin
Cultural Water Demand

3.10.9 Water Adequacy Determinations in the Safford 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 3.10-10. Figure 3.10-12 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- Twenty-three water adequacy determinations have been made in this basin through December 2008.
- Seventeen determinations of inadequacy have been made; the most common reason for an inadequacy determination was because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination.
- The number of lots receiving a water adequacy determination, by county, are:

County	Number of Subdivision Lots	Number of Lots Determined to be Adequate	Percent Adequate
Cochise	80	0	0
Gila	>154	38	~25
Graham	>671	76	~11
Greenlee	0	0	NA
Pinal	0	0	NA

Table 3.10-10 Adequacy Determinations in the Safford Basin[1]

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	Alder Heights	Graham	6 South	25 East	29, 32	63	53-700407	Inadequate	A1	9/17/2007	Graham Co. Utilities Cooperative
2	Apache Peaks Dev., Plat A	Gila	1 North	16 East	13, 14	38	53-500275	Adequate		4/20/1981	Apache Peaks Utilities
3	Arizona Sky Village	Cochise	17 South	32 East	19	80	53-400785	Inadequate	A1	10/28/2002	Dry Lot Subdivision
4	Buena Vista Ranches	Graham	8 South	26 East	29	25	53-300236	Adequate		12/17/1996	Dry Lot Subdivision
5	Copper Canyon Ranches #1B	Gila	1 North	15.5 East	29	NA	NA	Inadequate	A1	10/16/1990	Dry Lot Subdivision
6	Copper Canyon Ranches #2	Gila	1 North	16 East	10, 14, 15	65	53-500505	Inadequate	A1, A2, C	2/2/1995	Dry Lot Subdivision
7	Copper Canyon Ranches Unit III	Gila	1 North	15 East	10	51	53-400246	Inadequate	A1	1/20/1998	Dry Lot Subdivision
8	Desert Hills Ranchettes	Graham	8 South	26 East	6	49	53-500563	Inadequate	C	4/6/1976	Dry Lot Subdivision
9	Desert Hills Ranchettes #3	Graham	7 South	26 East	31	66	53-500564	Inadequate	A1, C	4/11/1983	Dry Lot Subdivision
10	Desert Hills Ranchettes #4	Graham	7 South 8 South	25 East 25 East	1 36	NA	53-500565	Inadequate	A1, C	5/21/1985	Dry Lot Subdivision
11	Fred Webb Park	Graham	5 South	24 East	20	92	53-700236	Inadequate	A1	3/15/2007	Dry Lot Subdivision
12	Galeyville Subdivision	Cochise	17 South	31 East	18	71	53-400763	Inadequate	A2	8/5/2002	Dry Lot Subdivision
13	High Mesa Air Park	Graham	8 South	26 East	2	NA	53-500788	Inadequate	D	6/21/1988	Dry Lot Subdivision
14	Los Alamos Hills #1	Graham	7 South	24 East	4	24	53-500916	Inadequate	A1	6/19/1985	Dry Lot Subdivision
15	Maloy High Chaparral Estates	Graham	8 South	26 East	2	64	53-400078	Inadequate	A1, C	5/21/1999	Dry Lot Subdivision
16	Mountain Air Estates	Graham	8 South	26 East	9	28	53-501017	Inadequate	C	3/6/1974	Dry Lot Subdivision
17	Mountain Breeze	Graham	8 South	26 East	7	4	53-501018	Inadequate	C	6/16/1976	Dry Lot Subdivision
18	Orchard Park	Graham	6 South	26 East	23	19	53-500099	Inadequate	A1	3/6/2007	Dry Lot Subdivision
19	Pima South Estates	Graham	6 South	25 East	30	27	53-501146	Adequate		11/30/1976	City Utilities Co
20	Pima South Estates #1	Graham	6 South	25 East	30	24	53-501147	Adequate		5/17/1994	General Utilities
21	Pima South Estates #2	Graham	6 South	25 East	30	6	53-501148	Adequate		10/18/1979	Graham County Utilities
22	Siesta Hot Springs	Graham	6 South	24 East	6	90	53-300003	Inadequate	A1,C	4/21/1998	Dry Lot Subdivision
23	Sundown	Graham	5 South	23 East	3	19	53-501495	Adequate		7/16/1979	Dry Lot Subdivision

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 unavailable; 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= Data currently not available to ADWR

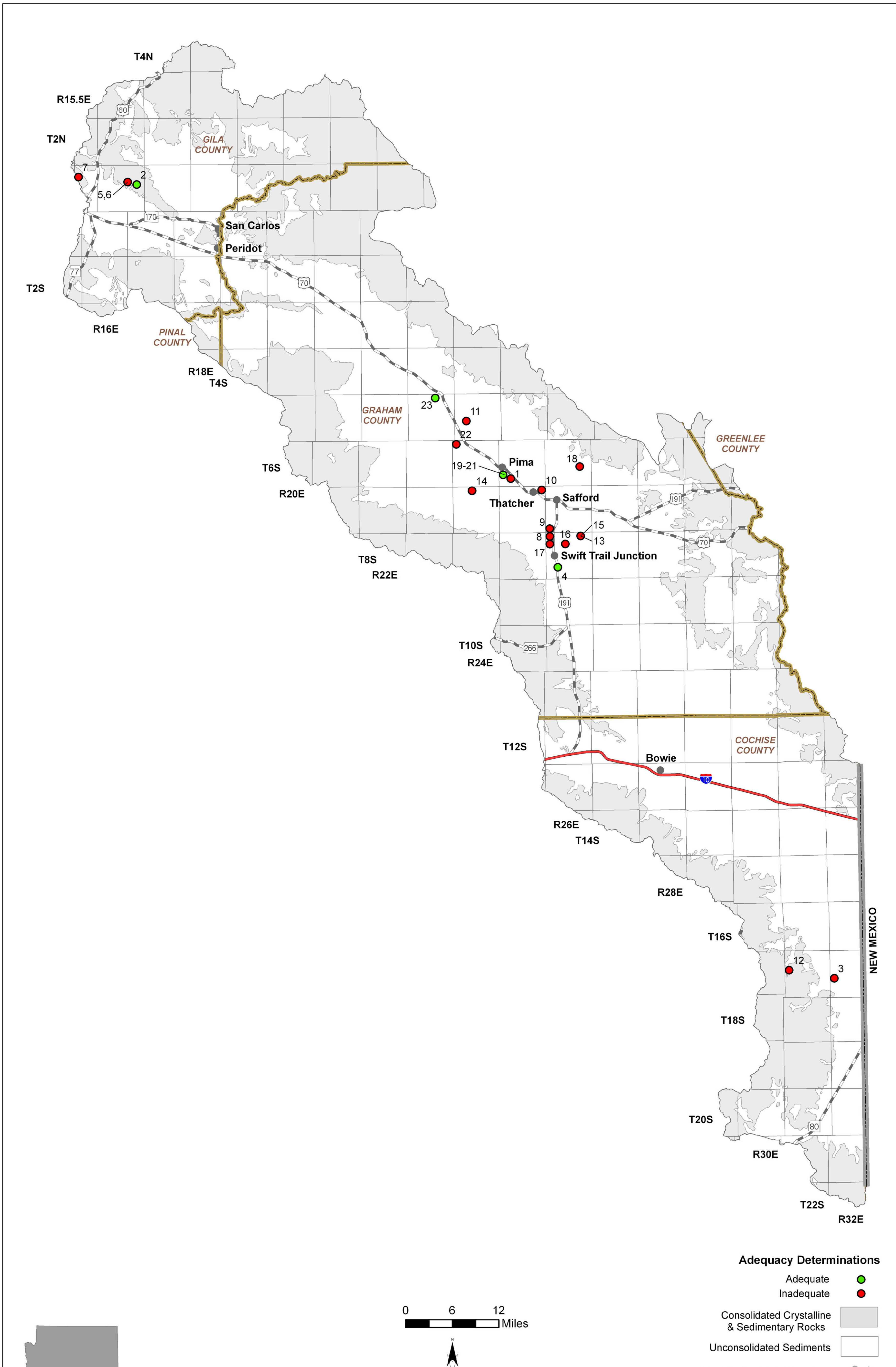


Figure 3.10-12
Safford Basin
Adequacy Determinations

SAFFORD BASIN

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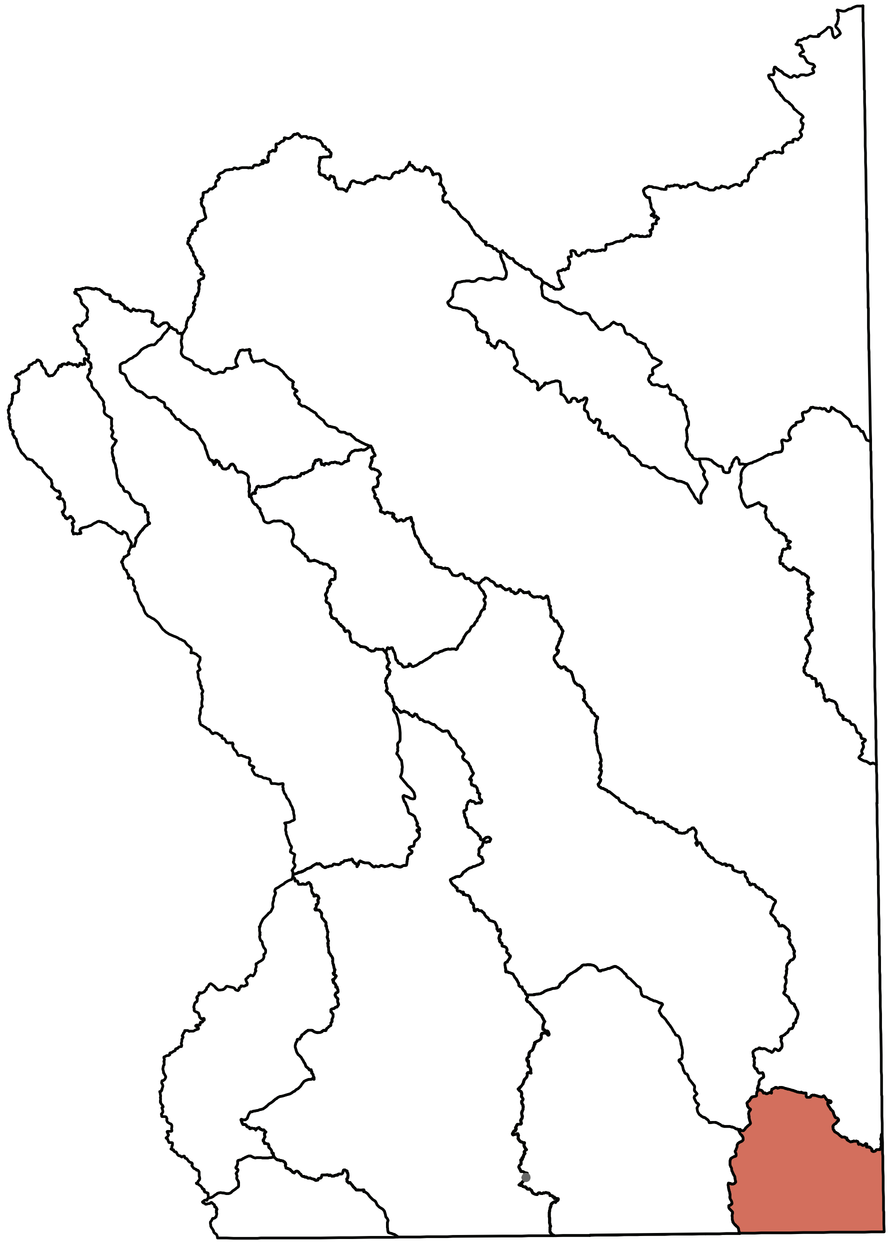
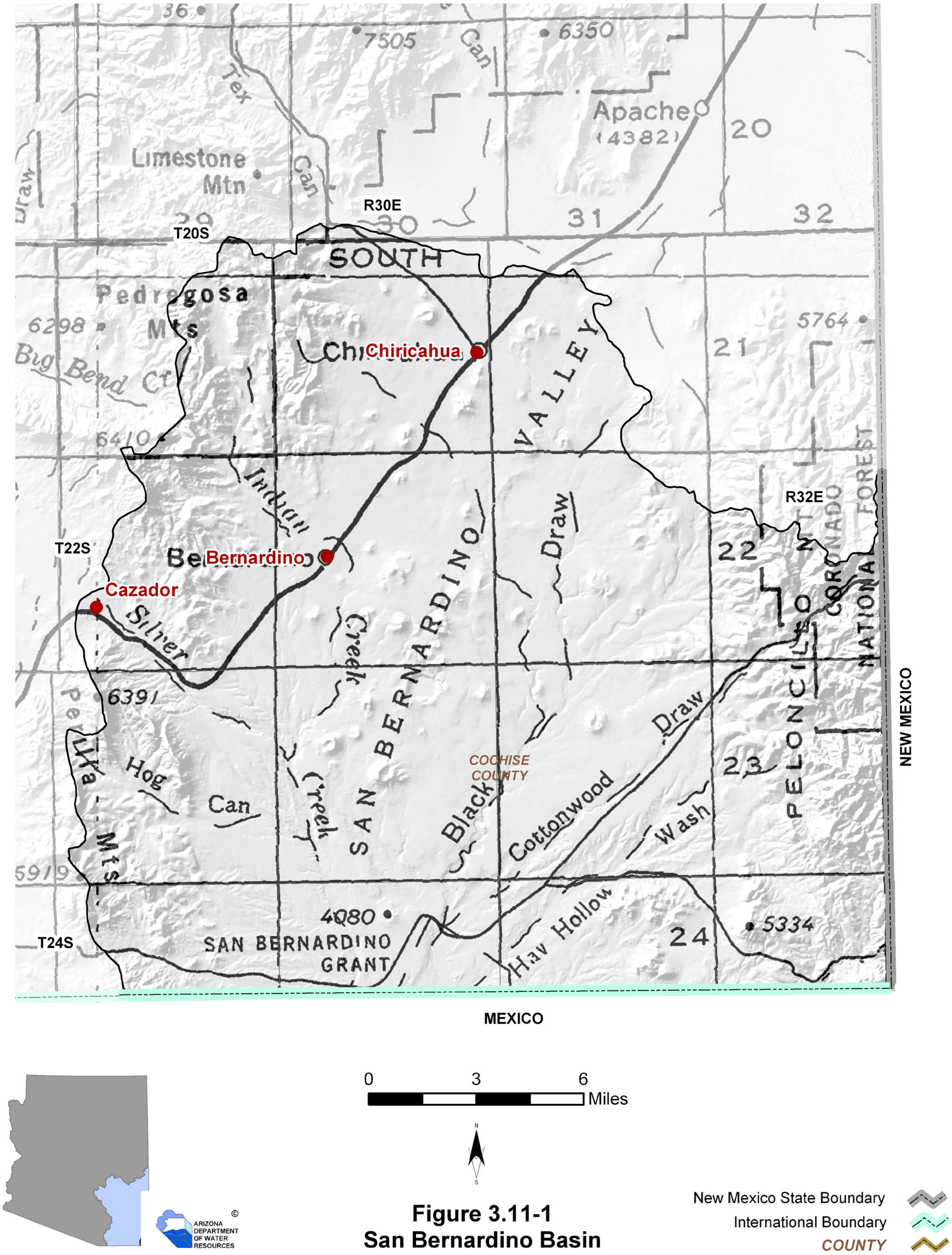
Section 3.11
San Bernardino Valley Basin



3.11.1 Geography of the San Bernardino Valley Basin

The San Bernardino Valley Basin is a small, 387 square mile basin in the southeastern corner of the planning area. Geographic features and principal communities are shown on Figure 3.11-1. The basin is characterized by a valley flanked by two mountain ranges. Vegetation is primarily semi-desert grassland with smaller areas of madrean evergreen woodland and Chihuahuan desertscrub. (see Figure 3.0-9) Riparian vegetation includes mesquite and cottonwood/willow along Black Draw.

- Principal geographic features shown on Figure 3.11-1 are:
    - San Bernardino Valley in the center of the basin
    - Black Draw east of Bernardino running north-south to the Mexico border
    - Peloncillo Mountains to the east
    - Pedregosa Mountains on the northwest basin boundary
    - Perilla Mountains to the west, which include the highest point in the basin at 6,391 feet
    - The lowest point at approximately 3,700 feet where Black Draw exits the basin



Base Map: USGS 1:500,000, 1981

Figure 3.11-1
San Bernardino Basin
Geographic Features

3.11.2 Land Ownership in the San Bernardino Valley Basin

Land ownership, including the percentage of ownership in each category, is shown for the San Bernardino Valley Basin in Figure 3.11-2. The principal feature of land ownership in this basin is the significant amount of State Trust Land, the largest of any basin in the planning area. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

State Trust

- 63.2% of land in this basin is held in trust for public schools and nine other beneficiaries under the State Trust Land system.
- Much of the state owned land in this basin is contiguous but interspersed with parcels of privately owned and Bureau of Land Management lands.
- Primary land use is grazing.

Private

- 24.3% of land is private.
- Most private land is interspersed with state owned land.
- The largest portions of contiguous private land are near the communities of Cazador, Bernardino and Chiricahua.
- Primary land uses are domestic and grazing.

National Forest

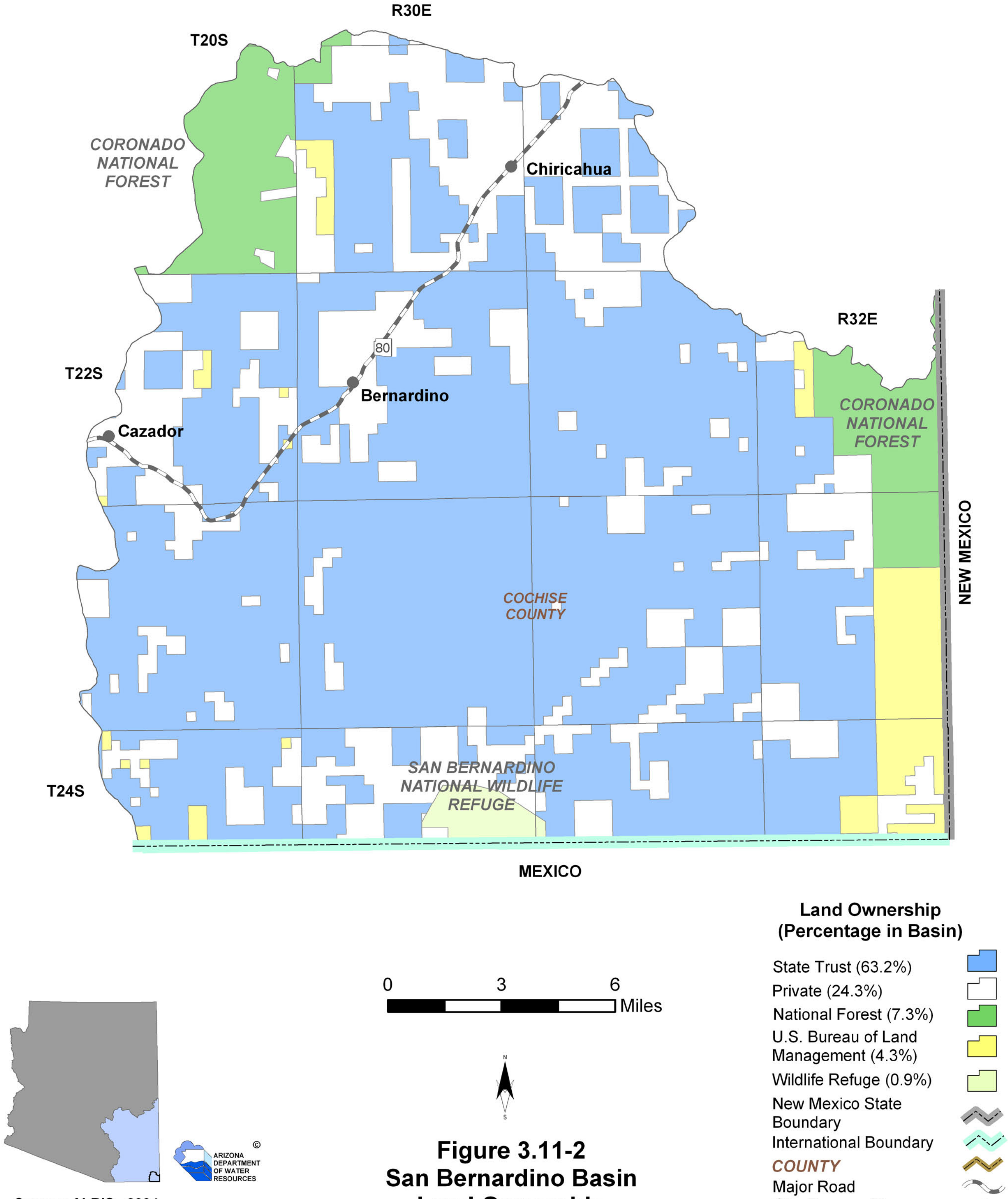
- 7.3% of land is federally owned and managed by the United States Forest Service (USFS).
- All forest land, although not contiguous, is in the Coronado National Forest, Douglas Ranger District.
- Primary land uses are grazing, recreation and timber production.

U.S. Bureau of Land Management (BLM)

- 4.3% of land is federally owned and managed by the Safford Field Office of the BLM.
- The majority of BLM land in this basin is in the east along the boundary with New Mexico.
- Primary land use is grazing.

Wildlife Refuge

- 0.9% of land is federally owned and managed by the U.S. Fish and Wildlife Service (USFWS).
- All USFWS land is in the San Bernardino National Wildlife Refuge.
- Primary land uses are wildlife protection and recreation.



Source: ALRIS , 2004

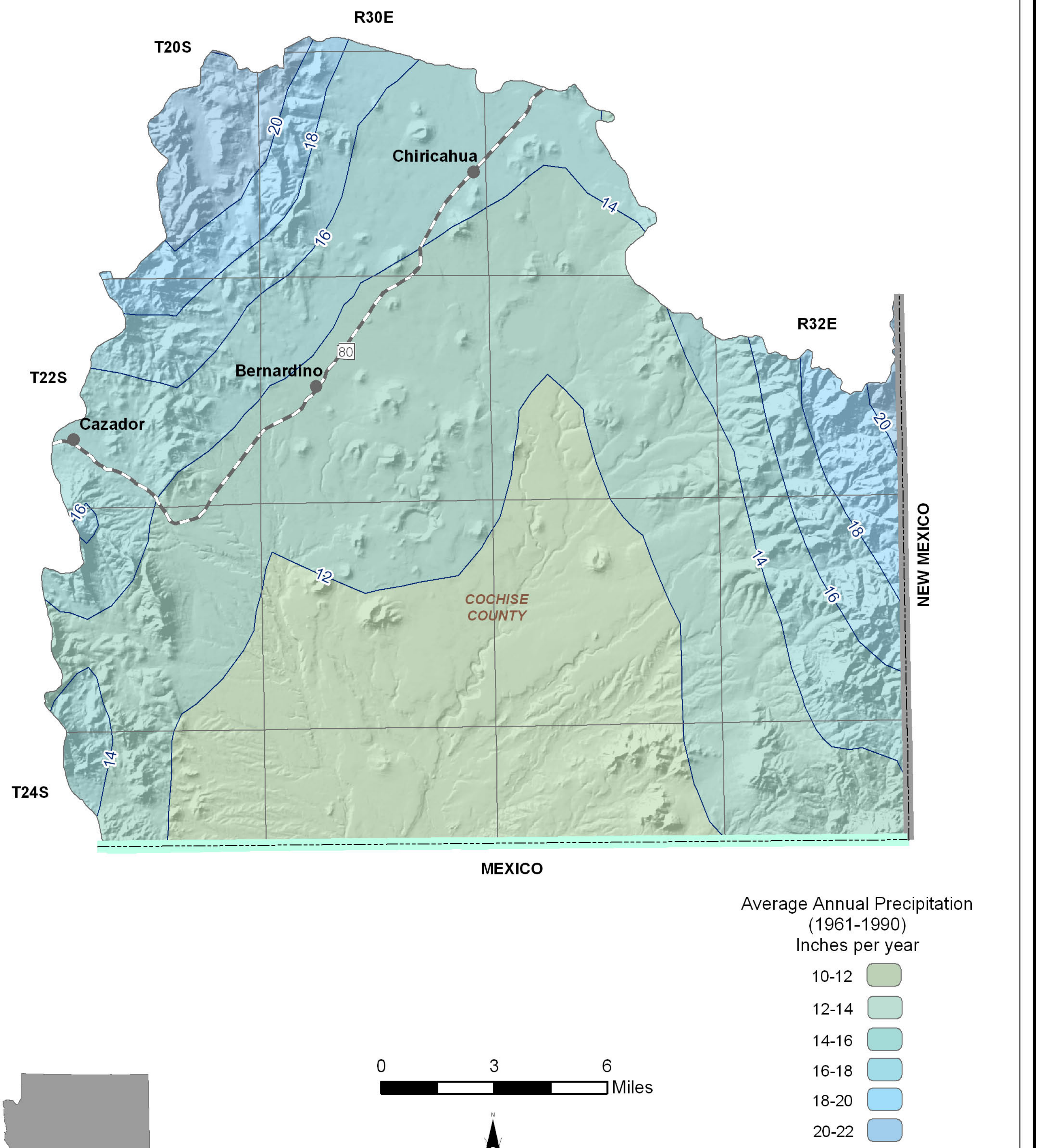
Figure 3.11-2
San Bernardino Basin
Land Ownership

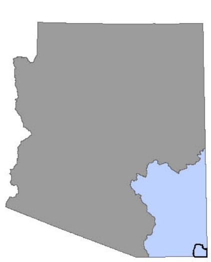
3.11.3 Climate of the San Bernardino Valley Basin

The San Bernardino Valley Basin does not contain any NOAA/NWS Co-op Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 3.11-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 3.0.3. A description of this and other climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 3.11-3
- Precipitation data shows average annual rainfall as as high as 22 inches at the Pedregosa Mountains in the northwest portion of the basin and in the northeast corner at the New Mexico border, and as low as 10 inches at the San Bernardino Valley along the border with Mexico.





Precipitation Data Source:
Oregon State University, 1998

Figure 3.11-3
San Bernardino Basin
Meteorological Stations and
Annual Precipitation

3.11.4 Surface Water Conditions in the San Bernardino Valley Basin

There are no streamflow data or flood ALERT equipment in this basin. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.11-1. The location of USGS runoff contours, large reservoirs and stream channels are shown on Figure 3.11-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Reservoirs and Stockponds

- Refer to Table 3.11-1
- Surface water is stored or could be stored in one large and five small reservoirs in the basin.
- Total maximum surface area in the large reservoir is 401 acres. The use of this reservoir is unknown.
- There are 151 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.11-4.
- Average annual runoff varies from 0.2 inches per year, or 10.6 acre-feet per square mile, in the middle part of the basin to 2 inches per year, or 106.6 acre-feet per square mile, at the northern boundary.

Table 3.11-1 Reservoirs and Stockponds in the San Bernardino Valley Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

B. Other Large Reservoirs (50 acre surface area or greater)[1]

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[2]	JURISDICTION
1	Dry[3]	AZ Land Dept.	401	U	State

Source: Compilation of databases from ADWR & others

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

Total number: 1
Total maximum storage: 45 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 4
Total surface area: 22 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 151 (from water right filings)

Notes:
[1]Capacity data not available to ADWR
[2]U=unknown
[3]Dry Lake

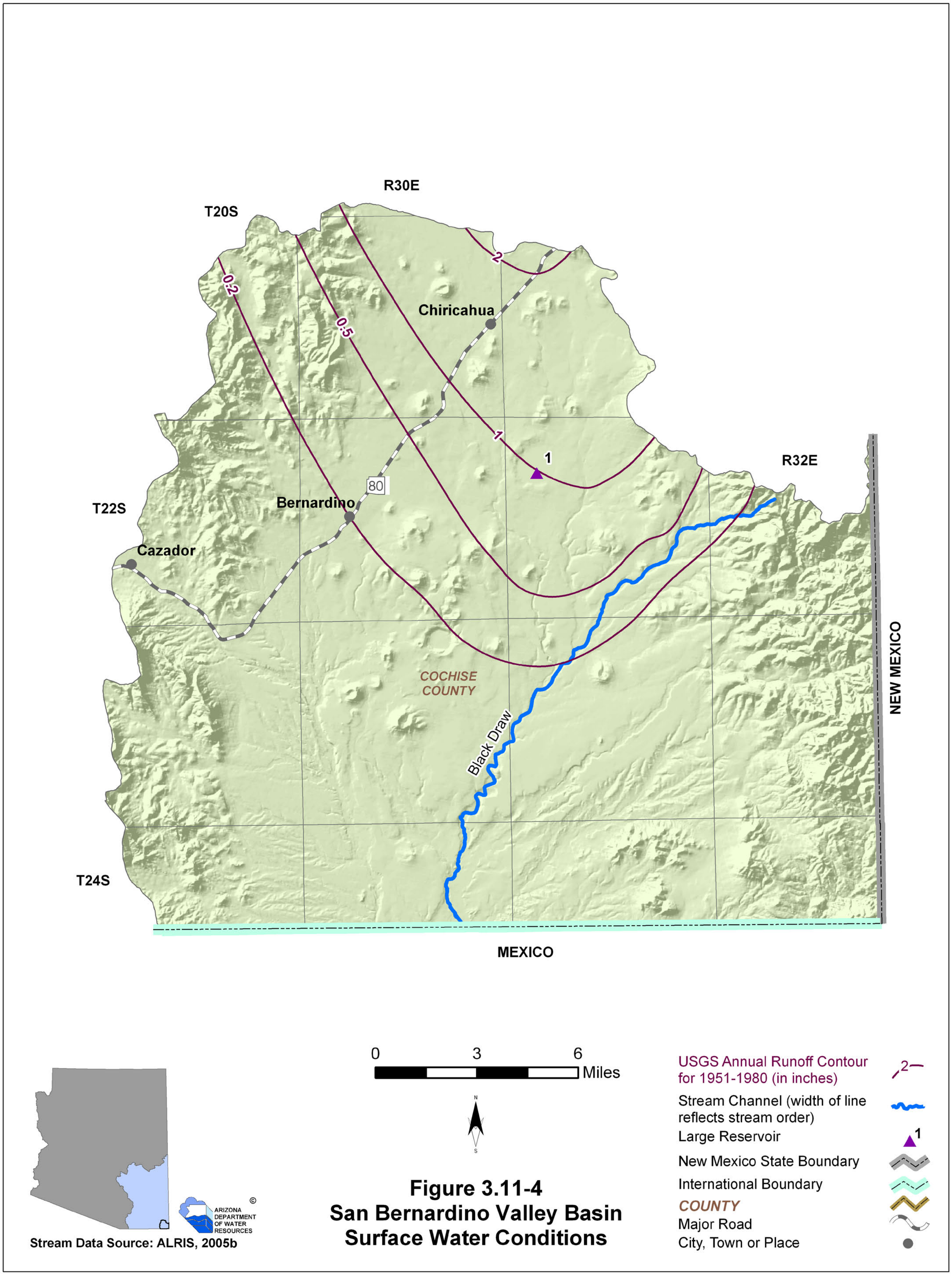


Figure 3.11-4
San Bernardino Valley Basin
Surface Water Conditions

3.11.5 Perennial/Intermittent Streams and Major Springs in the San Bernardino Valley Basin

Minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 3.11-2. There are no major springs identified in this basin. The locations of perennial and intermittent streams are shown on Figure 3.11-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one perennial stream, Black Draw, located near the border with Mexico.
- A number of intermittent streams are located on the eastern boundary of the basin.
- There is one minor spring in the basin, House Spring. The listed discharge rate may not be indicative of current conditions.
- The total number of springs identified by the USGS varies from 6 to 10, depending on the database reference.

Table 3.11-2 Springs in the San Bernardino Valley Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

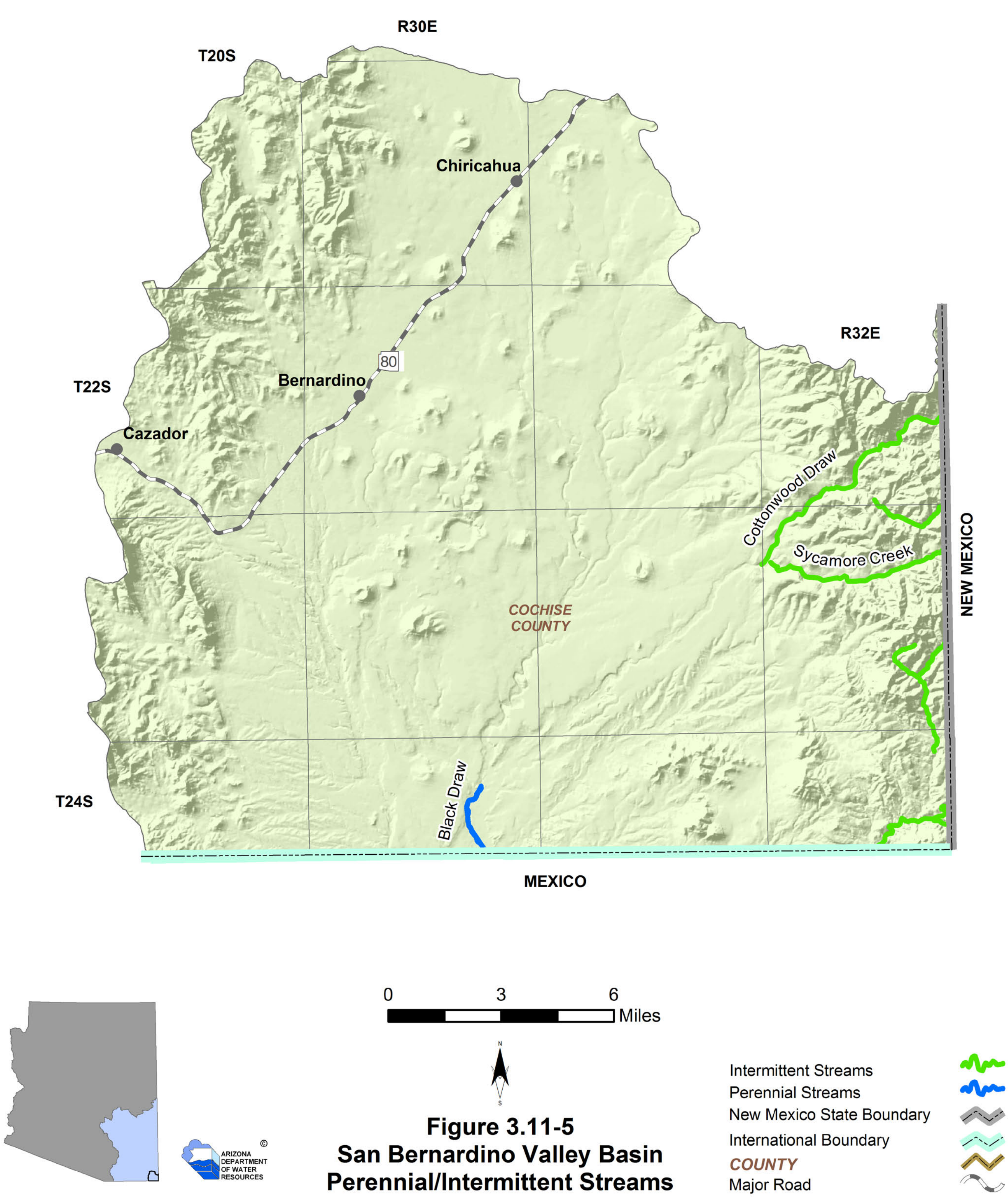
B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
House	312012	1091642	3	3/1/1985

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 6 to 10

Notes:
[1]Most recent measurement identified by ADWR



Stream Data Source: AGFD, 1993 & 1997

Figure 3.11-5
San Bernardino Valley Basin Perennial/Intermittent Streams and Major (>10 gpm) Springs

3.11.6 Groundwater Conditions of the San Bernardino Valley 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 3.11-3. Figure 3.11-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.11-7 contains hydrographs for selected wells shown on Figure 3.11-6. Figure 3.11-8 shows well yields in three 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 3.11-3 and Figure 3.11-6.
- The major aquifers in the basin are recent stream alluvium and volcanic rock.
- Artesian wells and springs support wetlands in this basin near the border with Mexico.
- Flow direction is generally from the north to the south.

Well Yields

- Refer to Table 3.11-3 and Figure 3.11-8.
- As shown on Figure 3.11-8 well yields in this basin range from less than 100 gallons per minute (gpm) to 1,000 gpm.
- One source of well yield information, based on three reported wells, indicates that the median well yield in this basin is 450 gpm.

Natural Recharge

- Refer to Table 3.11-3.
- The natural recharge estimate for this basin is 9,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 3.11-3.
- Storage estimates for this basin range from 1.6 million acre-feet (maf) to 2.0 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.11-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures four index wells in this basin. Hydrographs for two of these wells are shown in Figure 3.11-7.
- Depth to water was measured for three wells in this basin in 2003-2004 and varies from 612 feet in the north central portion of the basin to 30 feet along the border with Mexico.

Table 3.11-3 Groundwater Data for the San Bernardino Valley Basin

Basin Area, in square miles:	387	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Volcanic Rock	
Well Yields, in gal/min:	Range 22 - 600 Median 450 (3 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells 55)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	9,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	1,600,000 (to 1,200 ft)	ADWR (1990)
	2,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
Current Number of Index Wells:	4	
Date of Last Water-level Sweep:	2007 (70 wells measured)	

[1]Predevelopment Estimate

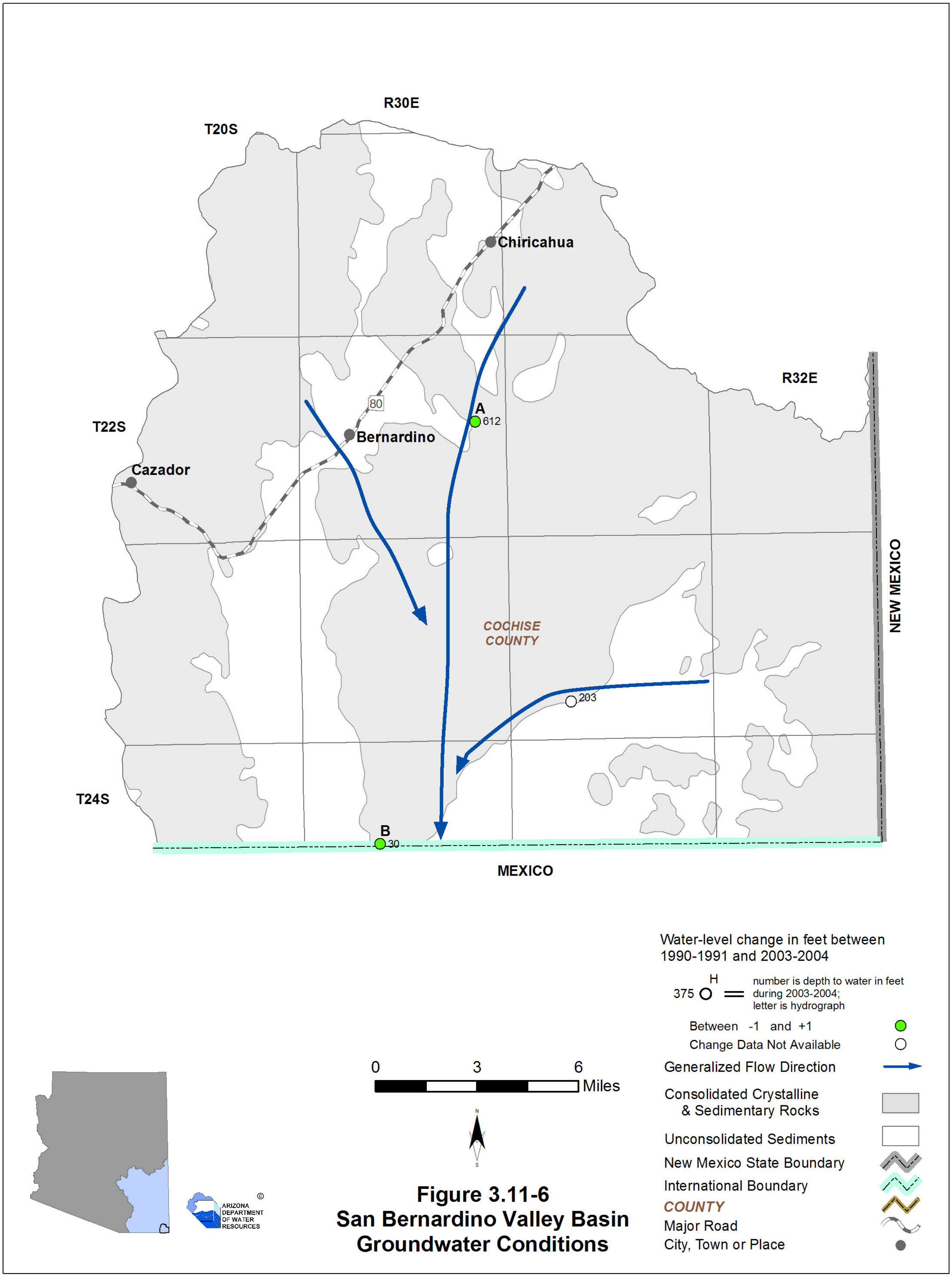
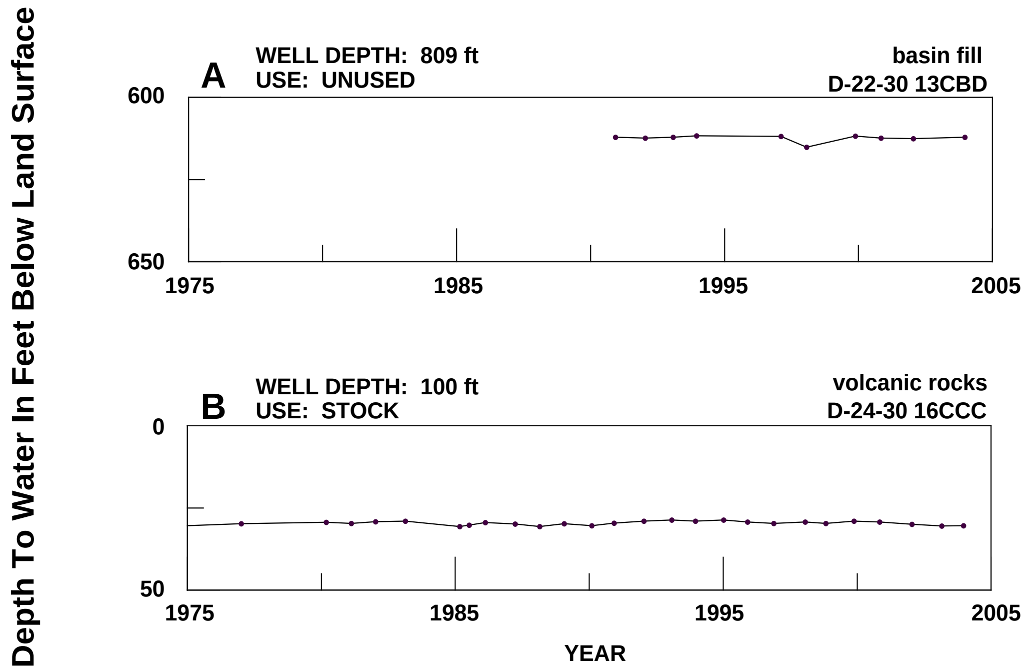


Figure 3.11-6
San Bernardino Valley Basin
Groundwater Conditions

Figure 3.11-7
San Bernardino Valley Basin
Hydrographs Showing Depth to Water in Selected Wells



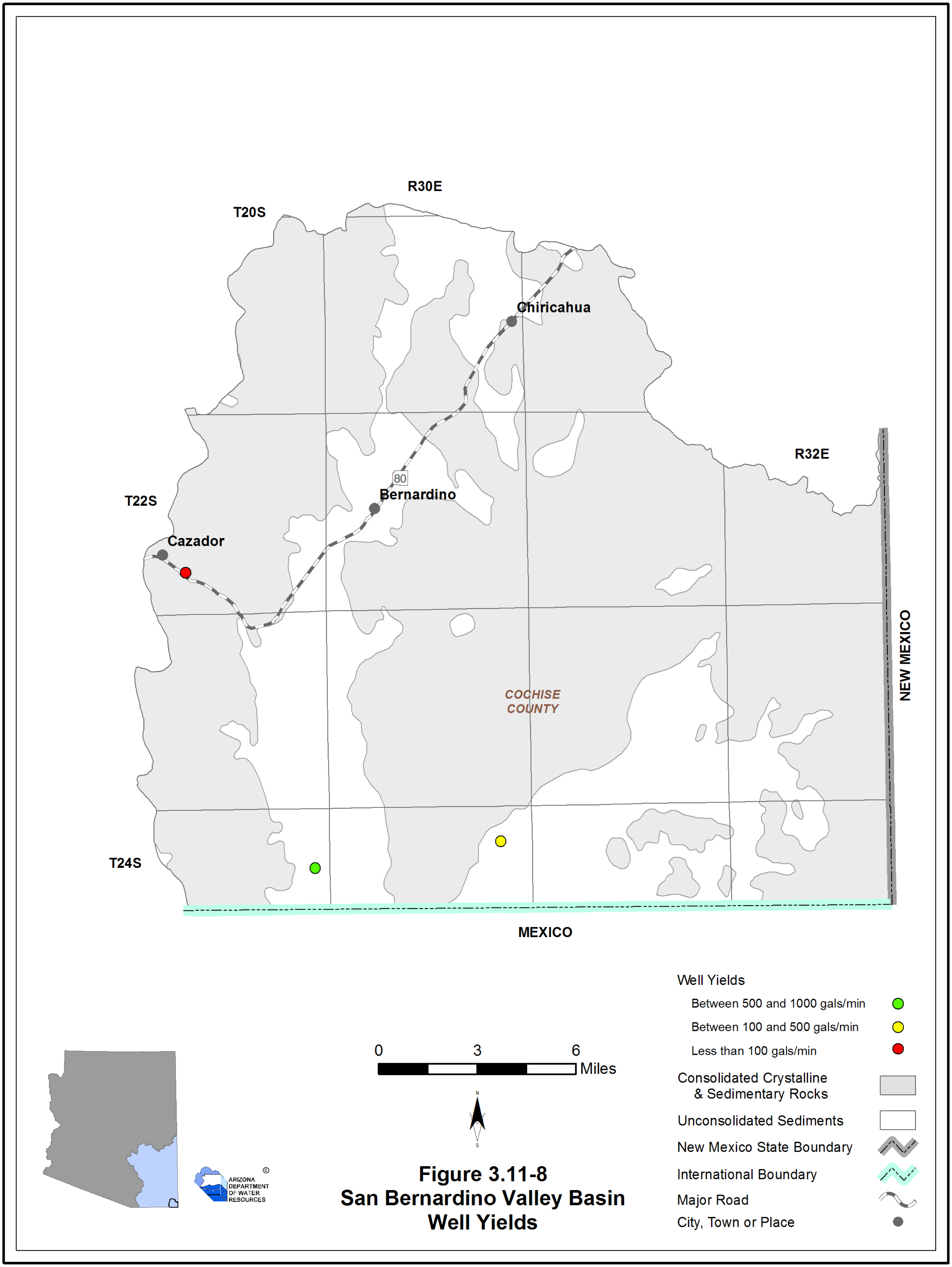


Figure 3.11-8
San Bernardino Valley Basin
Well Yields

3.11.7 Water Quality of the San Bernardino Valley Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.11-4A. There are no data on impaired lakes and streams in this basin. Figure 3.11-9 shows the location of exceedences keyed to Table 3.11-4A. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.11-4A.
- Two sites have nitrate concentrations that have equaled or exceeded DWS.

Table 3.11-4 Water Quality Exceedences in the San Bernardino Valley Basin[1]

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	24 South	29 East	11	NO3
2	Well	24 South	32 East	6	NO3

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:
Because of map scale, feature locations may appear different than the location indicated on the table
[1] Water quality samples collected between 1974 and 2002.
[2] NO3 = Nitrate

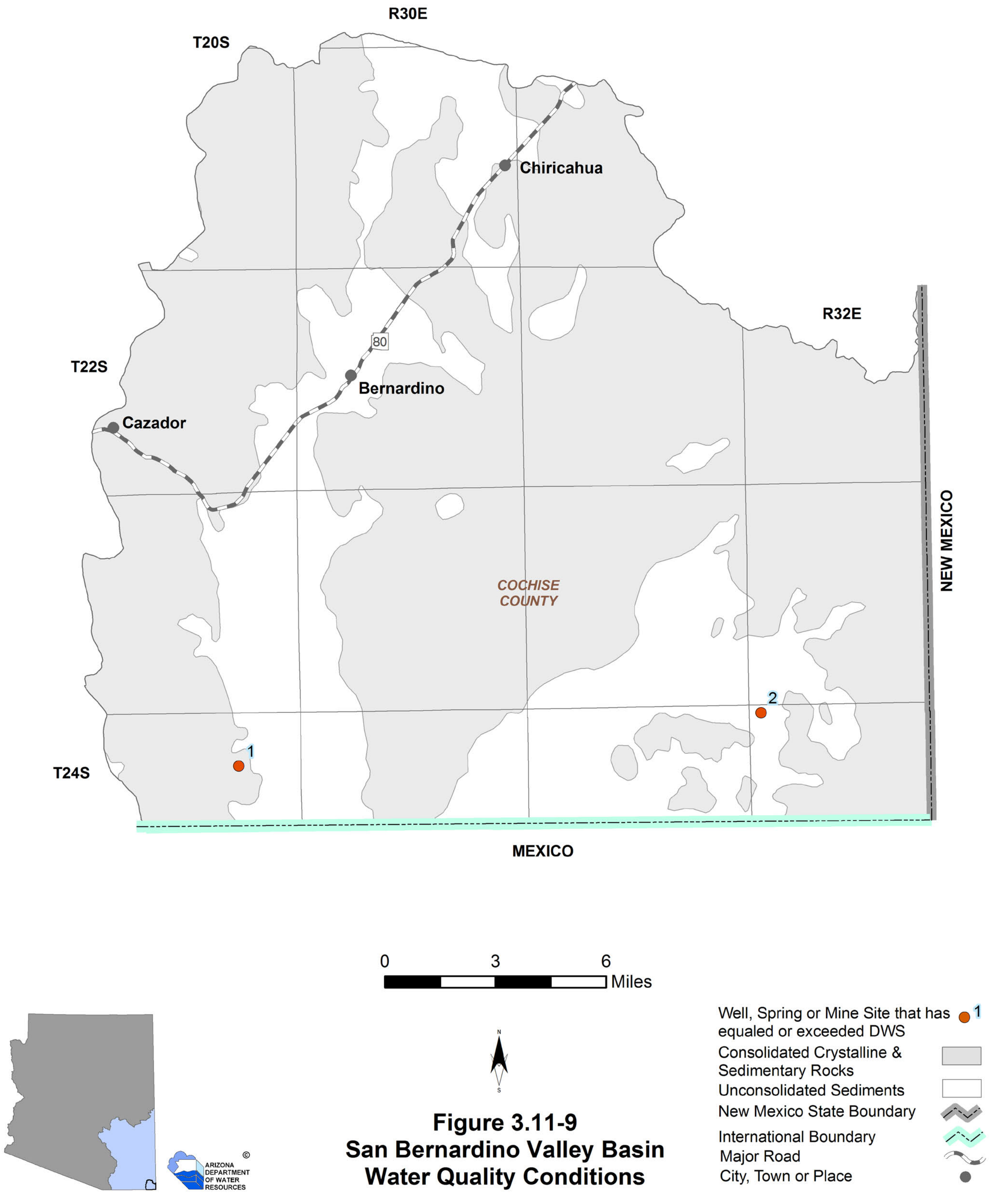


Figure 3.11-9
San Bernardino Valley Basin
Water Quality Conditions

3.11.8 Cultural Water Demand in the San Bernardino Valley 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 3.11-5. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the source of cultural demand map data, showed no demand centers for this basin. 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.11-5.
- Population increased between 1980-1990 and decreased between 1990-2000 but there was an overall increase in population.
- All water use in this basin is groundwater; pumping has decreased from 1971- 2005 with less than 300 AFA in the period from 1991 - 2005. All demand in this basin is for municipal (domestic) use.
- As of 2005 there were 164 registered wells with a pumping capacity of less than or equal to 35 gpm and 12 wells with a pumping capacity of more than 35 gpm.

Table 3.11-5 Cultural Water Demand in the San Bernardino Valley Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">111[2]</td><td rowspan="10">7[2]</td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>20</td></tr>
<tr><td>1981</td><td>26</td><td rowspan="5">11</td><td rowspan="5">0</td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>33</td></tr>
<tr><td>1983</td><td>39</td></tr>
<tr><td>1984</td><td>45</td></tr>
<tr><td>1985</td><td>51</td></tr>
<tr><td>1986</td><td>58</td><td rowspan="5">21</td><td rowspan="5">1</td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>64</td></tr>
<tr><td>1988</td><td>70</td></tr>
<tr><td>1989</td><td>76</td></tr>
<tr><td>1990</td><td>83</td></tr>
<tr><td>1991</td><td>81</td><td rowspan="5">7</td><td rowspan="5">2</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td><td rowspan="15">USGS (2007)</td></tr>
<tr><td>1992</td><td>79</td></tr>
<tr><td>1993</td><td>78</td></tr>
<tr><td>1994</td><td>76</td></tr>
<tr><td>1995</td><td>74</td></tr>
<tr><td>1996</td><td>73</td><td rowspan="5">8</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>71</td></tr>
<tr><td>1998</td><td>69</td></tr>
<tr><td>1999</td><td>68</td></tr>
<tr><td>2000</td><td>66</td></tr>
<tr><td>2001</td><td>68</td><td rowspan="5">6</td><td rowspan="5">2</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>69</td></tr>
<tr><td>2003</td><td>71</td></tr>
<tr><td>2004</td><td>72</td></tr>
<tr><td>2005</td><td>74</td></tr>
<tr><td>2010</td><td>82</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>105</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>WELL TOTALS:</td><td>164</td><td>12</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through June 1980.

3.11.9 Water Adequacy Determinations in the San Bernardino Valley Basin

There are no water adequacy applications on file with the Department as of December 2008 for the San Bernardino Valley Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

SAN BERNARDINO VALLEY BASIN
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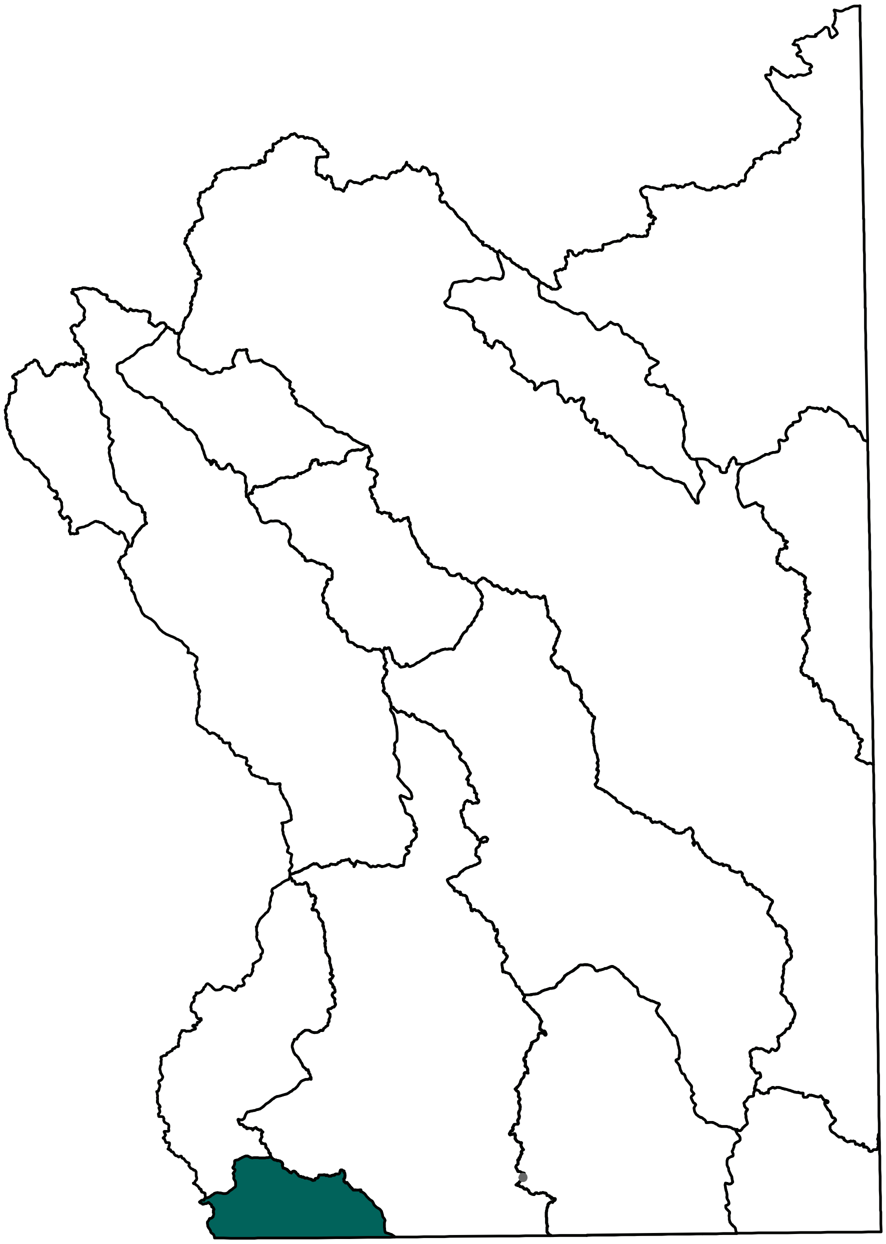
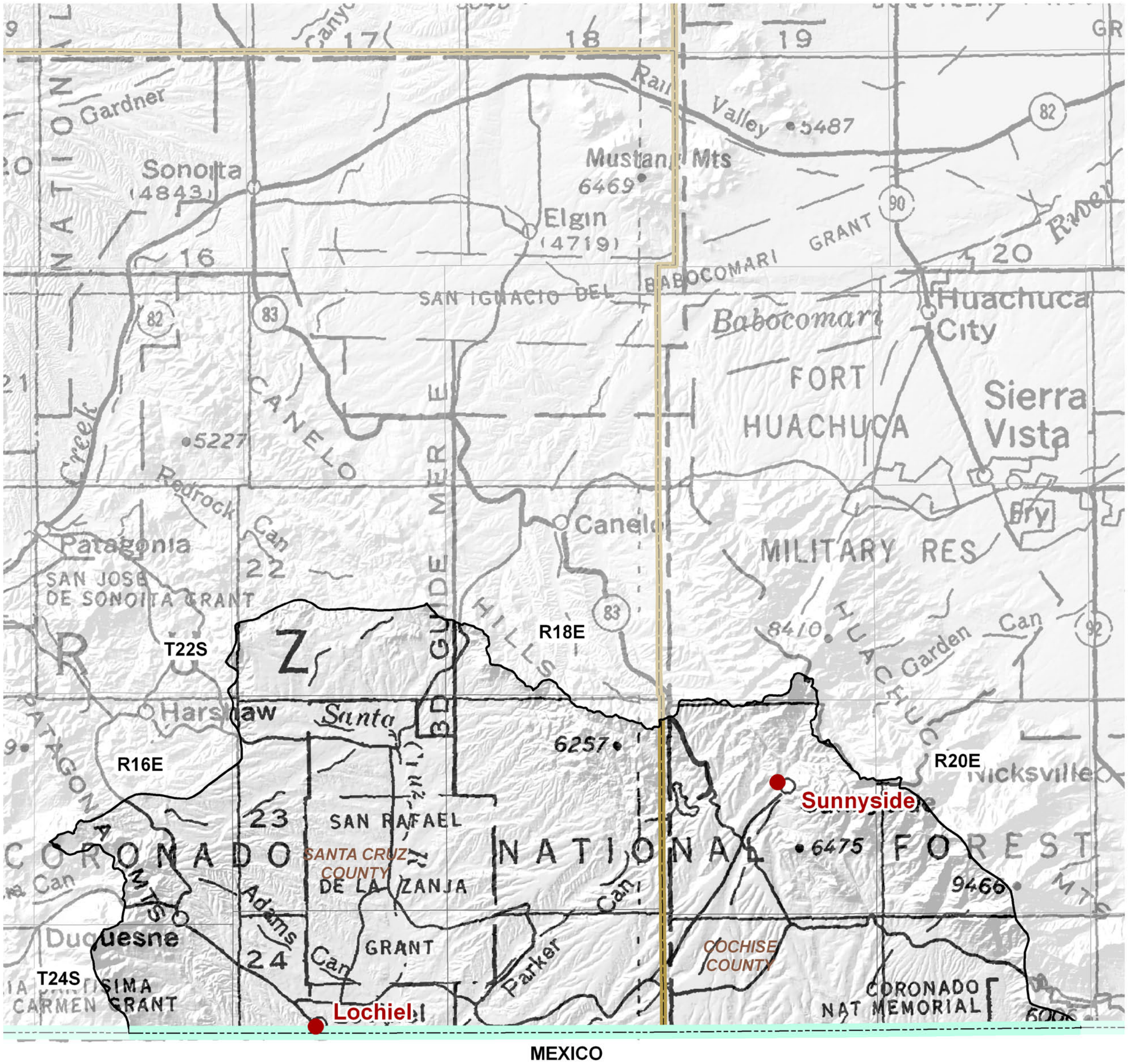
Section 3.12
San Rafael Basin



3.12.1 Geography of the San Rafael Basin

The San Rafael Basin is a small, 229 square mile basin in the southwest corner of the planning area. Geographic features and principal communities are shown on Figure 3.12-1. The sparsely populated basin is characterized by a high-elevation mountain range, a valley and plains and Great Basin grassland and madrean evergreen woodland vegetation. (see Figure 3.0-9) Riparian vegetation includes cottonwood/willow and strand along the Santa Cruz River.

- Principal geographic features shown on Figure 3.12-1 are:
    - The Santa Cruz River east of Lochiel
    - Parker Canyon west of Sunnyside
    - Huachuca Mountains along the eastern basin boundary, which include the highest point in the basin about 9,400 feet
    - The lowest point at 4,600 feet at Lochiel where the Santa Cruz River exits the basin
- Not indicated on Figure 3.12-1 is the San Rafael Valley flanking the Santa Cruz River



0 3 6
Miles

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Base Map: USGS 1:500,000, 1981

Figure 3.12-1
San Rafael Basin
Geographic Features

International Boundary
COUNTY
City, Town or Place

3.12.2 Land Ownership in the San Rafael Basin

Land ownership, including the percentage of ownership in each category, is shown for the San Rafael Basin in Figure 3.12-2. Principal features of land ownership are the lack of diversity in land ownership, 99% of land is under federal or private ownership, and the large portion of land managed by the National Forest Service. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

National Forest
- 73.1% of land is federally owned and managed by the United States Forest Service (USFS).
- Forest land is in the Coronado National Forest, Sierra Vista Ranger District.
- The basin includes most of the Miller Peak Wilderness area. (see Figure 3.0-12)
- Primary land uses are recreation, grazing and timber production.

Private
- 26.3% of land is private.
- There is a large concentration of private land in the Santa Cruz County portion of the basin.
- Private land in-holdings are located throughout the national forest lands in the basin.
- Primary land uses are domestic and grazing.

State Trust Lands
- 0.3% of land is held in trust for public schools through the Arizona State Trust Land system.
- Primary land use is grazing.

National Park Service (NPS)
- 0.2% of land is federally owned and managed by the National Park Service.
- All park lands are within the small portion of Coronado National Memorial in the basin.
- Primary land use is recreation.

U.S. Military
- 0.1% of land is federally owned and managed by the U.S. Army.
- All military lands are part of Fort Huachuca.
- Primary land use is military activities.

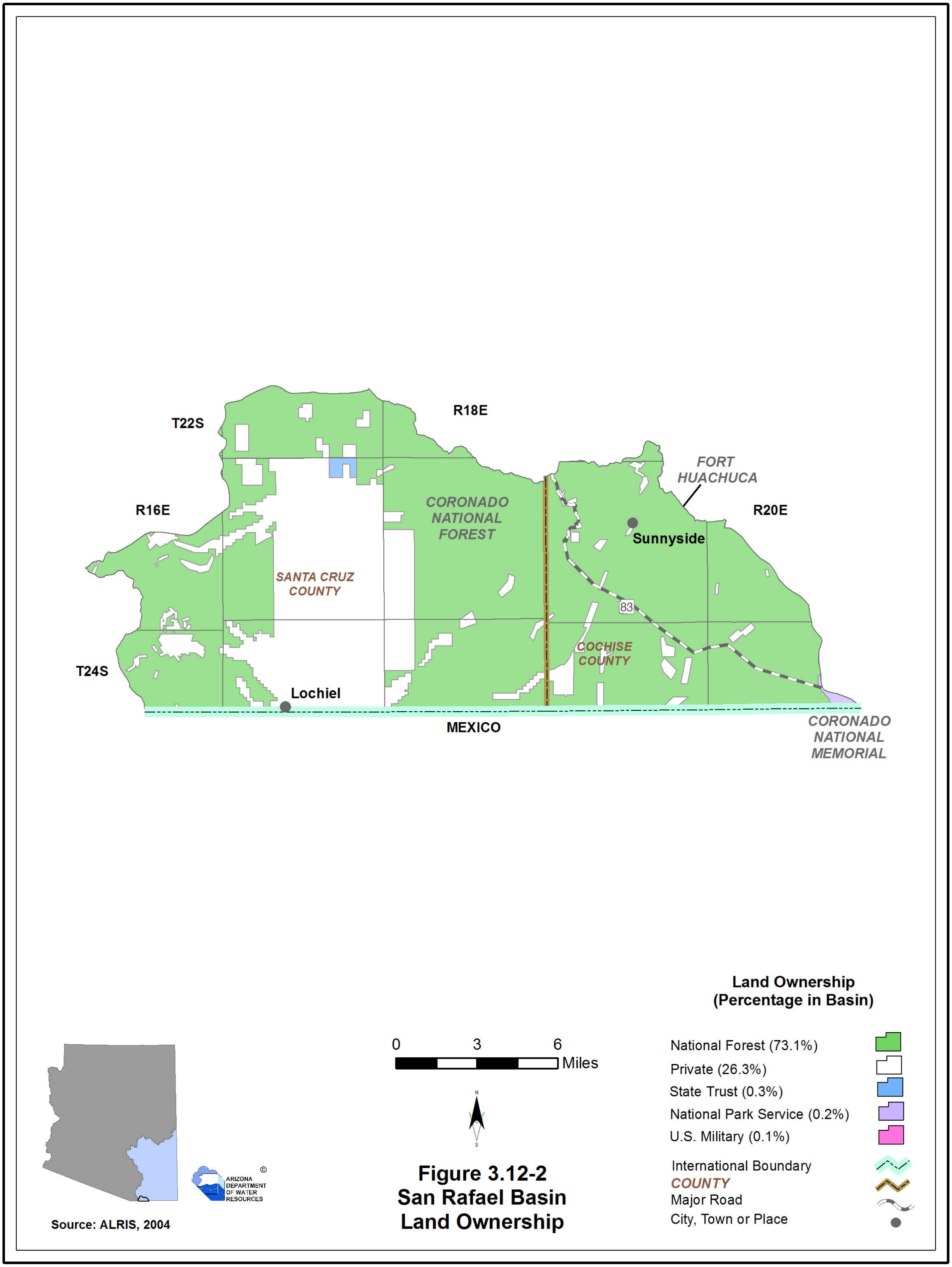


Figure 3.12-2
San Rafael Basin
Land Ownership

3.12.3 Climate of the San Rafael Basin

Climate data from a NOAA/NWS Co-op Network station are complied in Table 3.12-1 and the location is shown on Figure 3.12-3. Figure 3.12-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The San Rafael Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.12-1A
- There is one NOAA/NWS Coop network climate station in the basin at San Rafael Ranch with an average monthly maximum temperature of 74.1°F and average minimum temperature of 42.6°F.
- Annual average precipitation is 17.26 inches and most precipitation, 10.60 inches on average, occurs in the summer season. Summer precipitation is more than three times that of any other season.

SCAS Precipitation Data

- See Figure 3.12-3
- Other precipitation data shows rainfall as high as 38 inches at the Huachuca Mountains along the eastern basin boundary and as low as 18 inches in the San Rafael Valley.

Table 3.12-1 Climate Data for the San Rafael Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
San Rafael Ranch	4,740	1892-1968	74.1/Jul	42.6/Jan	2.81	1.16	10.60	2.70	17.26

Source: WRCC, 2005

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								

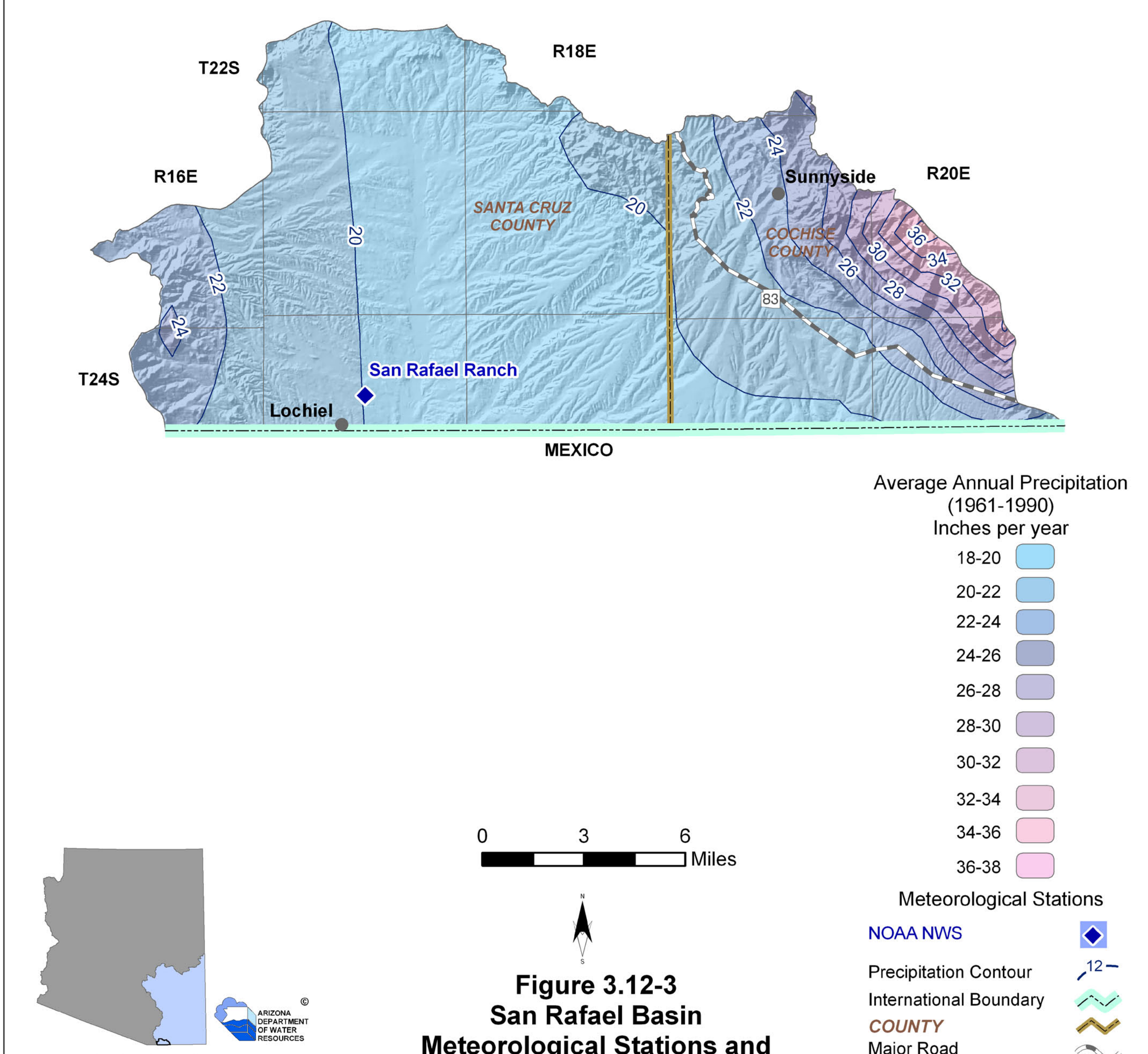


Figure 3.12-3
San Rafael Basin
Meteorological Stations and Annual Precipitation

Precipitation Data Source:
Oregon State University, 1998

3.12.4 Surface Water Conditions in the San Rafael Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.12-2. The basin does not contain flood ALERT equipment. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.12-3. The location of streamflow gages identified by USGS number and large reservoirs are shown on Figure 3.7-4. There were no runoff contours for this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.12-2.
- Data from one real-time station located at the Santa Cruz River are shown on the table and on Figure 3.12-4.
- The average seasonal flow is highest in the Summer (July-September) and lowest in the Spring (April-June).
- Maximum annual flow was 12,600 acre-feet in 1955 and minimum annual flow was 123 acre-feet in 1962.

Reservoirs and Stockponds

- Refer to Table 3.12-3.
- Surface water is stored or could be stored in one large reservoir and one small reservoir in the basin.
- The large reservoir is used for recreation and has a total maximum storage of 4,400 acre-feet.
- There are 258 registered stockponds in this basin.

Table 3.12-2 Streamflow Data for the San Rafael 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	
9480000	Santa Cruz River near Lochiel	82.2	4,620	1/1949-current (real time)	6	2	84	9	123 (1962)	1,419	2,388	12,600 (1955)	21

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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

Table 3.12-3 Reservoirs and Stockponds in the San Rafael Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE[1]	JURISDICTION
1	Parker Canyon	AZ Game & Fish	4,400	R	State

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 0
Total maximum storage: 0 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[2]

Total number: 1
Total surface area: 6 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 258 (from water right filings)

Notes:
[1]R=recreation
[2]Capacity data not available to ADWR

Figure 3.12-4
San Rafael Basin
Surface Water Conditions

3.12.5 Perennial/Intermittent Streams and Major Springs in the San Rafael Basin

Minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 3.12-4. There are no major springs identified in this basin. The locations of perennial and intermittent streams are shown on Figure 3.12-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one perennial stream, the Santa Cruz River, located east of Lochiel. This reach is the headwaters of the Santa Cruz River.
- Several intermittent streams are located in the eastern portion of the basin.
- There is one minor spring in the basin.
- The unnamed spring was last measured in 1981 and its listed discharge rate may not be indicative of current conditions.
- The total number of springs identified by the USGS varies from 23 to 24, depending on the database reference.

Table 3.12-4 Springs in the San Rafael Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

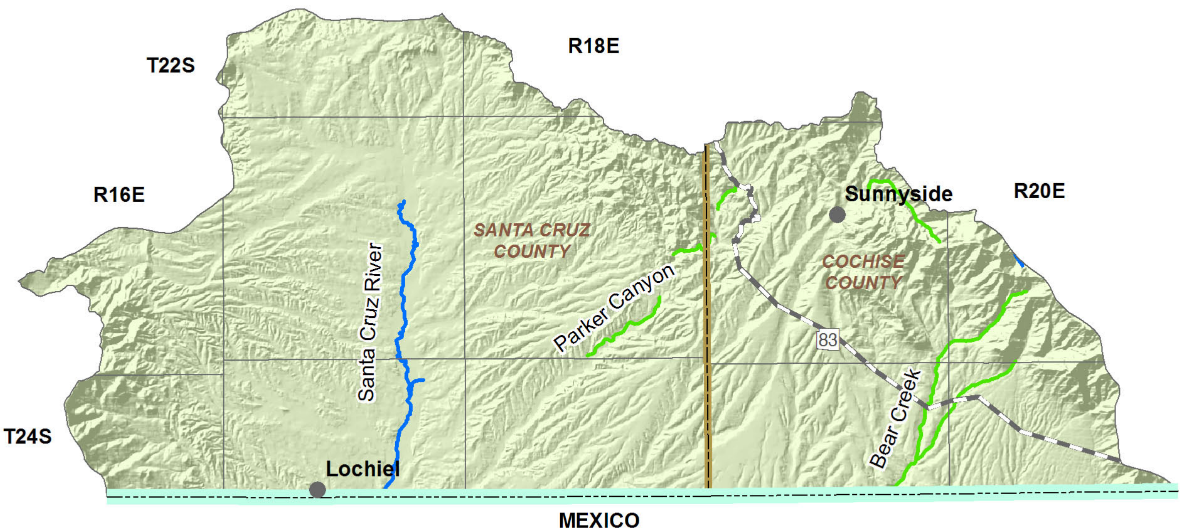
B. Minor Springs (1 to 10 gpm):

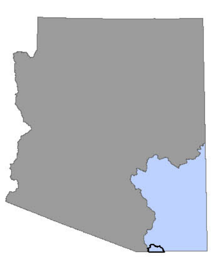
Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed	312726	1102350	1	10/22/1981

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 23 to 24

Notes:
[1]Most recent measurement identified by ADWR





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Stream Data Source: AGFD, 1993 & 1997

Figure 3.12-5
San Rafael Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

3.12.6 Groundwater Conditions of the San Rafael 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 3.12-5. Figure 3.12-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.12-7 contains hydrographs for selected wells shown on Figure 3.12-6. Figure 3.12-8 shows well yields in three 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 3.12-5 and Figure 3.12-6.
- The major aquifers in the basin are recent stream alluvium, composed of well-sorted silt, sand and gravel, and basin fill, consisting of clay, silt, sand and gravel.
- The streambed alluvium and the basin fill are hydrologically connected.
- Flow direction is generally from north to south.

Well Yields

- Refer to Table 3.12-5 and Figure 3.12-8.
- As shown on Figure 3.12-8 well yields in this basin range from less than 100 gallons per minute (gpm) to 1,000 gpm.
- One source of well yield information, based on 12 reported wells, indicates that the median well yield in this basin is 145 gpm.

Natural Recharge

- Refer to Table 3.12-5
- Principal sources of recharge in this basin are mountain-front recharge and infiltration from runoff in washes.
- The natural recharge estimate for this basin is 5,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 3.12-5.
- Storage estimates for this basin range from 4.0 million acre-feet (maf) to 5.0 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.12-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 10 index wells in this basin. Hydrographs for two of these wells are shown in Figure 3.12-7.
- The deepest recorded water level in 2003-2004 was 205 feet northwest of Lochiel and the shallowest was six feet northeast of Lochiel.

Table 3.12-5 Groundwater Data for the San Rafael Basin

Basin Area, in square miles:	229	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 7 - 700 Median 145 (12 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 3 - 465	ADWR (1994b)
	Range 0 - 2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	5,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	5,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	4,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	10	
Date of Last Water-level Sweep:	2005 (36 wells measured)	

[1]Predevelopment Estimate

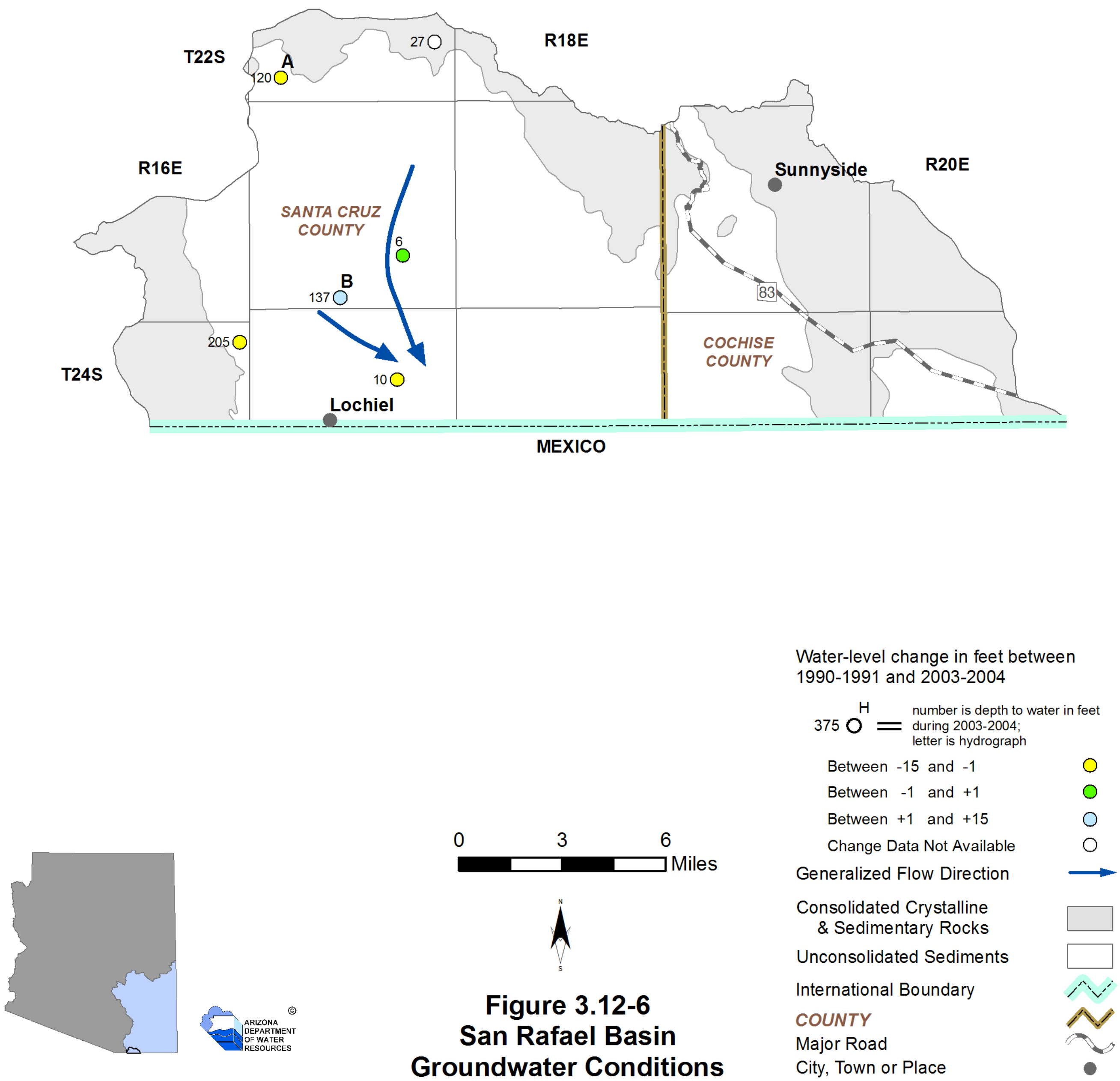
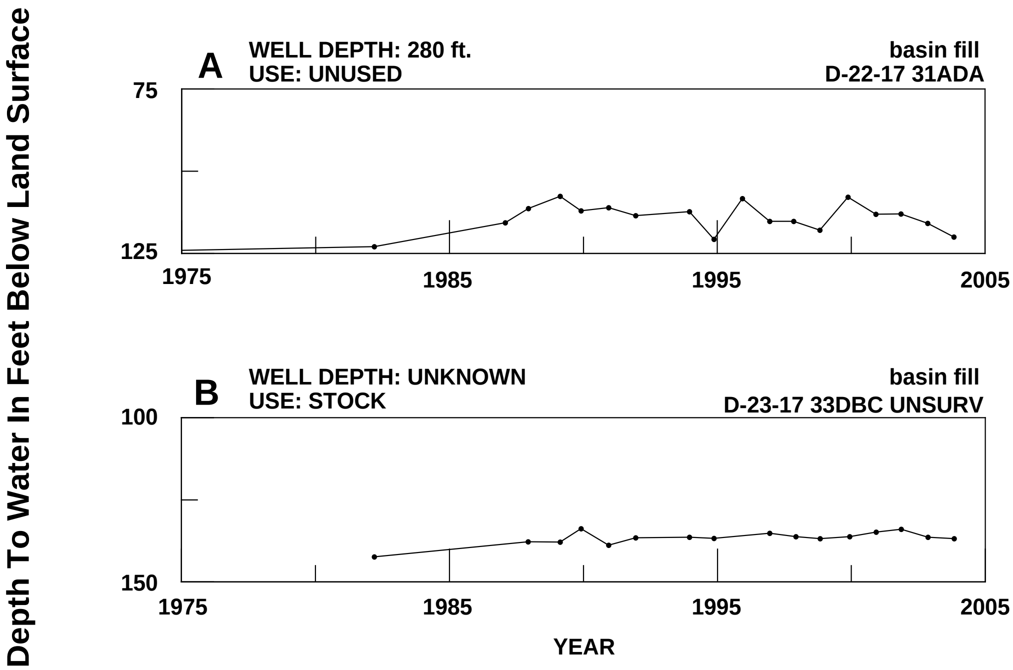


Figure 3.12-6
San Rafael Basin
Groundwater Conditions

Figure 3.12-7
San Rafael Basin
Hydrographs Showing Depth to Water in Selected Wells



In Hydrograph B UNSURV indicates there is no land survey for the area the well is in, and the coordinates are projected based on latitude and longitude.

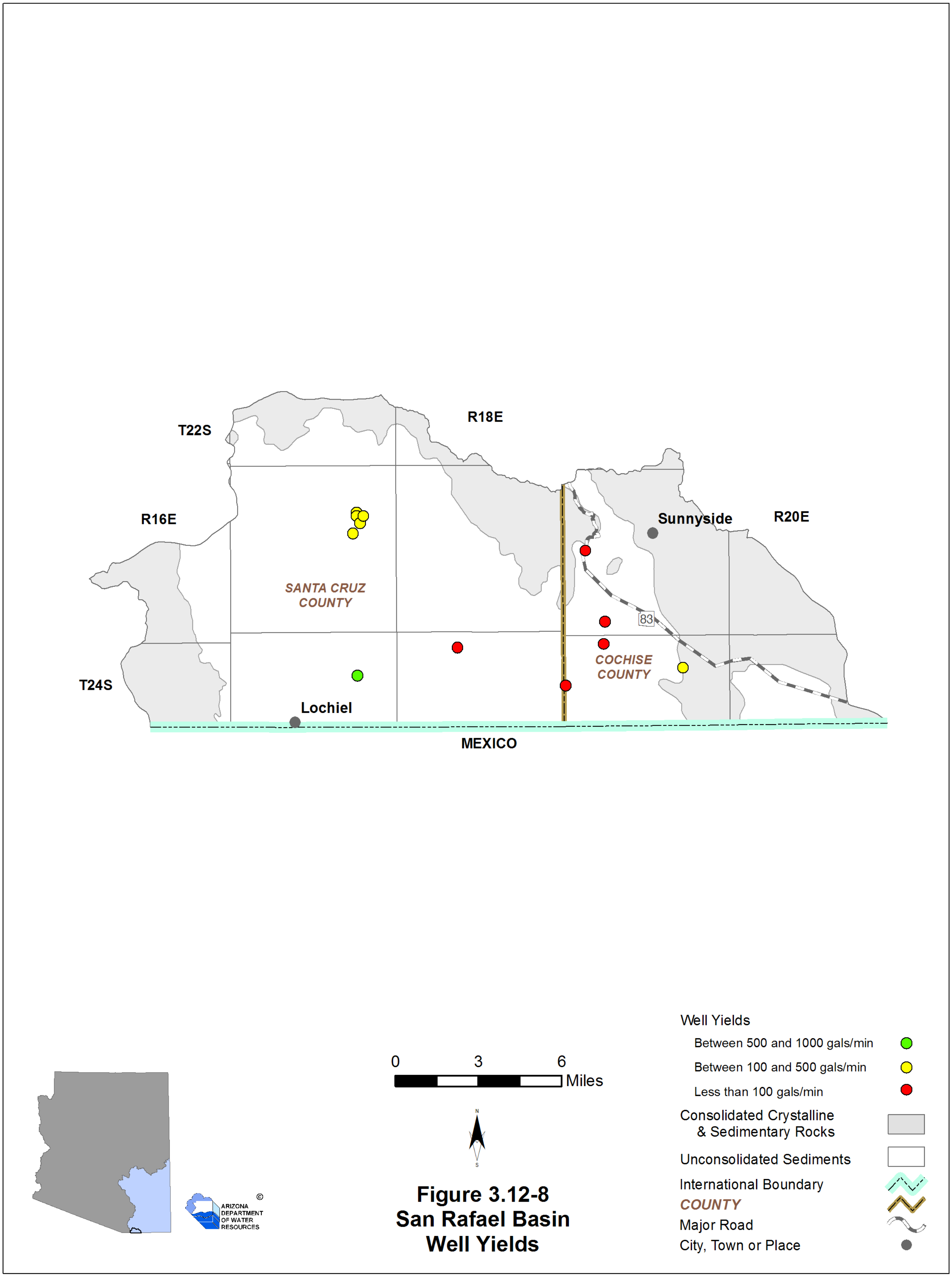


Figure 3.12-8
San Rafael Basin
Well Yields

3.12.7 Water Quality of the San Rafael Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.12-6A. 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 3.12-6B. Figure 3.12-9 shows the location of exceedences and impairment keyed to Table 3.12-6. A description of water quality data sources and methods is found in Volume 1, Appendix A. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.12-6A.
- Six sites have parameter concentrations that have equaled or exceeded DWS.
- Frequently equaled or exceeded parameters include arsenic and lead.
- Other parameters equaled or exceeded in the sites measured in this basin were radionuclides, cadmium and antimony.

Lakes and Streams with impaired waters

- Refer to Table 3.12-6B.
- Water quality standards for mercury were equaled or exceeded in Parker Canyon Lake.
- Parker Canyon Lake is part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. Sampling to create a TMDL report is ongoing.

Table 3.12-6 Water Quality Exceedences in the San Rafael Basin[1]

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	NR	23 South	16 East	21	As
2	NR	23 South	16 East	22	As
3	Well	23 South	16 East	22	Rad
4	NR	23 South	16 East	34	Cd
5	Well	23 South	19 East	18	Pb
6	Well	24 South	16 East	2	Pb, Sb

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Lake	Parker Canyon	NA	123	FC	Hg

Source: ADEQ 2005

Notes:
Because of map scale, feature locations may appear different than the location indicated on the table
NR = Information not available to ADWR
NA = Not applicable
[1] Water quality samples collected in 2002.
[2] As = Arsenic
Sb = Antimony
Cd = Cadmium
Pb = Lead
Hg = Mercury
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
[3] FC = Fish Consumption

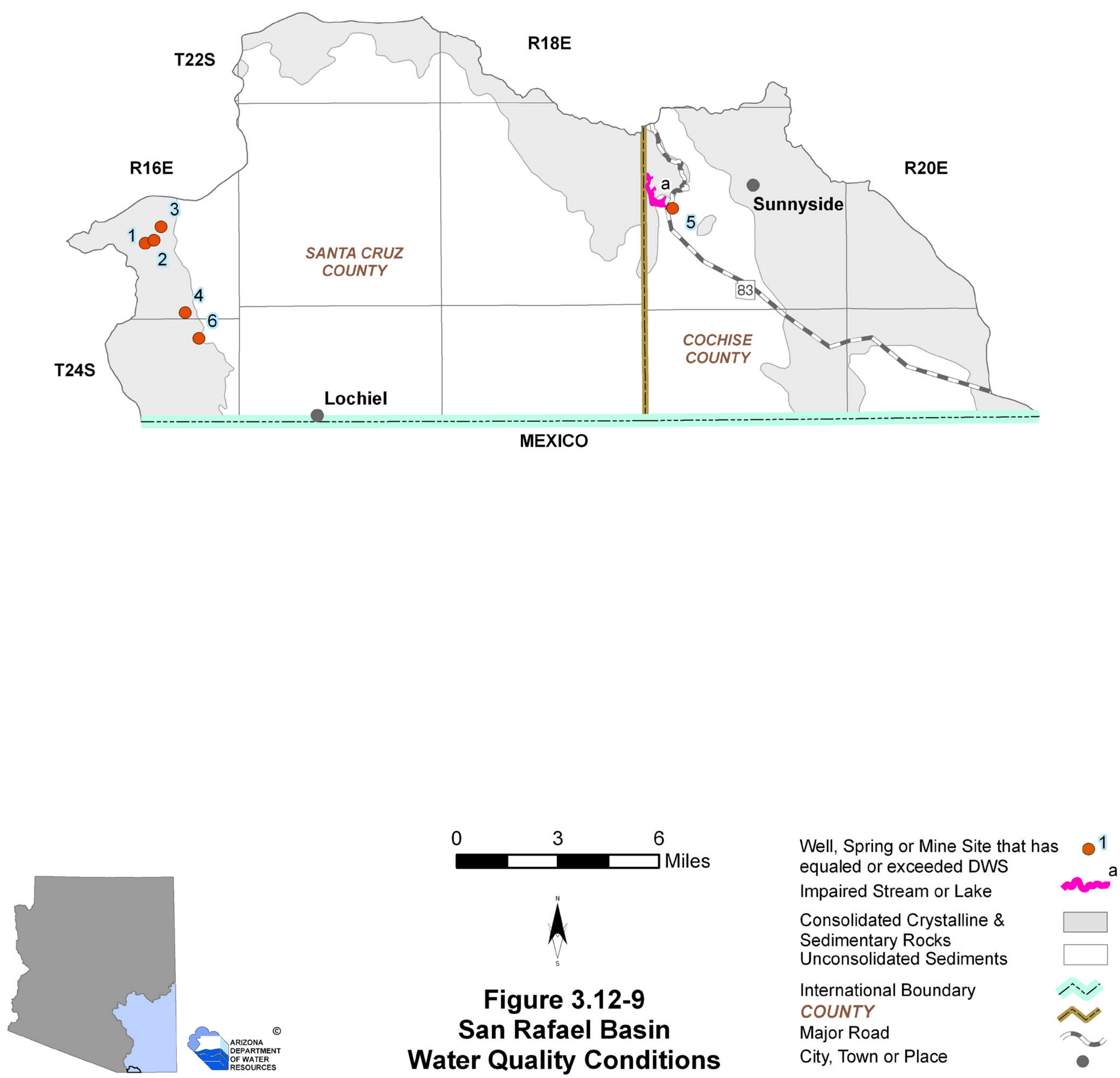


Figure 3.12-9
San Rafael Basin
Water Quality Conditions

3.12.8 Cultural Water Demand in the San Rafael 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 3.12-7. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the source of cultural demand map data, showed no demand centers for this basin. 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.12-7.
- Population remained almost unchanged from 1980 to 2005.
- Groundwater pumping remained constant from 1971 to 2005 at less than 300 AFA.
- All water use in this basin is groundwater, there are no recorded surface water diversions.
- Municipal demand is the only use in this basin and is minimal, less than 300 AFA. This includes domestic and stock watering use.
- As of 2005 there were 224 registered wells with a pumping capacity of less than or equal to 35 gpm and 26 wells with a pumping capacity of more than 35 gpm.

Table 3.12-7 Cultural Water Demand in the San Rafael Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">173[2]</td><td rowspan="10">24[2]</td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a) USGS (2007)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>143</td></tr>
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<tr><td>1982</td><td>142</td></tr>
<tr><td>1983</td><td>141</td></tr>
<tr><td>1984</td><td>141</td></tr>
<tr><td>1985</td><td>140</td></tr>
<tr><td>1986</td><td>140</td><td rowspan="5">17</td><td rowspan="5">1</td><td colspan="3" rowspan="5"><300</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>139</td></tr>
<tr><td>1988</td><td>138</td></tr>
<tr><td>1989</td><td>138</td></tr>
<tr><td>1990</td><td>137</td></tr>
<tr><td>1991</td><td>138</td><td rowspan="5">14</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td><td rowspan="15">USGS (2007)</td></tr>
<tr><td>1992</td><td>139</td></tr>
<tr><td>1993</td><td>140</td></tr>
<tr><td>1994</td><td>141</td></tr>
<tr><td>1995</td><td>142</td></tr>
<tr><td>1996</td><td>143</td><td rowspan="5">5</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>144</td></tr>
<tr><td>1998</td><td>145</td></tr>
<tr><td>1999</td><td>146</td></tr>
<tr><td>2000</td><td>147</td></tr>
<tr><td>2001</td><td>149</td><td rowspan="5">10</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>151</td></tr>
<tr><td>2003</td><td>154</td></tr>
<tr><td>2004</td><td>156</td></tr>
<tr><td>2005</td><td>158</td></tr>
<tr><td>2010</td><td>169</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>177</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>182</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>***WELL TOTALS:***</td><td>**224**</td><td>**26**</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent
[2] Includes all wells through June 1980.

3.12.9 Water Adequacy Determinations in the San Rafael Basin

There are no water adequacy applications on file with the Department as of December 2008 for the San Rafael Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

San Rafael Basin

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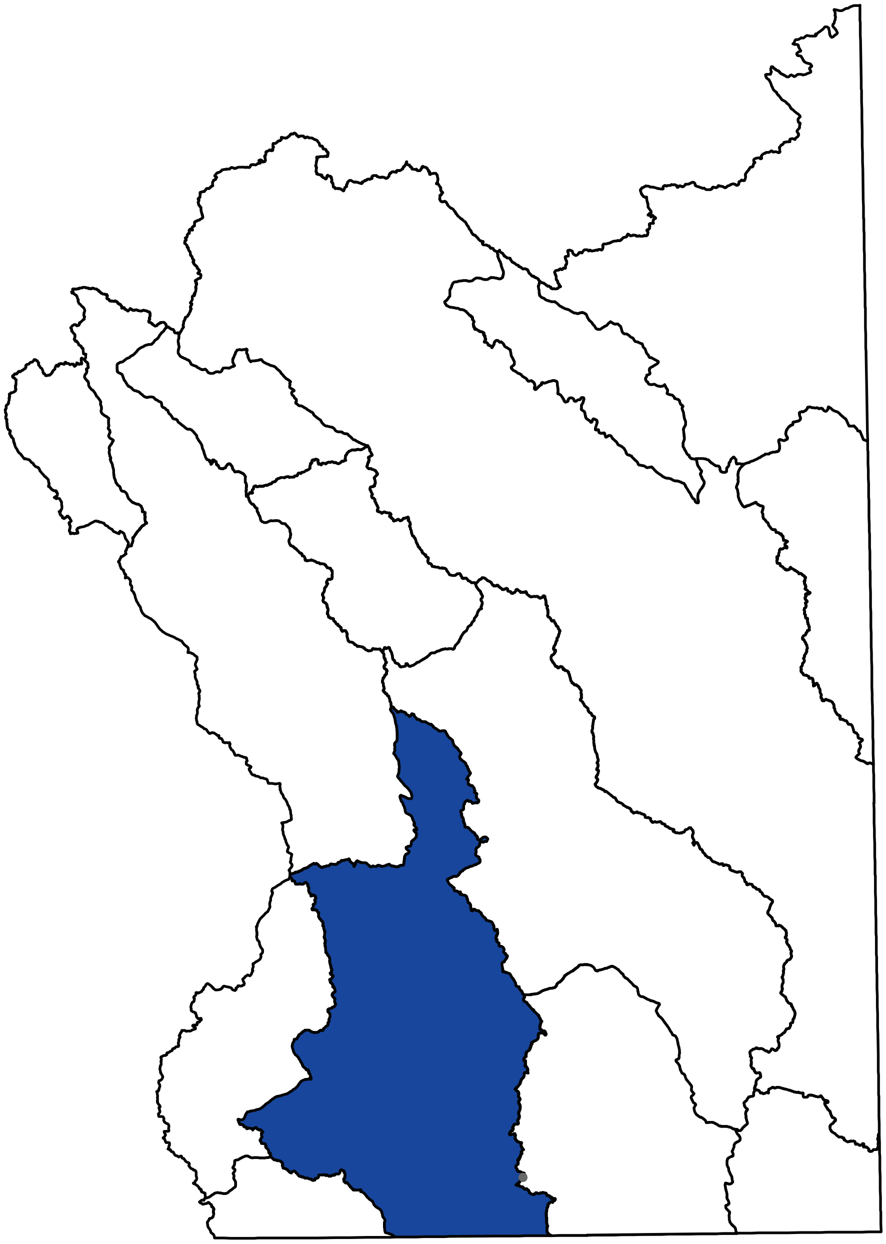
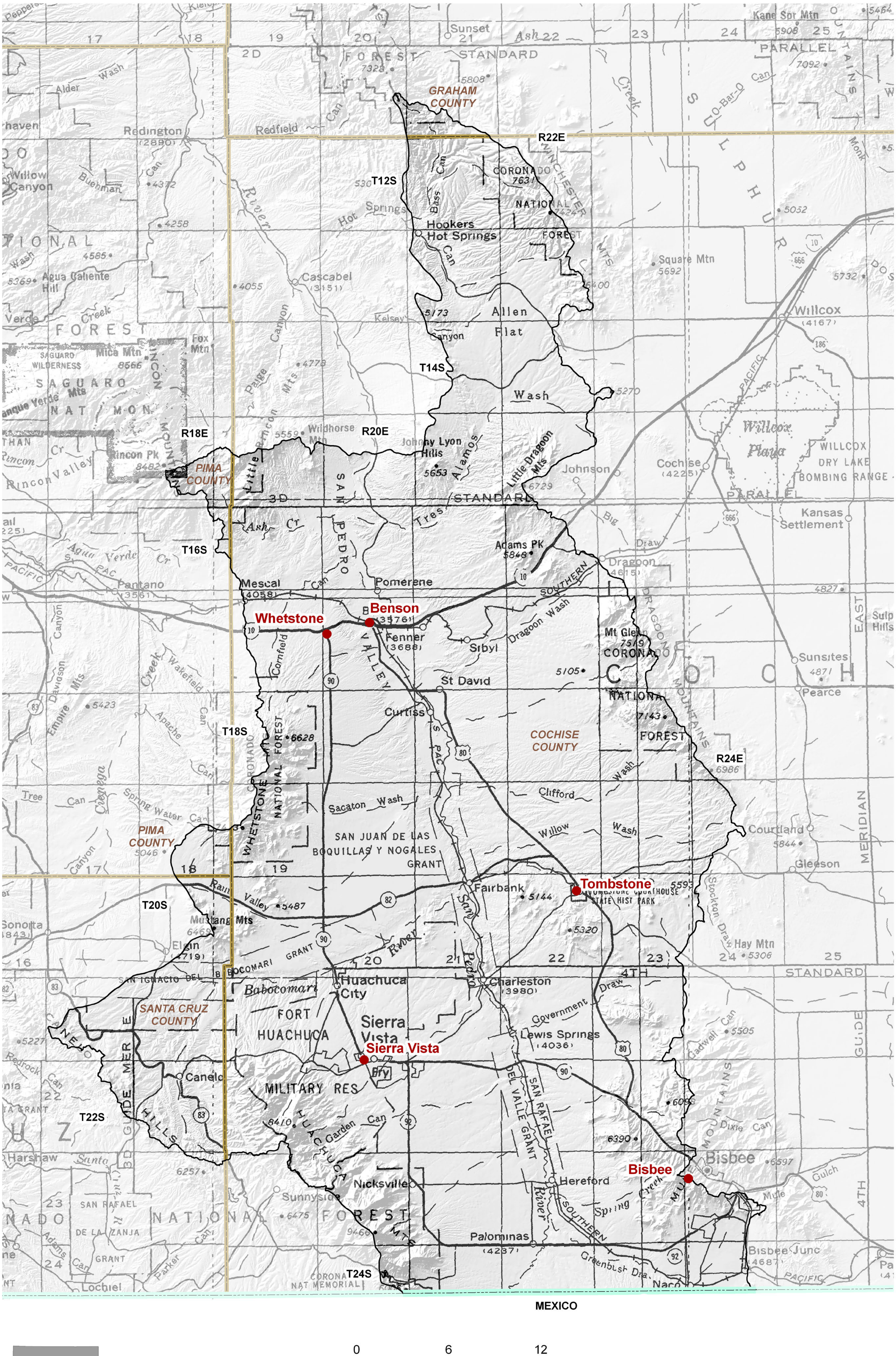
Section 3.13
Upper San Pedro Basin



3.13.1 Geography of the Upper San Pedro Basin

The Upper San Pedro Basin is a medium-size, 1,825 square mile basin in the southwestern portion of the planning area. Geographic features and principal communities are shown on Figure 3.13-1. The basin is characterized by a large valley flanked by a series of mountain ranges. Vegetation is primarily semi-desert grassland and Chihuahuan desertscrub with smaller areas of madrean evergreen woodland, plains and Great Basin grasslands and Rocky Mountain and madrean montane conifer forest. (see Figure 3.0-9) Riparian vegetation includes cottonwood/willow, mesquite and tamarisk along the San Pedro River and conifer oak and mixed broadleaf along Gardner, Ramsey and Miller Canyons.

- Principal geographic features shown on Figure 3.13-1 are:
    - San Pedro River, which flows north through the San Pedro Valley east of Sierra Vista and Benson
    - Babocomari River north of Sierra Vista
    - Garden and Ramsey canyons southwest of Sierra Vista
    - Tres Alamos Wash northeast of Benson
    - Greenbrush Draw north of the Mexico border in the vicinity of Naco
    - Huachuca Mountains southwest of Sierra Vista
    - Whetstone Mountains southwest of Whetstone
    - Canelo Hills west of Canleo
    - Mule Mountains east of Bisbee
    - Dragoon Mountains along the eastern boundary of the basin east of St. David
    - Allen Flat in the northern part of the basin
    - The highest point in the basin, 9,466 feet, at T23S, R20E in the Huachuca Mountains
    - The lowest point at approximately 3,000 feet where the San Pedro River exits the basin



ARIZONA DEPARTMENT OF WATER RESOURCES

Base Map: USGS 1:500,000, 1981

Figure 3.13-1
Upper San Pedro Basin
Geographic Features

COUNTY
International Boundary
City, Town or Place

3.13.2 Land Ownership in the Upper San Pedro Basin

Land ownership, including the percentage of ownership in each category, is shown for the Upper San Pedro Basin in Figure 3.13-2. Principal features of the land ownership in this basin are the relatively large amounts of state owned lands and private lands as well as the Fort Huachuca Military Base. More detailed information on protected areas is found in Section 3.0.4. A description of land ownership data sources and methods is found in Volume 1, Appendix A. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

State Trust
- 39.1% of land in this basin is held in trust for public schools and five other beneficiaries under the State Trust Land system.
- State owned land is fragmented in most of the basin, however, large contiguous parcels exist north of Interstate 10 and Highway 82, and east of Highway 90.
- Primary land use is grazing.

Private
- 33.3% of land is private.
- Much of the private land is interspersed with state owned land and, to a lesser extent, Bureau of Land Management lands.
- Contiguous private lands exist southeast of Sierra Vista, north of Fort Huachuca, southeast of Benson and in the vicinity of Benson.
- Primary land uses are domestic, commercial, industrial and farming.

National Forest
- 11.6% of land is federally owned and managed by the United States Forest Service (USFS).
- All forest lands, although not contiguous, are in the Coronado National Forest in four ranger districts: the Safford Ranger District at the northern tip of the basin; the Santa Catalina Ranger District north of Interstate 10 adjacent to Saguaro National Park; the Douglas Ranger District south of Interstate 10 on the eastern basin boundary; and the Sierra Vista Ranger District in the southern part of the basin adjacent to Fort Huachuca and south of Interstate 10 on the western basin boundary.
- This basin contains portions of the Miller Peak Wilderness area and the Rincon Mountain Wilderness area. (see Figure 3.0-12)
- Primary land uses are grazing, recreation and timber production.

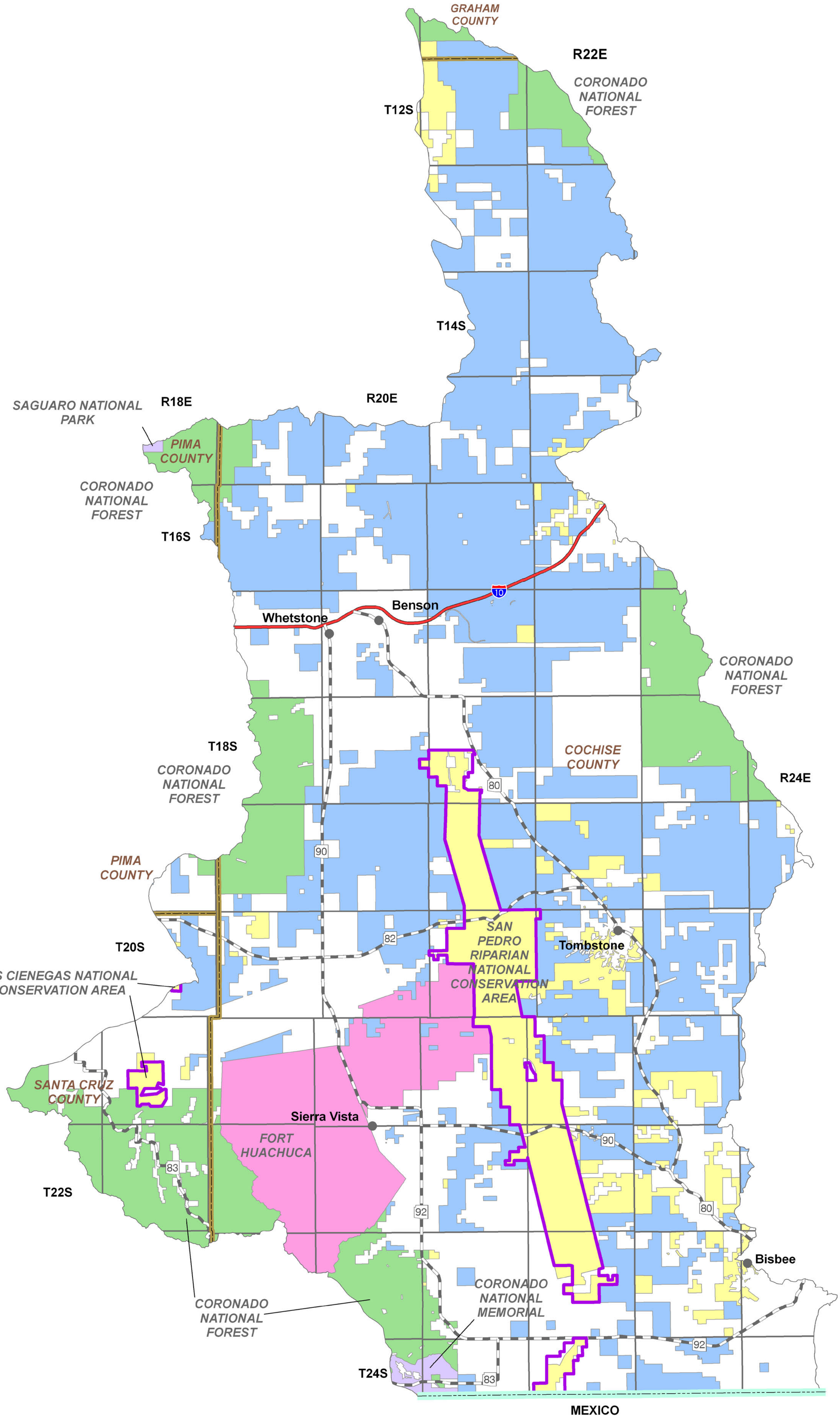
U.S. Bureau of Land Management (BLM)
- 8.9% of land is federally owned and managed by the Safford Field Office of the BLM.
- The majority of the BLM land in this basin is within the San Pedro Riparian National Conservation Area.
- This basin contains a portions of the Las Cienegas National Conservation Area and the Redfield Canyon Wilderness. (see Figure 3.0-12)
- Primary land uses are recreation and grazing.

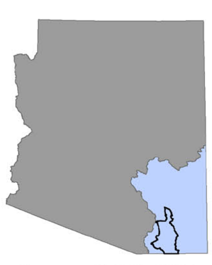
U.S. Military

- 6.8% of land is federally owned and managed by the U.S. Military.
- All military lands are within Fort Huachuca, which was established during the Indian Wars in 1877 and has existed as a military outpost, with varied missions, since that time.
- Primary land use is military activities.

National Park Service (NPS)

- 0.3% of land is federally owned and managed by the NPS.
- All park lands are within the Coronado National Memorial and Saguaro National Park.
- Primary land uses are recreation and resource protection.





Land Ownership (Percentage in Basin)
State Land (39.1%)
Private (33.3%)
National Forest (11.6%)
U.S.Bureau of Land Management (8.9%)
U.S.Military (6.8%)
National Park Service (0.3%)
National Conservation Area
COUNTY
International Boundary
Interstate Highway
Major Road
City, Town or Place

0 6 12 Miles

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Source: ALRIS, 2004
Bureau of Land Management, 1999

Figure 3.13-2
Upper San Pedro Basin
Land Ownership

3.13.3 Climate of the Upper San Pedro Basin

Climate data from NOAA/NWS Co-op Network stations is complied in Table 3.13-1 and the locations are shown on Figure 3.13-3. Figure 3.13-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Upper San Pedro Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.13-1A
- There are seven NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 74.6°F at Canelo 1 NW to 81.0°F at Benson. The average monthly minimum temperature occurs in December or January and ranges between 43.3°F at Canelo 1 NW to 47.8°F at Tombstone.
- Highest average seasonal rainfall occurs in the summer (July – September). For the period of record used, the highest annual rainfall is 21.18 inches at Coronado N.M. and 12.34 inches at Benson.

SCAS Precipitation Data

- See Figure 3.13-3
- Additional precipitation data shows rainfall as high as 38 inches at the Huachuca Mountains south of Sierra Vista and as low as 12 inches in the southcentral part of the basin.

Table 3.13-1 Climate Data for the Upper San Pedro Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Apache Powder Co.	3,690	1971-2000	80.3/Jul	45.5/Dec	2.16	1.01	8.38	2.66	14.21
Benson	3,670	1894-1975[1]	81.0/Jul	45.9/Jan	1.23	0.74	8.01	2.37	12.34
Bisbee 2	5,020	1961-1997[1]	77.6/Jul	46.6/Jan	2.74	1.22	8.39	3.10	15.44
Canelo 1 NW	5,010	1971-2000	74.6/Jul	43.3/Jan	3.68	1.32	9.17	3.87	18.04
Coronado N.M.	5,240	1971-2000	75.4/Jul	45.3/Jan	4.71	1.41	10.02	5.04	21.18
Fort Huachuca	4,670	1900-1981[1]	77.3/Jul	46.3/Jan	2.44	1.13	7.89	2.91	14.35
Tombstone	4,610	1971-2000	79.9/Jul	47.8/Jan	2.48	1.13	7.43	3.06	14.10

Source: WRCC, 2005

Notes:
[1]Average temperature for period of record shown; average precipitation from 1971-2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
None			

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								

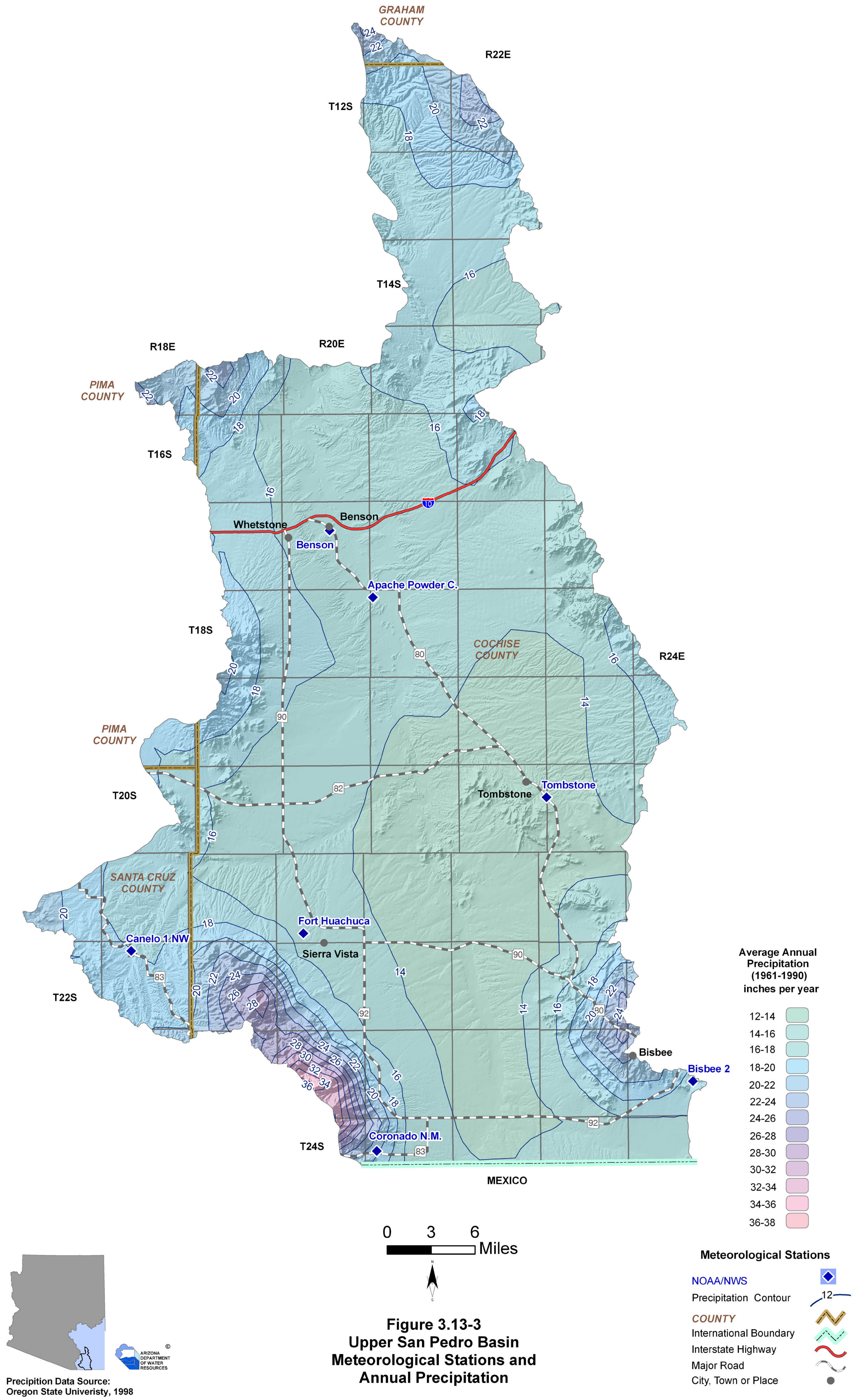


Figure 3.13-3
Upper San Pedro Basin
Meteorological Stations and
Annual Precipitation

3.13.4 Surface Water Conditions in the Upper San Pedro Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.13-2. This basin does not contain Flood ALERT equipment. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.13-3. The location of streamflow gages identified by USGS number and USGS runoff contours are shown on Figure 3.13-5. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.13-2.
- Data from 13 stations on seven watercourses are shown on the table and on Figure 3.13-5. Three stations have been discontinued and 10 are real-time stations.
- The average seasonal flow for almost all the stations is highest in the Fall (Oct.-Dec.) of the Summer (July-September) and lowest in Spring (April-June).
- Maximum annual flow was 102,107 acre-feet in 1984 at the San Pedro River near Tombstone and minimum annual flow was 0 acre-feet at Greenbush Draw near Palominas in 2001. The oldest operating gage is the San Pedro River at Charleston. A hydrograph of this gage is found in Figure 3.13-4.

Reservoirs and Stockponds

- Refer to Table 3.13-3.
- Surface water is stored or could be stored in four small reservoirs in the basin.
- There are 974 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 3.13-5.
- Average annual runoff is 0.5 inches, or 26.65 acre-feet per square mile, in this basin.

Figure 3.13-4 Annual Flows (in acre-feet) at San Pedro River at Charleston (Station # 9471000) Water Years 1905-2007

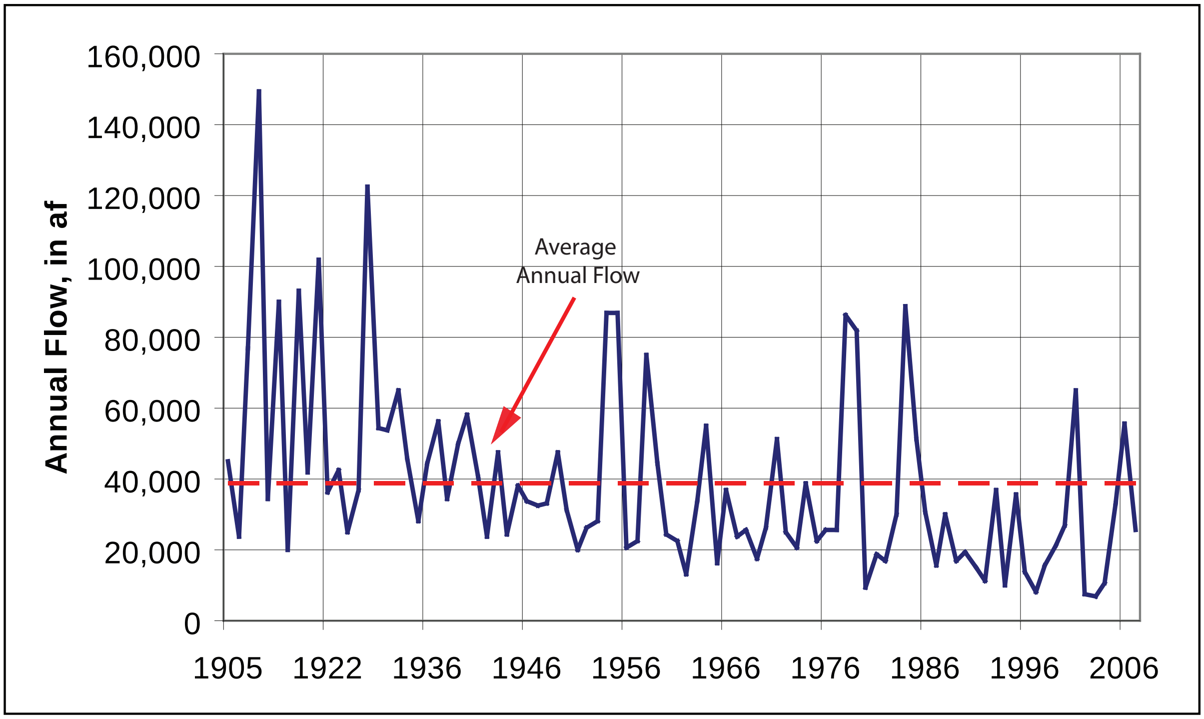


Table 3.13-2 Streamflow Data for Upper San Pedro Basin

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	
9470500	San Pedro River near Palominas	737	4,188	5/1930-current (real time)	10	2	70	17	4,403 (1962)	16,659	22,873	65,464 (2000)	44
9470520	Greenbush Draw near Palominas	NA	4,280	6/2000-9/2004 (discontinued)	0	11	35	54	0 (2001)	76	76	152 (2003)	3
9470700	Banning Creek near Bisbee	NA	4,767	2/2001-current (real time)	No statistics run, less than 3 years of data								2
9470750	Ramsey Canyon near Sierra Vista	NA	5,525	5/2000-current (real time)	10	8	9	73	24 (2003)	43	145	369 (2001)	3
9470800	Garden Canyon near Fort Huachuca	8	5,400	10/1959-current (real time)	39	11	35	15	71 (1997)	1,043	990	2,086 (1995)	11
9471000	San Pedro River at Charleston	1,234	3,954	3/1904-current (real time)	14	5	65	16	6,778 (2002)	33,203	38,636	152,798 (1914)	84
9471300	Huachuca Canyon near Fort Huachuca	3	NA	10/1961-9/1964 (discontinued)	No statistics run, less than 3 years of data								2
9471310	Huachuca Canyon near Fort Huachuca	NA	5,600	10/2000-current (real time)	11	7	9	73	7 (2002)	62	88	195 (2001)	3
9471380	Upper Babocomari River near Huachuca City	NA	5,500	7/2000-current (real tme)	16	9	28	47	1,433 (2003)	2,331	2,669	4,243 (2003)	3
9471400	Babocomari River near Tombstone	NA	3,980	3/2000-current (real time)	25	8	24	43	862 (2003)	1,028	1,028	1,195 (2001)	3
9471500	San Pedro River at Fairbanks	1,672	NA	10/1926-9/1928 (discontinued)	No statistics run, less than 3 years of data								1
9471550	San Pedro River near Tombstone	1,740	3,780	4/1967-current (real time)	19	4	49	28	7,314 (2002)	29,654	36,950	102,107 (1984)	24
9471800	San Pedro River near Benson	2,490	3,310	3/1966-current (real time)	5	1	87	8	8,618 (1973)	28,966	23,447	44,463 (1971)	9

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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
NA=Not available

Table 3.13-3 Reservoirs and Stockponds in the Upper San Pedro Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE	JURISDICTION
None identified by ADWR at this time					

Source: Compilation of databases from ADWR & others

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

Total number: 2
Total maximum storage: 247 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 2
Total surface area: 13 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 974 (from water right filings)

Notes:
[1]Capacity data not available to ADWR

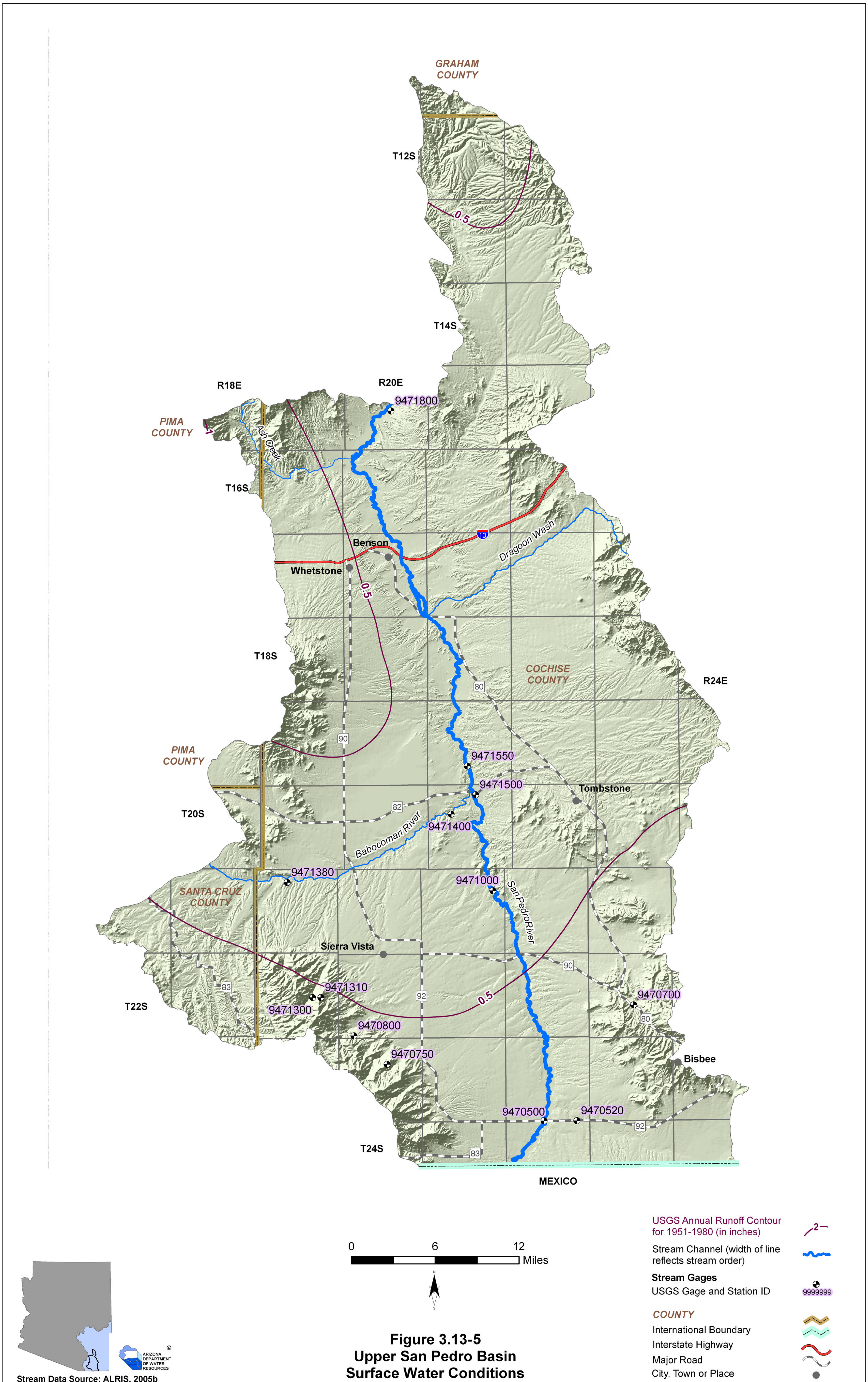


Figure 3.13-5
Upper San Pedro Basin
Surface Water Conditions

3.13.5 Perennial/Intermittent Streams and Major Springs in the Upper San Pedro 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 3.13-4. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.13-6. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are numerous perennial stream reaches in this basin, primarily in the southern portion of the basin.
- A number of intermittent stream reaches are located throughout most of the basin.
- The San Pedro River is intermittent through most of this basin with a perennial reach in the southern portion of the basin.
- There are 12 major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time. The largest discharge rate is 134 gpm at Garden Canyon No. 1.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.13-4. There are four minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. All but two of the measurements were taken prior to 1982.
- The total number of springs identified by the USGS varies from 79 to 91, depending on the database reference.

Table 3.13-4 Springs in the Upper San Pedro Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Garden Canyon No. 1	312807	1102132	134	2/11/1963
2	Huachuca Canyon	313103	1102318	108[3]	1958-1963
3	Unnamed[2]	313044	1102327	100	4/3/1941
4	Miller Canyon[2]	312516	1101554	97[3]	1973-1977
5	Garden Canyon No. 2	312728	1102155	76	1/8/1963
6	Lewis North	313456	1100819	45	6/30/2005
7	Hooker's Hot	322018	1101421	40	During or prior to 1982
8	Murray	313425	1101023	26	6/30/2005
9	Spring No. 3A[2]	313028	1102441	10	4/19/1960
10	Tree Root[2]	313029	1102442	10	4/19/1960
11	Spring No. 1	313102	1102315	10	4/3/1941
12	Unnamed (multiple)	322050	1101422	10	During or prior to 1982

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed[2]	330436	1095904	7	During or prior to 1982
Kiper	320309	1102340	5	5/17/1951
Kino	313340	1102631	4	3/30/1960
Unnamed	320316	1102233	2	10/12/1950

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 79 to 91

Notes:
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Average discharge

Stream Data Source: AGFD, 1993 &1997
Brown and Carmony, 1981

Figure 3.13-6
Upper San Pedro Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

3.13.6 Groundwater Conditions of the Upper San Pedro 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 3.13-5. Figure 3.13-7 shows aquifer flow direction, water-level change between 1990-1991 and 2003-2004 and recharge sites. Figure 3.13-8 contains hydrographs for selected wells shown on Figure 3.13-7. Figure 3.13-9 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 3.13-5 and Figure 3.13-7.
- The major aquifers in the basin are basin fill, consisting of younger basin fill, older basin fill and basal conglomerate, and recent stream alluvium.
- The basin fill is the principal aquifer although the stream alluvium is also utilized.
- Artesian conditions exist primarily in the vicinity of Benson.
- Flow direction is generally from south to north.
- The basin contains two sub-basins, the Allen Flat Sub-basin in the northern portion and the Sierra Vista Sub-basin.

Well Yields

- Refer to Table 3.13-5 and Figure 3.13-9.
- As shown on Figure 3.13-9 well yields in this basin range from less than 100 gpm to more than 2,000 gpm.
- One source of well yield information, based on 353 reported wells, indicates that the median well yield in this basin is 600 gpm.

Natural Recharge

- Refer to Table 3.13-5.
- The principal sources of recharge for this basin are mountain-front recharge and streambed infiltration.
- The estimate of natural recharge in this basin is 35,750 acre-feet per year (AFA).

Recharge Sites

- Refer Figure 3.13-7.
- There are two facilities in this basin that recharge effluent to the aquifer.
- The City of Sierra Vista Storage Facility is a permitted Underground Storage Facility (USF) by the Department (permit no. 73-583024). Under the permit the facility's maximum annual storage is 4,149 acre-feet.
- The Fort Huachuca Recharge Facility is not a permitted facility.
- In 2005, a total of 2,380 acre-feet of effluent was recharged by both facilities.

Water in Storage

- Refer to Table 3.13-5.
- Storage estimates for this basin range from 19.8 million acre-feet (maf) to 59 maf to a depth

of 1,200 feet.

Water Level

- Refer to Figure 3.13-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 59 index wells in this basin. Hydrographs for 15 index wells and five other wells are shown in Figure 3.13-7. Index well hydrographs are: A-C, E-I, K-M,P,Q, S and T.
- The Department measures water levels daily at four automated groundwater monitoring site in the basin.
- Deep water levels are found in the vicinity of Sierra Vista with water levels as deep as 585 feet measured in 2003-2004. Shallow water levels are found near the Mexico border in the vicinity of Highway 92 with levels as shallow as 10 feet in 2003-2004.

Table 3.13-5 Groundwater Data for the Upper San Pedro Basin

Basin Area, in square miles:	1,825	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 14 - 981 Median 335 (39 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 3 - 3,800 Median 600 (353 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 100 - 2,800	ADWR (1994b)
	Range 0 - 2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	35,750	ADWR (2005f)
Estimated Water Currently in Storage, in acre-feet:	21,000,000 - 59,000,000 (to 1,200 ft/not given)	ADWR (1990 and 1994b)
	35,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	48,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
	19,800,000 - 26,100,000 (to 1,200 ft)	ADWR (2005f)
Current Number of Index Wells:	59	
Date of Last Water-level Sweep:	2006 (688 wells measured)	

[1]Predevelopment Estimate

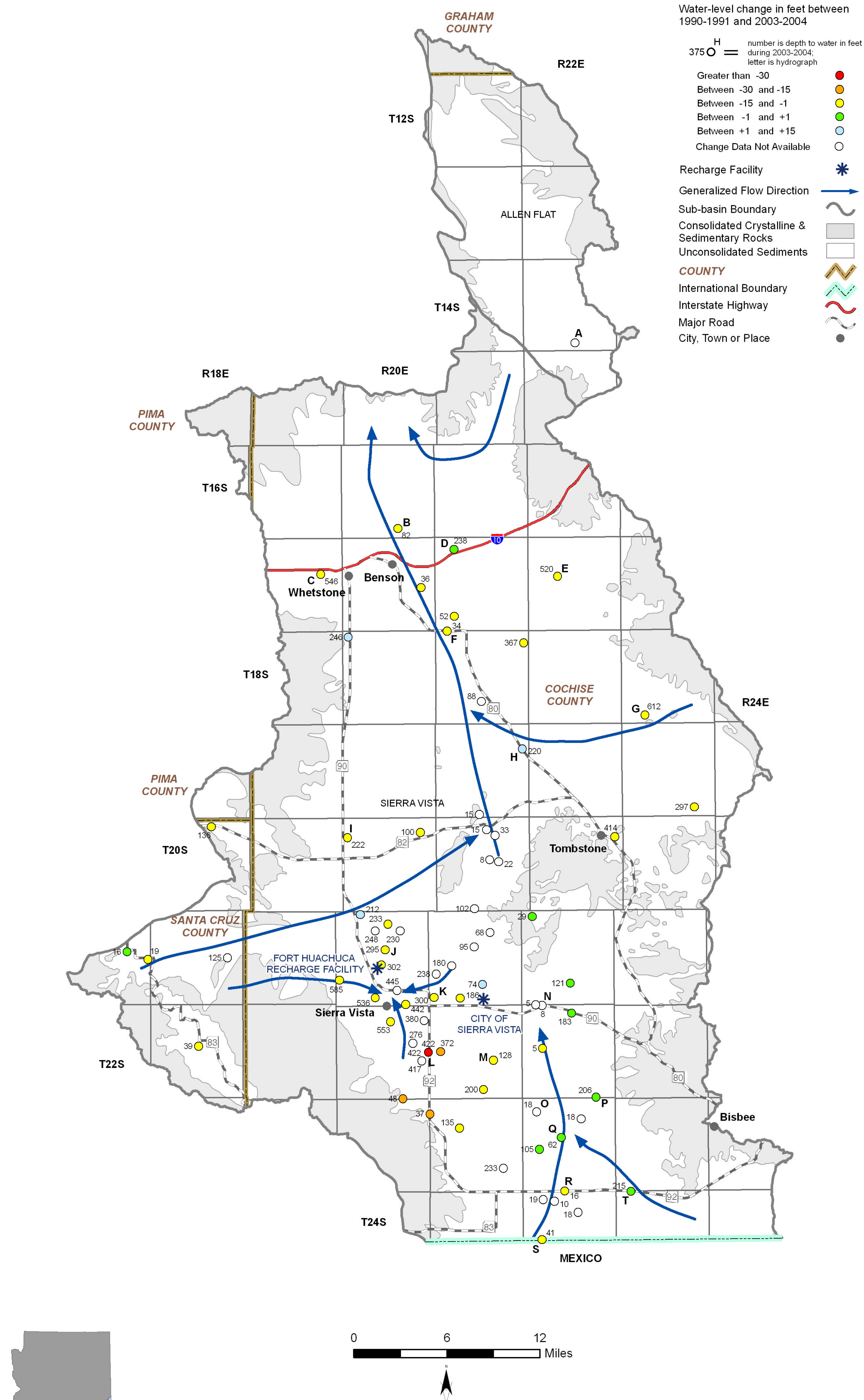


Figure 3.13-7
Upper San Pedro Basin
Groundwater Conditions

Figure 3.13-8
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

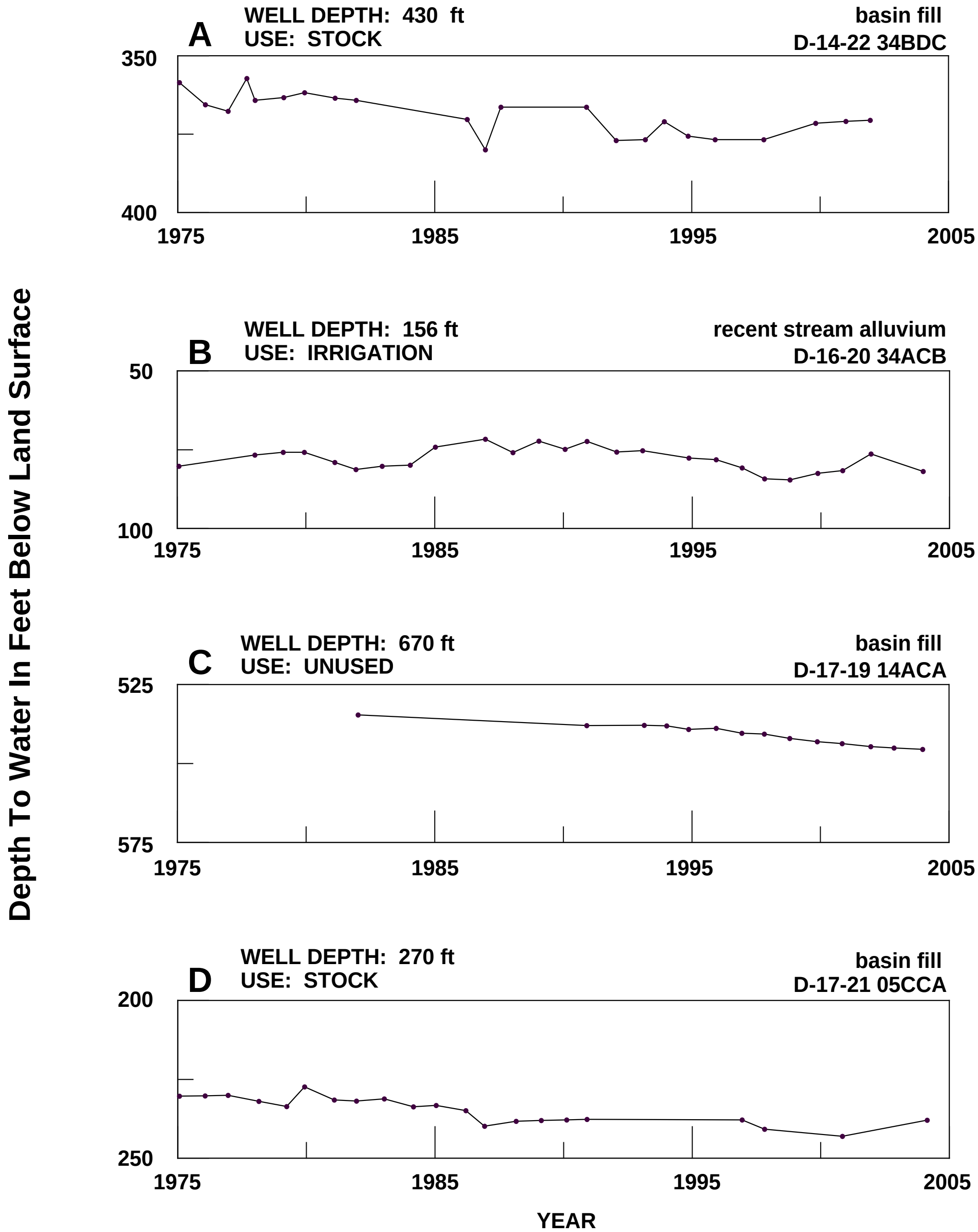


Figure 3.13-8 (Cont)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

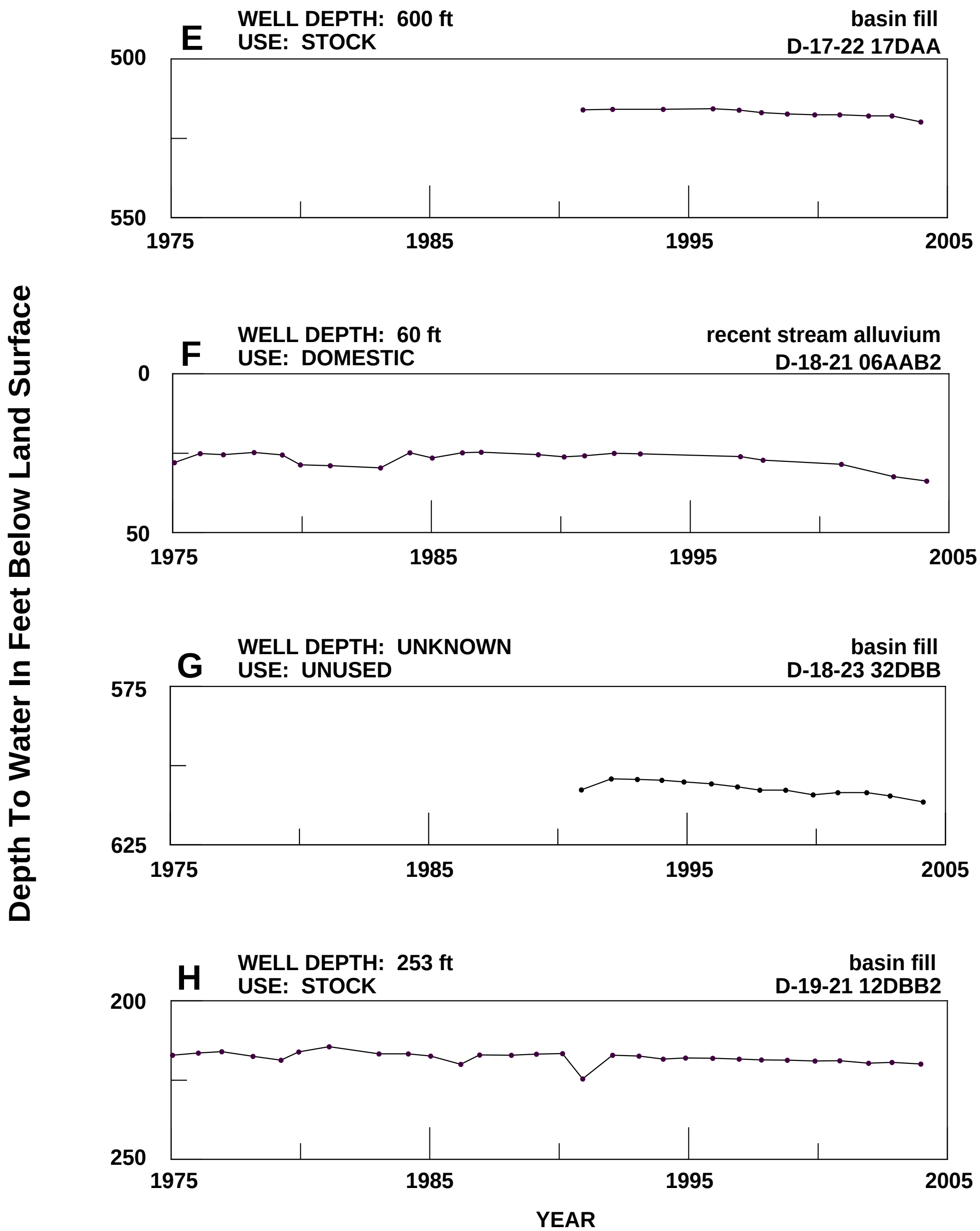


Figure 3.13-8 (Cont.)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

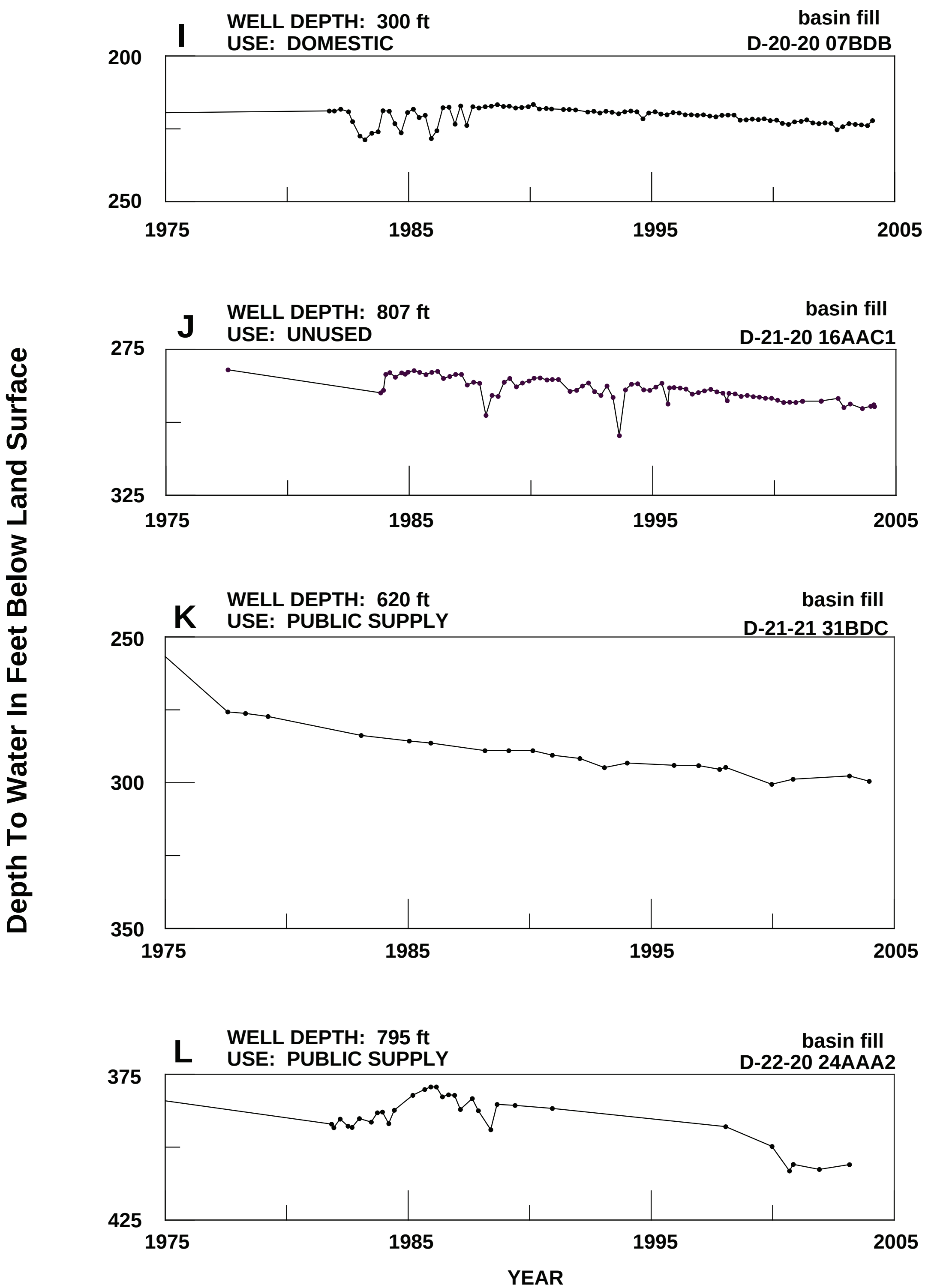
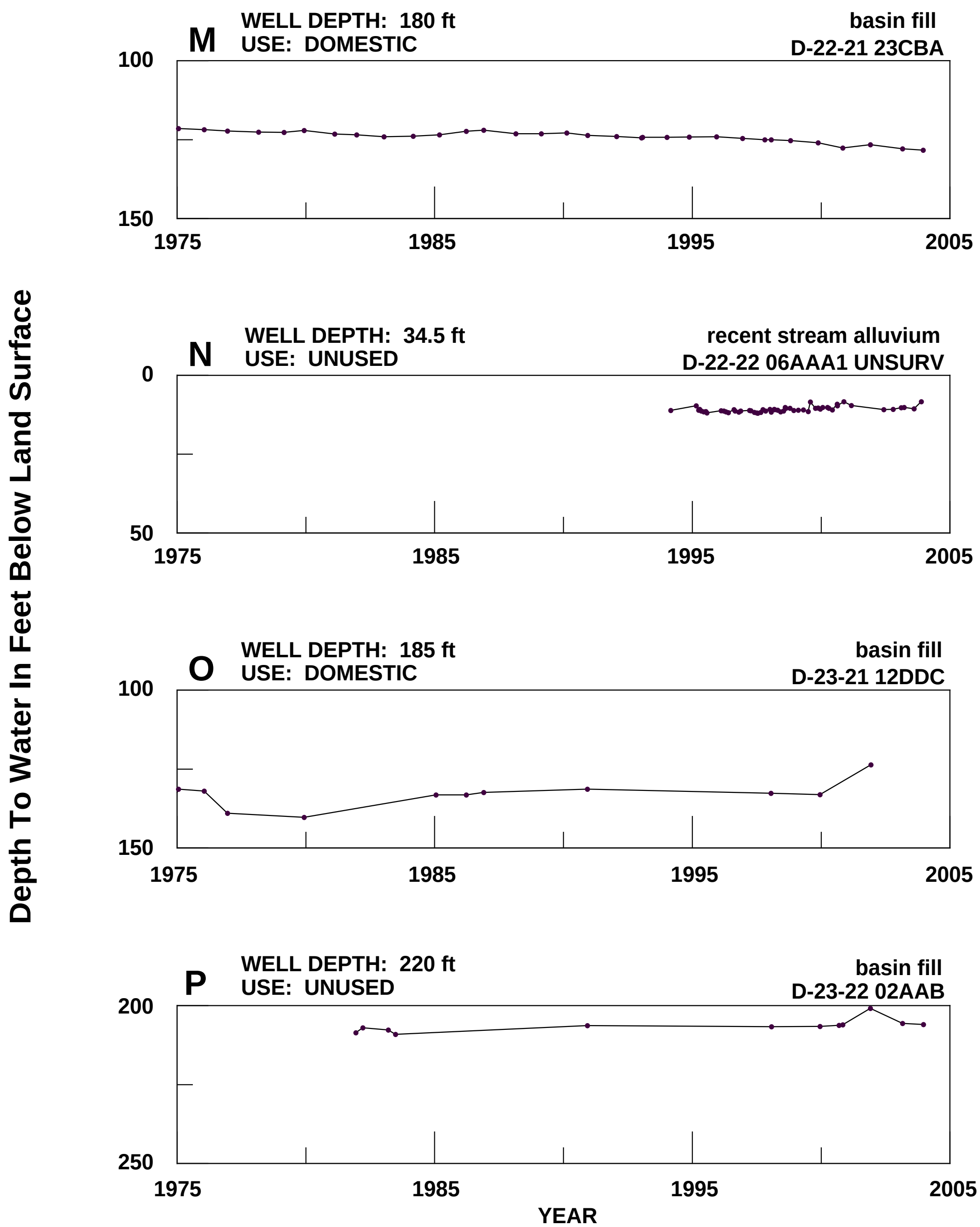
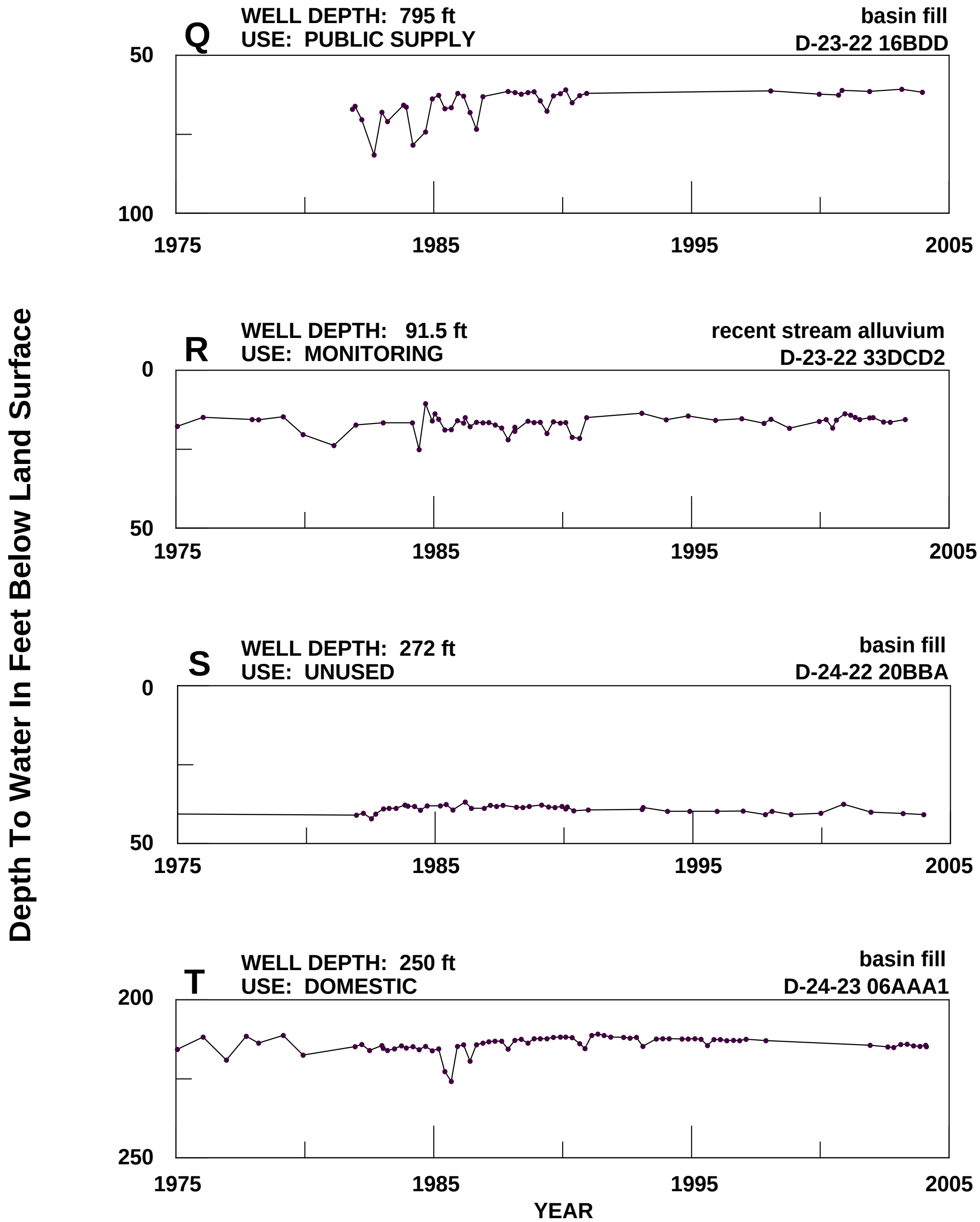


Figure 3.13-8 (Cont)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells



In Hydrograph N UNSURV indicates there is no land survey for the area the well is in, and the coordinates are projected based on latitude and longitude.

Figure 3.13-8 (Cont)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells



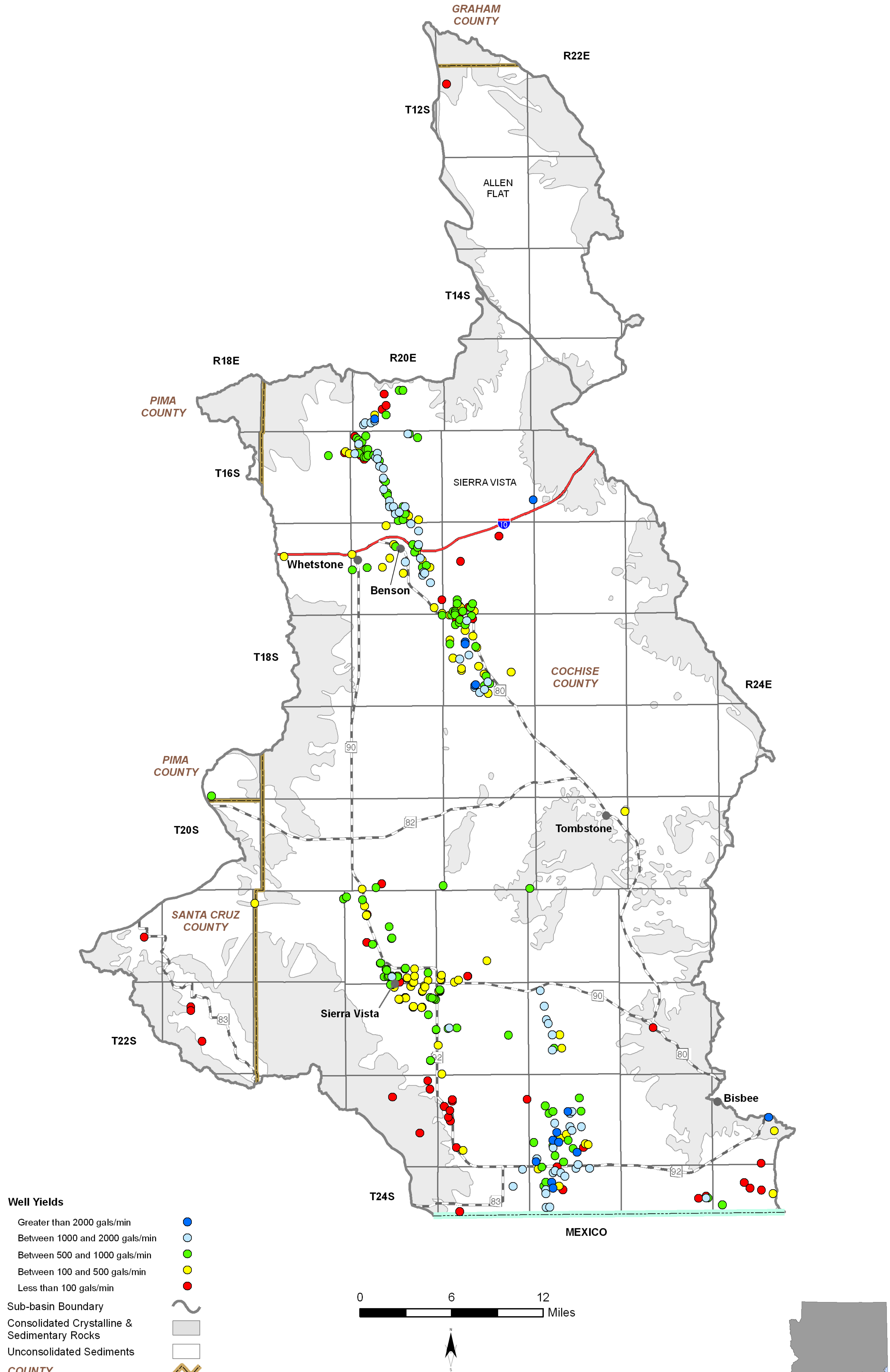


Figure 3.13-9
Upper San Pedro Basin
Well Yields

3.13.7 Water Quality of the Upper San Pedro Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.13-6A. 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 3.13-6B. Figure 3.13-10 shows the location of exceedences and impairment keyed to Table 3.13-6. 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. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.13-6A.
- Sixty-seven sites have parameter concentrations that have equaled or exceeded DWS.
- Frequently equaled or exceeded parameters include arsenic and fluoride.
- Other parameters commonly equaled or exceeded in the sites measured in this basin were cadmium, lead, nitrates, beryllium, mercury and total dissolved solids.

Lakes and Streams with impaired waters

- Refer to Table 3.13-6B.
- Water quality standards were exceeded in three reaches of the San Pedro River.
- The parameter exceeded was different for each reach; E. coli, nitrates and copper.
- Two of the three impaired stream reaches, San Pedro River from the Mexican border to Charleston and from Babocomari to Dragoon Wash, are part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. Sampling to create a TMDL report is ongoing.

Effluent Dependent Reaches

- See Figure 3.13-10
- There is one effluent dependent reach, Walnut Gulch, in the vicinity of Tombstone.

Table 3.13-6 Water Quality Exceedences in the Upper San Pedro Basin[1]

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	Spring	13 South	21 East	6	As
2	Well	13 South	21 East	6	As
3	Well	13 South	21 East	6	As
4	Well	13 South	22 East	33	As, Cd, Pb
5	Well	15 South	20 East	31	As, F
6	Well	16 South	20 East	34	As
7	Well	16 South	20 East	34	As
8	Well	16 South	22 East	15	F
9	Well	17 South	20 East	2	TDS
10	Well	17 South	20 East	4	As
11	Well	17 South	20 East	9	As
12	Well	17 South	20 East	9	As
13	Well	17 South	20 East	11	As, F
14	Well	17 South	20 East	11	F
15	Well	17 South	20 East	13	F
16	Well	17 South	20 East	15	As
17	Well	17 South	20 East	16	As
18	Well	17 South	20 East	16	As
19	Well	17 South	20 East	17	As
20	Well	17 South	20 East	22	As, F
21	Well	17 South	20 East	22	As
22	Well	17 South	20 East	22	As, F
23	Well	17 South	20 East	23	F
24	Well	17 South	20 East	36	NO3
25	Well	17 South	20 East	36	F
26	Well	17 South	20 East	36	As
27	Well	17 South	21 East	20	F
28	Well	17 South	21 East	29	F
29	Well	17 South	21 East	31	As, F
30	Well	17 South	21 East	31	NO3
31	Well	18 South	19 East	2	F
32	Well	18 South	20 East	1	As
33	Well	18 South	21 East	6	As, F
34	Well	18 South	21 East	7	As, Be, F
35	Well	18 South	21 East	7	As, Be, F
36	Well	18 South	21 East	7	As, Be, F
37	Well	18 South	21 East	7	F
38	Well	18 South	21 East	8	F
39	Well	18 South	21 East	9	As
40	Well	18 South	21 East	10	As, F
41	Well	18 South	21 East	10	As, F
42	Well	18 South	21 East	16	F
43	Well	18 South	21 East	17	F
44	Well	18 South	21 East	21	F
45	Well	18 South	21 East	28	As
46	Well	18 South	23 East	32	F
47	Well	19 South	21 East	36	As
48	Well	19 South	22 East	27	As

Table 3.13-6 Water Quality Exceedences in the Upper San Pedro Basin (Cont)[1]

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	
49	Well	19 South	22 East	27	As
50	Well	19 South	22 East	27	As
51	Well	20 South	19 East	24	Pb
52	Well	20 South	20 East	6	Hg
53	Well	20 South	20 East	7	Hg
54	Well	20 South	22 East	1	As
55	Well	20 South	22 East	1	As
56	Well	20 South	22 East	11	As, NO3
57	Well	21 South	20 East	16	Pb
58	Well	21 South	20 East	22	Pb
59	Well	21 South	21 East	33	NO3
60	Spring	22 South	19 East	14	Pb
61	Well	22 South	20 East	12	Cd
62	Well	23 South	21 East	7	Cd
63	Well	23 South	21 East	7	Cd
64	Well	23 South	21 East	18	Cd
65	Well	23 South	21 East	18	Cd
66	Well	23 South	22 East	33	Pb
67	Well	24 South	24 East	4	TDS

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[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	San Pedro River (Babocomari Creek to Dragoon Wash)	9	NA	FBC	E. coli
b	Stream	San Pedro River (Dragoon Wash to Tres Alamos Wash)	16	NA	A&W	NO3
c	Stream	San Pedro River (Mexico border to Charleston)	28	NA	A&W	Cu

Source: ADEQ 2005e

Notes:
Because of map scale, feature locations may appear different than the location indicated on the table
NA = Not applicable
[1] Water quality samples collected between 1977 and 2004.
[2] As = Arsenic
Be = Beryllium
Cd = Cadmium
Cu = Copper
F= Fluoride
Pb = Lead
Hg = Mercury
NO3 = Nitrate
TDS = Total Dissolved Solids
[3] A&W = Aquatic and Wildlife
FBC = Full Body Contact

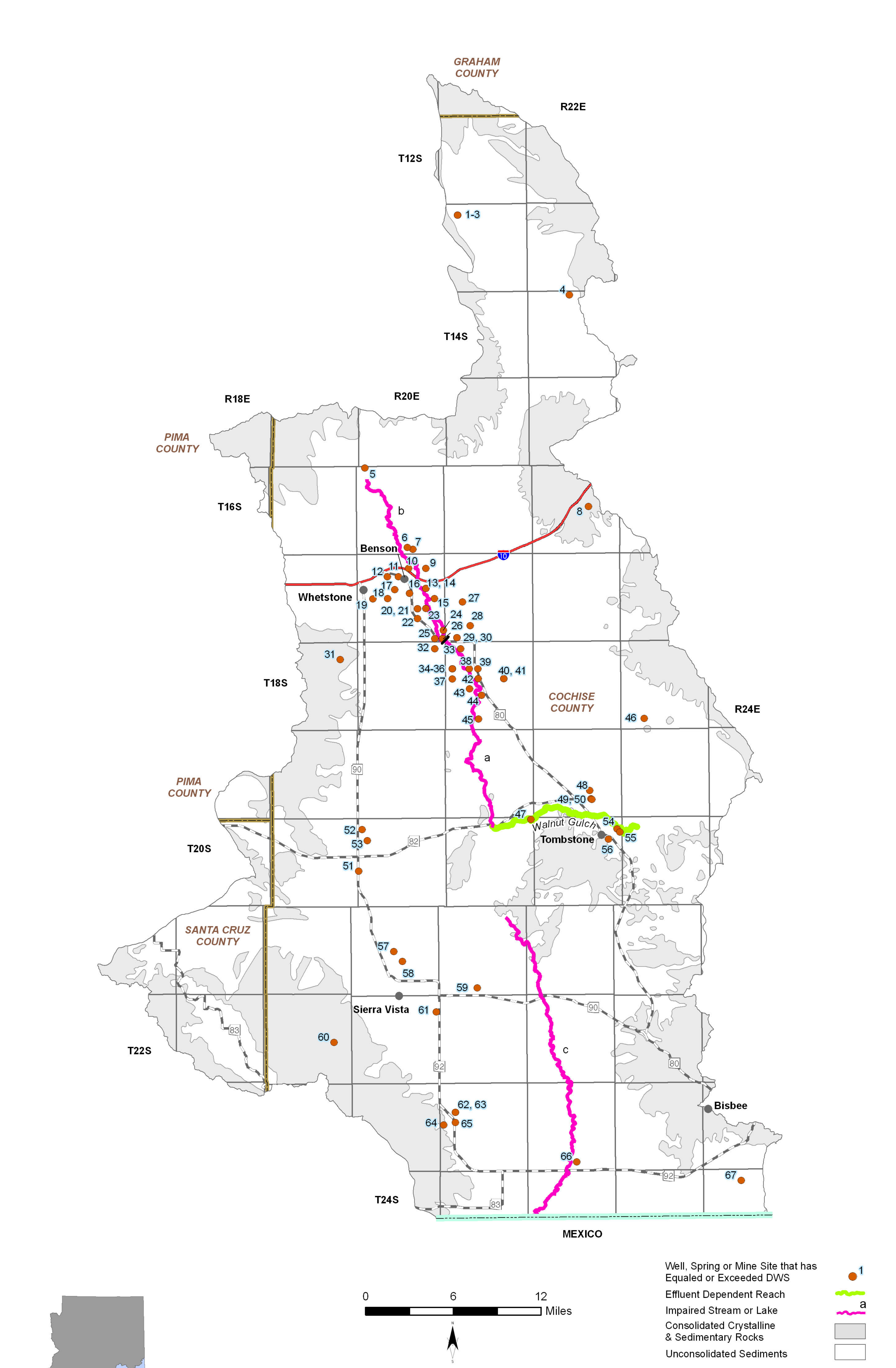


Figure 3.13-10
Upper San Pedro Basin
Water Quality Conditions

3.13.8 Cultural Water Demand in the Upper San Pedro 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 3.13-7. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.13-8. Figure 3.13-11 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.13-7 and Figure 3.13-11.
- Population has increased by about 1,200 residents a year from 1980 to 2000.
- This basin includes the largest population as well as the fastest growing population in the planning area.
- Total groundwater use increased from 1971 to 1985 and remained relatively constant until 2000. Groundwater use has recently declined with an average of 29,100 AFA in the period from 2001-2005.
- Total current surface water diversions are estimated to be comparable to historic diversion volumes with approximately 4,300 AFA diverted in the period from 1991 – 2005. However, actual diversions have not been consistently reported.
- Over 90% of the surface water diversions are for agriculture, however, over 75% of the agricultural water supply is groundwater.
- The majority of agricultural lands are in the vicinity of Benson.
- Most high intensity municipal and industrial demand is found near the population centers of Sierra Vista, Benson, Tombstone and Bisbee.
- Municipal demand constitutes over half the total groundwater use in the period from 1996-2005.
- There is one large inactive mine, the Copper Queen, in the vicinity of Bisbee, and at least two sand and gravel pits in the vicinity of Sierra Vista. All industrial water supply is groundwater.
- As of 2005 there were 5,021 registered wells with a pumping capacity of less than or equal to 35 gpm and 1,106 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.13-8.
- There are nine wastewater treatment facilities in the basin.
- Eight of these facilities serve communities and one is used for industrial purposes.
- The three former Bisbee wastewater facilities were recently consolidated into one new facility at San Jose. This new treatment facility has the capacity to treat 0.81 million gallons of wastewater per day.
- Over 56,000 people are served by these facilities, which generate more than 5,200 acre-feet of effluent per year.
- Two facilities discharged wastewater for irrigation in 2002 or 2003 but recent treatment facility consolidations in Bisbee will affect disposal methods.

- Three facilities discharge wastewater for golf course irrigation.
- Discharge from two facilities recharges the aquifer. Both are designed for the purpose of groundwater recharge. The Sierra Vista facility is permitted by the Department as an Underground Storage Facility and the Fort Huachuca Facility is not.

Table 3.13-7 Cultural Water Demand in the Upper San Pedro Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">Average Annual Demand (in acre-feet)</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th><th rowspan="2">Data Source</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">1,785[2]</td><td rowspan="10">653[2]</td><td colspan="3" rowspan="5">40,500</td><td colspan="3" rowspan="5">4,500</td><td rowspan="20">ADWR (1994a) ADWR (2005a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5">53,500</td><td colspan="3" rowspan="5">4,500</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>50,999</td></tr>
<tr><td>1981</td><td>52,215</td><td rowspan="5">474</td><td rowspan="5">130</td><td colspan="3" rowspan="5">55,500</td><td colspan="3" rowspan="5">4,500</td></tr>
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<tr><td>1985</td><td>57,079</td></tr>
<tr><td>1986</td><td>58,295</td><td rowspan="5">501</td><td rowspan="5">77</td><td colspan="3" rowspan="5">35,500</td><td colspan="3" rowspan="5">4,500</td></tr>
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<tr><td>1988</td><td>60,727</td></tr>
<tr><td>1989</td><td>61,943</td></tr>
<tr><td>1990</td><td>63,159</td></tr>
<tr><td>1991</td><td>64,645</td><td rowspan="5">592</td><td rowspan="5">95</td><td rowspan="5">15,600</td><td rowspan="5">1,600</td><td rowspan="5">16,500</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">4,300</td><td rowspan="15">USGS (2007) ADWR (2005a) ADWR (2008b) ADWR (2008c)</td></tr>
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<tr><td>1995</td><td>70,586</td></tr>
<tr><td>1996</td><td>72,071</td><td rowspan="5">765</td><td rowspan="5">76</td><td rowspan="5">17,400</td><td rowspan="5">1,600</td><td rowspan="5">15,000</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">4,300</td></tr>
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<tr><td>1998</td><td>75,042</td></tr>
<tr><td>1999</td><td>76,528</td></tr>
<tr><td>2000</td><td>78,013</td></tr>
<tr><td>2001</td><td>79,945</td><td rowspan="5">904</td><td rowspan="5">75</td><td rowspan="5">17,300</td><td rowspan="5">1,900</td><td rowspan="5">9,900</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">4,300</td></tr>
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<tr><td>2003</td><td>83,808</td></tr>
<tr><td>2004</td><td>85,739</td></tr>
<tr><td>2005</td><td>87,671</td></tr>
<tr><td>2010</td><td>97,329</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2020</td><td>113,044</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2030</td><td>125,700</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>5,021</td><td>1,106</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported.
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent.
[2] Includes all wells through June 1980.

Table 3.13-8 Effluent Generation in the Upper San Pedro 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	Golf Course/Turf Irrigation	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other			
Apache Nitrogen Products	Private	Industrial Facility	NA	NA					X					NA		
Benson WWTF	Town of Benson	Benson	3,505	560				San Pedro						Adv.Trt.I	1,206	2005
Fort Huachuca WWTP	US Army	Ft.Huachuca	8,414[1]	1,053				Mountain View				X		Adv.Tr.II	NA	2003
Huachuca City	City of Huachuca City	Huachuca City	600	150		X								Secondary	1,195	2002
Naco WWTF	Naco SD	Naco	846	83		X								Secondary	NA	2000
San Jose WWTF[2]	City of Bisbee	Bisbee	4,900	438	Greenbush Draw	X	X	Turquoise Valley[3]						Secondary	1,190	2007
Sierra Vista WWTP	City of Sierra Vista	Sierra Vista	36,000	2,800					X			P		Adv.Tr.II	4,800	2002
Southland Sanitation	Private	Sierra Vista	282	63		X	X							Secondary	NA	2007
Tombstone WWTP	City of Tombstone	Tombstone	1,465	112	Walnut Gulch									Secondary	300	2000
Total			**56,012**	**5,259**												

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
P = Permited Underground Storage Facility
NA: Data not currently available to ADWR
WWTF: Wastewater Treatment Facility
WWTP: Wastewater Treatment Plant
SD: Sanitation District
Adv Tr I: Advanced treatment level I
Adv. Tr. II: Advanced treatment level II
[1]Population varies due to temporary residents
[2]Consolidation of the city's 3 WWTF's in 2006
[3]Sometime in 2009, approximately 100 AF will be delivered for irrigation

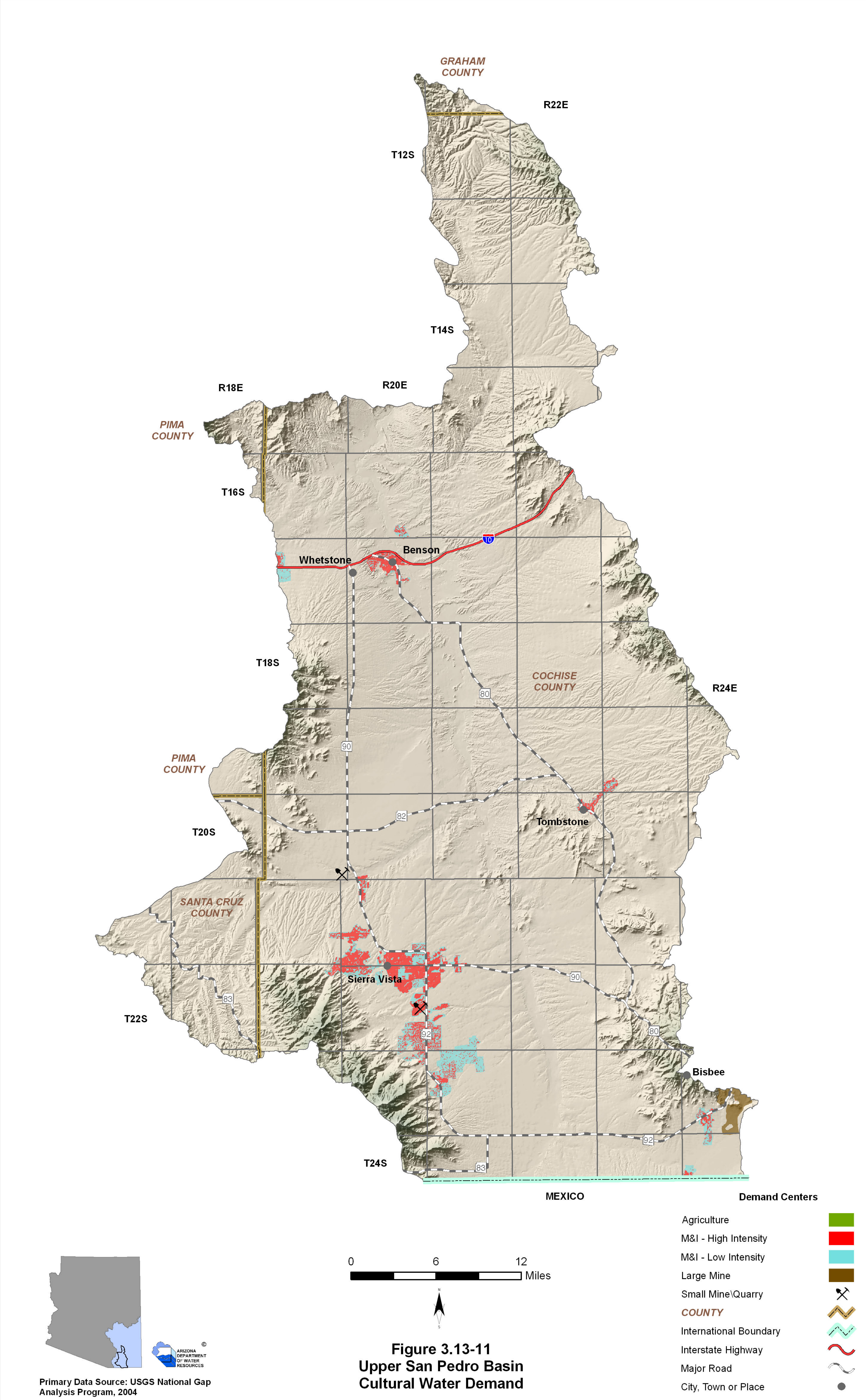

Figure 3.13-11
Upper San Pedro Basin
Cultural Water Demand

3.13.9 Water Adequacy Determinations in the Upper San Pedro 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 3.13-9A and B for water reports and analysis of adequate water supply. Designated water provider information is shown in Table 3.13-9C with date of application, date the designation was issued and projected or annual estimated demand. Figure 3.13-12 shows the locations of subdivisions and designated providers keyed to the Table A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All lots receiving an adequacy determination are in Cochise County. Two hundred and two water adequacy determinations have been made through December 2008. Of the 24,923 lots in 201 subdivisions for which lot information is available, 18,218 lots, or 73%, were determined to be adequate.
- In 1984, the Department began issuing determinations of inadequate water supply in the Sierra Vista Sub-basin due to lack of legal availability. At that time, the Gila River adjudication drew into question whether water withdrawn from certain wells would be considered groundwater or surface water. In 1993, the Department reexamined its position and determined that legal availability is based on the current legal right to use the water, and not on an adjudication determination that has yet to be made. Therefore, since 1993, the Department has not issued determinations that water supplies are inadequate in the Sierra Vista Sub-basin solely for lack of legal availability related to the possible future decisions in the Gila River adjudication.
- Other reasons for an inadequacy determination were because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination and water quality.
- Eight analyses of adequate water supply, for a total of 7,220 lots, have been issued in this basin.
- There are two designated water providers, Bachman Springs Utility Company and City of Benson. Total projected or annual estimated demand for the two providers is 14,686 acre-feet.

Table 3.13-9 Adequacy Determinations in the Upper San Pedro 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	Bella Sonoma	Cochise	21 South	20 East	35	45	53-401926	Adequate		8/3/2006	Bella Vista Water Company
3	Buena Loma #112	Cochise	22 South	21 East	7	7	53-500364	Inadequate	B	2/7/1985	Pueblo Del Sol Water Company
4	Buena Vista Ranchettes	Cochise	17 South	19 East	5	20	53-500368	Inadequate	B	7/16/1987	Dry Lot Subdivision
5	Campstone	Cochise	22 South	21 East	5	84	53-402082	Adequate		9/11/2006	Bella Vista Water Company
6	Campstone	Cochise	21 South	20 East	5, 6, 8	900	53-500388	Inadequate	B	8/17/1987	Town of Huachuca City
7	Campus Drive Business Park	Cochise	21 South	21 East	31	18	53-400029	Adequate		3/10/1999	Bella Vista Water Company
8	Canyon De Flores , Phase II	Cochise	22 South	20 East	23, 24	355	53-400908	Adequate		6/2/2003	Pueblo del Sol Water Company
9	Canyon De Flores Phase 1 - C	Cochise	22 South	20 East	24	69	53-400597	Adequate		9/27/2001	Pueblo del Sol Water Company
10	Canyon De Flores Phase ID	Cochise	22 South	20 East	24	64	53-400659	Adequate		1/16/2002	Pueblo del Sol Water Company
11	Canyon de Flores Phase E	Cochise	22 South	20 East	24	52	53-400686	Adequate		5/8/2002	Pueblo del Sol Water Company
12	Canyon de Flores Phase 1F	Cochise	22 South	20 East	24	61	53-400842	Adequate		11/2/2002	Pueblo Del Sol Water Company
13	Carmel	Cochise	21 South	21 East	31	54	53-500398	Inadequate	B	3/3/1987	Bella Vista Water Company
14	Casa Antigua Condominiums	Cochise	22 South	20 East	12	152	53-402097	Adequate		9/21/2006	Arizona Water Company - Sierra Vista
15	Casitas Place #2	Cochise	22 South	21 East	6	40	53-500421	Inadequate	B	6/24/1985	Bella Vista Water Company
16	Casitas Place Condominiums	Cochise	22 South	21 East	6	40	53-500422	Adequate		5/26/1983	Southwest Water Company
17	Chaparral Village North	Cochise	22 South	21 East	5	549	53-400847	Adequate		12/5/2002	Bella Vista Water Company
18	Charleston Village	Cochise	21 South	21 East	29	185	53-500448	Adequate		11/3/1993	Bella Vista Water Company
19	Cimmaron Place	Cochise	21 South	20 East	35	47	53-401496	Adequate		12/6/2004	Bella Vista Water Company
20	Circle G at Ramsey Ranch	Cochise	23 South	21 East	6	437	53-500459	Adequate		2/24/1995	East Slope Water Company
21	Circle S Ranches	Cochise	23 South	21 East	17	36	53-500460	Inadequate	B	12/12/1989	Horseshoe Ranch Water Company
22	Cochise Commercial Center	Cochise	22 South	21 East	7	15	53-500476	Inadequate	B	3/21/1986	Pueblo Del Sol Water Company
23	Cochise Terrace	Cochise	17 South	20 East	18	308	53-300410	Adequate		1/20/1998	City of Benson
24	Cochise Vista	Cochise	20 South	20 East	31	45	53-500478	Adequate		6/25/1973	Town of Huachuca City
25	Cochise Vista Condominiums	Cochise	22 South	21 East	7	17	53-500479	Adequate		8/11/1983	Pueblo Del Sol Water Company
26	Compass Point	Cochise	23 South	22 East	19	30	53-400685	Adequate		4/2/2002	Dry Lot Subdivision
27	Copper Pointe Estates	Cochise	22 South	20 East	12	52	53-400729	Adequate		10/22/2002	Arizona Water Company
28	Copper Sky Estates	Cochise	22 South	20 East	11, 12	180	53-400744	Adequate		7/15/2002	Arizona Water Company - Sierra Vista
29	Corona del Sol	Cochise	22 South	21 East	7	9	53-500510	Inadequate	B	12/17/1984	Pueblo Del Sol Water Company
30	Coronado Estates	Cochise	20 South	20 East	18, 19	7	53-500511	Inadequate	B	3/20/1989	Cochise Water Company

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

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						
31	Cottonwoods of San Pedro, The	Cochise	23 South	22 East	16	90	53-500520	Inadequate	A1,B	2/1/1994	Dry Lot Subdivision
32	Coventry Estates	Cochise	21 South	20 East	34	20	53-500200	Adequate		11/4/1983	Bella Vista Water Company
33	Covey Run	Cochise	23 South	21 East	21	26	53-401507	Adequate		11/14/2005	Dry Lot Subdivision
34	Crestview	Cochise	23 South	24 East	29	54	53-500540	Inadequate	A1	6/8/1993	AWC-Bisbee system
35	Crossroads Commerce Center 2001	Cochise	21 South	21 East	31	19	53-400501	Adequate		5/8/2001	Bella Vista Water Company
36	Deer Ridge Estates	Cochise	23 South	21 East	27	20	53-300294	Adequate		5/7/1997	Dry Lot Subdivision
37	Desert Mist Commerce Center	Cochise	22 South	21 East	5	52	53-500572	Inadequate	B	3/9/1989	Bella Vista Water Company
38	Desert Shadows #2A	Cochise	22 South	21 East	5	51	53-500580	Inadequate	B	1/7/1993	Bella Vista Water Company
39	Desert Shadows #2B	Cochise	22 South	21 East	5	33	53-500581	Inadequate	B	3/15/1994	Bella Vista Water Company
40	Eagle Ridge #1	Cochise	22 South	20 East	24	59	53-500595	Inadequate	B	10/14/1986	Pueblo Del Sol Water Company
41	Eagle Ridge #2	Cochise	22 South	20 East	24	155	53-500596	Inadequate	B	7/9/1987	Pueblo Del Sol Water Company
42	El Rancho Estates	Cochise	23 South	24 East	29	39	53-501727	Inadequate	A1	7/10/1989	Arizona Water Company
43	Executive Acres	Cochise	23 South	20 East	1	26	53-500627	Inadequate	A1	5/2/1985	Dry Lot Subdivision
44	Fairway Villas	Cochise	22 South	20 East	13	35	53-500637	Inadequate	B	4/13/1993	Pueblo Del Sol Water Company
45	Foothills Ranch	Cochise	23 South	21 East	7	49	53-500665	Inadequate	B	10/28/1992	Nicksville Water Company
46	Foothills Ranch, #4,5,6	Cochise	23 South	21 East	18	53	53-500666	Adequate		1/31/1995	Bella Vista Water Company
47	Gatewood	Cochise	21 South	20 East	35	75	53-401533	Adequate		11/5/2004	Bella Vista Water Company
48	Golden Acres Commercial #1	Cochise	22 South	21 East	19	9	53-500709	Adequate		7/22/1976	Southland Utilities Company
49	Golden Acres Mobile Home Park #2	Cochise	22 South	21 East	17	27	53-500710	Adequate		7/21/1981	Southland Utilities Company
50	Golden Acres Mobile Home Park #3	Cochise	22 South	21 East	19	278	53-500711	Adequate		6/17/1974	Southland Utilities Company
51	Golden Meadows #3	Cochise	22 South	21 East	30	8	53-500719	Adequate		8/9/1979	Southland Utilities Company
52	Golden Vistas	Cochise	22 South	21 East	30	59	53-300049	Adequate		3/29/1996	Southland Utilities Company
53	Golden Vistas, Phases 2 & 3	Cochise	22 South	21 East	29	120	53-400319	Adequate		4/14/2000	Southland Utilities Company
54	Grandeur Carmel	Cochise	21 South	21 East	31	54	53-500724	Adequate		10/26/1993	Bella Vista Water Company
55	Greenbriar Estates, Lots 1-32	Cochise	22 South	20 East	13	32	53-300274	Adequate		4/11/1997	Pueblo Del Sol Water Company
56	Greenways, The	Cochise	22 South	20 East	13	21	53-500763	Adequate		11/23/1981	Pueblo Del Sol Water Company
57	Heritage Park	Cochise	17 South	20 East	4	89	53-500783	Inadequate	A1,B	7/31/1984	Konen Water Company
58	Highland Park Estates	Cochise	22 South	20 East	20	110	53-400710	Adequate		5/14/2002	Arizona Water Company
59	Hobby Horse Ranch	Cochise	22 South	21 East	23, 26	35	53-300035	Adequate		7/20/1995	Dry Lot Subdivision
60	Hodgins Acres	Cochise	20 South	20 East	7	129	53-500795	Inadequate	B	7/17/1990	Whetstone Water Improvement District

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

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						
61	Holiday at Pueblo Del Sol	Cochise	22 South	21 East	19	191	53-401627	Adequate		6/7/2005	Pueblo Del Sol Water Company
62	Horseshoe Ranch Mobile Home Estates	Cochise	23 South	21 East	17	68	53-500805	Inadequate	B	10/23/1989	Horseshoe Ranch Water Company
63	Huachuca Commercial Center	Cochise	20 South	21 East	31	NA	NA	Inadequate	D	8/17/1987	Town of Huachuca City
64	Huachuca Commercial Center B	Cochise	20 South	21 East	5, 6	47	53-500806	Inadequate	D	8/17/1987	Town of Huachuca City
65	Huachuca Mountain Estates	Cochise	22 South	20 East	10	370	53-500807	Adequate		8/22/1975	Arizona Water Company
66	Huachuca Mountain Village,A&B	Cochise	22 South	20 East	25	208	53-500808	Adequate		5/25/1977	Pueblo Del Sol Water Company
67	Huachuca Terrace	Cochise	23 South	24 East	29	9	53-500809	Inadequate	A1	6/13/1987	AWC-Bisbee system
68	Ironhorse Village	Cochise	17 South	20 East	16	48	53-300394	Adequate		12/15/1997	City of Benson
69	Kinjockity Ranch	Cochise	23 South	21 East	32, 33, 34	281	53-401824	Adequate		10/7/2005	Bella Vista Water Company
70	La Marquesa	Cochise	23 South	21 East	21	103	53-700214	Adequate		8/10/2007	Bella Vista Water Company
71	La Pradera Estates	Cochise	23 South	21 East	21	26	53-402012	Adequate		7/6/2006	Dry Lot Subdivision
72	La Terraza Phase B	Cochise	22 South	20 East	24	33	53-400712	Adequate		8/7/2002	Pueblo Del Sol Water Company
73	La Terraza, Phase C	Cochise	22 South	20 East	23	28	53-401003	Adequate		9/17/2003	Pueblo Del Sol Water Company
74	Legends at Valiente I	Cochise	21 South	20 East	35	104	53-401337	Adequate		7/7/2004	Bella Vista Water Company
75	Legends at Valiente II	Cochise	21 South	20 East	35	100	53-401583	Adequate		2/4/2005	Bella Vista Water Company
76	Linda Vista	Cochise	23 South	21 East	8	76	53-500908	Adequate		2/27/1996	Nicksville Water Company
77	Loma Catarina	Cochise	17 South	20 East	15	20	53-500910	Adequate		11/4/1974	City of Benson
78	London Square #2	Cochise	21 South	20 East	34	42	53-500913	Adequate		8/19/1994	Bella Vista Water Company
80	Los Ranchos Subdivision	Cochise	23 South	21 East	25, 26	70	53-400238	Adequate		2/15/2000	Dry Lot Subdivision
81	McCormick Place	Cochise	22 South	21 East	6	4	53-500941	Adequate		9/13/1983	Southwest Water Company
82	Meadows, The	Cochise	22 South	20 East	3	406	53-500946	Adequate		6/12/1974	Southwest Water Company
83	Mesa Mountain Northeast	Cochise	21 South	21 East	33	20	53-500967	Inadequate	B	11/4/1991	Arizona Water Company
84	Mesa Verde Estates	Cochise	22 South	21 East	5	66	53-401257	Adequate		1/25/2005	Bella Vista Water Company
85	Mesa Verde/Mountain View	Cochise	22 South	21 East	5	127	53-500970	Adequate		3/15/1994	Bella Vista Water Company
86	Miracle Valley	Cochise	23 South	22 East	31	23	53-300271	Inadequate	C	6/3/1997	Miracle Valley Water Company
87	Mission Coronado Estates	Cochise	22 South	21 East	19	97	53-500988	Adequate		10/23/1979	Southland Utilities Company
88	Mission Hills Estates	Cochise	22 South	21 East	7	129	53-500990	Inadequate	B	4/13/1993	Pueblo Del Sol Water Company
89	Mission Shadows	Cochise	22 South	20 East	13	71	53-500991	Inadequate	B	3/6/1987	Pueblo Del Sol Water Company
90	Montebello	Cochise	21 South	21 East	31	39	53-501008	Adequate		6/23/1981	Bella Vista Water Company
91	Mountain Ridge	Cochise	22 South	20 East	24	364	53-501021	Inadequate	B	4/13/1993	Pueblo Del Sol Water Company

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

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						
92	Mountain Shadows	Cochise	22 South	20 East	24, 25	244	53-501022	Inadequate	B	2/12/1986	Pueblo Del Sol Water Company
93	Mountain Shadows #A	Cochise	22 South	20 East	25	82	53-501024	Adequate		7/9/1987	Pueblo Del Sol Water Company
94	Mountain Shadows "F", 1-40	Cochise	22 South	20 East	25, 26	40	53-300253	Adequate		2/19/1997	Pueblo Del Sol Water Company
95	Mountain View Terrace	Cochise	22 South	20 East	13, 24	169	53-501036	Inadequate	D	8/12/1987	Pueblo Del Sol Water Company
96	Mustang Heights	Cochise	20 South	19 East	14	33	53-501044	Adequate		5/31/1974	Mustang Water Company
97	Northpark	Cochise	21 South	20 East	35	59	53-501057	Inadequate	A1	7/30/1992	Bella Vista Water Company
98	Oakmont Subdivision	Cochise	22 South	20 East	12	87	53-500083	Adequate		8/27/2007	Arizona Water Company - Sierra Vista
99	Oasis Condominiums	Cochise	22 South	21 East	6	184	53-501069	Inadequate	B	5/23/1985	Southwest Water Company
100	Ocotillo Terrace Subdivision, 1-22	Cochise	21 South	20 East	35	22	53-300422	Adequate		5/27/1998	Bella Vista Water Company
101	Ocotillo Villas	Cochise	21 South	20 East	35	28	53-300023	Adequate		6/28/1995	Bella Vista Water Company
102	Park Place Townhouses	Cochise	23 South	24 East	29	36	53-501112	Inadequate	B	7/17/1985	AWC-Bisbee system
103	Patton Subdivision	Cochise	21 South	20 East	8	10	53-501127	Adequate		7/3/1979	Town of Huachuca City
105	Pueblo Las Brisas	Cochise	21 South	20 East	35	16	53-401946	Adequate		4/27/2006	Bella Vista Water Company
106	Pueblo del Sol	Cochise	22 South	21 East	7	127	53-501215	Adequate		6/24/1974	Southwest Water Company
107	Pueblo del Sol #5,6	Cochise	22 South	21 East	7	48	53-501217	Adequate		10/15/1974	Southwest Water Company
108	Pueblo del Sol #7	Cochise	22 South	21 East	5, 6	112	53-501218	Adequate		3/12/1976	Southwest Water Company
109	Pueblo del Sol #8	Cochise	22 South	21 East	6, 7	115	53-501219	Adequate		6/21/1977	Pueblo del Sol Water Company
110	Pueblo del Sol Tract 109	Cochise	22 South	21 East	6, 7	124	53-501220	Adequate		4/18/1980	Southwest Water Company
111	Pueblo del Sol Tract 110	Cochise	22 South	21 East	5, 6, 7	178	53-501221	Adequate		4/23/1982	Southwest Water Company
112	Pueblo del Sol Tract 111	Cochise	22 South	20 East	13	278	53-501222	Adequate		9/8/1981	Pueblo Del Sol Water Company
113	Pueblo del Sol Tract 112	Cochise	22 South	21 East	7	538	53-501223	Adequate		10/15/1982	Pueblo Del Sol Water Company
114	Pueblo del Sol Tract 113	Cochise	22 South	21 East	7	6	53-501224	Adequate		10/15/1982	Pueblo Del Sol Water Company
115	Pueblo del Sol Tract 115	Cochise	22 South	21 East	7	360	53-501225	Inadequate	B	11/30/1984	Pueblo Del Sol Water Company
116	Pueblo del Sol Co. Club Estate	Cochise	22 South	20 East	13	1165	53-501226	Adequate		10/23/1974	Pueblo Del Sol Water Company
117	Quail Hills	Cochise	21 South	20 East	5, 8	50	53-501233	Adequate		3/22/1978	Town of Huachuca City
118	Quail Hollow	Cochise	21 South	20 East	35	149	53-501235	Adequate		12/30/1982	Bella Vista Water Company
119	Quail Hollow #2	Cochise	21 South	20 East	29	5	53-501236	Adequate		12/8/1993	Bella Vista Water Company
120	Radine Ridge	Cochise	17 South	20 East	15	66	53-501243	Adequate		10/1/1992	City of Benson
121	Ranchitos Los Alamos #2	Cochise	17 South	20 East	4	64	53-501251	Adequate		1/2/1980	K-7 Development, Inc.

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

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						
122	Rancho Arizona Subdivision	Cochise	23 South	22 East	29	48	53-401225	Adequate		12/1/2004	Dry Lot Subdivision
123	Ranchos Carmela Estates	Cochise	21 South	20 East	25	44	53-501277	Adequate		10/23/1979	Bella Vista Water Company
124	Ranchos Carmella #3,4	Cochise	21 South	20 East	25	68	53-501279	Adequate		11/3/1993	Bella Vista Water Company
125	Reflections at Valiente	Cochise	21 South	20 East	35	146	53-401584	Adequate		2/4/2005	Bella Vista Water Company
126	Remington Park East	Cochise	22 South	20 East	11, 12	107	53-400757	Adequate		7/12/2002	Arizona Water Company - Sierra Vista
127	Rincon View Subdivision, Lots 1-59	Cochise	17 South	19 East	5, 8	59	53-400865	Adequate		1/24/2003	Mescal Lakes Water Systems Inc
128	Rio Corte Estates	Cochise	23 South	22 East	17	22	53-700351	Adequate		7/13/2007	Dry lot Subdivision
129	Rio Mesa	Cochise	22 South	21 East	5	139	53-700216	Adequate		8/10/2007	Bella Vista Water Company
130	San Pedro Estates	Cochise	16 South	20 East	35	36	43-401638	Adequate		5/6/2005	Pomerene Domestic Water Improvement District
133	San Pedro Terrace	Cochise	23 South	22 East	7	11	53-300117	Adequate		6/25/1996	San Pedro Terrace Homeowners Assoc.
134	Sandalwood	Cochise	22 South	20 East	2	36	53-501367	Inadequate	B	3/31/1988	Bella Vista Water Company
135	Seminole Winds	Cochise	21 South	20 East	8	93	53-501384	Adequate		4/29/1994	Town of Huachuca City
136	Si Tengo	Cochise	17 South	20 East	15	6	53-501392	Adequate		12/3/1980	City of Benson
137	Sierra Bonita Estates	Cochise	23 South	24 East	28	174	53-501395	Adequate		6/15/1979	AWC-Bisbee system
138	Sierra Bonita Estates B	Cochise	23 South	24 East	28	50	53-400326	Inadequate	A1	4/24/2000	AWC-Bisbee system
139	Sierra Bonita Ranches	Cochise	22 South	21 East	11	30	53-400937	Inadequate	C	11/3/2003	Arizona Water Company
140	Sierra Carmichael Condos	Cochise	21 South	20 East	34	120	53-501396	Inadequate	B	3/24/1986	Southwest Water Company
141	Sierra Charles Condominiums	Cochise	21 South	20 East	34	120	53-501397	Adequate		3/24/1986	Bella Vista Water Company
142	Sierra Court	Cochise	21 South	20 East	34	8	53-501398	Adequate		5/9/1994	Bella Vista Water Company
143	Sierra Grande	Cochise	24 South	21 East	14	2400	53-501401	Adequate		7/18/1973	Unformed Company by Developer
144	Sierra Shadows	Cochise	17 South	20 East	15	6	53-300563	Adequate		12/8/1998	City of Benson
145	Sierra Springs	Cochise	22 South	21 East	6	70	53-501402	Adequate		1/19/1995	Bella Vista Water Company
146	Sierra Tacoma Condos	Cochise	21 South	20 East	34	76	53-501403	Inadequate	B	3/24/1986	Bella Vista Water Company
147	Sierra Vista Estates #2	Cochise	22 South	21 East	31	4	53-501405	Inadequate	B	9/13/1989	East Slope Water Company
148	Sierra Vista Industrial Park	Cochise	21 South	20 East	31	34	53-501406	Adequate		6/15/1979	Bella Vista Water Company
149	Silverado	Cochise	22 South	20 East	11	90	53-401876	Adequate		11/18/2005	Arizona Water Company - Sierra Vista
150	Skov Estates Subdivision	Cochise	17 South	20 East	26	85	43-700528	Adequate		7/22/2008	Undetermined
152	Somerset	Cochise	22 South	20 East	1	16	53-501434	Inadequate	B	4/15/1988	Arizona Water Company
153	Sonora Verde Estates	Cochise	16 South	20 East	35	43	53-501440	Inadequate	B	12/1/1987	Pomerene Domestic Water Improvement District

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

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						
154	St. David Countryside Estates, 1-28	Cochise	17 South	21 East	32	28	53-501448	Adequate		4/2/1997	Saint David Water Association
155	St. David Townsite	Cochise	18 South	21 East	16	32	53-501449	Inadequate	B	2/24/1989	Stratman Water Company
156	Strathan Addition	Cochise	18 South	21 East	9	21	53-501460	Adequate		4/1/1975	Saint David Water Association
157	Sulger City (9/1974)	Cochise	20 South	20 East	6	13	53-501471	Adequate		9/26/1974	Sulger Water Company
158	Sulger City (1976)	Cochise	20 South	20 East	6	10	53-501467	Adequate		1/14/1976	Watermill Water Company
159	Sulger City (1982) Lots 19-32	Cochise	20 South	20 East	6	14	53-501468	Adequate		10/14/1982	Windmil Water Company
160	Sulger City (1993) Lots 1-33	Cochise	20 South	20 East	6	33	53-501469	Adequate		8/30/1993	Dry Lot Subdivision
161	Sulger City Lots	Cochise	20 South	20 East	6	30	53-501472	Adequate		7/24/1980	Dry Lot Subdivision
162	Sulger City No. 2	Cochise	20 South	20 East	6	21	53-300306	Adequate		6/24/1997	Sulger Water Company
163	Summit Heights	Cochise	22 South	20 East	11	187	53-401877	Adequate		3/14/2006	Arizona Water Company - Sierra Vista
164	Summit, The/Sierra Vista	Cochise	22 South	20 East	11, 12	1499	53-501476	Inadequate	D	11/2/1984	Arizona Water Company - Sierra Vista
165	The Estates at Willow Springs, Lots 1-110 & Tracts A-O	Cochise	19 South	22 East	28, 29	110	53-402015	Inadequate	A1	9/11/2007	Lucky Hills Water Co.
166	The Oaks	Cochise	23 South	21 East	20, 29	113	53-700419	Inadequate	A1	11/8/2007	Bella Vista Water Company
167	The Ranch	Cochise	21 South	21 East	30	226	53-400537	Adequate		7/20/2001	Bella Vista Water Company
168	The Ranch at Tombstone	Cochise	21 South	22 East	9, 10, 11	516	43-700559	Adequate		9/25/2008	NA
169	Tierra Del Sol Estates	Cochise	23 South	22 East	17	8	53-400207	Adequate		12/8/1999	Dry Lot Subdivision
170	Tierra de Las Flores	Cochise	23 South	24 East	33	142	53-501545	Inadequate	A1	4/21/1989	AWC-Bisbee system
171	Tombstone Territorial Estates	Cochise	20 South	22 East	1	419	53-501562	Adequate		7/26/1973	City of Tombstone
172	Tombstone Territory Estates #1	Cochise	20 South	22 East	1	19	53-501563	Adequate		4/24/1989	City of Tombstone
173	Tombstone Villas	Cochise	20 South	22 East	2	114	53-501564	Inadequate	A1	2/25/1986	City of Tombstone
174	Town & Country Estates	Cochise	22 South	20 East	11	80	53-501568	Adequate		7/18/1973	Arizona Water Company
175	Town & Country Estates #3,4	Cochise	22 South	20 East	11	90	53-501569	Adequate		3/18/1975	Arizona Water Company
176	Town & Country Estates 5,11,12	Cochise	22 South	20 East	10, 11	183	53-501573	Adequate		10/26/1976	Arizona Water Company
177	Town & Country Estates #6	Cochise	22 South	20 East	11	99	53-501570	Adequate		6/21/1977	Arizona Water Company
178	Town & Country Estates #7	Cochise	22 South	20 East	11	87	53-501571	Adequate		2/21/1978	Arizona Water Company
179	Town & Country Estates #8	Cochise	22 South	20 East	11	52	53-501572	Adequate		8/4/1976	Arizona Water Company
180	Townsite of Naco	Cochise	24 South	24 East	18, 19	443	53-501575	Inadequate	A1	1/28/1985	Naco Water Company
181	Tract 114, Lots 1-35	Cochise	22 South	20 East	13	35	53-501576	Adequate		8/23/1994	Pueblo Del Sol Water Company
182	Tract 117, Lots 1-67	Cochise	22 South	20 East	13	67	53-501577	Adequate		4/13/1994	Pueblo Del Sol Water Company
183	Trinity Terrace, Lots 1-17	Cochise	18 South	21 East	16, 17	17	53-300503	Adequate		8/5/1998	Dry Lot Subdivision
184	Villa La Casa	Cochise	22 South	21 East	7	4	53-501627	Inadequate	B	6/21/1985	Pueblo Del Sol Water Company
185	Villa del Rio #1	Cochise	22 South	20 East	3	20	53-501620	Adequate		11/12/1975	Southwest Water Company

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

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						
186	Villa del Rio #2	Cochise	22 South	20 East	3	68	53-501622	Adequate		12/14/1976	Southwest Water Company
187	Village Green	Cochise	22 South	20 East	1	141	53-501633	Inadequate	B	11/13/1984	Arizona Water Company - Sierra Vista
188	Village Park	Cochise	22 South	20 East	18	40	53-501635	Adequate		3/12/1976	Arizona Water Company - Sierra Vista
189	Village, The	Cochise	22 South	20 East	2	162	53-501636	Adequate		1/26/1976	Cochise Enterprises, Inc.
190	Villas San Luis	Cochise	21 South	20 East	34	28	53-501638	Adequate		2/9/1994	Bella Vista Water Company
191	Villas de San Andreas	Cochise	21 South	20 East	35	79	53-501637	Adequate		6/21/1977	Bella Vista Water Company
192	Vista Village #2	Cochise	21 South	20 East	35	67	53-501657	Adequate		7/27/1973	Bella Vista Water Company
193	Vista Village #3	Cochise	21 South	20 East	35	73	53-501658	Adequate		9/16/1976	Bella Vista Water Company
194	Vista Village #5	Cochise	21 South	20 East	35	122	53-501659	Adequate		9/29/1977	Bella Vista Water Company
195	Vista Village #6	Cochise	21 South	20 East	35	105	53-501660	Adequate		5/2/1979	Bella Vista Water Company
196	Vista del Oro	Cochise	23 South	21 East	20	44	53-300285	Adequate		5/22/1997	Bella Vista Water Company
198	Vistaview Estates	Cochise	22 South	21 East	5	356	53-400050	Adequate		4/20/1999	Bella Vista Water Company
200	Walnut Valley Ranch	Cochise	19 South	22 East	32	43	53-700361	Adequate		7/11/2007	Lucky Hills Water Co.
201	Whetstone Hills	Cochise	20 South	20 East	7	38	53-300377	Adequate		11/10/1997	Whetstone Water Improvement District
202	Whetstone Mesa Estates #5 (1995)	Cochise	20 South	20 East	7	15	53-300040	Adequate		7/24/1995	Whetstone Water Improvement District
203	White Wing	Cochise	22 South	20 East	35	114	53-501681	Adequate		2/5/1980	Antelope Run Water Company
204	Wild Horse	Cochise	23 South	21 East	29	77	53-300076	Adequate		1/4/1996	Bella Vista Water Company
205	Wild Horse #2	Cochise	23 South	21 East	28	79	53-300152	Adequate		6/12/1996	Bella Vista Water Company
206	Windmere Subdivision	Cochise	22 South	20 East	2	65	53-501694	Adequate		10/4/1978	Bella Vista Water Company
207	Windsong	Cochise	22 South	20 East	1	158	53-501695	Adequate		10/3/1978	Arizona Water Company - Sierra Vista
208	Winterhaven Country Club Estates	Cochise	22 South	20 East	14	438	53-300166	Adequate		11/4/1996	Pueblo Del Sol Water Company
209	Winterhaven, Phases 2E, 3,4A and 5	Cochise	22 South	20 East	14	438	53-401002	Adequate		9/17/2003	Pueblo Del Sol Water Company
210	Y-Lightning Subdividion	Cochise	23 South	21 East	4	30	53-401852	Adequate		11/14/2005	Dry Lot Subdivision

Table 3.13-9 Adequacy Determinations in the Upper San Pedro Basin[1] (Cont)

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
2	Benson Farms Estates	Cochise	16 South	20 East	33	208	43-700443	7/28/2008	Undetermined
79	Los Ranchitos Estates	Cochise	17 South	20 East	4	43	43-700442	7/28/2008	Undetermined
104	Pomerene River Estates	Cochise	16 South	20 East	21, 28	637	43-700411	12/4/2007	NA
131	San Pedro Partners Master Planned Community	Cochise	17 South	19 East	13	850	43-401730	7/13/2005	NA
132	San Pedro Partners Master-Planned Community	Cochise	17 South	19 East	13	225	43-402189	7/3/2007	City of Benson
151	Smith Ranch	Cochise	17 South	19 East	14, 15, 22, 23, 26, 27	4859	43-401628	12/12/2005	Smith Ranch Water Co.
197	Vistaview Estates	Cochise	22 South	21 East	4	356	43-300190	10/28/1996	NA
199	Walnut Valley Ranch	Cochise	19 South	22 East	32	42	43-402021	5/18/2006	Lucky Hills Water Co.

C. Designated Adequate Water Supply

Map Key	Water Provider Name	County	Designation No.	Projected or Annual Estimated Demand	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	Bachman Springs Utility Company	Cochise	40-401893.0000	1,212.62	10/4/2005	6/5/2006	2014
b	City of Benson	Cochise	41-401803.0001	13,474	4/19/2007	6/14/2008	2021

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 unavailable; 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= Data not currently available to ADWR

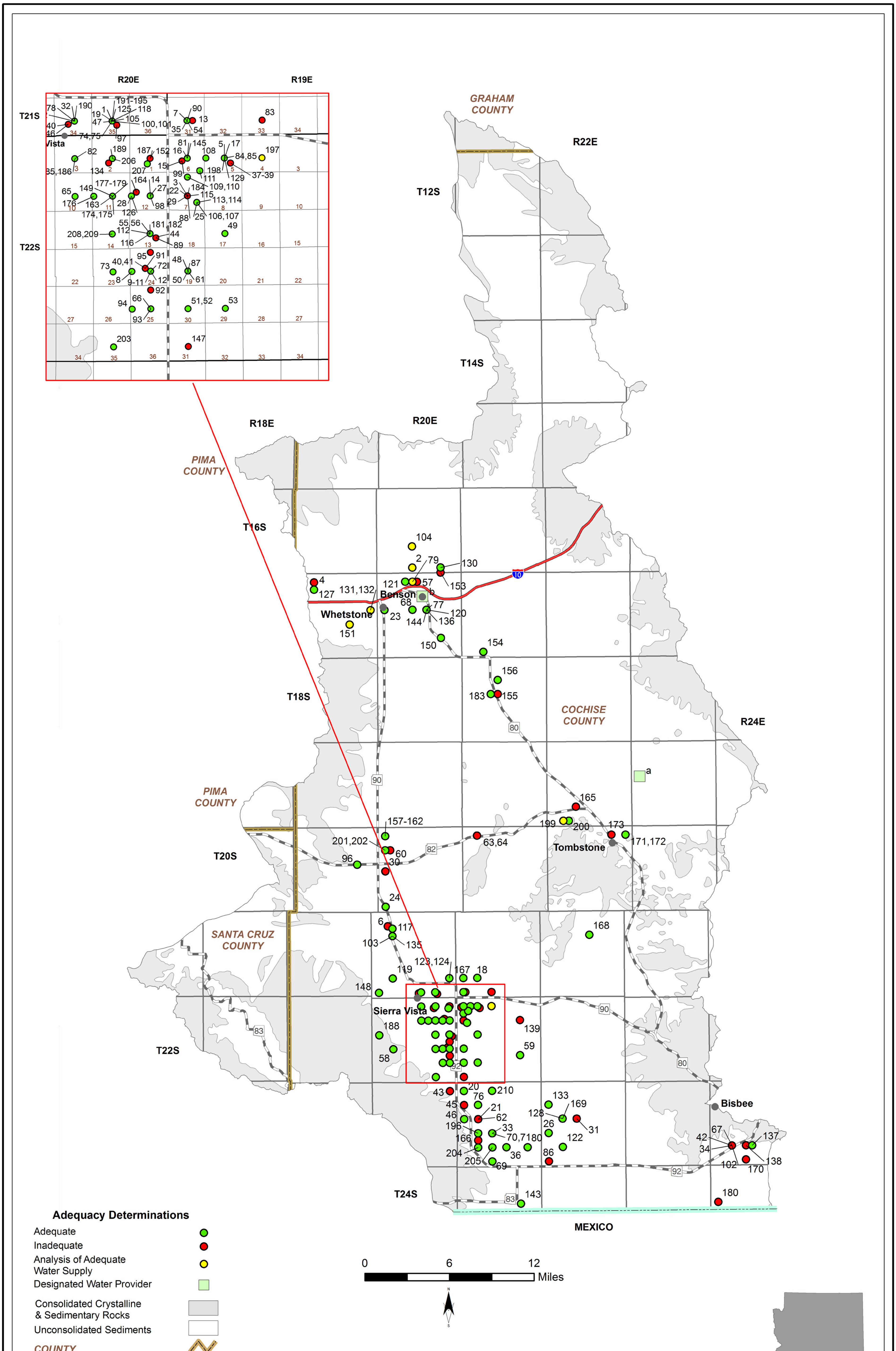

Figure 3.13-11
Upper San Pedro Basin
Adequacy Determinations

Upper San Pedro Basin
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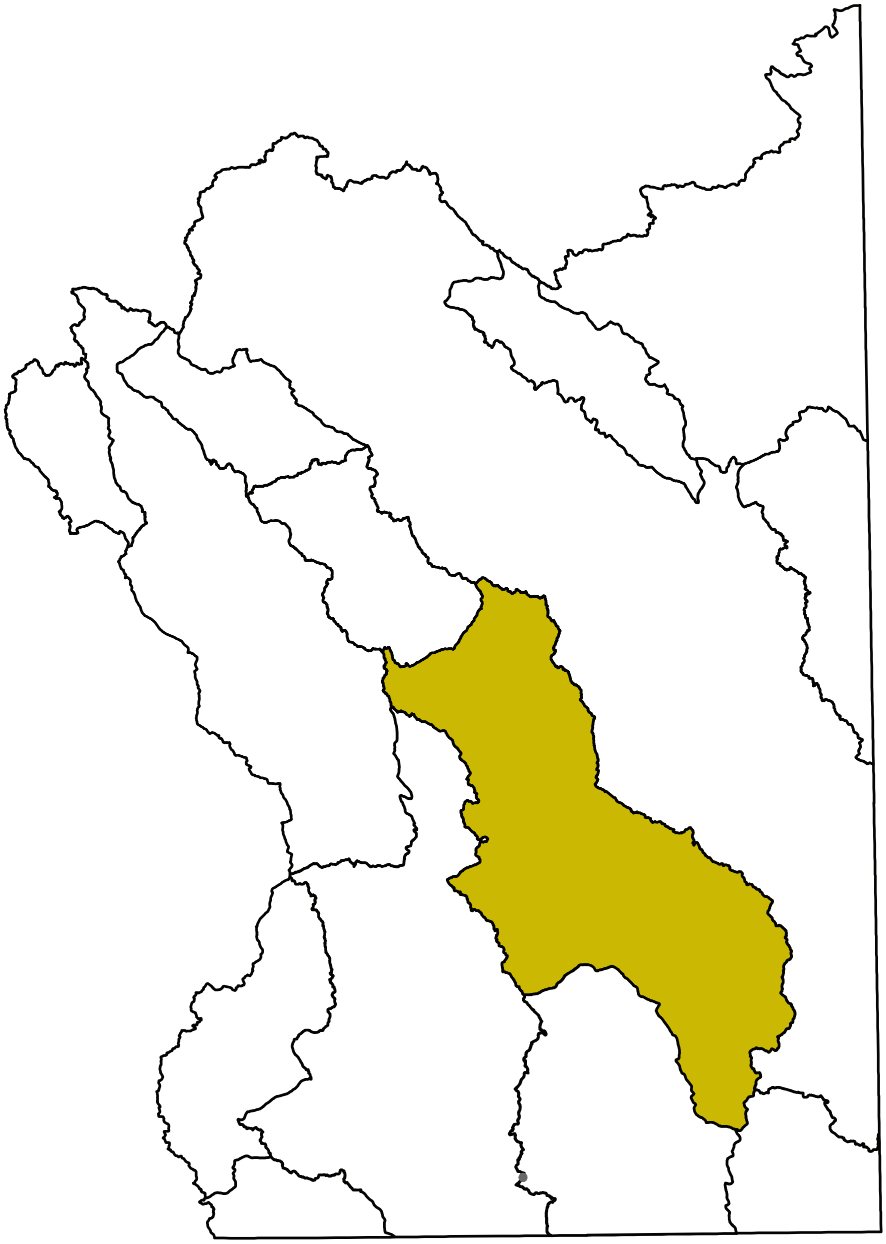
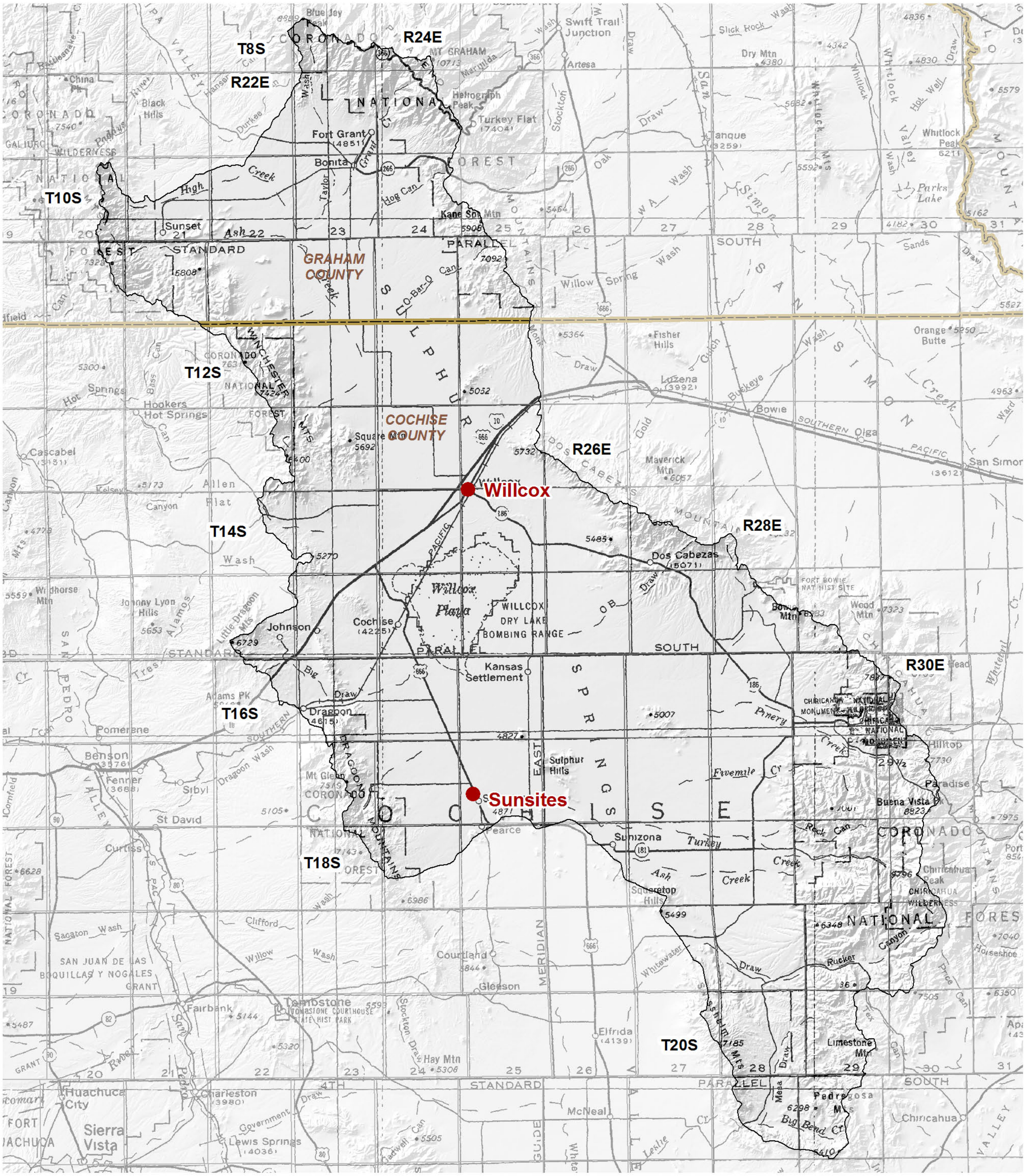
Section 3.14
Willcox Basin



3.14.1 Geography of the Willcox Basin

The Willcox Basin is a medium-size, 1,911 square mile basin in the center of the planning area. Geographic features and principal communities are shown on Figure 3.14-1. The basin is characterized by a large valley surrounded by a series of medium-high to high-elevation mountain ranges. Vegetation is primarily semi-desert grassland with smaller areas of madrean evergreen woodland and Rocky Mountain and madrean montane conifer forest. (see Figure 3.0-9) Riparian vegetation includes conifer oak and mixed broadleaf on Turkey Creek and conifer oak on Rucker Canyon.

- Principal geographic features include:
    - Ash Creek in the northern portion of the basin
    - Turkey Creek east of Sunizona and Pinery Creek east of Chiricahua National Monument
    - Rucker Canyon in the southern portion of the basin
    - Sulphur Springs Valley running north-south through the center of the basin
    - Willcox Playa south of Willcox
    - Winchester Mountains on the northwestern, Dragoon Mountains on the central western, Swisshelm Mountains on the southwestern and the Pinaleño Mountains on the northeast boundaries of the basin
    - Dos Cabezas and Chiricahua Mountains to the east and southeast of Willcox, with the highest point in the basin, Buena Vista Peak at 8,823 feet
    - The lowest point at 4,100 feet at the Willcox Playa



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Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES

**Figure 3.14-1
Willcox Basin
Geographic Features**

COUNTY
City, Town or Place

3.14.2 Land Ownership in the Willcox Basin

Land ownership, including the percentage of ownership in each category, is shown for the Willcox Basin in Figure 3.14-2. Principal features of land ownership in this basin are the abundance of private land and the diversity of land ownership types, seven total. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 3.0.4. Land ownership categories are discussed below in the order from largest to smallest percentage in the basin.

Private
- 51.1% of land is private.
- The majority of the private land is through the center of the basin and is contiguous.
- A small portion of private land in the southern tip of the basin remains in private ownership but is managed federally as the Leslie Canyon National Wildlife Refuge.
- Primary land uses are farming, domestic, commercial, mining and industrial.

State Trust
- 24.2% of land in this basin is held in trust for public schools and thirteen other beneficiaries under the State Trust Land System.
- Two large strips of state owned land are located north of Interstate 10 and the remainder of state owned land in the basin is interspersed with private land.
- A small portion of state trust land in the southern tip of the basin remains in state ownership but is managed federally as the Leslie Canyon National Wildlife Refuge.
- Primary land use is grazing.

National Forest
- 19.6% of land is federally owned and managed by the United States Forest Service (USFS).
- Although the National Forest land is not contiguous, all lands are within the Coronado National Forest in two ranger districts, Douglas Ranger District south of Interstate 10 and the Safford Ranger District north of Interstate 10.
- The basin contains most of the Chiricahua Wilderness area in the southeastern area of forest lands and a portion of the Galiuro Wilderness area in the northwestern area of forest lands. (see Figure 3.0-12)
- Primary land uses are recreation, grazing and timber production.

U.S. Military
- 2.3% of land is federally owned and managed by the U.S. Military.
- All military land in the basin is part of the Willcox Range.
- Primary land use is for military activities.

U.S. Bureau of Land Management (BLM)
- 1.8% of land is federally owned and managed by the BLM.
- BLM land is located southeast of Interstate 10 along the eastern basin boundary and in other small parcels scattered throughout the basin.

- Primary land use is grazing.

National Park Service (NPS)

- 0.9% of land is federally owned and managed by the NPS.
- All park land is within the Chiricahua National Monument.
- Primary land use is recreation.

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

- 0.1% of land is state owned and managed by Arizona Game and Fish Department.
- All Game and Fish land in this basin is within the Willcox Playa Wildlife Area.
- Primary land uses are wildlife protection and recreation.

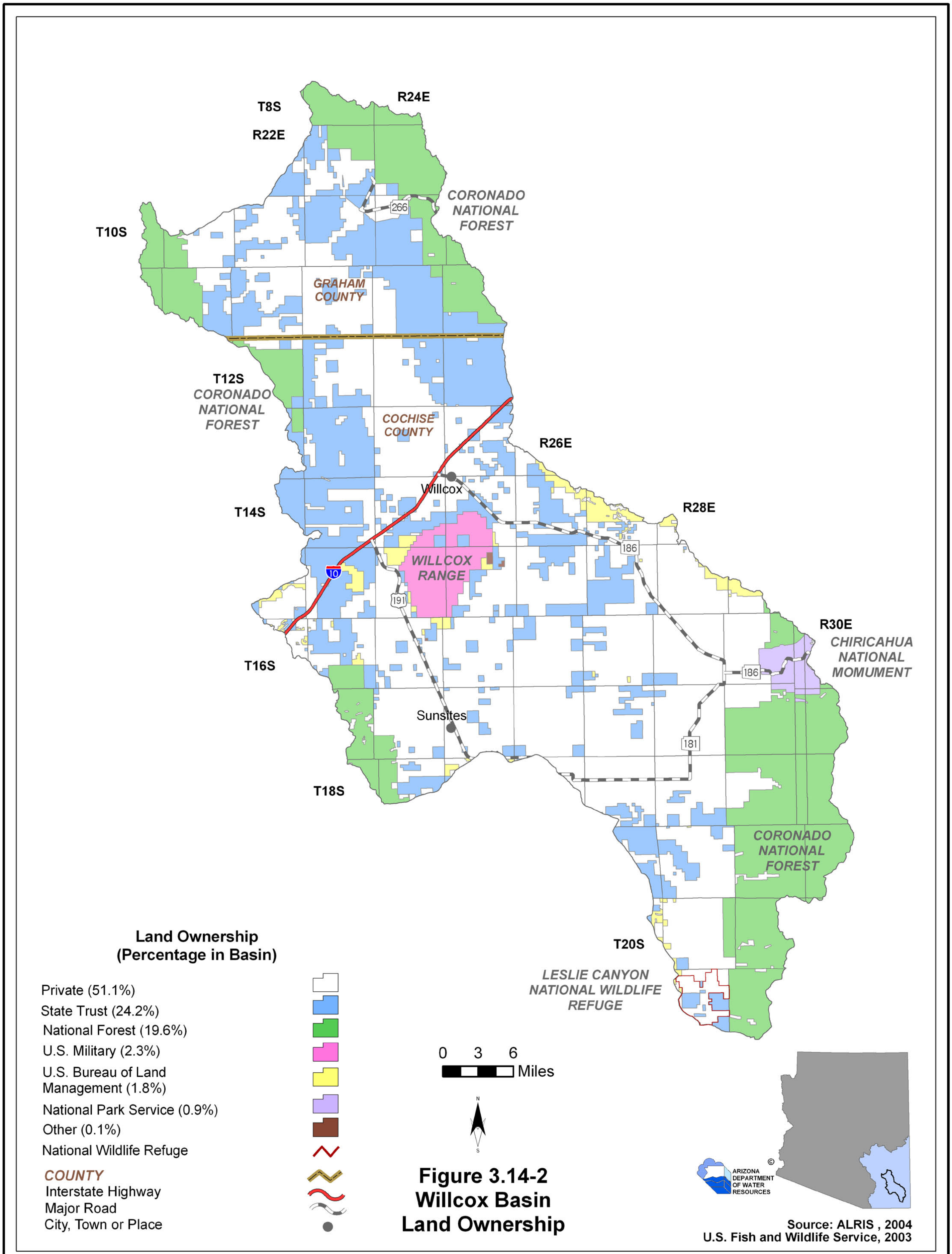


Figure 3.14-2
Willcox Basin
Land Ownership

3.14.3 Climate of the Willcox Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 3.14-1 and the locations are shown on Figure 3.14-3. Figure 3.14-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Willcox Basin does not contain Evaporation Pan and SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 3.0.3. A description of the climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 3.14-1A
- There are six NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 74.8°F at Chiricahua N.M. to 79.5°F at Willcox. The average monthly minimum temperature occurs in December or January and ranges between 42.6°F at Cochise Stronghold to 44.9°F at Fort Grant.
- Highest average seasonal rainfall occurs in the summer (July - September). For the period of record used, the highest annual rainfall is 20.95 inches at Chiricahua N.M. and the lowest is 10.78 inches at Cochise 4 SSE.

AZMET

- Refer to Table 3.14-1C
- There are two AZMET station in the basin, average annual evaporation ranges from 71.19 inches to 74.11 inches.

SCAS Precipitation Data

- See Figure 3.14-3
- Additional precipitation data shows rainfall as high as 48 inches in the Chiricahua Mountains at Chiricahua Peak, elevation 9,760 feet. This is the highest average annual precipitation in the planning area. Precipitation is as low as 10 inches in the vicinity of the Pearce Sunsites station.
- This basin contains the largest range of average annual rainfall in the planning area with 38 inches separating areas of lowest and the highest precipitation.

Table 3.14-1 Climate Data for the Willcox Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Total Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Chiricahua N.M.	5,300	1971-2000	74.8/Jul	44.0/Jan	4.24	1.85	9.86	5.00	20.95
Cochise 4 SSE	4,180	1899-1954	78.5/Jul	42.7/Jan	2.05	0.75	5.98	2.00	10.78
Cochise Stronghold	4,920	1925-1948	77.3/Jul	42.6/Jan	4.27	1.60	9.26	3.71	18.85
Fort Grant	4,830	1900-2004[1]	78.9/Jul	44.9/Jan	2.31	1.39	7.33	5.68	16.70
Pearce Sunsites	4,350	1971-2000	78.6/Jul	44.6/Jan	2.19	0.95	7.53	2.54	13.21
Willcox	4,180	1971-2000	79.5/Jul	43.8/Dec	2.74	1.00	6.22	3.39	13.35

Source: WRCC, 2005

Notes:
[1]Average temperature for period of record shown; average precipitation from 1971-2000

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
None			

C. AZMET:

Station Name	Elevation (feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Bonita	4,419	1999 - current	73.59 (9)
Kansas Settlement	4,200	2006 - current	71.19 *(1)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record	Average Snowpack, at Beginning of the Month, as Inches Snow Water Content *(Number of measurements to calculate average)*					
			Jan.	Feb.	March	April	May	June
None								

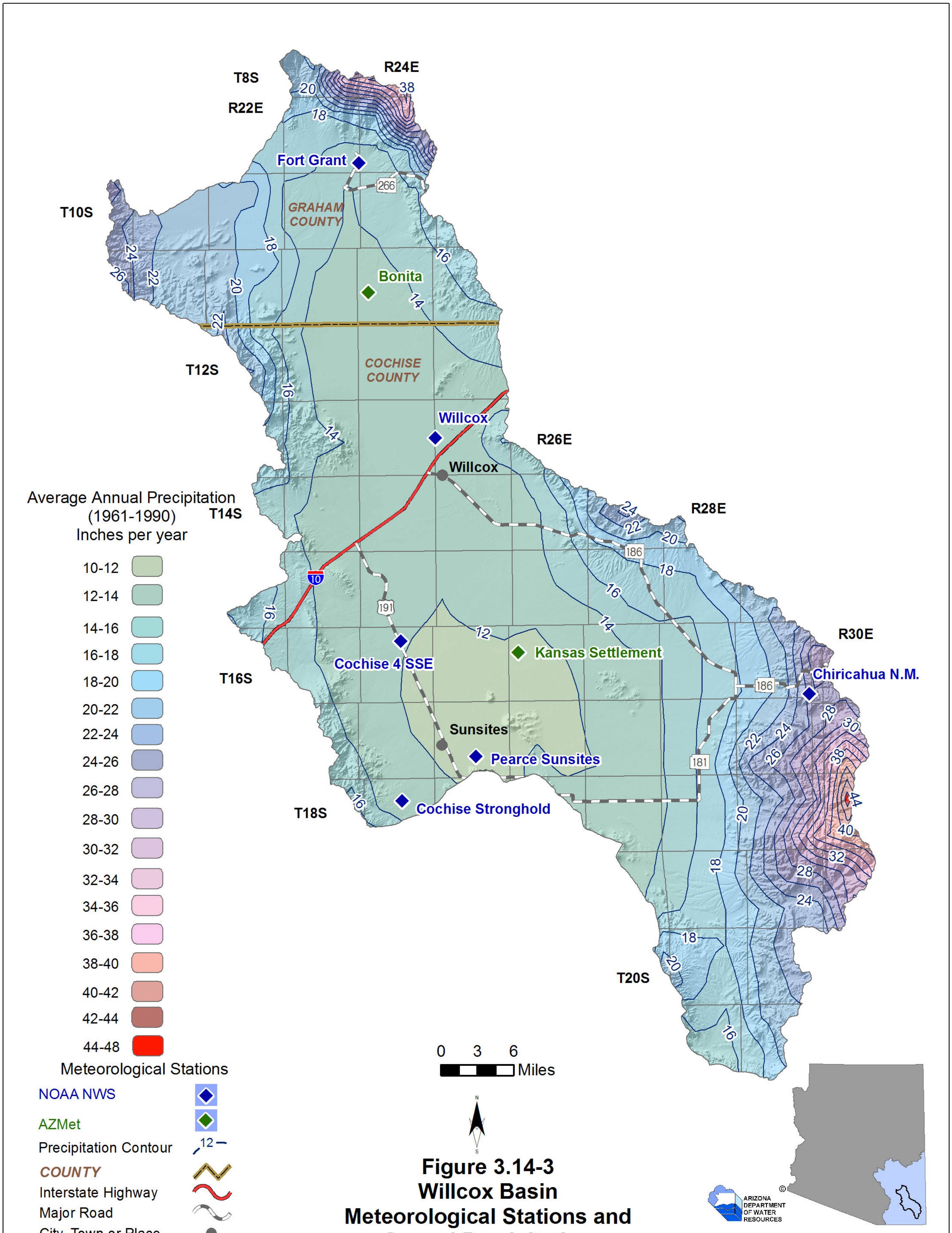


Figure 3.14-3
Willcox Basin
Meteorological Stations and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

3.14.4 Surface Water Conditions in the Willcox Basin

Streamflow data, including average seasonal flow, average annual flow and other information is shown in Table 3.14-2. Flood ALERT equipment in the basin is shown on Table 3.14-3. Reservoir and stockpond data, including maximum storage or maximum surface area of large reservoirs and type of use of the stored water, are shown in Table 3.14-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 3.14-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 3.14-2.
- Data from three stations on three watercourses are shown on the table and on Figure 3.14-4. Two stations have been discontinued, the remaining one is a real-time station.
- The average seasonal flow for all the stations is highest in the Summer (July-September) and lowest in the Spring (April-June).
- Maximum annual flow in this basin was 10,787 acre-feet in 1921 on West Turkey Creek and minimum annual flow was 22 acre-feet in 1976 on Leslie Creek.

Flood ALERT Equipment

- Refer to Table 3.14-3.
- There is one station in the basin as of October 2005.

Reservoirs and Stockponds

- Refer to Table 3.14-4.
- Surface water is stored or could be stored in two large and nine small reservoirs in this basin.
- There are registered 762 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.14-4.
- Average annual runoff increases from 0.2 inches, or 10.6 acre-feet per square mile, in the center of the basin to five inches, or 266.5 acre-feet per square mile, toward the Chiricahua Mountains in the southeast.

Table 3.14-2 Streamflow Data for the Willcox Basin

Station Number	USGS Station Name	Drainage Area (in mi²)	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	
9536500	West Turkey Creek near Light	19	NA	8/1919-9/1925 (discontinued)	13	11	53	24	521 (1922)	4,474	5,460	10,787 (1921)	5
9537000	Whitewater Draw near Rucker	39	NA	8/1919-9/1925 (discontinued)	16	10	39	35	956 (1922)	5,010	4,421	6,342 (1923)	5
9537200	Leslie Creek near McNeal	79	4,620	10/1969-current (real time)	16	7	55	21	22 (1976)	746	1,066	3,201 (1984)	25

Source: USGS (NWIS) 2005 & 2008

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of 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
NA = Not available

Table 3.14-3 Flood ALERT Equipment in the Willcox Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
3070	Willcox ADOT Weather Station	Weather Station	10/1/2001	ADWR

Source: ADWR 2005c

Notes:
ADOT = Arizona Department of Transportation
ADWR = Arizona Department of Water Resources

Table 3.14-4 Reservoirs and Stockponds in the Willcox Basin

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

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM STORAGE (AF)	USE	JURISDICTION
None identified by ADWR at this time					

B. Other Large Reservoirs (50 acre surface area or greater)[1]

MAP KEY	RESERVOIR/LAKE NAME (Name of dam, if different)	OWNER/OPERATOR	MAXIMUM SURFACE AREA (acres)	USE[2]	JURISDICTION
1	Willcox Playa[3]	US Military	29,500	O	Federal
2	Unnamed[4]	Private	309	P	Landowner

Source: Compilation of databases from ADWR & others

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

Total number: 2
Total maximum storage: 185 acre-feet

D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 7
Total surface area: 182 acres

E. Stockponds (up to 15 acre-feet capacity)

Total number: 762 (from water right filings)

Notes:
[1]Capacity data not available to ADWR
[2]O=other; P=fire protection, stock or farm pond
[3]Dry Lake
[4]Intermittent Lake

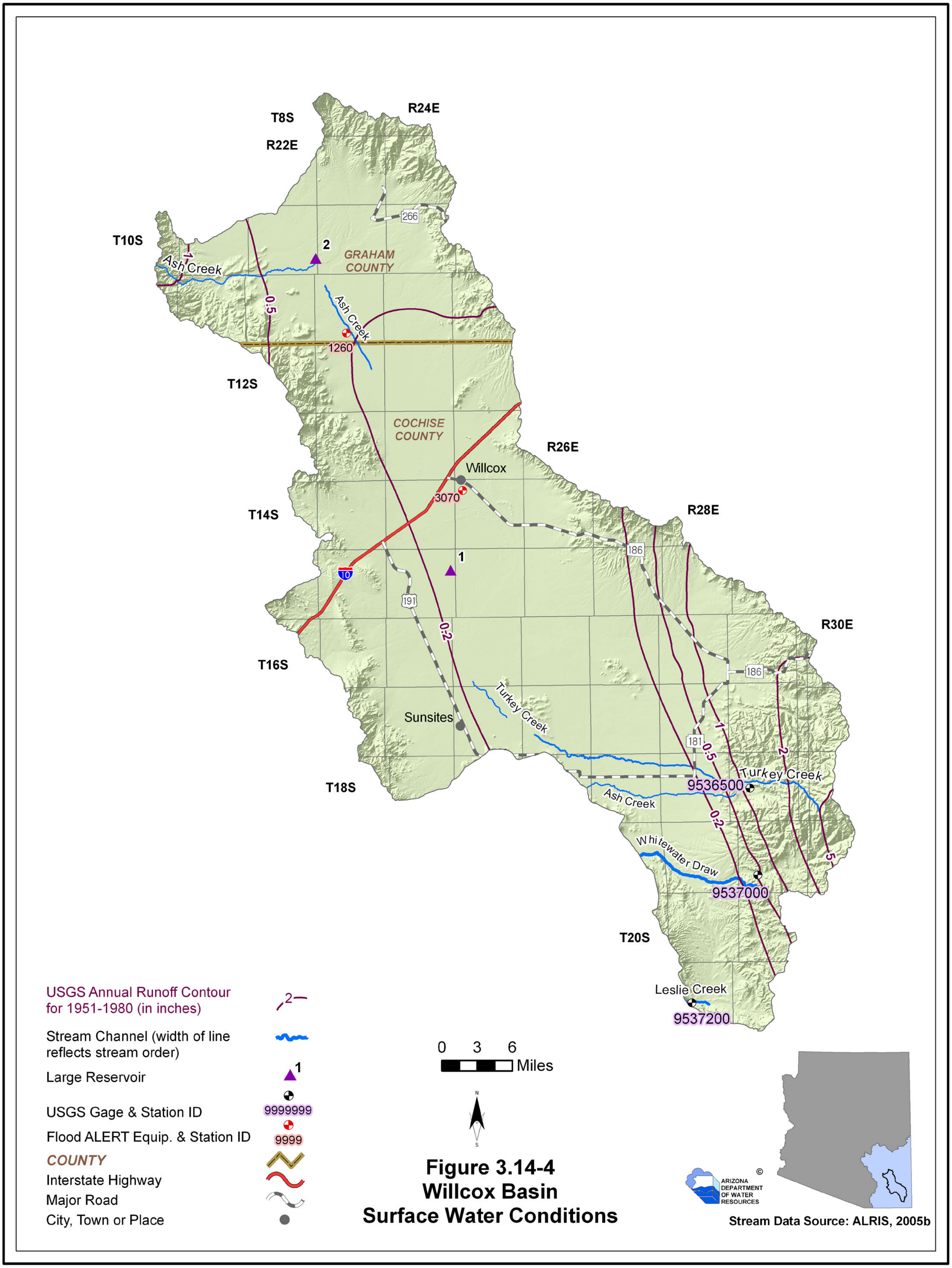


Figure 3.14-4
Willcox Basin
Surface Water Conditions

3.14.5 Perennial/Intermittent Streams and Major Springs in the Willcox Basin

Minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 3.14-5. There are no major springs identified in this basin. The locations of perennial and intermittent streams are shown on Figure 3.14-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are five perennial stream reaches in this basin, Turkey Creek, Rucker Canyon, Grant Creek, Big Creek and Leslie Creek. Most perennial streams are in the Chiricahua Mountains along the southeastern boundary or the Pinaleño Mountains on the northeastern boundary.
- A number of intermittent stream reaches are located in these two mountain ranges as well.
- Springs with measured discharge of 1 to 10 gallons per minute (gpm) are not mapped but coordinates are given in Table 3.14-5. There are eight minor springs identified in this basin.
- Listed discharge rates may not be indicative of current conditions. All of the minor spring measurements were taken prior to 1985.
- The total number of springs identified by the USGS varies from 87 to 92, depending on the database reference.

Table 3.14-5 Springs in the Willcox Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Walnut	321228	1093617	3	07/1984
Unnamed	321152	1093413	3	11/1981
Rosemary's[2]	321228	1093621	2	08/1984
Howard Canyon (left fork)[2,3]	321144	1093349	2[4]	08/1984
Howard Canyon[2,3]	321144	1093357	1	08/1984
Unnamed[2]	321145	1095543	1	02/1946
Unnamed[2]	320451	1095543	1	Not available
Unnamed[2]	321259	1093716	1	09/1981

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 87 to 92

Notes:
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Location approximated by ADWR
[4]Most recent measurement < 1 gpm

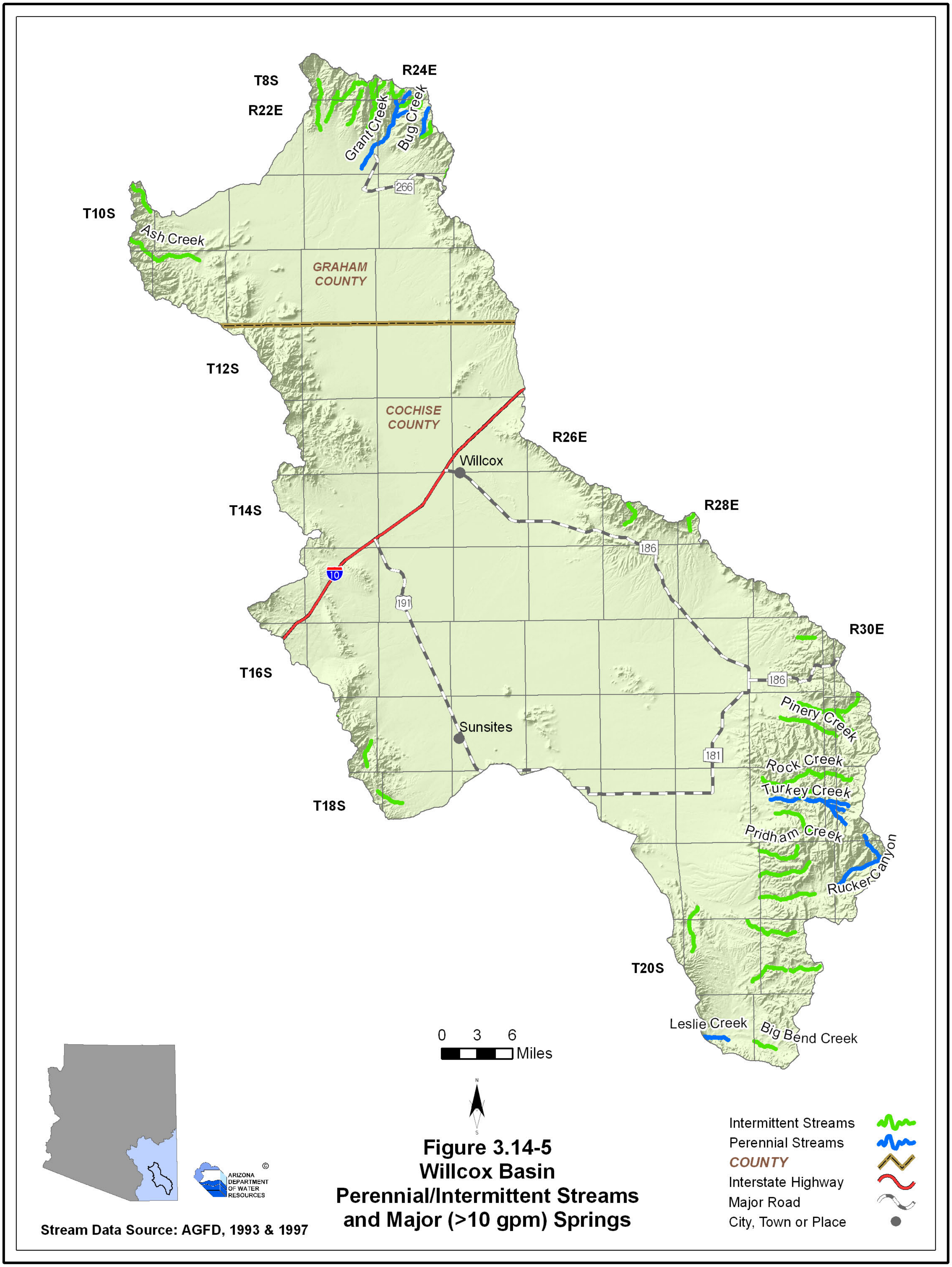


Figure 3.14-5
Willcox Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

3.14.6 Groundwater Conditions of the Willcox 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 3.14-6. Figure 3.14-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.14-7 contains hydrographs for selected wells shown on Figure 3.14-6. Figure 3.14-8 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 3.14-6 and Figure 3.14-6.
- The major aquifers in the basin are recent stream alluvium from stream and lake-bed deposits and basin fill.
- The Willcox Basin is a “closed basin” with no inter-basin groundwater inflow or outflow.
- Groundwater flow conditions have been altered significantly in several locations due to groundwater pumping as shown by flow directions on Figure 3.14-6. Historically flows were from the perimeter of the Sulphur Springs Valley toward the Willcox Playa.

Well Yields

- Refer to Table 3.14-6 and Figure 3.14-8.
- As shown on Figure 3.14-8 well yields in this basin range from less than 100 gpm to more than 2,000 gpm.
- One source of well yield information, based on 1,007 reported wells, indicates that the median well yield in this basin is 750 gpm.

Natural Recharge

- Refer to Table 3.14-6.
- Natural recharge estimates range from 15,000 acre-feet per year (AFA) to 47,000 AFA.

Water in Storage

- Refer to Table 3.14-6.
- Storage estimates for this basin range from 42 million acre-feet (maf) to 59 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 3.14-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 47 index wells in this basin. Hydrographs for 12 index wells and four other wells are shown in Figure 3.14-7. Index well hydrographs are: A-E, G-K, M and N.
- The Department measures water levels daily at two automated groundwater monitoring sites in the basin.
- The deepest recorded water level in 2003-2004 was 431 feet in the vicinity of Highway 191 near the southern basin boundary and the shallowest recorded water level in 2003-2004 was 36 feet in the vicinity of Willcox.

Table 3.14-6 Groundwater Data for the Willcox Basin

Basin Area, in square miles:	1,911	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 108 - 2,199 Median 621.5 (64 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 2 - 3,500 Median 750 (1,007 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells (Wells55)
	Range 50 - 2,000	ADWR (1990 and 1994b)
	Range 0 - 2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	47,000	Anderson and Freethey (1995)
	46,000	Freethey and Anderson (1986)
	15,000	ADWR (1994b)
Estimated Water Currently in Storage, in acre-feet:	42,000,000 - 45,300,000 (to 1,200 ft)	ADWR (1990 and 1994b)
	44,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	59,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	47	
Date of Last Water-level Sweep:	2005 (845 wells measured)	

[1]Predevelopment Estimate

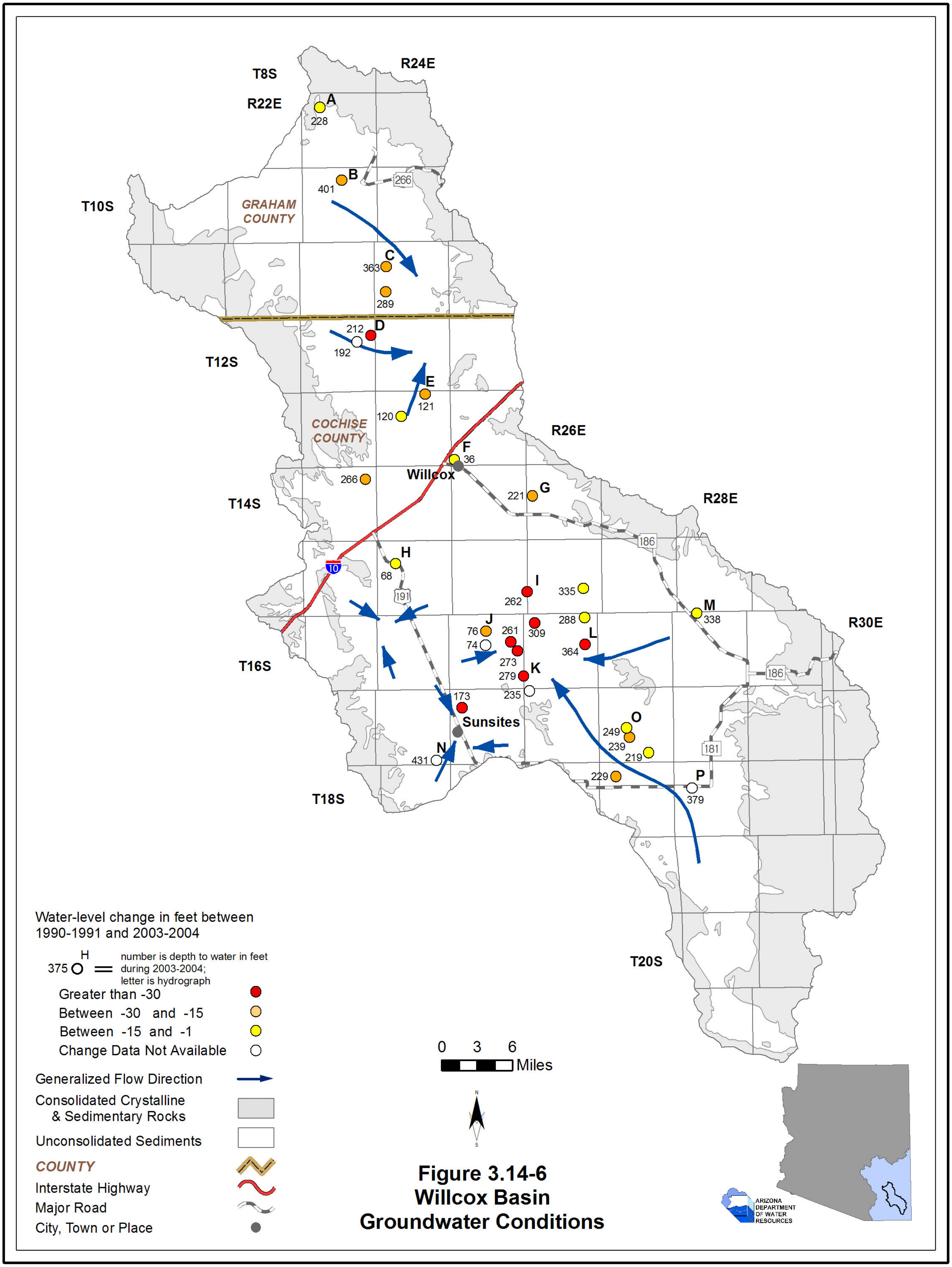


Figure 3.14-6
Willcox Basin
Groundwater Conditions

Figure 3.14-7
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

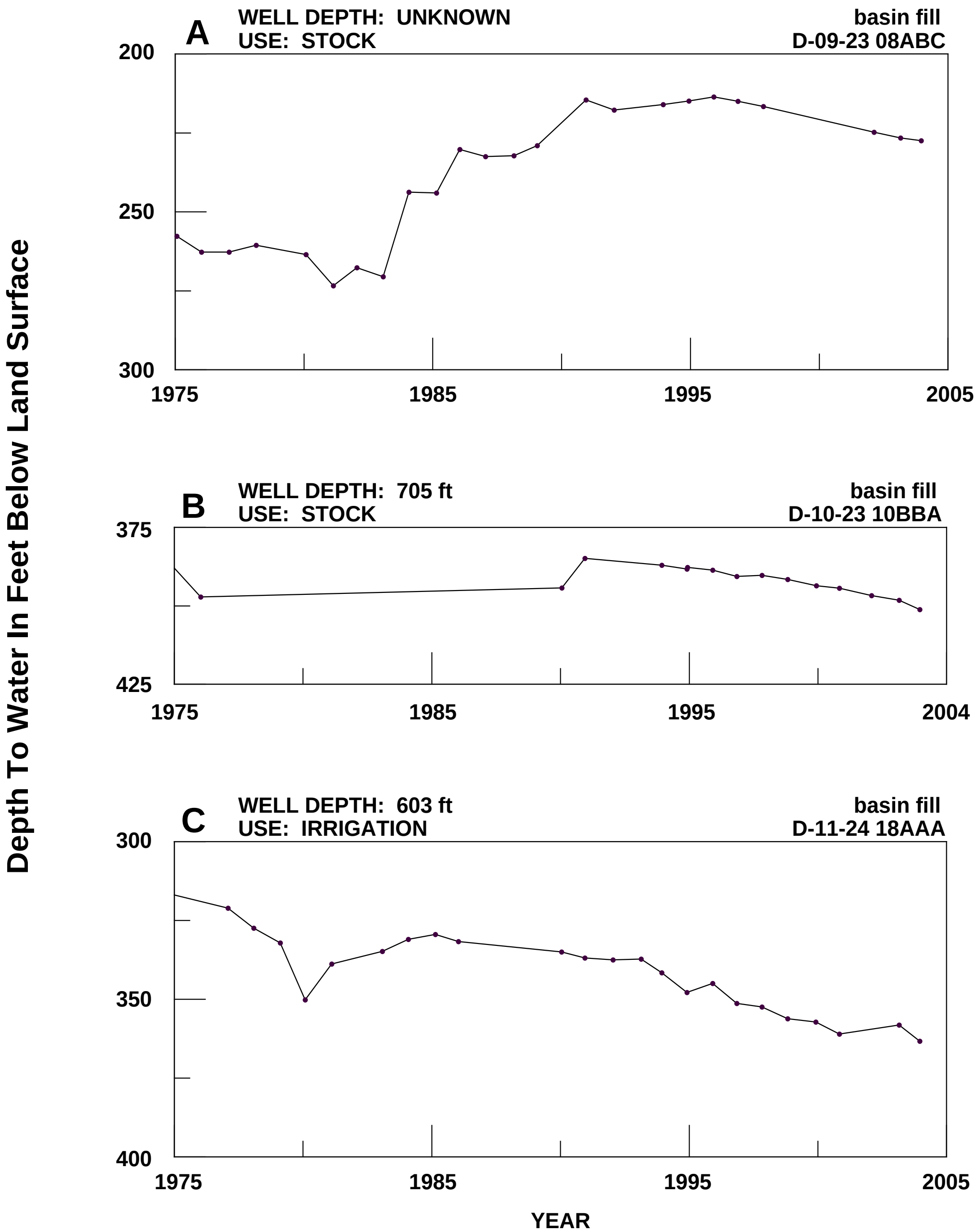


Figure 3.14-7 (Cont)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

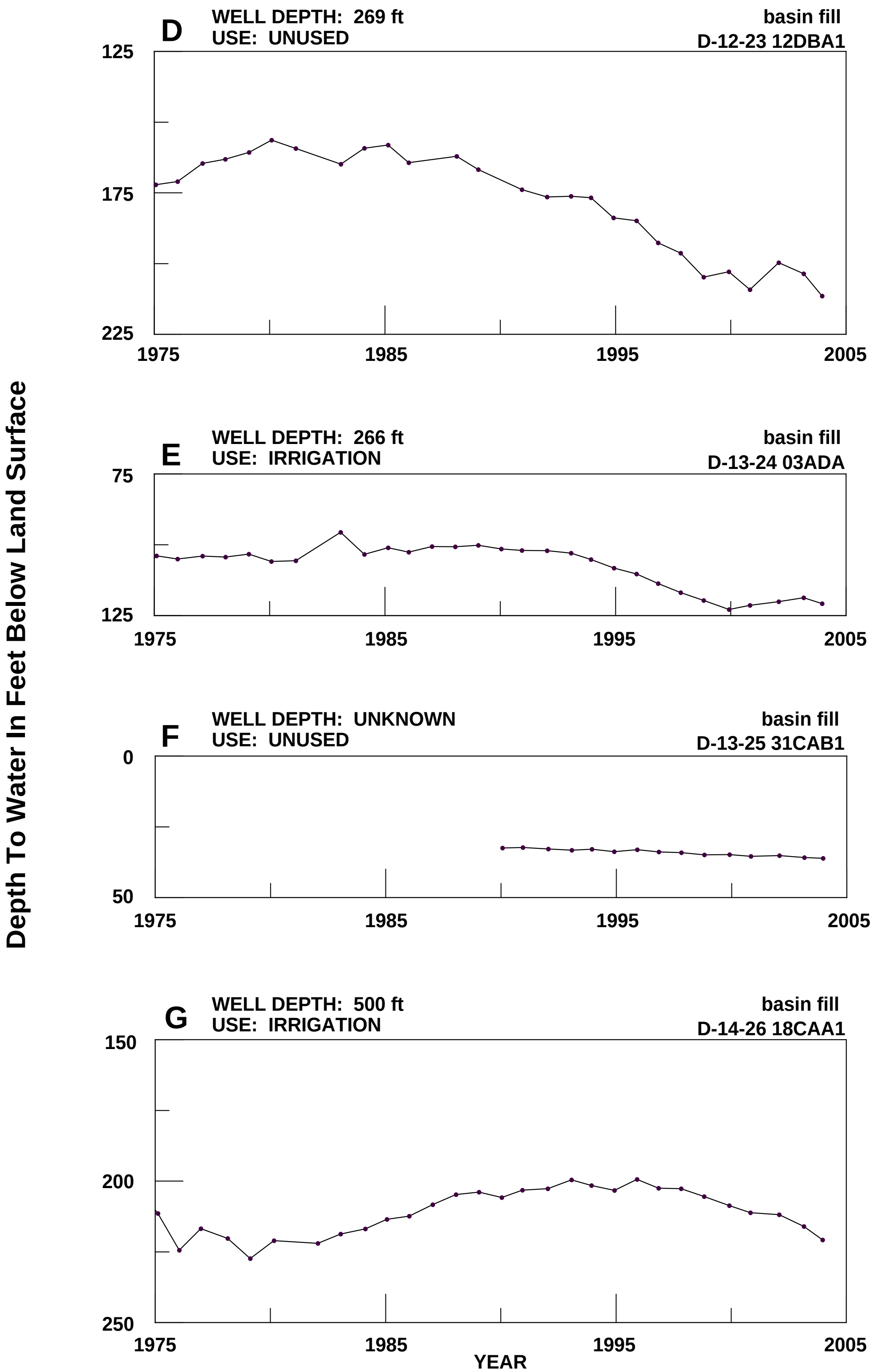


Figure 3.14-7 (Cont)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

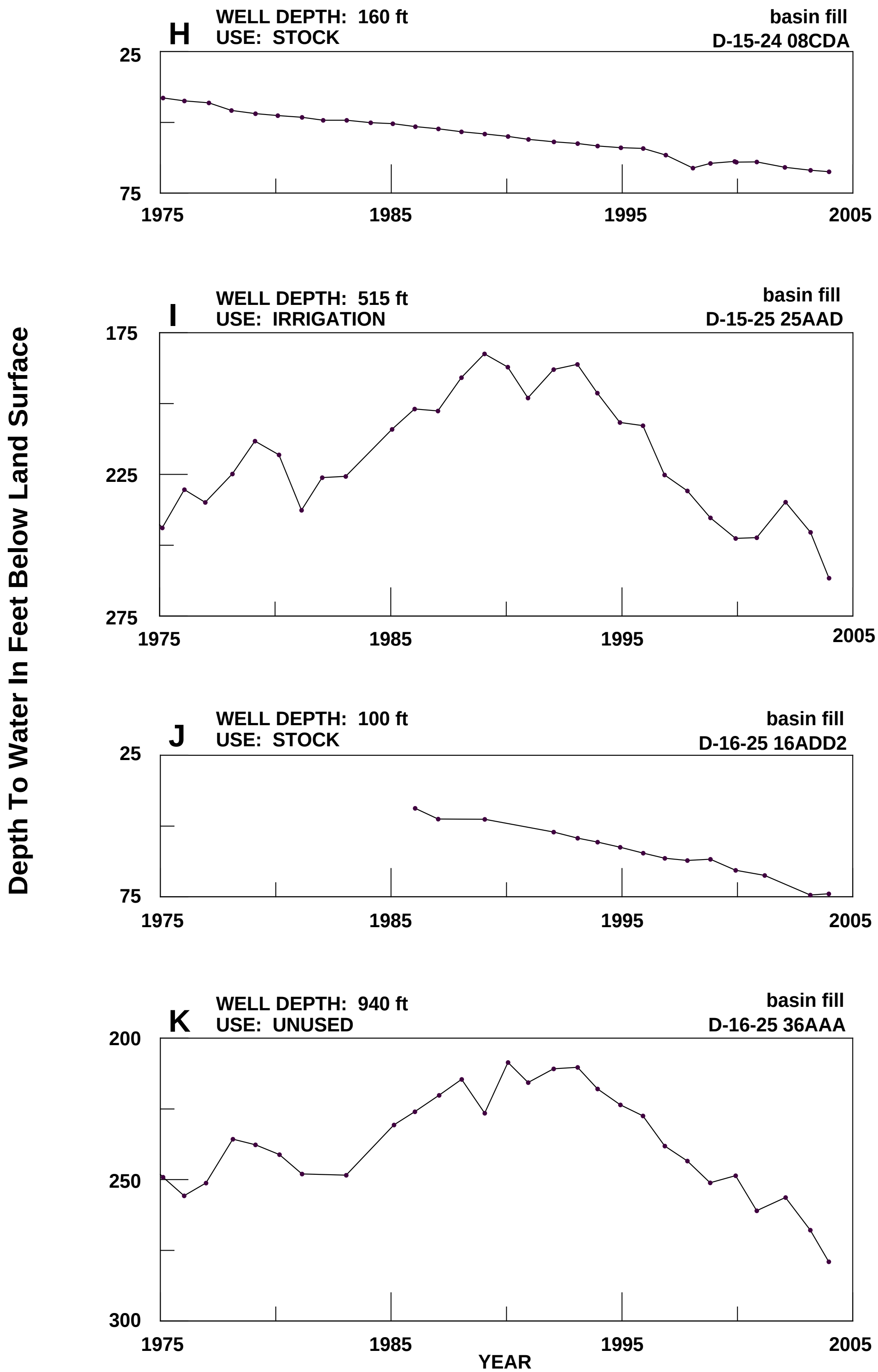


Figure 3.14-7 (Cont)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

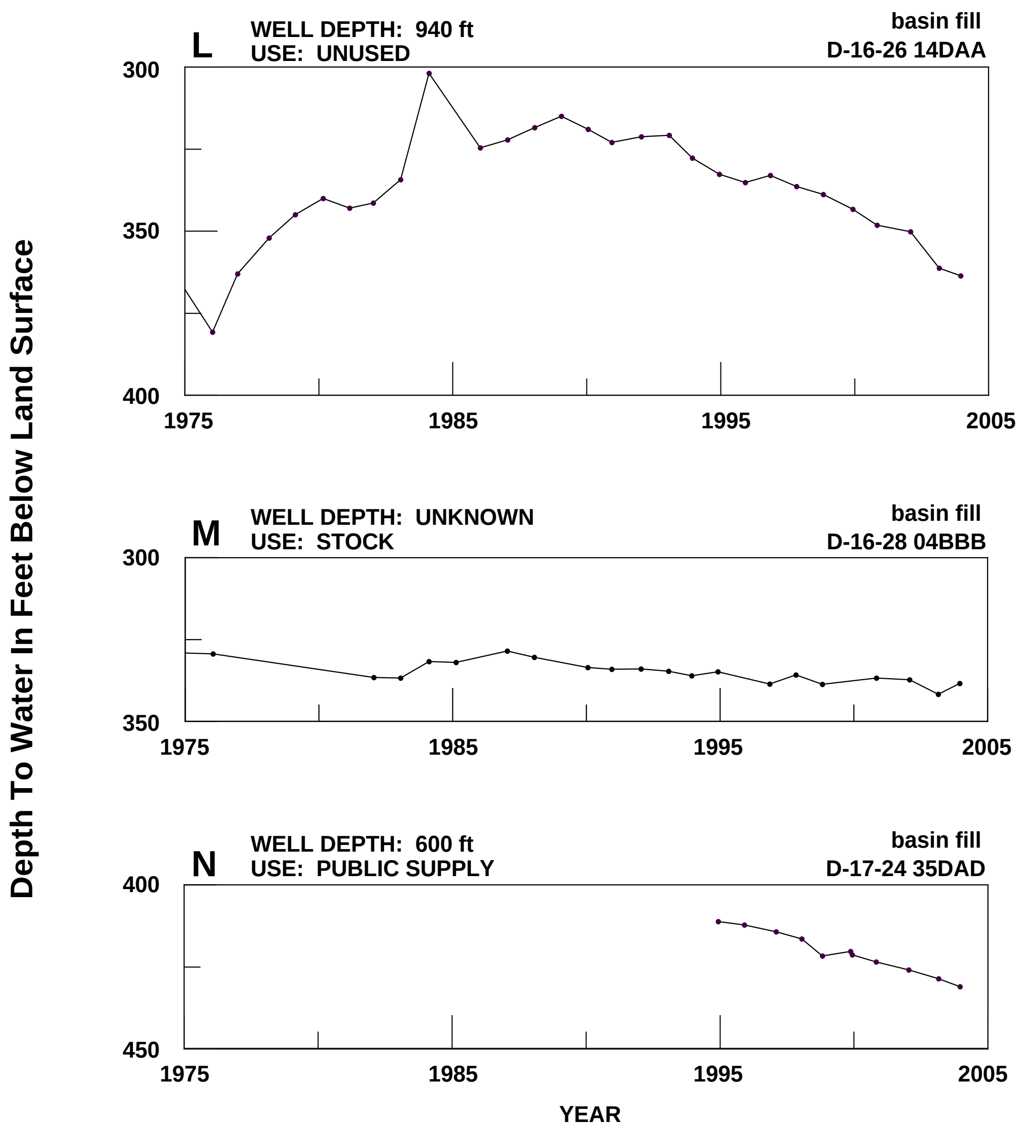
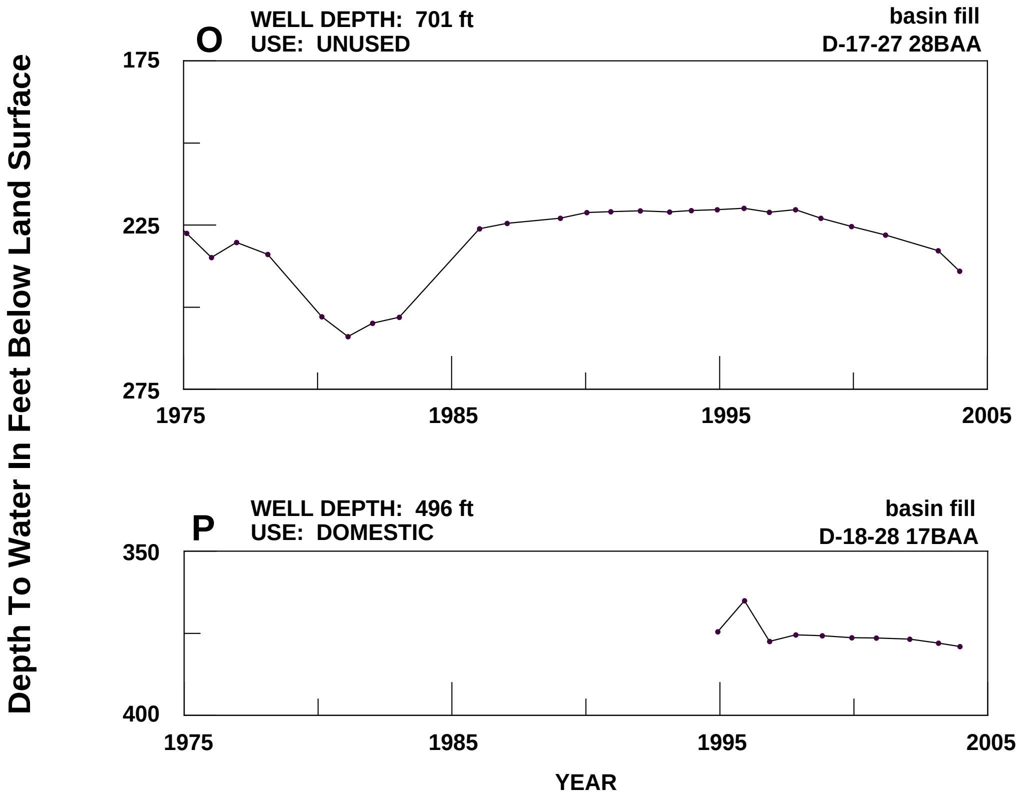


Figure 3.14-7 (Cont)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells



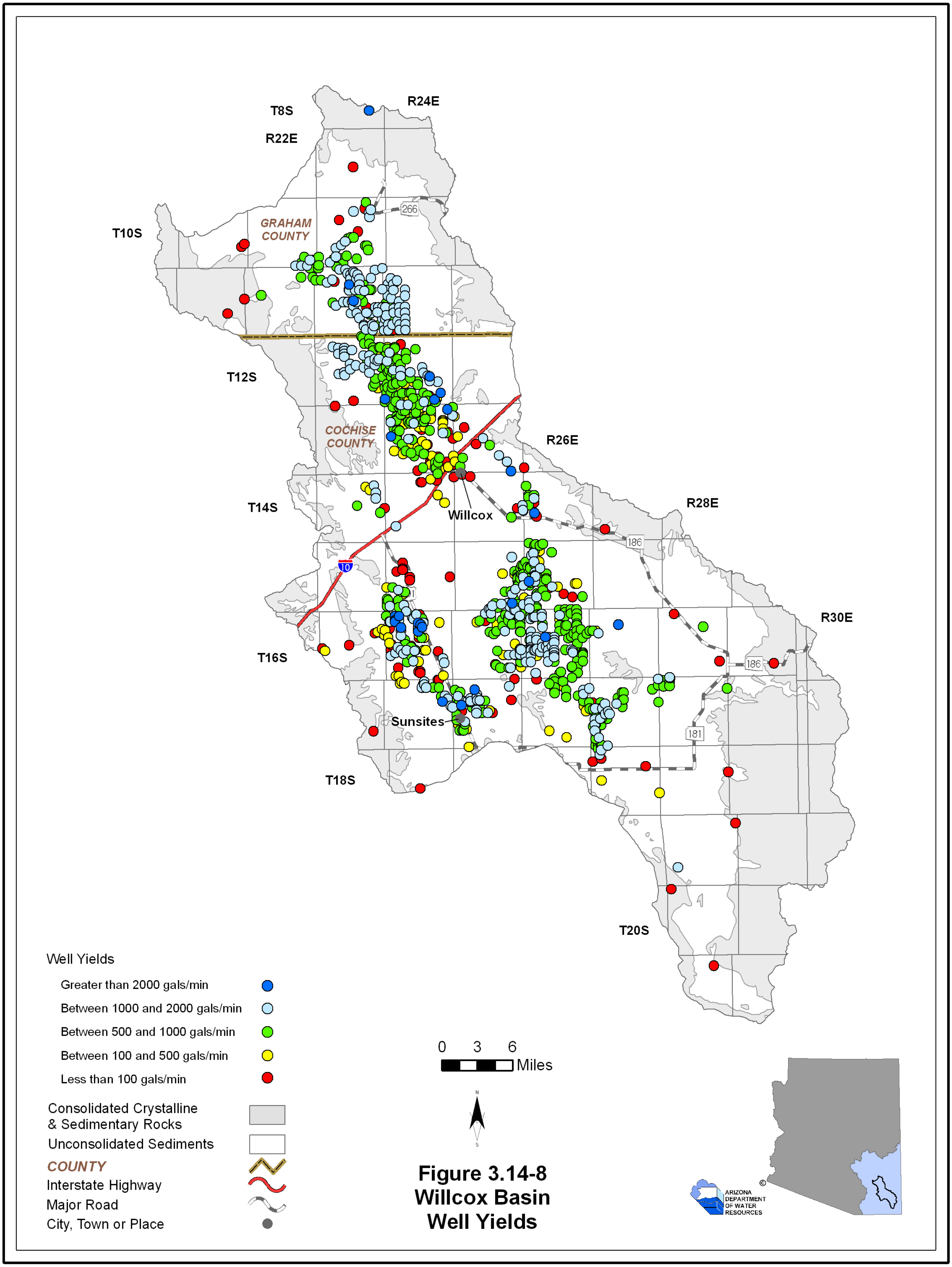


Figure 3.14-8
Willcox Basin
Well Yields

3.14.7 Water Quality of the Willcox Basin

Sites with parameter concentrations that have equaled or exceeded drinking water standard(s) (DWS), including location and parameter(s) are shown in Table 3.14-7A. There are no data on impaired lakes and streams in this basin. Figure 3.14-9 shows the location of exceedences keyed to Table 3.14-7A. 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. A description of water quality data sources and methods is found in Volume 1, Appendix A.

Well, Mine or Spring sites that have equaled or exceeded drinking water standards (DWS)

- Refer to Table 3.14-7A.
- Seventy-three sites have parameter concentrations that have equaled or exceeded DWS.
- Frequently equaled or exceeded parameters include arsenic and fluoride.
- Other parameters equaled or exceeded in the sites measured in this basin were radionuclides, nitrates, lead, beryllium, antimony and total dissolved solids.

Table 3.14-7 Water Quality Exceedences in the Willcox Basin[1]

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	Spring	10 South	24 East	1	F, Rad
2	Well	12 South	24 East	27	F
3	Well	12 South	24 East	31	F
4	Well	12 South	24 East	31	As
5	Well	12 South	24 East	32	NO3
6	Well	12 South	25 East	36	NO3
7	Well	13 South	24 East	5	As, F
8	Well	13 South	24 East	21	As
9	Well	13 South	24 East	27	As
10	Well	13 South	25 East	8	As, F
11	Well	13 South	25 East	12	F, NO3
12	Well	13 South	25 East	12	Rad
13	Well	13 South	25 East	17	As, F
14	Well	13 South	25 East	19	As, F
15	Well	13 South	25 East	21	As, F
16	Well	13 South	25 East	21	As, F
17	Well	13 South	25 East	29	As, F
18	Well	13 South	25 East	31	As, F
19	Well	14 South	23 East	10	Rad
20	Well	14 South	23 East	12	F
21	Well	14 South	23 East	12	F
22	Well	14 South	23 East	15	F
23	Well	14 South	24 East	1	Rad
24	Well	14 South	24 East	3	As, F
25	Well	14 South	24 East	3	F
26	Well	14 South	24 East	8	NO3
27	Well	14 South	24 East	14	As, F
28	Well	14 South	24 East	15	F
29	Well	14 South	24 East	17	As, Pb
30	Well	14 South	24 East	31	F
31	Well	14 South	25 East	19	F
32	Well	14 South	26 East	18	Pb
33	Well	14 South	26 East	18	NO3
34	Well	14 South	26 East	18	As
35	Well	14 South	26 East	25	Rad
36	Well	14 South	27 East	32	Rad
37	Well	15 South	23 East	26	NO3
38	Well	15 South	24 East	6	As, F
39	Well	15 South	24 East	20	TDS
40	Well	15 South	24 East	21	As, F
41	Well	15 South	25 East	13	NO3
42	Well	15 South	25 East	13	NO3
43	Well	16 South	24 East	4	Be
44	Well	16 South	24 East	5	Be
45	Well	16 South	24 East	5	Be
46	Well	16 South	24 East	10	Be
47	Well	16 South	24 East	10	Be
48	Well	16 South	24 East	10	Be
49	Well	16 South	24 East	36	F

Table 3.14-7 Water Quality Exceedences in the Willcox Basin (Cont)[1]

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	
50	Well	16 South	25 East	9	F
51	Well	16 South	25 East	10	Sb, NO3
52	Well	16 South	25 East	18	F
53	Well	16 South	25 East	18	F
54	Well	16 South	25 East	23	NO3
55	Well	16 South	26 East	23	F
56	Well	16 South	26 East	24	F
57	Well	16 South	26 East	24	F
58	Well	16 South	26 East	25	F
59	Well	16 South	26 East	26	F
60	Well	16 South	26 East	35	F
61	Well	16 South	29 East	26	F, Rad
62	Well	17 South	25 East	9	NO3
63	Well	17 South	25 East	9	As
64	Well	17 South	25 East	23	F
65	Well	17 South	26 East	6	F
66	Well	17 South	26 East	11	F
67	Well	17 South	26 East	25	F
68	Well	17 South	27 East	19	F
69	Well	17 South	27 East	19	F
70	Well	17 South	27 East	30	F
71	Well	17 South	29 East	12	F, Rad
72	Well	18 South	25 East	5	As
73	Well	18 South	26 East	1	F

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	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:
Because of map scale, feature locations may appear different than the location indicated on the table
[1] Water quality samples collected between 1981 and 2004.
[2] Sb = Antimony
As = Arsenic
Be = Beryllium
F= Fluoride
Pb = Lead
NO3 = Nitrate
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
TDS = Total Dissolved Solids

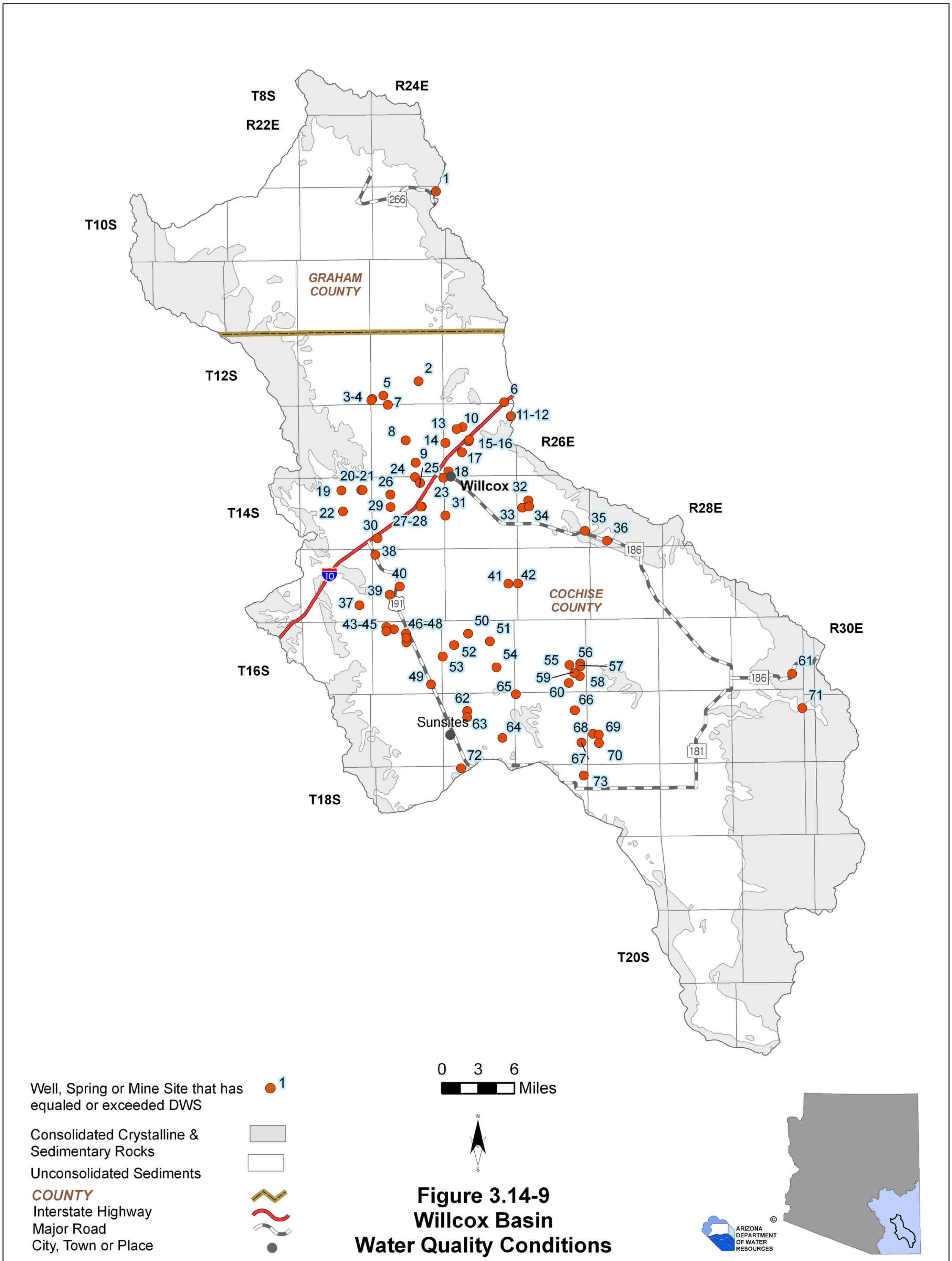


Figure 3.14-9
Willcox Basin
Water Quality Conditions

3.14.8 Cultural Water Demand in the Willcox 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 3.14-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.14-9. Figure 3.14-10 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 3.0.7.

Cultural Water Demand

- Refer to Table 3.14-8 and Figure 3.14-10.
- Population has increased by about 3,000 residents from 1980 to 2000.
- Total groundwater use decreased from 1971 to 1990 and has increased from 1991 to 2005 due to agricultural pumpage, with an average of 176,300 AFA in the period from 2001-2005.
- All surface water diversions are for municipal demand at Fort Grant, a state prison at the end of Highway 266, with less than 300 acre-feet diverted from 1991 – 2005.
- Over 90% of all water use in this basin is for agriculture.
- Agricultural demand has increased from 1991 with an average of 167,400 AFA pumped in the period from 2001-2005.
- Agricultural demand is widely distributed throughout the Sulphur Springs Valley down the center of the basin.
- This basin contains both the most overall groundwater demand in the planning area and the most groundwater demand for agriculture.
- Most high intensity municipal and industrial demand is found near Willcox.
- Low intensity municipal and industrial demand is located near Willcox and along Highway 191.
- Approximately 90% of municipal water supply is groundwater.
- There is one large active mine, Johnson Camp Mine, west of Interstate 10.
- There is one power plant, the Apache Station Generation Plant, in the vicinity of Highway 191. This is the only power plant in the planning area.
- As of 2005 there were 3,150 registered wells with a pumping capacity of less than or equal to 35 gpm and 1,873 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 3.14-9.
- There are three wastewater treatment facilities in the basin that generate more than 500 acre-feet of effluent per year.
- Almost 4,000 people are served by these facilities.
- One facility, the Willcox Wastewater Treatment Plant, discharges wastewater for golf course/turf irrigation.

Table 3.14-8 Cultural Water Demand in the Willcox 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		1,784[2]	1,429[2]	308,000			NR			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				214,000			NR			
1977										
1978										
1979										
1980	9,064									
1981	9,135	195	152	117,000			NR			
1982	9,206									
1983	9,277									
1984	9,347									
1985	9,418									
1986	9,489	242	111	86,000			NR			
1987	9,560									
1988	9,631									
1989	9,702									
1990	9,773									
1991	10,031	205	74	2,600	6,400	123,600	<300	NR	NR	USGS (2007) ADWR (2008b) ADWR (2008c)
1992	10,289									
1993	10,547									
1994	10,805									
1995	11,063									
1996	11,321	331	52	2,700	5,600	123,600	<300	NR	NR	
1997	11,580									
1998	11,838									
1999	12,096									
2000	12,354									
2001	12,656	393	55	2,700	6,200	167,400	<300	NR	NR	
2002	12,957									
2003	13,259									
2004	13,560									
2005	13,862									
2010	15,369									
2020	16,973									
2030	18,237									
WELL TOTALS:		**3,150**	**1,873**							

Notes:
NR - Not reported
[1] Does not include evaporation losses from stockponds and reservoirs, or effluent.
[2] Includes all wells through June 1980.

Table 3.14-9 Effluent Generation in the Willcox 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	Golf Course/Turf Irrigation	Wildlife Area	Industrial Use	Discharge to Another Facility	Infiltration Basins	Other			
Clear Springs Utility WWTP	Clear Springs Utility Co	Clear Springs	512	45		X								Primary	NA	2007
Travel Centers of America LLC	Private	Willcox	NA													
Willcox WWTP	Town of Willcox	Willcox	3,355	504		X		Twin Lakes						Secondary	79	2000
Total			**3,867**	**549**												

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
WWTP: Wastewater Treatment Plant

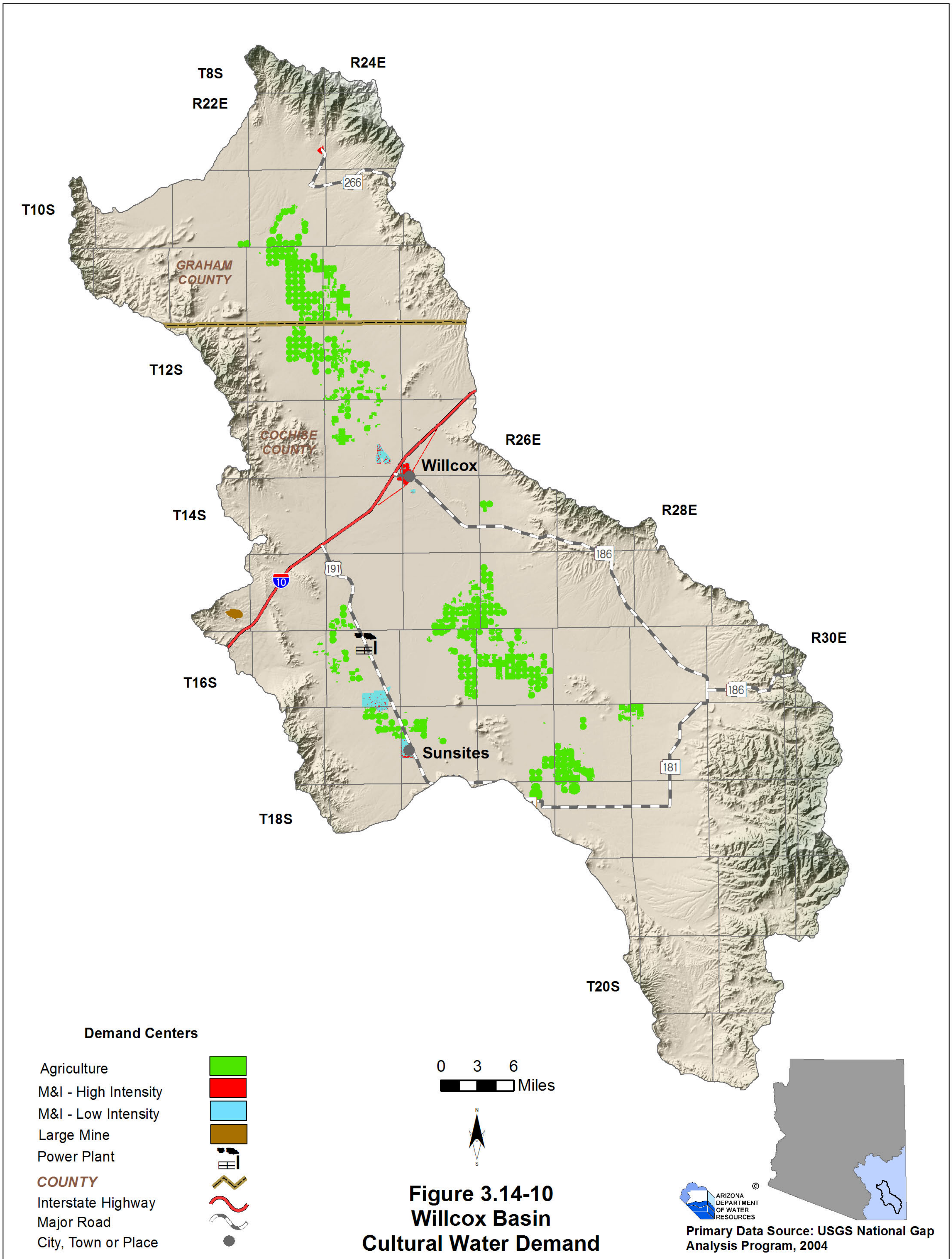


Figure 3.14-10
Willcox Basin
Cultural Water Demand

Primary Data Source: USGS National Gap Analysis Program, 2004

3.14.9 Water Adequacy Determinations in the Willcox 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 3.14-10A. Designated water provider information is shown in Table 3.14-10B with date of application, date the designation was issued and projected or annual estimated demand. Figure 3.14-11 shows the locations of subdivisions and designated providers keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All lots receiving an adequacy determination are in Cochise County. Twenty water adequacy determinations for 1,577 lots have been made in this basin through December 2008. Nine hundred and eighty-nine lots, or 62%, were determined to be adequate.
- All determinations of inadequacy were because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination and poor water quality.
- There is one designated water provider, City of Willcox, with a projected or annual estimated demand of 1,923 acre-feet.

Table 3.14-10 Adequacy Determinations in the Willcox 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	Arizona Bell Country Club # 3	Cochise	13 South	25 East	15	154		Adequate		03/11/74	Hidden Valley Water Company
2	Arizona Sunsites	Cochise	17 South	25 East	18, 19	102		Adequate		07/22/82	Clear Springs Water Company
3	Arizona Sunsites # 1	Cochise	16 South	24 East	33	NA	22-300064	Inadequate	A1	03/14/96	Dry Lot Subdivision
			17 South	24 East	4, 9, 10, 15, 16						
4	Arizona Sunsites # 2	Cochise	17 South	24 East	21, 27, 28, 33, 34	65		Inadequate	A1	01/12/93	Dry Lot Subdivision
5	Arizona Sunsites # 3 Blks 330-428	Cochise	18 South	24 East	1	23	22-300354	Inadequate	A1	09/03/97	Dry Lot Subdivision
6	Arizona Sunsites # 4	Cochise	17 South	24 East	13, 14, 22, 23, 24, 25, 26, 35	216		Inadequate	A1	01/12/93	Dry Lot Subdivision
7	Arizona Sunsites # 5	Cochise	17 South	25 East	31	35		Inadequate	A1	01/12/93	Dry Lot Subdivision
8	Arizona Sunsites # 6	Cochise	16 South	25 East	22, 23, 26, 27, 28	211		Inadequate	A1	01/12/93	Dry Lot Subdivision
9	Arizona Sunsites # 7	Cochise	16 South	24 East	4, 9, 10	NA		Inadequate	A1	01/12/93	Dry Lot Subdivision
10	Arizona Sunsites # 8	Cochise	17 South	25 East	30	12		Inadequate	A1	01/12/93	Dry Lot Subdivision
11	Branding Iron Estates	Cochise	13 South	24 East	11	46		Adequate		11/14/78	Dry Lot Subdivision
12	Foremost Subdivision	Cochise	17 South	25 East	9	50	22-400198	Adequate		11/10/99	Dry Lot Subdivision
13	Stronghold Mobile Estates	Cochise	17 South	24 East	14	NA		Inadequate	A1	11/10/82	Dry Lot Subdivision
14	Sunny Acres of Arizona # 1, 2	Cochise	16 South	26 East	31	466		Adequate		10/11/74	Dry Lot Subdivision
15	Sunsite Heights Block 22	Cochise	17 South	25 East	19	45		Adequate		12/15/78	Clear Springs Water Company
16	Sunsite Heights Blocks 5 & 8	Cochise	17 South	25 East	19	6		Adequate		05/27/94	Clear Springs Water Company
17	Sunsite Townhouses # 1A	Cochise	17 South	25 East	19	45		Adequate		12/17/78	Clear Springs Water Company
18	Sunsites Ranches	Cochise	18 South	24 East	14, 22, 24	26	22-300037	Inadequate	A1	07/28/95	Dry Lot Subdivision
19	Treasuredale Heights	Cochise	17 South	25 East	19	45		Adequate		12/15/78	Clear Springs Water Company
20	Twin Peaks	Cochise	14 South	26 East	18	30		Adequate		05/12/80	Dry Lot Subdivision

B. Designated Adequate Water Supply

Map Key	Water Provider Name	County	Designation No.	Projected or Annual Estimated Demand *(af/yr)*	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	City of Wilcox	Cochise	41-900017.0001	1,923	6/10/2008	Pending	NA

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 unavailable; 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= Data not currently available to ADWR

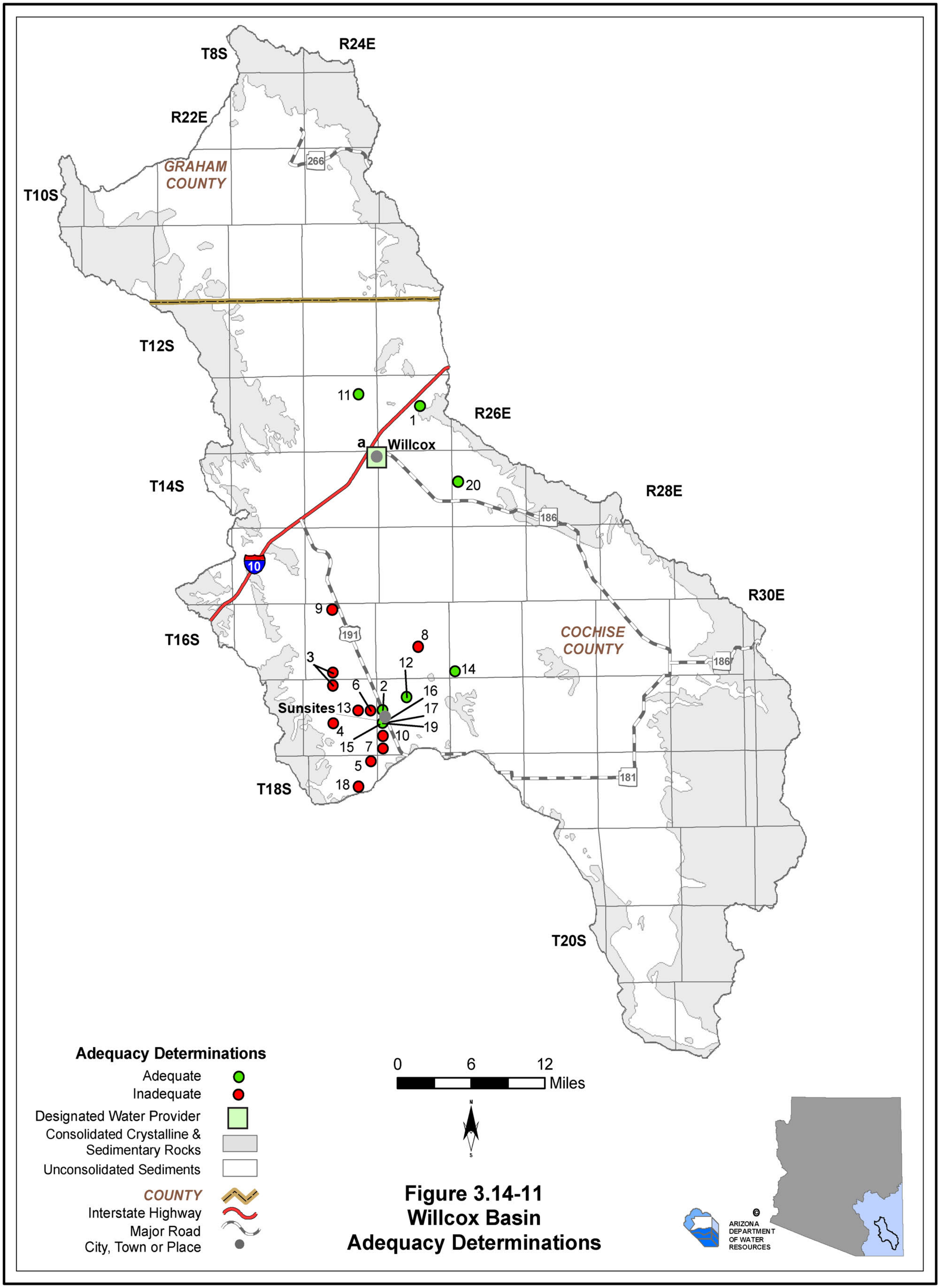


Figure 3.14-11
Willcox Basin
Adequacy Determinations

WILLCOX BASIN
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ACRONYMS AND ABBREVIATIONS

ADEQ	Arizona Department of Environmental Quality
ADMMR	Arizona Department of Mines and Mineral Resources
ADWR	Arizona Department of Water Resources
AEPCO	Arizona Electric Power Cooperative
af	Acre-feet
AFA	Acre-feet per year
AGFD	Arizona Game and Fish Department
ALERT	Automated Local Evaluation in Real Time
ALRIS	Arizona Land Resource Information System
ANP	Apache Nitrogen Products Inc.
AMA	Active Management Area
ASARCO	American Smelting and Refining Company
AWPF	Arizona Water Protection Fund
AZMET	Arizona Meteorological Network
BLM	United States Bureau of Land Management
BOR	United States Bureau of Reclamation
CAP	Central Arizona Project
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLIMAS	Climate Assessment for the Southwest
DES	Arizona Department of Economic Security
DNT	Dinitoglycerine
DOD	United States Department of Defense
ENSO	El Niño-Southern Oscillation
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCD	Flood Control District
GIS	Geographic Information System
GRIC	Gila River Indian Community
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
GVID	Gila Valley Irrigation District
GWSI	Groundwater Site Inventory System
INA	Irrigation Non-expansion Area
LUST	Leaking Underground Storage Tank
MHP	Mobile Home Park
M&I	Municipal and Industrial
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
NPS	United States National Park Service
NRCD	Natural Resources Conservation District
NRCS	Natural Resources Conservation Service
NWIS	National Water Information System
NWR	National Wildlife Refuge

Pan ET	Pan Evapotranspiration
PDO	Pacific Decadal Oscillation
PCC	Program Certificate Conveyence
PWUA	Pomerene Water Users Association
SDID	Saint David Irrigation District
SNOTEL	SNOpack TELemetry
SPRNCA	San Pedro Riparian National Conservation Area
SX/EW	Solvent extraction/electrowinning
TDS	Total Dissolved Solids
TNC	The Nature Conservancy
TMDL	Total Maximum Daily Load
TNT	Trinitroglycerin
USFS	United States Forest Service
USFWS	Unites States Fish and Wildlife Service
USGS	United States Geological Survey
USPP	Upper San Pedro Partnership
UVD	Upper Valley Districts
VRP	Voluntary Remediation Program
WIFA	Water Infrastructure Finance Authority
WQARF	Water Quality Assurance Revolving Fund
WRCC	Western Regional Climate Center
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

APPENDIX A

APPENDIX A
Arizona Water Protection Fund Projects
In the Southeastern Arizona Planning Area through Fiscal Year 2008

SOUTHEASTERN ARIZONA PLANNING AREA			
Groundwater Basin	**AWPF Grant #**	**Project Title**	**Project Category**
Aravaipa Canyon	96-0014	Klondyke Tailings Response Strategy Analysis (RSA)	Research
Cienega Creek	95-016	Refinement of Geologic Model, Lower Cienega Basin, Pima County, Arizona	Research
Cienega Creek	96-0006	Hydrogeologic Investigation of Groundwater Movement and Sources of Base Flow to Sonoita Creek and Implementation of Long-Term Monitoring Program	Research
Cienega Creek	96-0020	Cienega Creek Stream Restoration	Stream Restoration & Revegetation
Cienega Creek	97-034	Oak Tree Gully Stabilization	Upland Channel Restoration
Cienega Creek	98-049	Empire/Cienega/Empirita Fencing Project	Fencing
Cienega Creek	99-068	Lower Cienega Creek Restoration Evaluation Project	Research
Cienega Creek	99-090	Redrock Riparian Improvement	Fencing & Water Developments
Douglas	98-066	Hay Mountain Watershed Rehabilitation	Watershed Restoration
Duncan Valley	95-014	Gila Box Riparian and Water Quality Improvement Project	Fencing & Upland Water Developments
Duncan Valley	08-155	Restoration of the Gila River at Apache Grove	Stream Restoration
Lower San Pedro	97-035	Watershed Improvement to Restore Riparian and Aquatic Habitat on the Muleshoe Ranch CMA	Fencing & Watershed Restoration
Lower San Pedro	97-040	Bingham Cienega Riparian Restoration Project	Revegetation
Lower San Pedro	97-044	San Pedro River Preserve Riparian Habitat Restoration Project	Habitat Restoration
Lower San Pedro	99-069	Riparian and Watershed Enhancements on the A7 Ranch – Lower San Pedro River	Fencing & Upland Water Developments

SOUTHEASTERN ARIZONA PLANNING AREA (Cont)			
Groundwater Basin	**AWPF Grant #**	**Project Title**	**Project Category**
Lower San Pedro	07-142	Reduction of Erosion and Sedimentation along the Lower San Pedro River Through Hydrologic Restoration of Modified Ephemeral Washes	Habitat & Stream Restoration
Lower San Pedro	00-109	Lower San Pedro Watershed Project	Feasibility Study
Lower San Pedro	00-111	Cooperative Grazing Management for Riparian Improvement on the San Pedro	Fencing & Upland Water Developments
Morenci	99-077	Blue Box Crossing	Channel Restoration
Morenci	00-102	Upper Eagle Creek Restoration on East Eagle Allotment: 4 Drag Ranch	Fencing & Upland Water Developments
Morenci	05-129	Georges Lake Riparian Restoration Project	Fencing & Habitat Protection
Morenci	06-135	Double Circle Ranch Riparian Fencing Project	Fencing
Morenci	07-145	Kaler Ranch Erosion Control Project, Phase II	Habitat Stream Protection
Safford	96-0012	Eagle Creek Watershed and Riparian Stabilization	Fencing & Upland Water Developments
Safford	96-0018	San Carlos Spring Protection Project	Fencing
Safford	96-0015	Abandonment of an Artesian Geothermal Well	Habitat Protection
Safford	96-0028	Creation of a Reference Riparian Area in the Gila Valley – Discovery Park	Habitat Restoration
Safford	97-036	Stable Isotopes as Tracers of Water Quality Constituents in the Upper Gila River	Research
Safford	98-052	Tritium as a Tracer of Groundwater Sources and Movement in the Upper Gila River Drainage	Research
Safford	98-054	Fluvial Geomorphology Study and Demonstration Projects to Enhance and Restore Riparian Habitat on the Gila River from the New Mexico Border	Research
Safford	99-086	Abandonment of Gila Oil Syndicate Well #1	Habitat Protection
Safford	00-099	Gila Reference Riparian Area, Discovery Park	Revegetation
San Rafael	97-045	Santa Cruz Headwaters Project	Fencing & Upland Water Developments

SOUTHEASTERN ARIZONA PLANNING AREA (Cont)			
Groundwater Basin	**AWPF Grant #**	**Project Title**	**Project Category**
San Rafael	99-096	Upper Santa Cruz Watershed Restoration	Fencing & Upland Water Developments
Upper San Pedro	95-009	Regeneration and Survivorship of Arizona Sycamore	Research
Upper San Pedro	95-005	Preservation of the San Pedro River Utilizing Effluent Recharge	Constructed Wetland
Upper San Pedro	95-015	San Pedro Riparian National Conservation Area Watershed Rehabilitation/ Restoration Project	Revegetation & Upland Channel Restoration
Upper San Pedro	95-018	Autecology and Restoration of Sporobolus Wrightii Riparian Grasslands in Southern Arizona	Research
Upper San Pedro	95-020	Teran Watershed Enhancement	Upland Channel Restoration
Upper San Pedro	96-0013	Happy Valley Riparian Area Restoration Project	Fencing
Upper San Pedro	96-0001	San Pedro Riparian National Conservation Area Watershed Protection and Improvement Project	Fencing
Upper San Pedro	97-027	Lyle Canyon Allotment Restoration Project	Fencing & Upland Water Developments
Upper San Pedro	99-070	Lyle Canyon Allotment Riparian Area Restoration Project --- Phase 2	Fencing & Upland Water Developments
Upper San Pedro	08-151	Test of Riparian Recovery Following Cessation of Groundwater Pumping	Research
Willcox	03-116	Cottonwood Creek Restoration	Upland Channel Restoration

APPENDIX B

Appendix B: Community Water System Annual Reports and Submitted Plans

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
91-000518	ARAVAIPA WATER CO-ARAVAIPA	Aravaipa Canyon	10	10		20	10	CUSTOMER	10			10	10	CUSTOMER
91-000598	CASA ARROYO ASSN INC	Cienega Creek					6	CUSTOMER	5			5	5	CUSTOMER
91-000592	PATAGONIA WATER DEPT	Cienega Creek	140			140	139	CUSTOMER	128			128	129	CUSTOMER
91-000604	RED ROCK ACRES HOA	Cienega Creek	3			3	3	CUSTOMER	3			3	3	CUSTOMER
91-000602	ROLLING WHEELS MOBILE HOMES	Cienega Creek	NR						NR					
91-000591	SONOITA VALLEY WATER CO	Cienega Creek	7			7	7	CUSTOMER	9			9	7	CUSTOMER
91-000594	SONOITA WATER UTILITY	Cienega Creek	NR						15			15	11	CUSTOMER
91-000065	BISBEE DOUGLAS INTL APT	Douglas	375			375	375	CUSTOMER	401			401	401	CUSTOMER
91-000054	COCHISE COLLEGE PARK WATER ASSOC	Douglas	NR						NR					
91-000035	DOUGLAS WATER DEPT	Douglas	3,880			3,880	3,881	CUSTOMER	NR					
91-000038	ELFRIDA DOMESTIC WATER UTL	Douglas	NR						56			56	56	CUSTOMER
91-000055	LACOSTA WATER USERS ASSOC	Douglas	1		1	2	1	CUSTOMER	NR					
91-000037	MCNEAL WC	Douglas	NR						6			6	6	CUSTOMER
91-000057	MONTE VISTA WATER CO LLC	Douglas	NR						10			10	10	CUSTOMER
91-000075	NACO WATER CO LLC-BISBEE	Douglas	17			17	12	CUSTOMER	12			12	12	CUSTOMER
91-000081	NTM AVIATION	Douglas	28			28	28	CUSTOMER	34			34	34	CUSTOMER
91-000080	VISION QUEST LODGE MARY	Douglas	NR						2			2	2	CUSTOMER
91-000173	DUNCAN, TOWN OF	Duncan Valley	572			572	110	CUSTOMER	689			689	110	CUSTOMER
91-000178	TOWN OF DUNCAN-HUNTER WTR	Duncan Valley	56			56	15	CUSTOMER	61			61	15	CUSTOMER
91-000179	VALLEY VIEW MHP	Duncan Valley	NR						NR					
91-000176	VERDE LEE WATER CO	Duncan Valley	NR						65			65	63	CUSTOMER
91-000123	ASARCO-HAYDEN OPS	Lower San Pedro	NR						10,906		234	11,140	10,243/189	CUSTOMER/ SYSTEM
91-000025	AZ WATER CO - SIERRA VISTA	Lower San Pedro	1,262			1,262	1,174	CUSTOMER	1,314			1,314	1,241	CUSTOMER
91-000118	AZ WATER CO - WINKELMAN	Lower San Pedro	111			111	103/12	CUSTOMER/ SYSTEM	128			128	112 13	CUSTOMER/ SYSTEM
91-000529	BIDEGAIN WATER COMPANY	Lower San Pedro	NR						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
91-000569	BREEZEWAY TRAILER PARK	Lower San Pedro	4			4	4	CUSTOMER	NR					
91-000146	HAYDEN, TOWN OF	Lower San Pedro			78	78	78	CUSTOMER	NR					
91-000532	KEARNY, TOWN OF	Lower San Pedro	126	357		483	435/190	CUSTOMER/ OTHER	462			462	411/184	CUSTOMER/ OTHER
91-000533	KELVIN-SIMMONS CO-OP	Lower San Pedro	780			780	46	CUSTOMER	815			815	48	CUSTOMER
91-000525	MAMMOTH, TOWN OF	Lower San Pedro	240			240	240/6	CUSTOMER/ OTHER	233			233	233	CUSTOMER
91-000579	SAGUARO MOBILE HOME PARK	Lower San Pedro	NR						2			2	2	CUSTOMER
91-000576	STEPHENS TRAILER PARK	Lower San Pedro	17			17	1	CUSTOMER	6,515			6,515	6,515	CUSTOMER
91-000015	ALPINE ESTATES WATER COM	Morenci	NR						NR					
91-000001	ALPINE WATER SYSTEM	Morenci	NR						NR					
91-000174	PHELPS DODGE - MORENCI WATER & ELEC (CLIFTON)	Morenci	274	519		793	739	CUSTOMER	NR					
91-000175	PHELPS DODGE - MORENCI WATER & ELEC (MAIN)	Morenci	NR						NR					
91-000170	ASH CREEK WATER COMPANY	Safford	27			27	27	CUSTOMER	24			24	24	CUSTOMER
91-000171	ASPC SAFFORD/FORT GRANT	Safford	NR						NR					
91-000027	BOWIE WID	Safford	NR						NR					
91-000169	CITY OF SAFFORD	Safford	NR						1,329	3,253		4,582	4,250/197/890	CUSTOMER/ SYSTEM/OTHER
91-000168	EDEN WATER COMPANY INC	Safford			70	70	53	CUSTOMER			71	71	61	CUSTOMER
91-000166	GRAHAM COUNTY UTILITIES	Safford	51			51	39	CUSTOMER	44			44	39	CUSTOMER
91-000167	GRAHAM COUNTY UTILITIES	Safford	416			416	333/62	CUSTOMER/ SYSTEM	449			449	425 73	CUSTOMER/ SYSTEM
91-000177	LOMA LINDA WATER CO	Safford	43			43	42	CUSTOMER	36			36	36	CUSTOMER
91-000045	SAN SIMON WATER IMPROVEME	Safford	40			40	39	CUSTOMER	NR					
91-000172	USDJ FBP FED CORR INST	Safford	122		1	123	124	CUSTOMER	NR					
91-000069	ANTELOPE RUN	Upper San Pedro	63			63	62	CUSTOMER	NR					
91-000073	ASHLEY'S MHP	Upper San Pedro	11			11	11	CUSTOMER	NR					
91-000024	AZ WATER CO - BISBEE	Upper San Pedro	1,131			1,131	936	CUSTOMER	1,094			1,094	913	CUSTOMER
91-000031	BELLA VISTA CITY	Upper San Pedro	NR						3,369			3,369	3,154	CUSTOMER

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
91-000028	BELLA VISTA SOUTH	Upper San Pedro	NR						183			183	176	CUSTOMER
91-000026	BENSON, CITY OF	Upper San Pedro	878			878	762/470	CUSTOMER/ OTHER	842			842	759/445	CUSTOMER/ OTHER
91-000030	CLOUD NINE WATER CO INC	Upper San Pedro	32			32	32	CUSTOMER	26			26	26	CUSTOMER
91-000078	DESERT WINDS MOBILE PARK	Upper San Pedro	6			6	6	CUSTOMER	6			6	6	CUSTOMER
91-000046	EAST SLOPE WATER COMPANY	Upper San Pedro	290			290	290	CUSTOMER	NR					
91-000039	HOLIDAY WATER COMPANY	Upper San Pedro	46			46	46	CUSTOMER	NR					
91-000079	HOLY TRINITY MONASTERY	Upper San Pedro	160			160	160	CUSTOMER	161			161	161	CUSTOMER
91-000040	HUACHUCA CITY	Upper San Pedro	NR						213			213	213	CUSTOMER
91-000041	INDIADA WATER COMPANY	Upper San Pedro					12	CUSTOMER	NR					
91-000077	KOKOPELLI SPRINGS	Upper San Pedro	NR						NR					
91-000062	MESCAL LAKES WATER SYSTEM	Upper San Pedro	91			91	85	CUSTOMER	67			67	85	CUSTOMER
91-000043	NACO WATER CO	Upper San Pedro	83			83	67	CUSTOMER	76			76	65	CUSTOMER
91-000034	NORTHERN SUNRISE WC - CORONADO	Upper San Pedro	NR						59			59	45	CUSTOMER
91-000063	NORTHERN SUNRISE WC - MUSTANG/ CRYSTAL	Upper San Pedro	NR						33			33	25	CUSTOMER
91-000064	NORTHERN SUNRISE WC - SIERRA SUNSET	Upper San Pedro	NR						10			10	7	CUSTOMER
91-000044	PALOMINAS WATER & SEWER C	Upper San Pedro	3			3	3	CUSTOMER	NR					
91-000033	POMERENE DOMESTIC WATER	Upper San Pedro	220			220	223	CUSTOMER	227			227	206	CUSTOMER
91-000058	PUEBLO DEL SOL WATER CO	Upper San Pedro	1,501			1,501	1,426	CUSTOMER	1,453			1,453	1,398	CUSTOMER

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
91-000071	SIERRA VISTA MH VILLAGE	Upper San Pedro	50			50	50	CUSTOMER	50			50	50	CUSTOMER
91-000032	SOUTHERN SUNRISE WC - COCHISE /HORSESHOE	Upper San Pedro	NR						156			156	129	CUSTOMER
91-000042	SOUTHERN SUNRISE WC - MIRACLE VALLEY	Upper San Pedro	NR						35			35	31	CUSTOMER
91-000047	SOUTHLAND UTL-GOLDEN ACRES	Upper San Pedro	153			153	153	CUSTOMER	160			160	161	CUSTOMER
91-000053	ST DAVID WATER	Upper San Pedro	212			212	197	CUSTOMER	213			213	200	CUSTOMER
91-000067	STRATMAN WATER COMPANY	Upper San Pedro	13			13	12	CUSTOMER	14			14	12	CUSTOMER
91-000048	SUE JUAN WC	Upper San Pedro	54			54	55	CUSTOMER	52			52	52	CUSTOMER
91-000076	SULGER WATER COMPANY 2	Upper San Pedro	3			3	3	CUSTOMER	NR					
91-000051	SUNIZONA WATER CO	Upper San Pedro	NR						16			16	16	CUSTOMER
91-000070	SUNRISE MOBILE HOME PARK	Upper San Pedro	NR						NR					
91-000049	TOMBSTONE, CITY OF	Upper San Pedro	NR						NR					
91-000068	US ARMY-FORT HUACHUCA	Upper San Pedro	NR						1,274			1,274	1,414/661	CUSTOMER/ OTHER
91-000072	WHETSTONE VILLAGE MOBILE	Upper San Pedro	11			11	11	CUSTOMER				0		
91-000052	WHETSTONE WD	Upper San Pedro					141	CUSTOMER	74			74	73	CUSTOMER
91-000056	WILLOW LAKES PROPERTY OWNERS ASSOCIATION	Upper San Pedro	NR						NR					
91-000029	CLEAR SPRINGS	Willcox	168			168	135	CUSTOMER	131			131	116	CUSTOMER
91-000061	CLEAR SPRINGS UTILITY	Willcox	5			5	5	CUSTOMER	5			5	5	CUSTOMER
91-000050	WILLCOX, CITY OF	Willcox	NR						987			987	790/168	CUSTOMER/ OTHER

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

Community Water Systems that have submitted a plan to the Department as of 12/2008

PCC	NAME	Basin
91-000518	ARAVAIPA WATER CO-ARAVAIPA	Aravaipa Canyon
91-000591	SONOITA VALLEY WATER CO	Cienega Creek
91-000592	PATAGONIA WATER DEPT	Cienega Creek
91-000594	SONOITA WATER UTILITY	Cienega Creek
91-000598	CASA ARROYO ASSN INC	Cienega Creek
91-000604	RED ROCK ACRES HOA	Cienega Creek
91-000035	DOUGLAS WATER DEPT	Douglas
91-000065	BISBEE DOUGLAS INTL APT	Douglas
91-000075	NACO WATER CO LLC-BISBEE	Douglas
91-000081	NTM AVIATION	Douglas
91-000173	DUNCAN, TOWN OF	Duncan Valley
91-000176	VERDE LEE WATER CO	Duncan Valley
91-000178	TOWN OF DUNCAN-HUNTER WTR	Duncan Valley
91-000025	AZ WATER CO - SIERRA VISTA	Lower San Pedro
91-000118	AZ WATER CO - WINKELMAN	Lower San Pedro
91-000123	ASARCO-HAYDEN OPS	Lower San Pedro
91-000532	KEARNY, TOWN OF	Lower San Pedro
91-000533	KELVIN-SIMMONS CO-OP	Lower San Pedro
91-000569	BREEZEWAY TRAILER PARK	Lower San Pedro
91-000576	STEPHENS TRAILER PARK	Lower San Pedro
91-000579	SAGUARO MOBILE HOME PARK	Lower San Pedro
91-000174	PHELPS DODGE - MORENCI WATER & ELEC (CLIFTON)	Morenci
91-000175	PHELPS DODGE - MORENCI WATER & ELEC (MAIN)	Morenci
91-000167	GRAHAM COUNTY UTILITIES	Safford
91-000169	CITY OF SAFFORD	Safford
91-000166	GRAHAM COUNTY UTILITIES	Safford
91-000168	EDEN WATER COMPANY INC	Safford
91-000170	ASH CREEK WATER COMPANY	Safford
91-000171	ASPC SAFFORD/FORT GRANT	Safford
91-000177	LOMA LINDA WATER CO	Safford
91-000024	AZ WATER CO - BISBEE	Upper San Pedro
91-000026	BENSON, CITY OF	Upper San Pedro
91-000031	BELLA VISTA CITY	Upper San Pedro
91-000040	HUACHUCA CITY	Upper San Pedro
91-000058	PUEBLO DEL SOL WATER CO	Upper San Pedro
91-000028	BELLA VISTA SOUTH	Upper San Pedro
91-000030	CLOUD NINE WATER CO INC	Upper San Pedro
91-000032	SOUTHERN SUNRISE WC - COCHISE/HORSESHOE	Upper San Pedro
91-000033	POMERENE DOMESTIC WATER	Upper San Pedro
91-000034	NORTHERN SUNRISE WC - CORONADO	Upper San Pedro
91-000042	SOUTHERN SUNRISE WC - MIRACLE VALLEY	Upper San Pedro
91-000043	NACO WATER CO	Upper San Pedro
91-000044	PALOMINAS WATER & SEWER C	Upper San Pedro
91-000047	SOUTHLAND UTL-GOLDEN ACR	Upper San Pedro
91-000049	TOMBSTONE, CITY OF	Upper San Pedro
91-000051	SUNIZONA WATER CO	Upper San Pedro
91-000052	WHETSTONE WD	Upper San Pedro
91-000053	ST DAVID WATER	Upper San Pedro
91-000062	MESCAL LAKES WATER SYSTEM	Upper San Pedro

PCC	NAME	Basin
91-000063	NORTHERN SUNRISE WC - MUSTANG/CRYSTAL	Upper San Pedro
91-000064	NORTHERN SUNRISE WC - SIERRA SUNSET	Upper San Pedro
91-000067	STRATMAN WATER COMPANY	Upper San Pedro
91-000071	SIERRA VISTA MH VILLAGE	Upper San Pedro
91-000072	WHETSTONE VILLAGE MOBILE	Upper San Pedro
91-000073	ASHLEY'S MHP	Upper San Pedro
91-000076	SULGER WATER COMPANY 2	Upper San Pedro
91-000077	KOKOPELLI SPRINGS	Upper San Pedro
91-000079	HOLY TRINITY MONASTERY	Upper San Pedro
91-000050	WILLCOX, CITY OF	Willcox
91-000029	CLEAR SPRINGS	Willcox
91-000061	CLEAR SPRINGS UTILITY	Willcox

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 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.

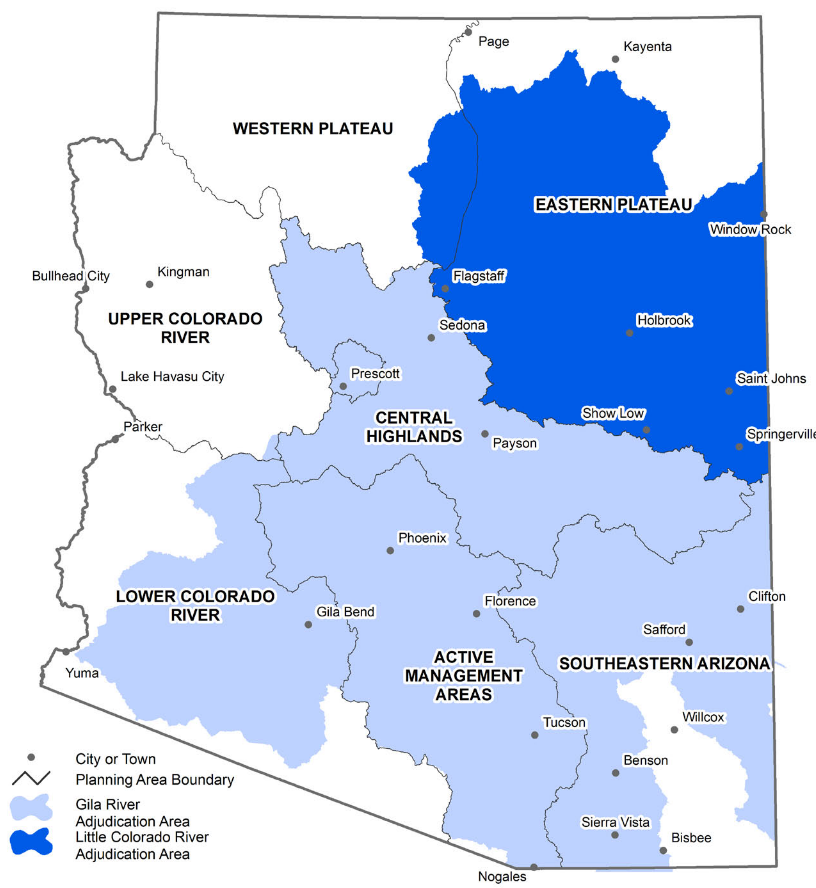
A CWR may also be issued based on a stockpond claim (38) if it is found that the facts stated in the claim are true and entitle the claimant to a water right for the stockpond. The priority date depends on the date that the owner of the stockpond filed the claim. If filed prior to March 17, 1996, the 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". 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 jointed into large, comprehensive determinations.

Arizona currently has two general stream adjudications – the Gila Adjudication and the LCR Adjudication. (See Figure C-1) 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. § 45-256.

Figure C-1 General Stream Adjudications in Arizona



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.

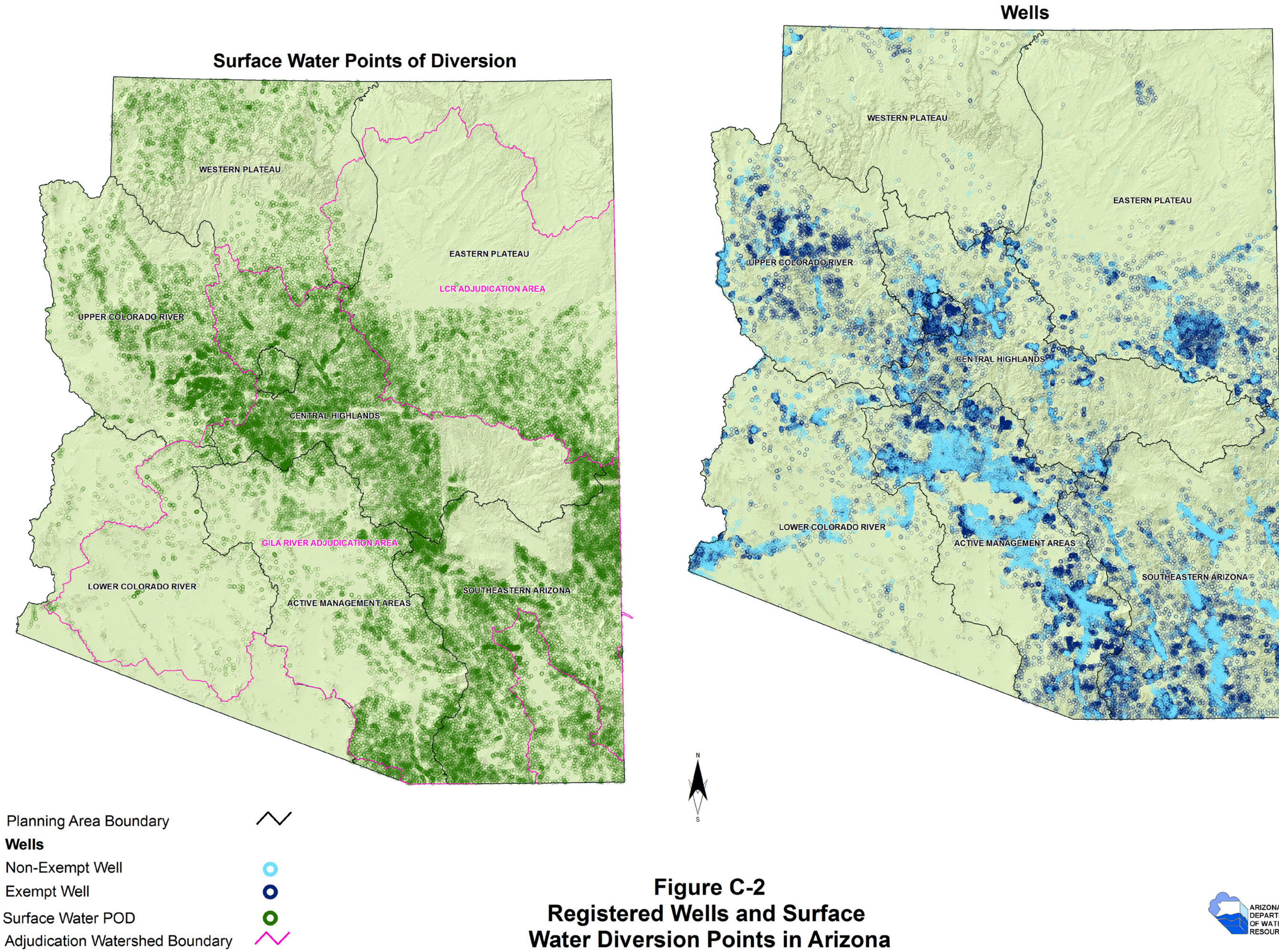


Figure C-2
Registered Wells and Surface Water Diversion Points in Arizona

ARIZONA DEPARTMENT OF WATER RESOURCES ©

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.

APPENDIX D

APPENDIX D: RURAL WATERSHED PARTNERSHIPS ISSUE SUMMARY (2008)

SOUTHEASTERN ARIZONA PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
Community Watershed Alliance/ Middle San Pedro Watershed	Cochise County Benson J-Six Mescal HOA St. David Irrigation District Pomerene Irrigation District Local Citizenry TNC ADWR NRCD ADEQ Coop Extension USGS USDA/ARS USGS USBoR	• Cursory groundwater study completed. • AMA evaluation completed. • Active agricultural fields identified and surveyed • HSR completed • 7-year comprehensive groundwater study and numeric model development initiated. • Completed Watershed Based Plan • Obtained TRIF Grant to conduct groundwater age dating	• Growth proposed in the Benson area • Limited groundwater data • Different perceptions of issues and goals within the area between Benson, irrigation districts, local citizenry, and the Upper San Pedro Partnership • Unable to get principle players to the table to discuss water • Unregulated lot splits • New arsenic drinking water standard • Limited funding resources for planning, projects, infrastructure and studies • ESA issues • Superfund site/poor quality groundwater conditions • Potential impact of adjudication court subflow definition • Limited funding resources for planning, projects, infrastructure and studies • Mandatory water adequacy required for all new subdivisions
Eagle Creek Partnership	Local ranchers & special interest groups ADWR	• Stream Reconnaissance study completed.	• Little or no groundwater data available • Unresolved Indian water rights settlements • Limited funding resources for planning, projects, infrastructure and studies
Gila Watershed Partnership	Safford Thatcher Pima Graham County Greenlee County Duncan ADWR AZG&F	• Fluvial Geomorphology Study • Completed water demand study • Capped several saline wells contributing to the degradation in water quality of the Gila River	• Indian water rights settlement issues • Poor quality surface and groundwater • Growth associated with new Phelps Dodge mine and unregulated lot splits • ESA issues throughout the watershed, critical

SOUTHEASTERN ARIZONA PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
	ADEQ Coop Extension BLM USFS USBoR NRCS/RCD	• Resin bush eradication project completed. • Obtained several DEQ 319 grants for Gila River related projects • Initiated San Simon legacy database project • Completed Watershed Based Plan • Completed Point of Pines restoration project • Awarded several Water Protection Fund grants	habitat designation, and mitigation efforts • Desire to maintain rural setting and especially maintaining agriculture at current or higher levels • Lack of technical data on the groundwater system • Invasive species issues impacting the surface water supply (tamarisk) • Potential impacts of adjudication court subflow definition • New arsenic drinking water standard • Drought impacts on surface water supplies, agriculture and cattle ranching • Numerous high hazard unsafe dams in area • Limited funding resources for planning, projects, infrastructure and studies • Regular flooding in the Duncan-Virden area
Lower San Pedro Watershed Partnership-Redington NRCD	Redington Cascabel Local ranchers ADWR NRCD/RCD	• Watershed reconnaissance study completed.	• Unresolved adjudication and Indian water rights settlement issues • Little or no groundwater data • Opposition to government assistance in obtaining groundwater information • Potential impacts of adjudication court subflow definition • Limited funding resources for planning, projects, infrastructure and studies
Upper San Pedro Partnership	Sierra Vista Ft. Huachuca Cochise County Huachuca City Bisbee Tombstone TNC Huachuca	• Comprehensive groundwater study • Completed numeric groundwater model • Decision Support System model completed.	• Impacts on endangered species • Federal mandate to achieve sustainability by 2011 • Lawsuits from environmental groups • Anticipated growth • Potential impacts on riparian regime by continuation of current pumping

SOUTHEASTERN ARIZONA PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
	Audubon Bella Vista Water ADWR ADEQ AACD NRCD State Land USF&W USFS BLM USDA/ARS USGS USBoR Coronado National Monument	• San Pedro Riparian National Conservation Area Water Demand study • Recharge study of detention basins completed • Engineering design to transfer effluent from Huachuca City to Ft. Huachuca for treatment and recharge completed • Bisbee wastewater treatment plant for use by Turquoise Valley golf course completed. • Second iteration of water conservation & management plan completed. • Section 321 Report to Congress annually submitted. • Funded more than $1,000,000 in conservation projects in watershed. • Conduct public outreach and educational forums • Completed Water Supply Appraisal study. • Introduced Congressional Bill to obtain authority to conduct feasibility study • Preliminary Upper San Pedro Water District formed	• Political obstacles from potential water augmentation projects • Potential loss of Ft. Huachuca • Interbasin transfer prohibition • Potential impacts of adjudication court subflow definition • Pumping impacts by Mexico on the San Pedro River and downstream users • Unregulated lot splits • Limited funding resources for planning, projects, infrastructure and studies • High cost of augmentation projects • Mandatory water adequacy required for all new subdivisions
Willcox Playa Watershed Group	Willcox Cochise County Cooperative Extension Local Citizenry	• Initiated multiple year comprehensive groundwater study	• Approximately 100,000+ ac-ft of groundwater overdraft annually • Potential for subsidence

SOUTHEASTERN ARIZONA PLANNING AREA			
Watershed Partnership	**Primary Participants**	**Projects & Accomplishments**	**Issues**
		• Initiated the collection of relative gravity data	• Limited funding resources • Increased agricultural production • Little or no groundwater data • Water quality concerns • Mandatory water adequacy required for all new subdivisions