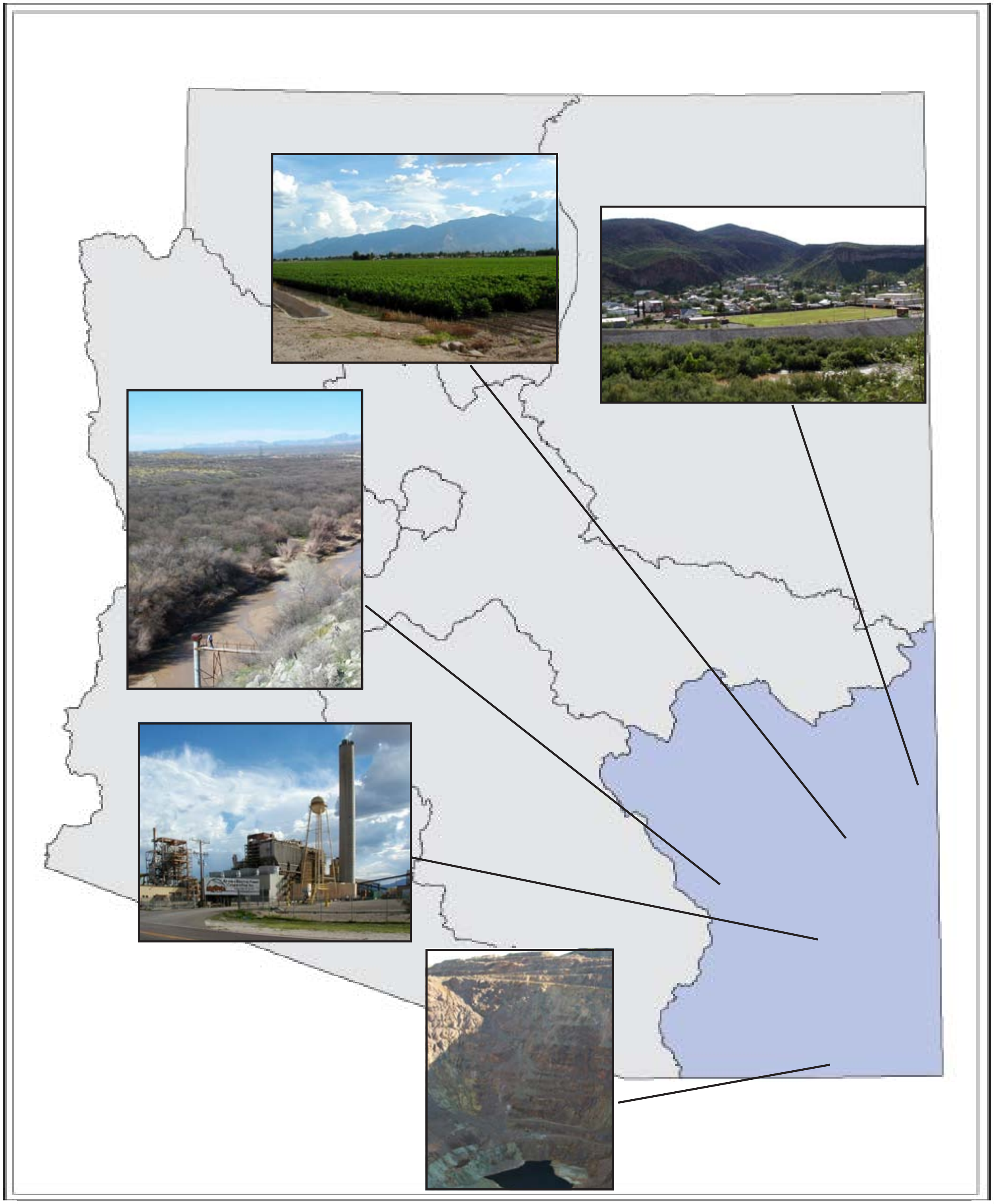
ARIZONA WATER ATLAS
VOLUME 3
SOUTHEASTERN ARIZONA PLANNING AREA



Arizona Department of Water Resources

DRAFT

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ARIZONA WATER ATLAS
VOLUME 3 - SOUTHEASTERN ARIZONA PLANNING AREA (Draft)

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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 divides Arizona into seven planning areas (Figure 3.0-1). There is a separate Atlas volume for each planning area, an introductory volume composed of background information, and an executive summary 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.

There are additional, more detailed data available to those presented in this volume. They may be obtained by contacting the Arizona Department of Water Resources' Statewide Conservation and Strategic Planning Division.

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 at Mount Graham to 1,920 feet near Winkelman. Cochise County is entirely contained in the planning area as well as portions of seven other counties: Apache, Gila, Graham, Greenlee, Pima, Pinal and Santa Cruz 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 186,600. 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 38,000 residents in the incorporated area and an additional 14,300 residents in the unincorporated area southeast of the city. The agricultural water use sector is the largest user with significant agricultural use in the Douglas, Safford and Willcox Basins. The Douglas Irrigation Non-expansion Area (INA), an area designated as having insufficient groundwater to provide a reasonably safe supply for irrigation, is located in the Douglas Basin. Major cities and towns, counties and the boundaries of the INA are shown on Figure 3.0-2.

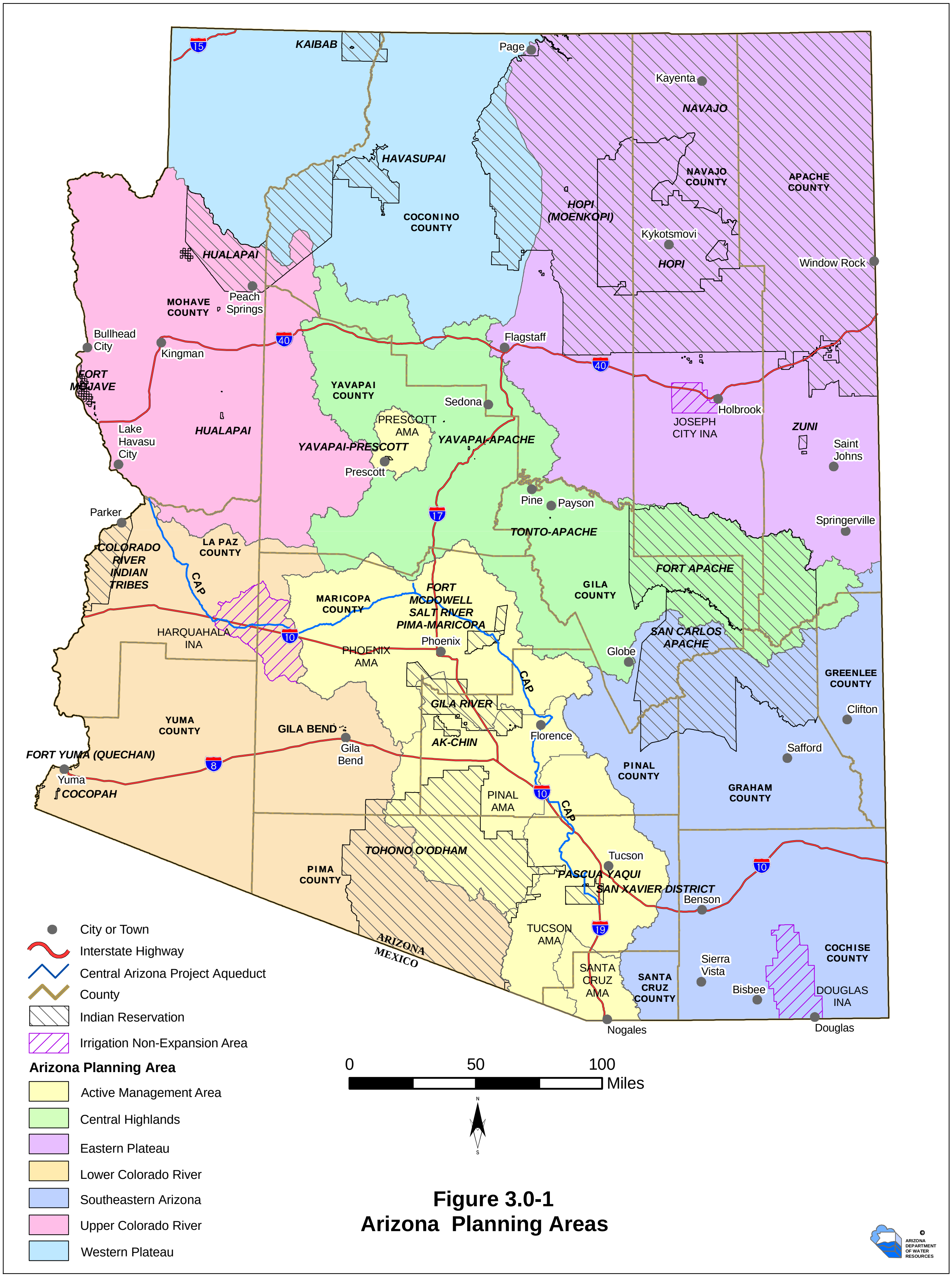


Figure 3.0-1
Arizona Planning Areas

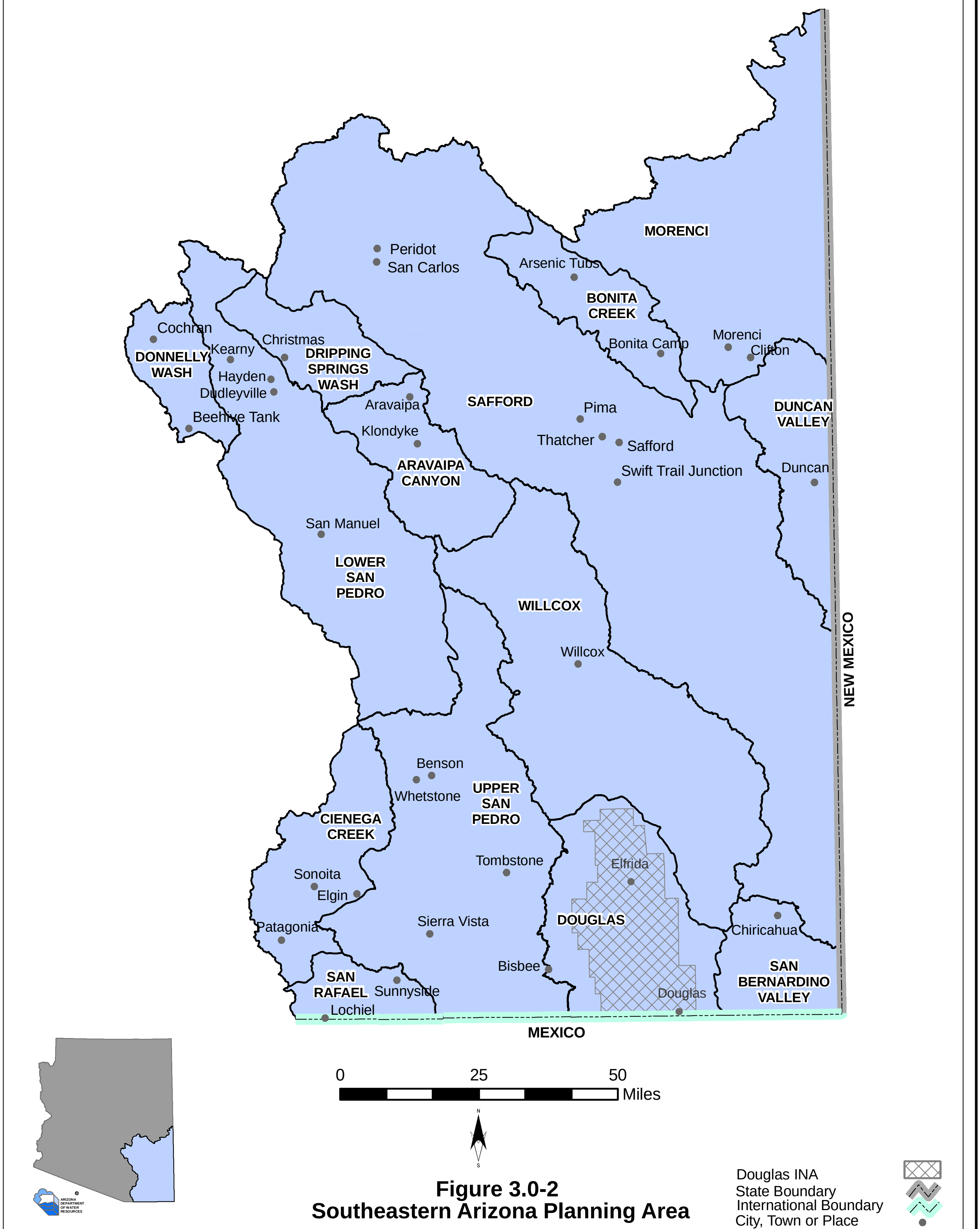


Figure 3.0-2
Southeastern Arizona Planning Area

3.0.1 Geography

The Southeastern Arizona Planning Area includes 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.

The planning area encompasses 16,072 sq. miles. It 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. Most of the 2,900 sq. mile San Carlos Apache Reservation, (83.1% or about 2,400 sq. miles), 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 Volume 1, Figure 1-2). 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 physiographic province, 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 1,920 feet near Winkelman in the Lower San Pedro Basin to 10,713 feet at Mount Graham in the Pinaleño Mountains in the Safford 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 planning area includes drainages of the San Pedro River and Upper Gila River. 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 at Winkelman. 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. (ADWR, 1994a)

3.0.2 Hydrology[1]

Groundwater Hydrology

The Southeastern Arizona Planning Area is generally characterized by alluvial basins with large reserves of groundwater in gently sloping valleys separated by mountain ranges. 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 much 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 to depths of over 1,000 feet, 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 in thickness and are composed of sands, gravels, silts, clays and some limestones. Thin layers of sand and gravel along major streams make up the stream alluvium. 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. Groundwater generally flows from the basin margins to the central axis of the basin where most of the groundwater discharge occurs. There are also occurrences of confined groundwater (artesian conditions) 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 Saint David, in 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.

The north and northeastern basins of the planning area (Bonita Creek, Dripping Springs Wash, Duncan Valley and Morenci) contain major aquifers composed of stream alluvium, basin fill, volcanic rock and sedimentary rock (Gila Formation). These basins contribute groundwater flow to the Safford Basin. The Safford Basin is composed of three sub-basins. The southernmost sub-basin is the San Simon Valley sub-basin. In this sub-basin, groundwater is found under artesian conditions in the lower aquifer. The upper aquifer generally contains high total dissolved solids (TDS) and fluoride. In the Gila Valley sub-basin, located in the middle part of the Safford Basin, the principal aquifer is the younger basin fill. Groundwater is also utilized from the older basin fill, which generally is found under artesian conditions and where well discharges may be quite high. Groundwater in both the younger and older basin fill may be high in TDS in this sub-basin. The main water-bearing unit in the San Carlos Valley sub-basin, located in the northern part of the Safford Basin, is the younger stream alluvium.

In basins located on the western side of the planning area that are tributary to the San Pedro River (Aravaipa Canyon, Donnelly Wash, Lower and Upper San Pedro), groundwater is found in the

[1] Much of the information in this section is taken from the Arizona Water Resources Assessment, Volume 1, ADWR August, 1994.

stream alluvium and in basin-fill sediments. Both these aquifers are found in the Aravaipa Canyon Basin, while the principal aquifer in the Donnelly Wash Basin is a very narrow strip of basin fill alluvium. In the Upper San Pedro Basin, the basin fill is the principal aquifer although the stream alluvium is also utilized. An interesting feature in this basin 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). In the Lower San Pedro Basin the hydrologic characteristics of the regional basin fill aquifer vary widely due to the amount of cementation and fine-grained layers. Artesian conditions exist about five miles north to ten miles south of Mammoth in wells drilled deeper than 500 feet. Water quality is generally suitable for most uses in these basins.

Hydrogeologic conditions in the Cienega Creek Basin are complex. The basin has been divided into three groundwater sections based on the presence of a distinctive aquifer or set of aquifers: upper Cienega Creek, lower Cienega Creek and Sonoita Creek. The main aquifer in the upper Cienega Creek section, which includes most of the basin's central valley, is the basin fill alluvium. In the lower Cienega Creek section, which coincides with the surface water divide at "the Narrows" on Cienega Creek, north to the basin boundary, there are three aquifers: stream alluvium, basin fill and the Pantano formation. The main aquifer in this section is the stream alluvium. The basin-fill alluvium is a poor aquifer in this section with relatively low well yields and interbedded clay layers that create a leaky, confined aquifer and artesian conditions. The southwestern section of the basin is the Sonoita Creek section where the main aquifer is the stream alluvium that forms the floodplain of Sonoita Creek and its tributaries. Groundwater quality is generally good throughout the basin.

The Willcox Basin is a "closed basin" with no groundwater inflow or outflow from adjacent basins. Groundwater is found in alluvial deposits consisting of stream and lake-bed deposits. The stream deposits are the most productive water-bearing unit. The lake bed deposits are mainly clay that 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. Groundwater flow conditions have been altered significantly due to groundwater pumping. 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, 2006a). High TDS concentrations exist in some areas (ADWR, 1994b) and exceedences of fluoride and arsenic have been reported in a number of wells.

Groundwater from three basins (San Bernardino Valley, Douglas and San Rafael) flows into Mexico. The Douglas and San Bernardino Valley Basins contain volcanic rock that serves as an aquifer material. There is a long alluvial valley in the Douglas Basin where the main aquifer is the basin fill. In the vicinity of Elfrida, groundwater flow directions have been altered due to agricultural pumpage. The major aquifer in the San Rafael Basin is stream alluvium and basin fill, which are hydrologically connected. Groundwater quality is generally suitable for most uses in these basins. More detail on the hydrogeology of each basin is described in the groundwater conditions section for each basin.

Surface Water Hydrology

Surface water in the planning area can generally be divided into four areas: the Upper Gila River drainage basins, the Middle Gila River/San Pedro River drainage, the Willcox Basin and areas that drain into Mexico.

The Upper Gila watershed drains about 7,400 square miles in the planning area above Coolidge Dam and is within the Morenci, Duncan Valley, Bonita Creek 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 acre-feet per year 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 acre-feet per year (ADWR, 2006). 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 west of the New Mexico border. Flow in this stretch is maintained by tributary inflow and springs, including hot springs (ADWR, 1994b). Flow in the Gila River becomes intermittent farther downstream due to seasonal variations in flow and impoundment in San Carlos Reservoir. Inflow to the San Carlos Reservoir from the Gila and San Carlos Rivers averages about 310,000 acre-feet per year. (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 from Pima near the Gila River (USGS, 2006b).

Below Coolidge Dam, flow in the Gila River is from releases from the San Carlos Reservoir and flood flow from the San Pedro River, the only major tributary in this stretch of the Gila River located within the Southeastern Arizona Planning Area (ADWR, 1994b). Since 1936, an average of 260,000 acre-feet per year of reservoir storage and inflows have been released to the river below Coolidge Dam (ADWR, 2006). Dripping Springs Wash and Donnelly Wash Basins are included in the Middle Gila River drainage as are the basins of the San Pedro River drainage. Basins within the San Pedro River drainage include Aravaipa Canyon, and the Upper and Lower San Pedro Basins. The Cienega Creek and San Rafael groundwater basins contribute tributary surface water to the San Pedro River drainage (ADWR, 1991). Surface water flow in the Cienega Creek Basin also drains to the Santa Cruz River.

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. Major tributaries to the San Pedro River are the Babocomari River and Aravaipa Creek. In this drainage there are fairly productive springs in the Huachuca Mountains and in the vicinity of the San Pedro River in the Lower San Pedro Basin.

Surface water drainage in the Willcox Basin is to the Willcox Playa, which occupies about 50 square miles in the center of the basin. A playa is a nearly level area at the bottom of a closed desert basin, sometimes temporarily covered by water. There are a few perennial streams in the basin that originate in the Pinaleño and the Chiricahua Mountains. Perennial streams include Grant, Leslie, Turkey and Rucker Creeks. There are no large springs identified in the basin.

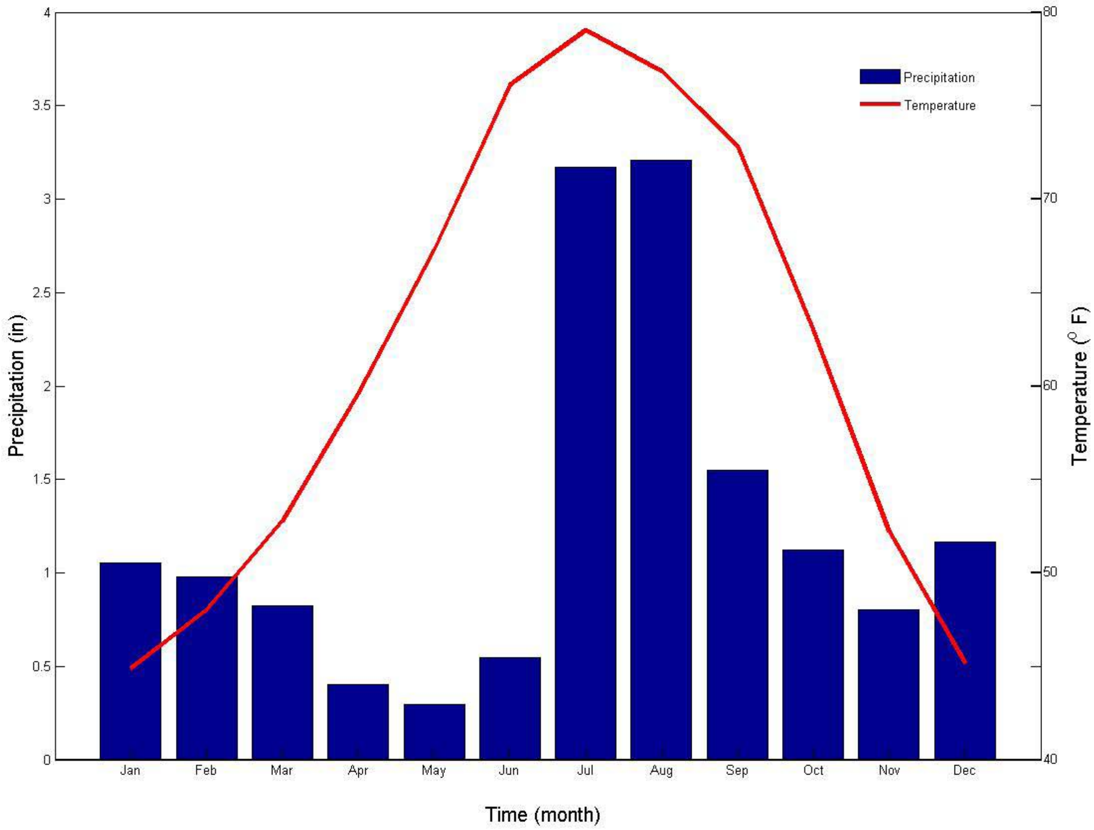
The Douglas, San Bernardino Valley and San Rafael Valley basins generally drain south into Mexico. Whitewater Draw is the major drainage in the Douglas Basin. Black Draw is the main surface water drainage in the San Bernardino Valley Basin and becomes perennial just north of the international boundary. In this basin, artesian wells and springs support wetlands. The San Rafael Valley contains a surface water divide that separates the drainage into two watersheds. Most of the Valley is drained by the Santa Cruz River that flows south into Mexico, then north into Arizona east of Nogales. The eastern part of the valley drains south to Mexico into the San Pedro River Watershed and San Pedro River, which flows north into the planning area. There are no major springs (>10 gpm) identified in any of the three Mexican drainage basins.

3.0.3 Climate

Annual average precipitation in the planning area is 14.7 inches, with over 52% coming in July, August, and September (Figure 3.0-3). This planning area receives the most summer precipitation in the state because of its proximity to the core monsoon region in Mexico. The monsoon is strongest in northwestern Mexico, and Arizona usually only receives the northernmost fringes of precipitation. However, 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. Figure 3.0-4 shows seasonal precipitation averages for selected basins in the planning area that illustrates seasonal precipitation variability as well as climatic differences between basins.

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.

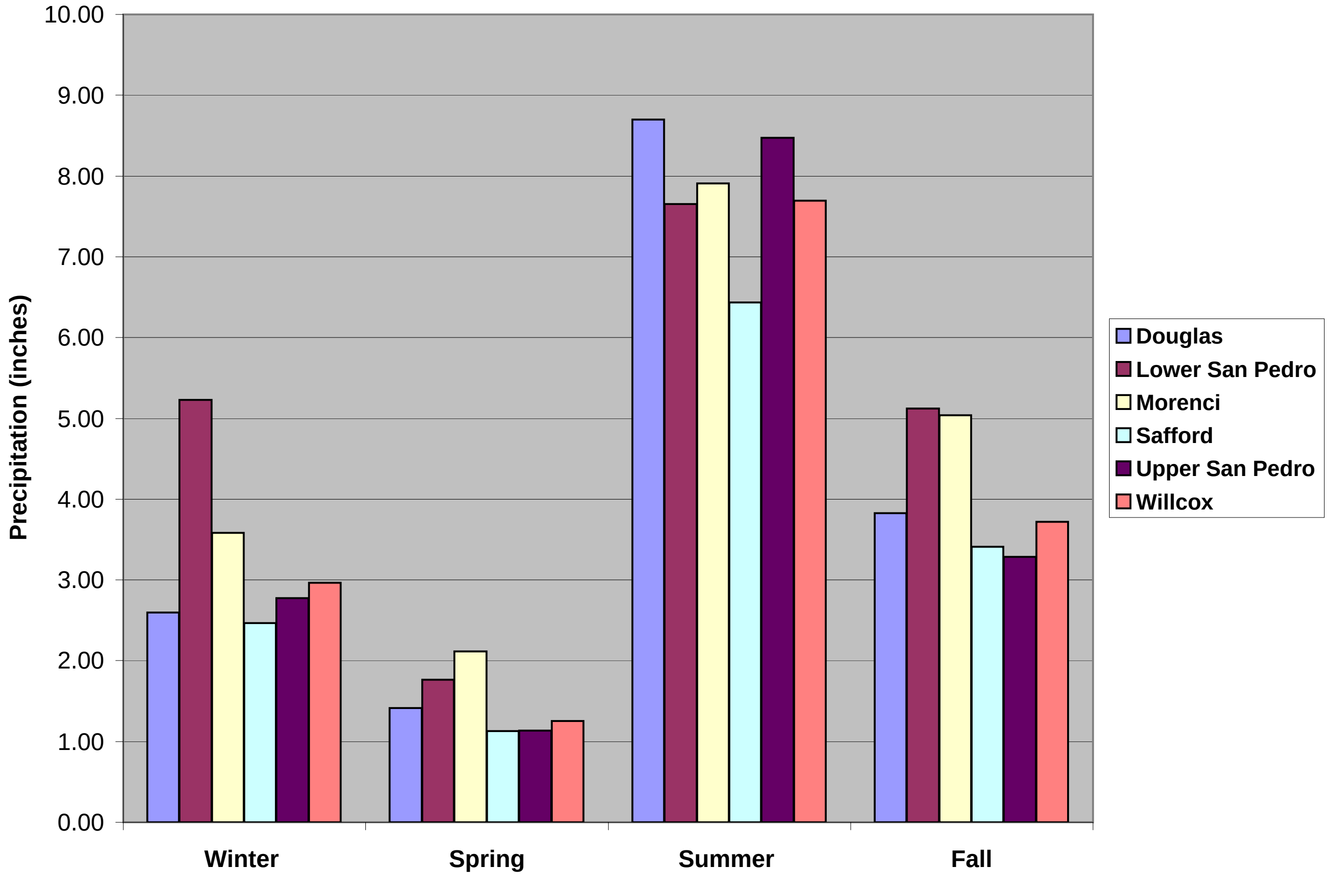
Figure 3.0-3 Average monthly precipitation and temperature in the Southeastern Arizona Planning Area, 1930-2002



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

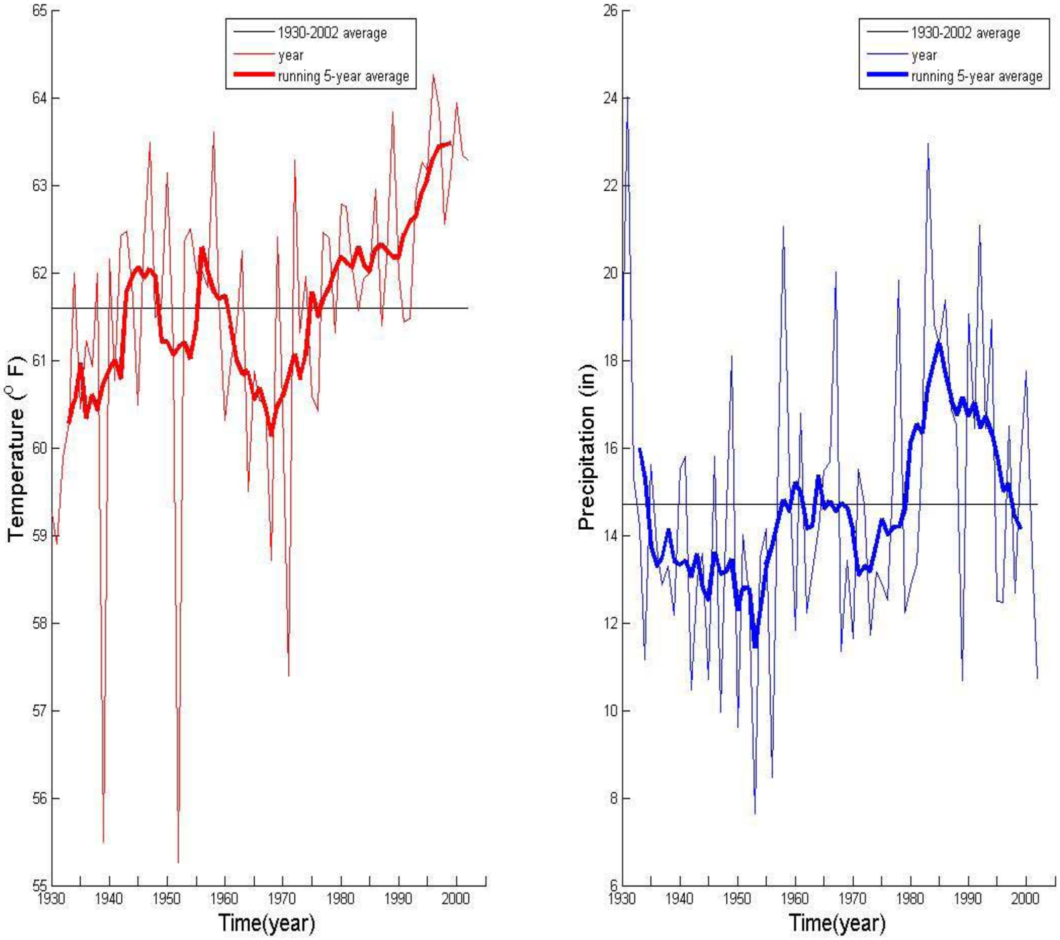
As in other areas of Arizona, precipitation is extremely variable, both spatially and from year to year. For example, during the 2005-2006 winter, the planning area received 6.3 inches less precipitation than during the 2004-2005 winter. This variability can also be observed on longer time scales. The 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 3.0-5). 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 3.0-6).

Figure 3.0-4 Average annual precipitation for selected basins in the Southeastern Arizona Planning Area



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.

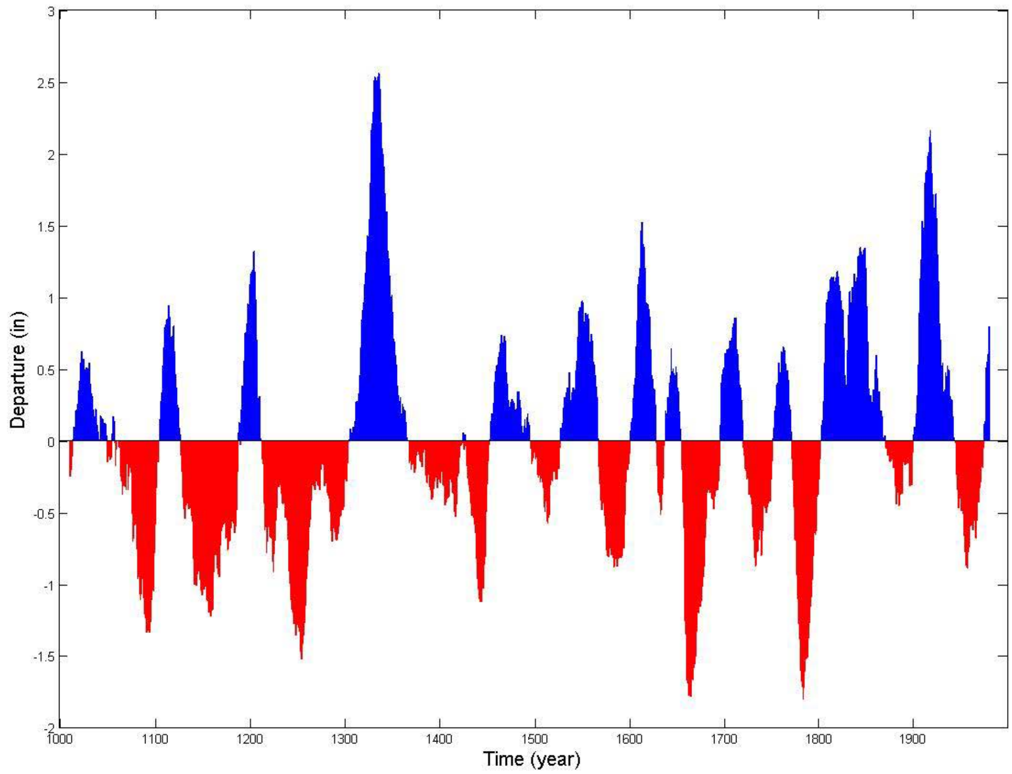
Figure 3.0-5 Average temperature (left) and total precipitation in the Southeastern Arizona Planning Area from 1930-2002



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: Ben Crawford, CLIMAS.

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 (Figure 3.0-5). Temperature observations are consistent with global temperature trends; however, some warming may be attributed to changes in land-cover resulting from population growth.

Figure 3.0-6 Arizona NOAA climate division 7 (southeastern Arizona; Graham, Greenlee, Cochise, Santa Cruz, and Pima Counties) winter (November-April) precipitation departures from average, 1000-1988, reconstructed from tree rings



Data are presented as a 20-year moving average to show variability on decadal time scales. 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: Ben Crawford, CLIMAS.

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. Discussed in this section are historic conditions, the effect of cultural activities on environmental conditions, and actions undertaken to restore and protect water resources and habitat.

Biotic communities in the Southeastern Arizona Planning Area range from Upland Sonoran to Subalpine conifer forests. Much of the area is semi-desert grassland and Chihuahuan desert. The sky island ecosystems of the planning area are relatively isolated from each other, and as a result there are a high 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)

The planning area has been substantially altered in many locations by grazing and farming activities. 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. 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). 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)

Arizona Water Protection Fund Programs

Forty riparian restoration projects in the Southeastern Arizona Planning Area have been funded by the Arizona Water Protection Fund Program (AWPF) through 2005. 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 Southeastern Arizona Planning Area through 2005 is found in Appendix A of this volume. (A description of the program, a complete listing of all projects funded, and a reference map is found in Appendix C of 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, listed in Table 3.0-1 and shown on Figure 3.0-7. 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 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.

Table 3.0-1 Instream Flow Claims 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
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

Map Key	Stream	Applicant	Application No.	Permit No.	Certificate No.	Filing Date
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, 2005b

Threatened and Endangered Species

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 May 2006 are shown in Table 3.0-2.[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.

Conservation Areas, Refuges and Preserves

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 Saint 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 with the principle objective 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. Four perennial waterways, the Gila

[2] An “endangered species” is defined by the 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 foreseeable future throughout all or a significant portion of its range.”

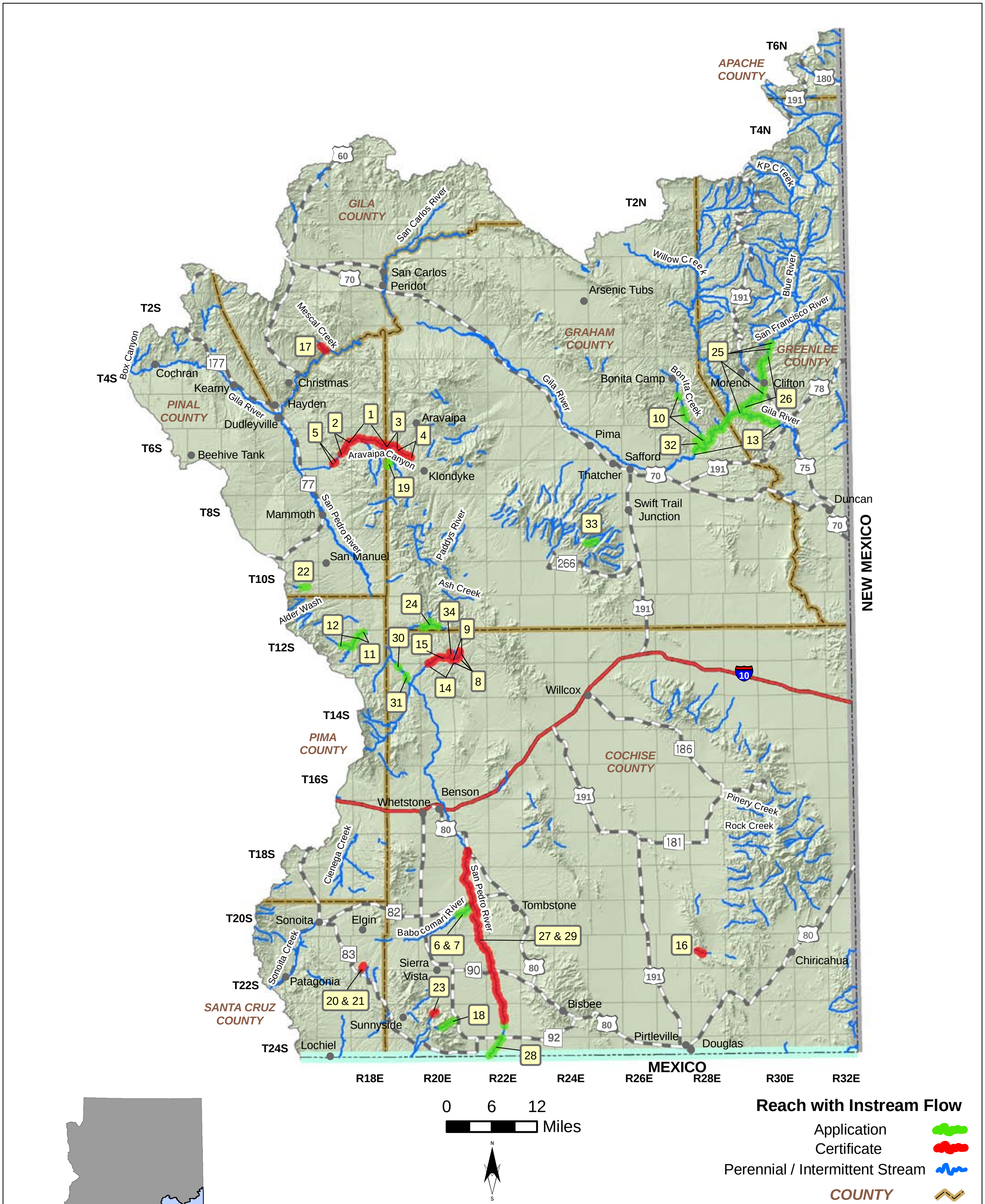


Figure 3.0-7
Southeastern Arizona Planning Area
Instream Flow Applications

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

Common Name	Threatened	Endangered	Elevation/Habitat
Apache Trout	X		>5000 ft./cold mountain streams
Arizona Cliff-rose		X	<4,000 ft./white soils of tertiary limestone lake bed deposits
Arizona hedgehog cactus		X	3,700-5,200 ft./ecotone between interior chapparal and madrean evergreen woodland
Bald Eagle	X		Varies/large trees or cliffs near water
Beautiful shiner	X		<4,500 ft./small to medium sized streams and ponds
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		3,300-8,900ft./streams, rivers, backwaters, ponds stock tanks
Cochise pincushion cactus	X		>4,200 ft./ semi-desert 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		<8,000ft./benthic species of small to large perennial streams
Mexican Gray Wolf		X	4,000-12,000 ft. /chapparal, woodland, forests
Mexican Spotted Owl	X		4,100-9,000 ft./canyons, dense forests with multi-layered foliage structure
Mount Graham red squirrel		X	>8,000 ft./montane upper elevation mature to old-growth conifer forest

Common Name	Threatened	Endangered	Elevation/Habitat
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
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	<4,500ft./small to moderate sized streams, springs, cienegas in shallows

Source: USFWS, 2006a

River, Bonita Creek, Eagle Creek, and San Francisco River are contained in the area. A 15-mile segment of Bonita Creek and 23 miles of the Gila River are included in the conservation area.

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 in order to protect a number of natural resources including aquatic, wildlife, vegetative and riparian. Livestock grazing and recreation are allowed to continue in “appropriate” areas. Goals include protecting water quality and water quantity. (BLM, 2006c).

A notable wilderness area, Aravaipa Canyon Wilderness Area, 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, 2006a).

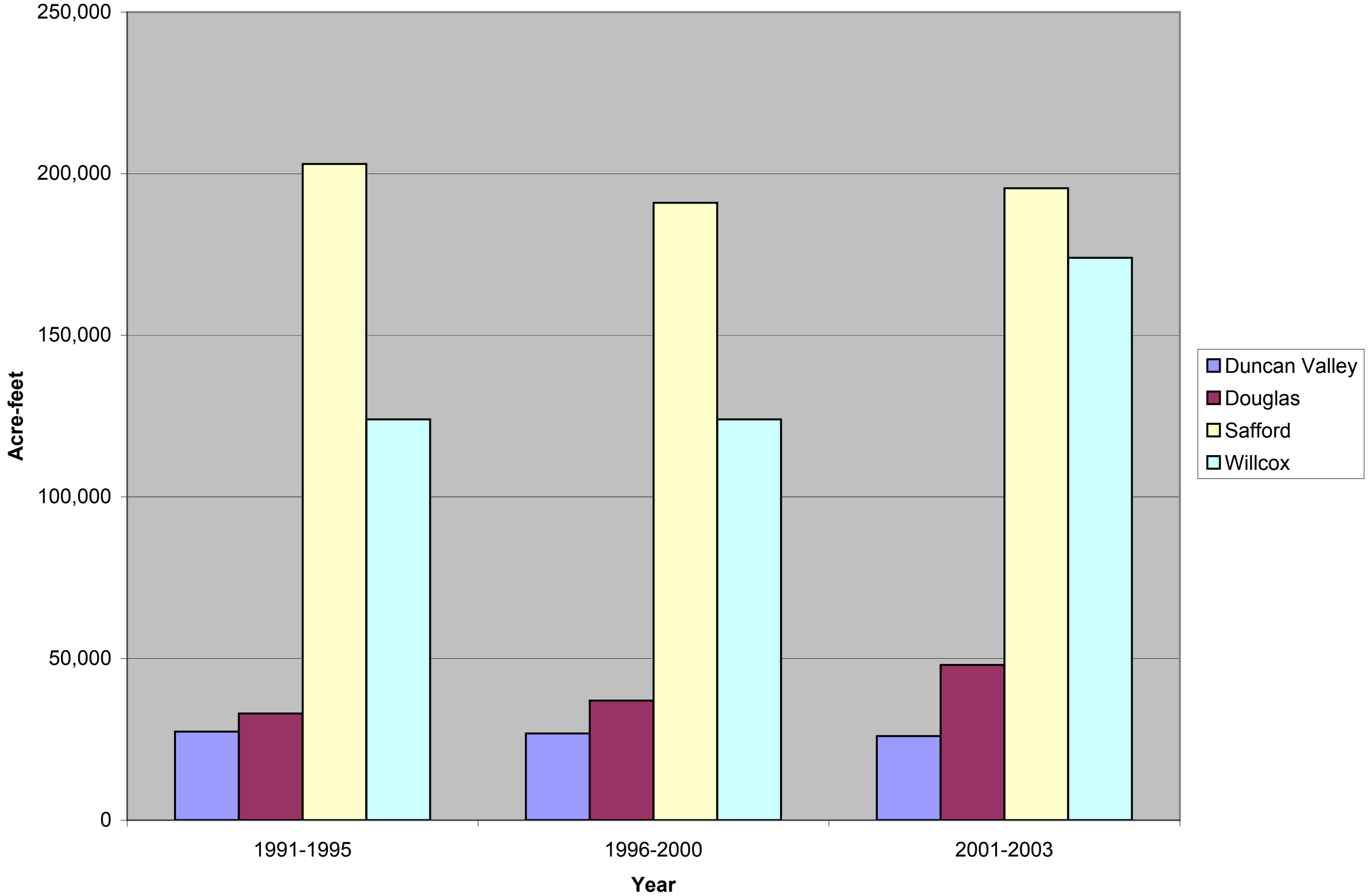
There are two National Wildlife Refuges (NWR) in the planning area, the San Bernardino NWR in the San Bernardino Valley Basin and Leslie Canyon NWR located in the Douglas and Willcox Basins. Both refuges were established in the 1980s to protect water resources and habitat for endangered native fishes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

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 previously mentioned Aravaipa Canyon Preserve, TNC preserves include Buehman Canyon Preserve and the San Pedro River Preserve near Winkelman, all 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 USFS.

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 in Palominas in the Upper San Pedro Basin. (TNC, 2006b)

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 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, with current annual demand averaging about 50,000 acre-feet over the average annual use from 1991-2000. A brief description of agricultural areas follows, listed generally in descending order of water demand.

Figure 3.0-12. Agricultural Demand in the Duncan Valley, Douglas, Safford and Willcox Basins, 1991-2003



Source: USGS, 2005; ADWR, 2005f

<u>Safford and Duncan Valley Basins</u>

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, chile, 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 2001-2003, an average of 122,500 acre-feet of groundwater and 73,000 acre-feet of surface water were used annually in the Safford Basin.

Table 3.0-3 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	2005 Pop. Estimate	Percent Change 2000-2005	Projected 2050 Pop.
Sierra Vista	USP	32,983	37,775	14.5	43,690	15.7%	61,833
Sierra Vista SE	USP	9,237	14,348	55.3	NA	---	16,854
Douglas	DOU	13,137	14,312	8.9	17,195	20.1	17,974
Safford	SAF	7,359	9,232	25.5	9,360	1.4	18,776
Bisbee	USP/DOU	6,288	6,090	-3.1	6,570	7.9	6,875
Benson	USP	3,824	4,711	23.2	4,740	0.6	4,806
San Manuel	LSP	4,009	4,375	9.1	NA	---	5,102
Thatcher	SAF	3,763	4,022	6.9	4,550	13.1	7,273
Willcox	WIL	3,122	3,733	19.6	3,885	4.1	4,281
San Carlos	SAF	2,918	3,716	2.7	NA	---	4,220
Oracle[1]	LSP	3,043	3,563	17.1	NA	---	9,883
Clifton	MOR	2,840	2,596	-8.6	2,495	-3.9	4,101
Whetstone	USP	1,289	2,354	82.6	NA	---	2,548
Kearny	LSP	2,262	2,249	-0.6	2,185	-2.8	3,587
Swift Trail Jct.	SAF	1,203	2,195	82.5	NA	---	6,574
Pima	SAF	1,725	1,989	15.3	2,085	4.8	3,350
Morenci	MOR	1,799	1,879	4.4	NA	---	2,422
Huachuca City	USP	1,782	1,751	-1.7	1,830	4.5	2,633
Mammoth	LSP	1,845	1,762	-4.5	1,740	-1.2	2,312
St. David	USP	1,468	1,744	18.8	NA	---	2,928
Tombstone	USP	1,220	1,504	23.3	1,610	7.0	1,789
Dudleyville	LSP	1,356	1,323	-2.4	NA	---	2,769
Peridot	SAF	957	1,266	32.3	NA	---	3,192
Total >1,000		109,429	128,489	17.4	NA	---	196,082
Other		46,236	58,123	25.7	NA	---	104,874
Total		**155,665**	**186,612**	**19.9**	**NA**	**---**	**300,956**

Source: DES, 2005
Note: 2005 population estimates not available for unincorporated communities
[1] 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 Basin; DOU=Douglas Basin; SAF=Safford Basin; WIL=Willcox Basin; LSP=Lower San Pedro Basin; MOR=Morenci Basin

Population Growth and Water Use

The state currently 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 for certain area plans and is pursuing creation of an overlay district in the southern part of the Upper San Pedro Basin that would set water conservation standards for new developments. 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. References to completed plans are listed in basin references in this volume and may contain useful information for water resource planning.

The Department's Water Adequacy Program also connects water supply and demand to growth to some extent but does not control growth. Developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents. The service areas of the Cities of Benson, Douglas, Willcox, Safford and the Empirita Water Company have been designated as having an adequate water supply. If a subdivision is served by one of these water providers then a separate adequacy determination is not required. Basin adequacy determinations, including the reason for the inadequate determination, are provided in the basin sections of this volume and are summarized below.

Table 3.0-4 Water Adequacy Determinations in the Southeastern Arizona Planning Area as of 5/2005

Basin	Number of Subdivisions	Number of Lots	Adequate	Inadequate	Percent of Lots Inadequate
Aravaipa Canyon	none	none	none	none	none
Bonita Creek	none	none	none	none	none
Cienega Creek	12	441	289	152	34
Donnelly Wash	1	59	0	59	100
Douglas	6	415	65	350	84
Dripping Springs Wash	none	none	none	none	none
Duncan Valley	3	268	61	207	77
Lower San Pedro	11	UNK	145	UNK	UNK
Morenci	9	1,759	1,725	34	19
Safford	20	731	139	592	81
San Bernardino Valley	none	none	none	none	none
San Rafael	none	none	none	none	none
Upper San Pedro	185	22,508	18,266	4,242	19
Willcox	20	1,577	989	588	37
TOTAL	267	27,903	21,679	6,224	22

UNK = Unknown

3.0.6 Water Supply

Local aquifers are the primary water supply for the planning area for municipal, industrial and agricultural use. Only about 18% 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 in the Lower San Pedro and Upper San Pedro Basins, from Aravaipa Creek in the Aravaipa Canyon Basin and from the Gila River for use in the Duncan Valley and Safford Basins. The Gila River diversions are substantial, accounting for 95% of all surface water diversions in the planning area. Small amounts of surface water are diverted for municipal use in the Morenci, Upper San Pedro and Willcox Basins and 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 issues in the Southeastern Arizona Planning Area. 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 but 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. Surface water is an industrial and municipal supply in the Morenci Basin at Morenci.

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 Saint 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 Aravaipa Canyon Basin, 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.

Phelps Dodge Corporation provides water to the Morenci Mine Complex and the town of Morenci in the Morenci Basin in part through complex exchange agreements involving several water sources, some of which are located outside the planning area. Currently, Phelps Dodge 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 Upper Salt River Basin. This water is pumped over the watershed divide into Willow and Eagle Creeks where it is transported for about 51 miles before being commingled with water from Phelps Dodge's Upper Eagle Creek Well Field. Phelps Dodge also uses water from Eagle Creek, Chase Creek and the San Francisco River (ADWR, 2005c). 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.

The location of surface water resources are shown on maps entitled "Surface Water Conditions" and "Perennial/Intermittent Streams and Major (>10 gpm) Springs" for each basin and in basin tables containing data on streamflow, flood ALERT equipment, reservoirs, stockponds and springs in the Water Resource Characteristics sections.

Groundwater

Major aquifers supplying groundwater are basin fill, sedimentary rock (Gila Conglomerate), volcanic rock and recent stream alluvium. Groundwater supplies about 82% of the water demand in the planning area.

Groundwater development in basins located in the north and northeastern part of the planning area (Bonita Creek, Dripping Springs Wash, Duncan Valley and Morenci) is primarily from wells that tap the younger basin fill or the Gila Formation. Basin fill is the major aquifer in all three sub-basins of the Safford Basin. In some areas of the Safford Basin the groundwater supply may contain high total dissolved solids (TDS) and fluoride, which may affect its suitability for use.

In basins located on the western side of the planning area (Aravaipa Canyon, Donnelly Wash, Lower and Upper San Pedro), groundwater is pumped from the stream alluvium and from basin-fill sediments. Most irrigation wells are located in the stream alluvium while most industrial and domestic wells are located in the regional basin fill. The recent stream alluvium is the main source of water in the Aravaipa Canyon Basin for all uses and water quality is good. There is very limited water development in the Donnelly Wash Basin. In the Upper San Pedro Basin, most of the water used is pumped from aquifers. Artesian conditions in some areas support modest groundwater discharges for irrigation use in the Benson-Pomerene area, though to a lesser extent, and historically in the Palominas-Hereford area. Groundwater quality is generally good although there are some areas of local contamination including nitrate contamination near St. David. In the Lower San Pedro Basin, 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. Water quality is generally suitable for most uses.

Groundwater conditions in the Cienega Creek Basin are somewhat complex as described in Section 3.0.2. Stream alluvium aquifers support stock and domestic uses in the northern part of the basin while basin fill is the principal aquifer in the central valley of the basin. In the southwestern section of the basin, the stream alluvium aquifer supplies almost all groundwater used in the area for irrigation, domestic and stock purposes. There are no serious water quality issues that affect the use of groundwater in the basin.

The principal source of groundwater for all purposes in the Willcox Basin is alluvial deposits. There has been heavy agricultural pumpage in some areas, resulting in changes in groundwater flow direction, supply depletion and possible land subsidence (USGS, 2006a).

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. Most wells in the basin are located immediately north of the international border where water levels are generally less than 100 feet below land surface. Artesian wells and springs support wetlands designated as the San Bernardino National Wildlife Refuge. The main aquifer in the Douglas Basin is basin fill, which supplies most of the large-capacity wells. In the City of Douglas area, groundwater is pumped from basin fill with interbedded volcanic rock. 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. Groundwater quality is generally suitable for most uses in the basin but high concentrations of fluoride occur locally, making some water marginal for domestic uses. There is very little groundwater development in the San Rafael Basin where ranching is the primary activity. Groundwater is obtained from stream alluvium and basin fill.

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 Water Resource Characteristics sections.

Effluent

Effluent is utilized as a water supply in the Lower San Pedro, Safford, Upper San Pedro, and Willcox basins for golf course irrigation, agricultural irrigation and groundwater recharge. About 3% of the water demand in the Upper San Pedro Basin is met by effluent. In 2002, about 800 acre-feet of effluent from the Sierra Vista, Fort Huachuca and Benson Wastewater Treatment Plants was delivered for golf course irrigation and almost 1,000 acre-feet of effluent was recharged to the aquifer at Fort Huachuca and at the Sierra Vista Recharge Facility.

Contamination Sites

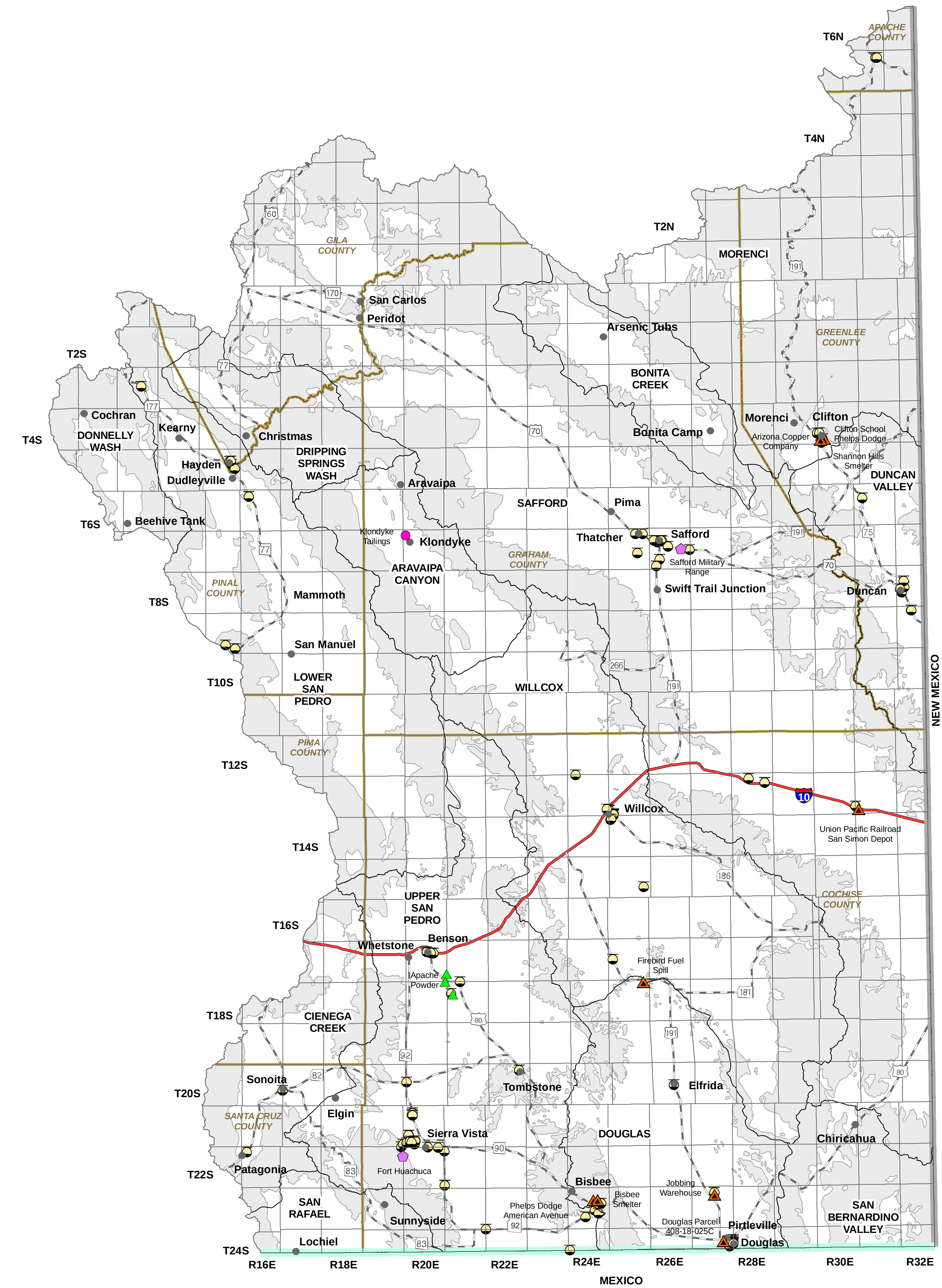
Sites of environmental contamination may impact the availability of water supplies. An inventory of Department of Defense (DOD), Superfund (Environmental Protection Agency designated sites), Water Quality Assurance Revolving Fund (WQARF, state designated sites), Voluntary Remediation Program (VRP) and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

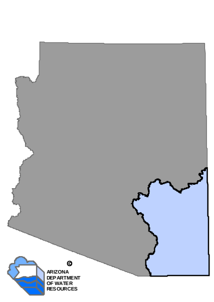
Table 3.0-5 lists the DOD, Superfund, VRP and WQARF sites, the contaminant and affected media and the basin location of the site. In addition, there are 203 active Leaking Underground Storage Tank (LUST) sites in the planning area, most of which are located in the Safford Basin and the Upper San Pedro Basin. The location of all contamination sites is shown on Figure 3.0-8.

Table 3.0-5 Active 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, trinitroglycerin (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, 2006a; ADEQ 2006b





Data Source: ADEQ,2005.

Figure 3.0-8
Southeastern Arizona Planning Area Contamination Sites

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

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)

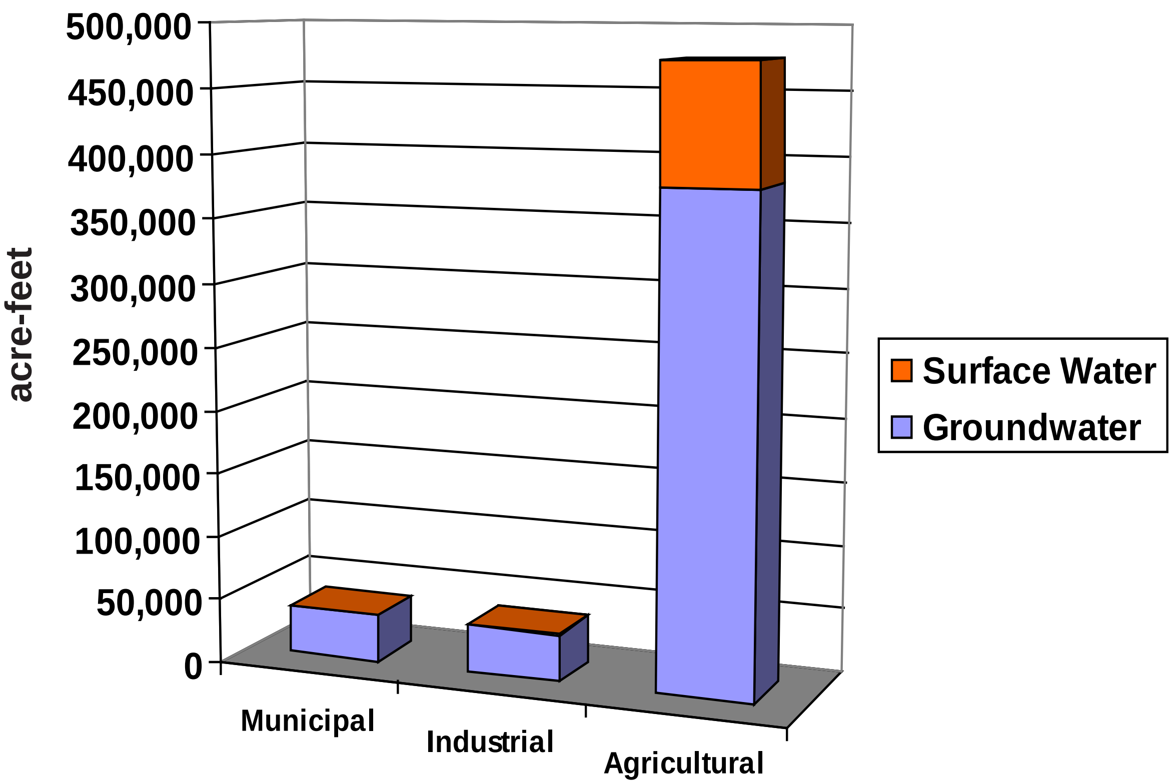
3.0.7 Cultural Water Demand

Total cultural water demand in the Southeastern Arizona Planning Area averaged approximately 550,000 acre-feet per year in the period from 2001-2003. The agricultural demand sector is by far the largest water demand sector with over 475,000 acre-feet of demand (see Figure 3.0-9). This is primarily due to agricultural demand in 4 basins Willcox, Safford, Duncan Valley and Douglas, which account for 443,500 acre-feet, or 93% 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 37,800 acre-feet of primarily groundwater demand per year in the period from 2001-2003. Only about 800 acre-feet of surface water was reported for municipal purposes. Industrial demand, primarily from mining, is about 33,700 acre-feet per year. Of this, about 500 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 199,000 acre feet per year in the Safford Basin. (See Figure 3.0-10)

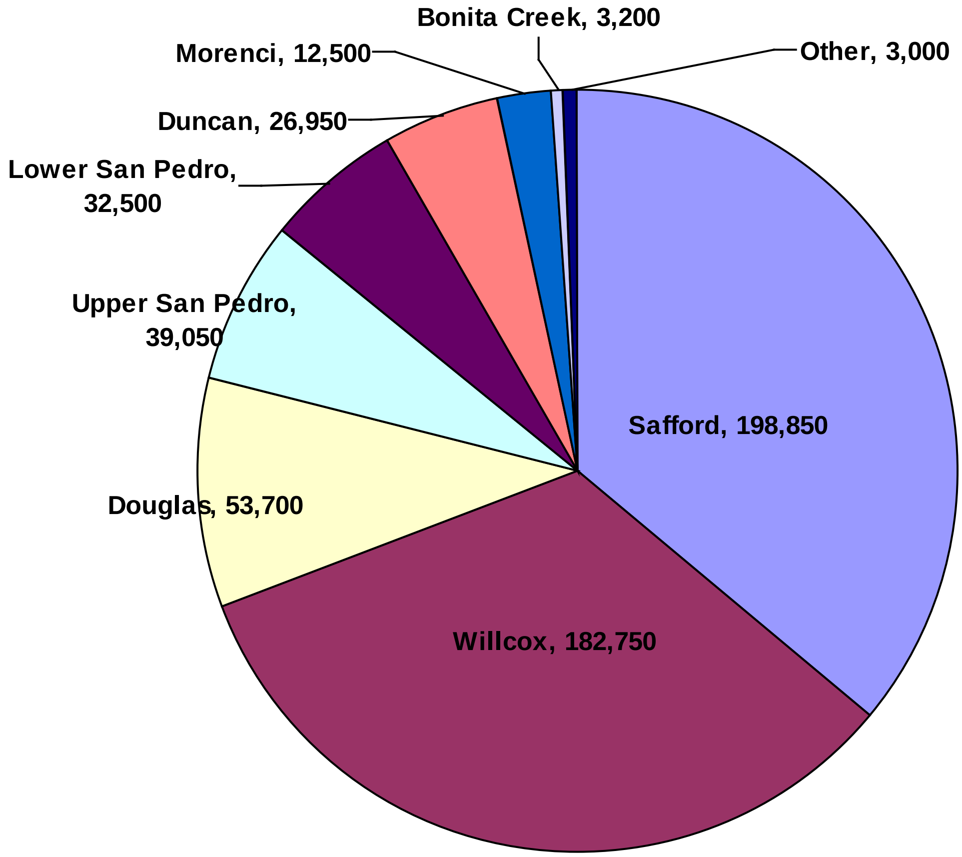
Detailed current information on San Carlos Apache Reservation water demand was not available to the Department. The reservation population is approximately 10,000, primarily residing in the communities of San Carlos/Peridot and Bylas/Calva. There is a golf course, hotel and casino complex (Apache Gold) 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 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 the population increase since the BIA estimate and 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 acre-feet per year.

Figure 3.0-9 Southeastern Arizona Planning Area average annual cultural water demand by sector, 2001-2003



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 becomes enforceable on or before 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 3.0-10 Average total water demand by basin in acre-feet, 2001-2003



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." (ADWR, 2006). 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 the 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).

Municipal Demand

Primary municipal demand centers are the Sierra Vista area (including Bisbee), Douglas, Safford/Thatcher, Benson, San Manuel and Willcox. Groundwater is the primary water supply for municipal use throughout the planning area. Municipal water demand in 2003 is summarized by groundwater basin in Table 3.0-6. Mining demand and municipal demand cannot be accurately distinguished in the Morenci area and groundwater and surface water supplies are commingled. As a result, the demand shown in Table 3.0-6 for the Morenci Basin is an estimate and all water used is assumed to be groundwater. There is little population or municipal demand in a number of basins in the planning area including Aravaipa Canyon, Bonita Creek, Cienega Creek, Donnelly Wash, Dripping Springs Wash, Duncan Valley, San Bernardino Valley and the San Rafael Basins. As shown, almost half of the municipal demand in the planning area is in the Upper San Pedro Basin. Municipal demand on the San Carlos Apache 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 acre-feet per year.

Table 3.0-6 2003 municipal water demand in the Southeastern Arizona Planning Area

Basin	Groundwater (acre-feet)	Surface Water (acre-feet)	Effluent[1] (acre-feet)
Aravaipa Canyon	<300	0	0
Bonita Creek[3]	<300	0	0
Cienega Creek	600	0	0
Donnelly Wash	<300	0	0
Douglas	5,700	0	0
Dripping Springs Wash	<300	0	0
Duncan Valley	650	0	0
Lower San Pedro	2,000	0	NR
Morenci[2]	1,100	NR	0
Safford[3]	6,000	0	500
San Bernardino Valley	<300	0	0
San Rafael	<300	0	0
Upper San Pedro	18,000	<300	800
Willcox	2,700	<300	211
Total Municipal	37,500	<600	1,511

Sources: ADEQ, 2005a; ADWR, 2004; ADWR, 2005d; S. Tadayon, 2004; USGS, 2005

NR = Supply utilized but not reported

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

[2] Surface water and groundwater are commingled in this basin and cannot be distinguished.

[3] Shown on Table 3.0-6 is water utilized within the basin. The Cultural Demand Table for Bonita Creek in Section 3.2.8 reflects water withdrawn in the basin. Almost all of the approximately 3,200 acre-feet withdrawn in the Bonita Creek Basin is conveyed to the Safford Basin.

Only eleven water providers in the planning area served 450 acre-feet or more in 2003**.** These providers and their demand in 1991 and 2000 are shown in Table 3.0-7. 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, 225 gpcd in Douglas.

Table 3.0-7 Water providers serving 450 acre-feet or more of water per year, excluding effluent, in the Southeastern Arizona Planning Area

Basin/Water Provider	1991 (acre-feet)	2000 (acre-feet)	2003 (acre-feet)
Douglas			
Douglas Water Department	2,999	3,621	4,685
Lower San Pedro			
Arizona Water Company San Manuel	855	743	613[1]
Town of Kearny	483	648	489
Morenci			
Morenci Water and Electric	773	1,180	1,043
Safford			
City of Safford	3,748	3,836	4,006
Graham County Utilities, Inc - Pima	298	435	476
Upper San Pedro			
Arizona Water Company Bisbee	962	1,003	1,200
Arizona Water Company Sierra Vista	862	1,109	1,255
Bella Vista Water Company - Sierra Vista	2,907	3,208	3,640
City of Benson	545	728	912
Pueblo del Sol Water Company - Sierra Vista	360	1,136	1,470

Sources: ADWR 2005d; Upper Gila Watershed Partnership, 2005; WIFA, 2005; USGS, 2006c
[1] Data provided is water delivery for 2005

There are few municipally-owned water providers in the planning area. Municipal water utilities have more flexibility in setting water rates than private water companies, which are regulated by the Arizona Corporation Commission. 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)

There are several golf courses in the planning area that are served from a municipal water supply. They are shown in Table 3.0-8 with estimated demand and source of water and are discussed below. Demand estimates account for elevation of the facility and duration of the irrigation season.

Table 3.0-8 Municipal golf course demand in the Southeastern Arizona Planning Area (c. 2004)

Facility	Basin	# of Holes	Demand (acre-feet)	Water Supply
Douglas Municipal Golf Course	Douglas	18	440	Groundwater
Hayden Golf Course	Lower San Pedro	9	211	Groundwater
Mt. Graham Golf Course	Safford	18	500	Effluent
Mountain View Golf Course	Upper San Pedro	18	370	Effluent
San Pedro Golf Course	Upper San Pedro	18	500	Effluent/Groundwater
Twin Lakes Municipal Golf Course	Willcox	9	211	Effluent

Source: ADWR, 2005e

Effluent is a municipal supply in a number of communities. As shown in Table 3.0-8, it is a supply for golf course irrigation in the Upper San Pedro, Safford and Willcox Basins. In the Upper San Pedro Basin, approximately 1,000 acre-feet of effluent were used in 2002 to irrigate three facilities: the Chaffee Parade Field (53 acre-feet) and Mountain View Golf Course at Fort Huachuca; and the San Pedro Golf Course at Benson. Effluent is recharged to the aquifer in constructed recharge facilities at Fort Huachuca and by the City of Sierra Vista. Between 2002 and 2005 a total of approximately 6,500 acre-feet of effluent was recharged at the Sierra Vista facility. Fort Huachuca recharges about 500 acre-feet of effluent per year. Plans are underway to transport and recharge 200 acre-feet/year of Huachuca City effluent at the Fort Huachuca recharge facility (ADWR, 2005a).

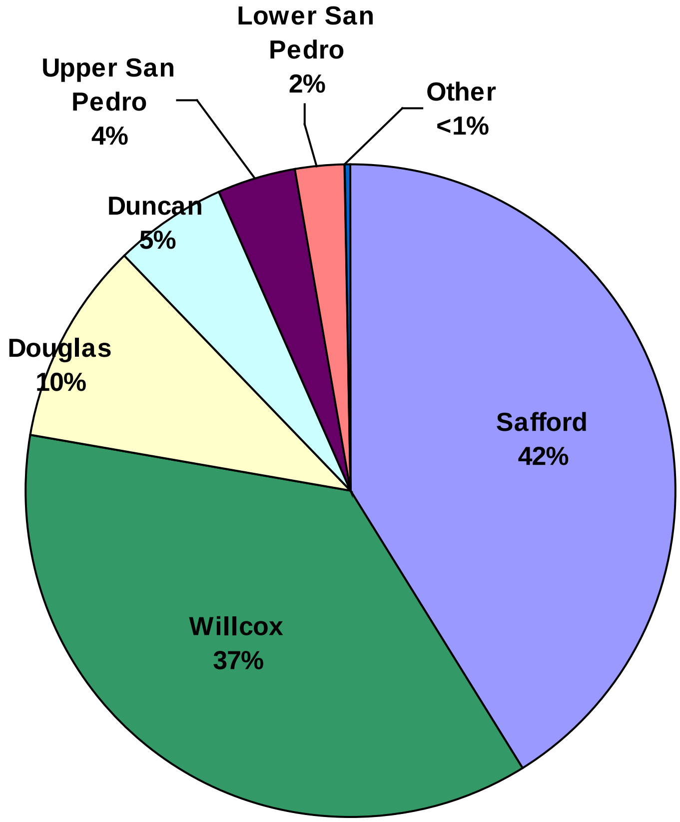
Effluent is used for irrigation at Kearny, Safford, Fort Grant, Thatcher and Bisbee. This irrigation is typically part of the effluent disposal method. There are two effluent treatment wetlands located in the Upper San Pedro Basin. The wetland at the Apache Nitrogen Products facility was constructed as part of the Superfund clean-up and the wetland at the Sierra Vista Treatment Plant is operated in conjunction with the recharge facility.

The three separate wastewater treatment facilities that serve the Bisbee population centers of Old Bisbee, Warren and San Jose are in the process of being combined into a single plant at San Jose. In addition, the Bisbee collection system will be improved to reduce leakage and a substantial number of residents on septic systems will be connected to the sewer system. Effluent from Old Bisbee (about 130,000 gpd) has historically been discharged to Mule Gulch in the Douglas Basin. Plans are to either deliver the treated effluent to an end user and/or recharge it (ADWR, 2005a). Estimates of effluent production are found in the Cultural Water Demand sections for each basin.

Agricultural Demand

Agriculture is a large water use sector and an important segment of the economy in the planning area, particularly in the Safford, Willcox, Douglas and Duncan Valley Basins (Figure 3.0-11). Relatively recent declines in irrigated acreage have occurred in some planning area basins, including the Upper San Pedro Basin due to the establishment of the SPRNCA, urbanization and economic factors, and in the Lower San Pedro Basin due to land conservation efforts. Some additional agricultural land reductions have occurred in both of these basins since 2003 that are not reflected in the cultural demand tables.

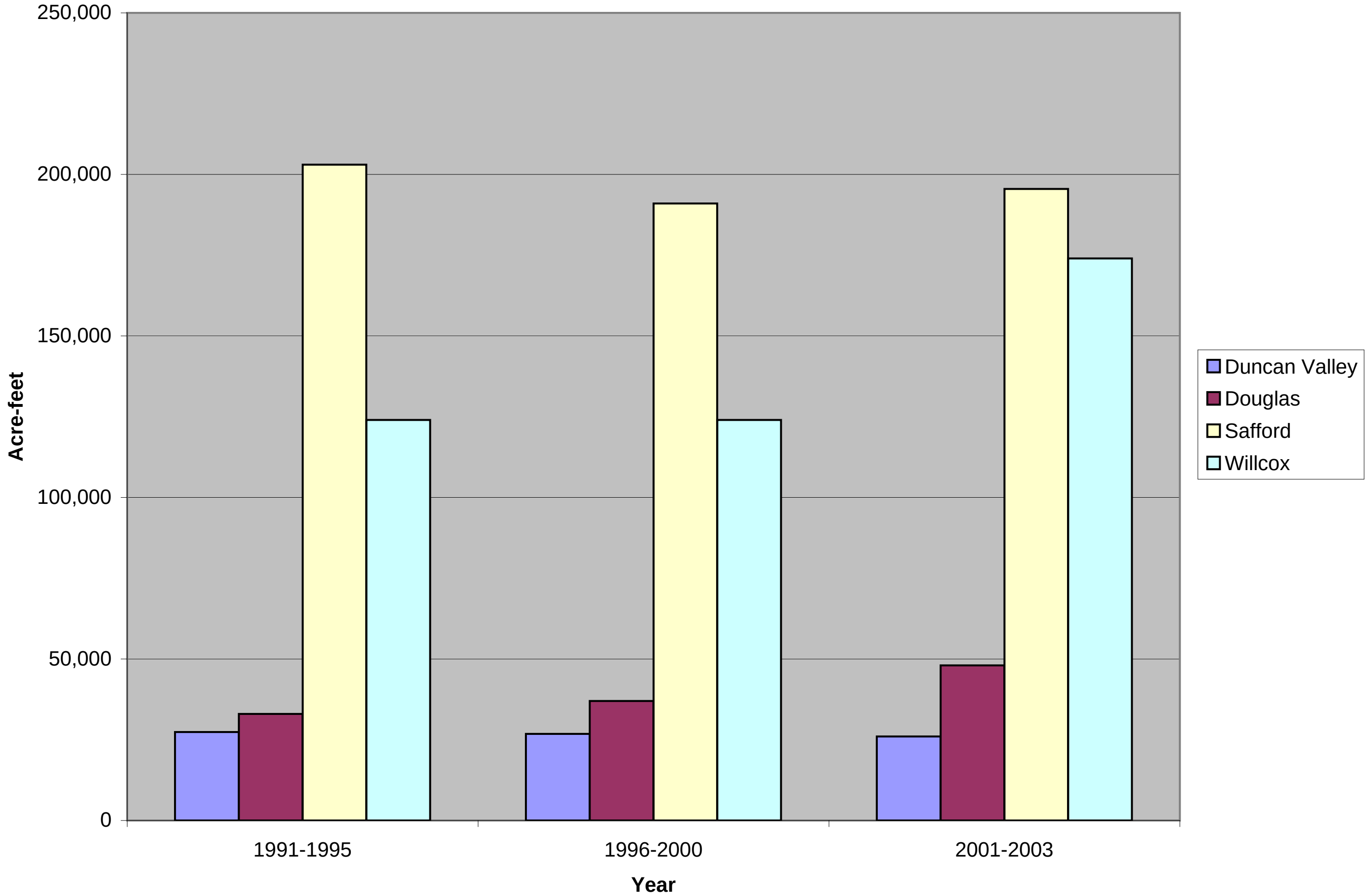
Figure 3.0-11 Average percentage of total agricultural demand in groundwater basins in the Southeastern Arizona Planning Area, 2001-2003



Source: USGS, 2005; ADWR, 2005f

Agricultural demand is stable or expanding in those basins with historically large agricultural demand (Figure 3.0-12). Although expansion of irrigated agricultural land is not permitted within the Douglas Irrigation Non-Expansion area (INA), demand increased on existing farmland to an average of about 48,000 acre-feet a year during the period 2001-2003 compared to an average of about 35,000 acre-feet per year from 1991-2000. In the Safford and Duncan Valley Basins, agricultural water demand has remained relatively stable since 1991, although 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 acre-feet per year was used. However, demand is now increasing with current annual demand averaging about 50,000 acre-feet over the average annual use from 1991-2000. A brief description of agricultural areas follows, listed generally in descending order of water demand.

Figure 3.0-12. Agricultural Demand in the Duncan Valley, Douglas, Safford and



Willcox Basins, 1991-2003

Source: USGS, 2005; ADWR, 2005f

<u>Safford and Duncan Valley Basins</u>

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, chile, 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 2001-2003, an average of 122,500 acre-feet of groundwater and 73,000 acre-feet of surface water were used annually in the Safford 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 wheat and there is some commercial vegetable production. 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 of Gila River bottom land. Surface water rights for use within this district are also specified in the Gila River Decree (ADWR, 1998). In the Duncan Valley Basin, an average of 11,500 acre-feet of groundwater and 14,500 acre feet of surface water were used annually during the period 2001-2003.

Conditions of the GRIC Water Rights Settlement would 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 (and including those in New Mexico) and could potentially impact flows in the Gila River (ADWR, 2006).

Willcox Basin

There is significant irrigation throughout the Sulphur Springs Valley in the Willcox Basin. North of the Town of Willcox are extensive orchards of apples and other fruits including U-pick orchards and vegetable farms. One of Arizona's few hydroponic tomato nurseries, Eurofresh Farms, a large, year-round producer of greenhouse tomatoes, is located in the northern part of the basin (Arizona Department of Agriculture, 2006). 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 and the formation of several large cones of depression. These groundwater level declines may have caused land subsidence and surface fissures south of the Town of Willcox (USGS, 2006a). Approximately 52,000 acres are currently irrigated, with about 174,000 acre-feet of groundwater demand per year.

Douglas Basin

Most of the Douglas Basin was designated as an 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 acre-feet per year to about 45,000 acre-feet per year. However, as mentioned previously, demand is increasing with almost 55,000 acre-feet withdrawn in 2003. Irrigated acreage is located primarily in the central and northern part of the basin in the Sulfur Springs Valley. Currently, approximately 16,000 acres are being irrigated. Principal crops are alfalfa and corn. Center-pivot irrigation is the predominant irrigation method in the basin. 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, 2006a).

Upper San Pedro Basin

In the Upper San Pedro Basin, almost all the remaining agriculture is in the Benson area. In 2002, there were an estimated 2,200 acres in the Benson area and 800 acres in the Palominas area under irrigation with a demand of about 14,500 acre-feet of groundwater and 4,300 acre feet of surface water. Reportedly in 2006, approximately 500 acres of irrigation in the Palominas area were taken out of production. There are two irrigation providers in the Benson area that deliver surface water from the San Pedro River: the Saint David Irrigation District (SDID) and the Pomerene Water Users Association (PWUA). Approximately 39% of the currently irrigated lands in the Benson area are served by one of these two districts. When insufficient surface water is available, SDID delivers groundwater pumped from two district wells. The PWUA does not operate groundwater wells to supplement the surface water supply although members use the canal system to deliver their own pumped water to their fields. Principal crops in the basin are alfalfa and pasture. (ADWR, 2005a)

<u>Lower San Pedro Basin</u>
Agricultural demand in the Lower San Pedro Basin averaged about 11,000 acre-feet a year during the period 2000-2003. Irrigated acreage is located along the San Pedro River throughout the length of the basin but primarily in the northern and southern portions of the basin. It is estimated that approximately 1,300 acres were irrigated in 2003 (USGS, 2005). Groundwater is the primary water supply for irrigation. Surface water diversions from the San Pedro River account for less than 1,000 acre-feet per year of the total water supply. Historically, principal crops have been pasture and small grains (ADWR, 1991).

<u>Other Areas</u>
There is currently limited vineyard irrigation in the Cienega Creek Basin in the Elgin area with some vineyard expansion planned. It is estimated that there were about 170 acres of vineyards in 2003 irrigated with groundwater. Water demand is estimated to be relatively low since vineyards are typically drip irrigated.

According to a CLIMAS report, several hundred acres of hay irrigation are occurring on the 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). According to a Bureau of Indian Affairs (BIA) study (1974), 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. This study reported about 400-700 acres under irrigation, mostly alfalfa, hay and pasture, with a consumptive use of 3,500 acre-feet in the early 1970s. Most of the irrigable acreage was located along the San Carlos and Gila Rivers and was irrigated with surface water, supplemented with well water (Bookman-Edmonston Engineering, Inc., 1979).

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 3.0-9 for selected years.

Table 3.0-9 Industrial water demand in selected years in the Southeastern Arizona Planning Area

	1991	2000	2003
Type/Basin/Source	**Water Use (acre-feet)**		
Mining Total	**35,658**	**24,541**	**30,173**
Cienega Creek			
Groundwater	<300	<300	<300
Lower San Pedro			
Groundwater	18,000	4,800	18,500
Morenci			
Surface Water	1,782	1,004	1,085
Groundwater	14,500	18,000	10,000
Safford			
Groundwater	700	450	300
Upper San Pedro			
Groundwater	226	134	143
Willcox			
Groundwater	300	153	145
Power Plant Total	**6,600**	**6,000**	**6,100**
Willcox			
Groundwater	6,600	6,000	6,100
Golf Course Total	**1,808**	**1,908**	**2,258**
Duncan Valley			
Groundwater	211	211	211
Lower San Pedro			
Groundwater	422	422	422
Morenci			
Groundwater	75	75	75
Upper San Pedro			
Groundwater	1,100	1,200	1,550
Dairy/Feedlot Total	**251**	**264**	**848**
Duncan Valley			
Groundwater	92	92	92
Upper San Pedro			
Groundwater	42	42	42
Willcox			
Groundwater	117	130	714

Sources: USGS 2005; ADWR 2005c; ADEQ 2005b; ADWR, 2005e

Mining is the largest industrial user in the planning area, primarily due to activities in the Lower San Pedro and Morenci Basins. Major mining activities are discussed below.

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. Reportedly, almost all of the water used at Morenci is recycled, some of it many times (Info Mine, 2006). Most of the water utilized by the mine and by the Morenci Water & Electric Company (a subsidiary of Phelps Dodge) 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). Phelps Dodge 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 acre-feet per year of its allocation of CAP water by means of an exchange at the Black River. Under the 1944 Horseshoe Exchange Agreement, Phelps Dodge also is entitled to diversions of up to 250,000 acre-feet from the Black River. As of 2003, Phelps Dodge had used almost 102,500 acre-feet of Horseshoe Reservoir credits (ADWR, 2005c). 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 Kearney, a SX/EW operation and a smelter at Hayden.

There are two large copper mines in the planning area that 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. It is unknown to the Department at this time if any mining operations will resume in the future at this site. (ADWR, 2006)

The Phelps Dodge 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 acre-feet/year (Southwest Ground-water Consultants, Inc., 2004).

Phelps Dodge is developing a large open pit mining operation in the Safford Basin eight miles north of the town of Safford. The 3,400 acre Dos Pobres and San Juan operation is expected to be completed in 2008 and will include 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 (ADEQ, 2006c) Average annual groundwater demand by the mine is projected to be about 5,500 acre-feet per year (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, near Willcox. The plant is a gas-fired combined cycle plant built in 1963 that generates 520 megawatts of electric energy for its cooperative members, which are located throughout Arizona and California (AEPCO, 2006). Groundwater demand in 2003 was similar to that in 1991 but demand can vary annually, 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 defined as those courses with their own facility water supply. They are shown in Table 3.0-10 with estimated demand and source of water.

Demand estimates account for the elevation of the facility and duration of the irrigation season.

Table 3.0-10 Industrial golf course demand in the Southeastern Arizona Planning Area (c. 2004)

Facility	Basin	# of Holes	Demand (acre-feet)	Water Supply
Alpine Country Club	Morenci	18	75	Groundwater
Greenlee Country Club	Duncan	9	211	Groundwater
Kearny Golf Course	Lower San Pedro	9	211	Groundwater
Pueblo del Sol Country Club (Sierra Vista)	Upper San Pedro	18	475	Groundwater
San Manuel Golf Club	Lower San Pedro	9	211	Groundwater
Turquoise Hills Country Club (Benson)	Upper San Pedro	18	475	Groundwater
Turquoise Valley Country Club (Naco)	Upper San Pedro	18	500	Groundwater

Source: ADWR 2005e

There is also a golf course on the San Carlos Apache Reservation, the Apache Stronghold Golf Club, located near the Junction of Highway 77 and 170 in the Safford Basin. The water supply for this course is groundwater and effluent with an estimated use of 423 acre-feet, but it is not known if the service is from a municipal provider or from an industrial well.

Only two dairies have been identified in the planning area. There is a small, approximately 350 animal dairy north of Benson in the Upper San Pedro Basin and a new, large dairy of about 5,000 animals near Kansas Settlement in the Willcox Basin. Demand is about 42 acre-feet and 588 acre-feet respectively. 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 2004. 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 2000 used 289 acre-feet of groundwater, a reduction of about 250 acre-feet since 1991.

There are a number of sand and gravel facilities 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 Department estimated that a typical sand and gravel facility in the Upper San Pedro Basin uses less than 50 acre-feet per year (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 activities, establishment of conservation easements and other activities in the planning area.

Water resource issues have been identified in the Southeastern Arizona Planning Area 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 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 issues. Groups currently active within the planning area are the Middle San Pedro Partnership, the Eagle Creek Partnership, the Upper Gila Watershed Partnership, the Lower San Pedro Watershed Partnership-Redington NRCD, and the Upper San Pedro Partnership. A complete description of participants, activities and issues is found in Appendix B. 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

Legal:

- Unresolved Indian water rights settlements
- Unresolved surface water adjudication
- Potential impact of adjudication court subflow definition
- Interbasin transfer prohibition

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

Two of the partnerships in the planning area, the Upper Gila Watershed Partnership in the Safford 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 Upper 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 (BOR, 2004). It also produced a study on current and projected water demand for the watershed. Both studies are posted on the Department's website.

A number of water management practices have been implemented in the Sierra Vista subwatershed portion of the Upper San Pedro Basin and additional ones are planned. These include groundwater recharge, direct effluent use, water conservation ordinances and municipal conservation programs. 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).

The USPP and its members have initiated many conservation programs in the Sierra Vista area including the Water Wise program, a toilet rebate program and water conservation ordinances. Fort Huachuca, a partnership member, has implemented aggressive conservation efforts at the Fort that have reduced on-post water consumption by almost 45% since 1993. Cochise County has created a Water Conservation Office and requires comprehensive water conservation measures that apply when permitted land uses are intensified through rezonings, special uses and master development plans. It is pursuing adoption of an overlay district allowing these measures to also apply to permitted uses (Cochise County, 2006). The USPP is also evaluating water augmentation options including evaluating the costs and feasibility of constructing a pipeline to transport Central Arizona Project Water to the area.

Because the Upper San Pedro groundwater basin extends into Mexico, the Partnership is interested in promoting 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 is expected to take seven years and will result in a groundwater flow model. The Willcox/Douglas investigations are 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, 2006a).

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. A report of the findings from the survey was completed in 2004 by the Department.

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, which can be compressed into three categories: infrastructure, water supply and water quality. Infrastructure issues, which include storage and well capacity problems, were ranked among the top five issues by a majority of respondents. Water supply concerns also ranked relatively high, primarily due to concerns about adequate future supplies. In addition, about half of respondents noted at least one drought impact. Primary drought impacts noted were increased demand, increased peak demand and lowered groundwater levels.

Table 3.0-11 Water resource issues ranked by 2003 survey respondents in the Southeastern Arizona Planning Area (12 water providers and 2 jurisdictions)

Issue	Ranked as one of the top 5 issues (of 18)	Percent of respondents
Inadequate well capacity to meet peak demand	7	50
Inadequate water supplies to meet future demand	4	29
Infrastructure in need of replacement	5	36
Inadequate capital to pay for infrastructure improvements	6	43

Source: ADWR, 2004

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

In regard to the question of groundwater level trends in their service area, the 47 respondents reported as follows: 29 stable; 13 falling, 4 don't know, 1 variable. One water provider reported rising water levels. Responses are shown for those basins with respondents in Table 3.0-12.

Table 3.0-12 Groundwater level trends reported by 2004 survey respondents by groundwater basin (47 respondents)

Basin	Stable	Falling	Rising	Variable	Unknown
Aravaipa Canyon	1				
Cienega Creek	2				1
Douglas	2	2			
Duncan	1	2			1
Lower San Pedro	2			1	1
Morenci	1				
Safford	3	2			
Upper San Pedro	15	6	1		1
Willcox	2				

Source: ADWR, 2005h

Water providers were asked to rank issues from 0 to 4 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 similar as shown in Table 3.0-13. Responses indicate that inadequate capital for infrastructure improvements is an overwhelming concern in the planning area. Other infrastructure issues and drought also ranked high.

Table 3.0-13 Water resource issues ranked by 2004 survey respondents in the Southeastern Arizona Planning Area (44 water providers)

Issue	Moderate concern	Major concern	Total	Percent of respondents reporting issue was a moderate or major concern
Inadequate storage capacity to meet peak demand	8	7	15	34
Inadequate well capacity to meet peak demand	6	5	11	25
Inadequate water supplies to meet current demand	5	4	9	20
Inadequate water supplies to meet future demand	5	9	14	32
Infrastructure in need of replacement	9	9	18	41
Inadequate capital to pay for infrastructure improvements	4	23	27	61
Drought related water supply problems	9	8	17	39

Source: ADWR, 2005h

Issue response from several basins was limited as shown in Table 3.0-14. However, drought, inadequate water supplies for future demand, infrastructure in need of repair and inadequate capital for infrastructure improvements, were listed as a major or moderate concern in almost all basins.

Table 3.0-14 Number of 2004 survey respondents, by groundwater basin, that ranked the survey water resource issues a moderate or major concern (44 water providers)

Issue	ARA	CCK	DOU	DUN	LSP	MOR	SAF	USP	WIL
Inadequate storage capacity to meet peak demand			2	1		1	3	8	
Inadequate well capacity to meet peak demand			2		1		3	4	1
Inadequate water supplies to meet current demand			1		1		2	4	1
Inadequate water supplies to meet future demand	1		1	1	1	1	3	5	1
Infrastructure in need of replacement			3	1	1	1	2	8	2
Inadequate capital to pay for infrastructure improvements	1		4	2	1		4	14	1
Drought related water supply problems	1	1	2	2	1	1	4	4	1
Total number of respondents	1	1	4	3	1	2	6	24	2

Source: ADWR, 2005h
ARA = Aravaipa Canyon Basin
CCK = Cienega Creek Basin
DOU = Douglas Valley Basin
DUN = Duncan Basin
LSP = Lower San Pedro Basin
MOR = Morenci Basin
SAF = Safford Basin
USP = Upper San Pedro Basin
WIL = Willcox Basin

3.0.9 Groundwater Basin Water Resource Characteristics

Sections 3.1 through 3.14 that follow 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 Section 1.3 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 and show 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. State legislation set aside specific sections in each township to be held in trust by the state for educational purposes, and other specified purposes, which are identified for each basin (Arizona State Land Department, 2006).

Climate

Climate data including temperature, rainfall and snowfall, and evaporation rates are critical factors in the hydrologic cycle and in water resource planning and management. Annual averages and variability, seasonality, and long-term trends are presented for each basin, as available, and may be useful in evaluating cultural water demands and supplies.

Surface Water Conditions

Depending on physical and legal availability, surface water may be an important water supply in some basins. Streamflow, flood gage, reservoir, stockpond and runoff contour data are presented for each basin, as available, and provide information on the physical availability of this supply. Seasonal and annual streamflows are an indication of the potential volume of surface water available for use. Stream gage stations are included in the basin tables if there is at least one year of record and annual streamflow statistics are included only if there are at least three years of record. 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 showing the approximate location of perennial and intermittent streams is provided for each basin. For some basins, more than one source of information was used. Due to recent drought, stream designations may or may not reflect current flow conditions. Also shown on the map and listed in tables is information on the springs in each basin. Some of the springs and perennial and intermittent stream reaches provide a water supply for municipal, industrial and agricultural purposes. Springs provide important habitat for wildlife, plants and invertebrates and therefore are of interest to the environmental community.

Groundwater Conditions

Groundwater is an important water supply for much of Arizona. Several indicators of groundwater conditions are presented for each basin.

- Major aquifer type(s) can be a general indicator of aquifer storage and productivity. Basin fill and alluvial aquifers generally have greater water in storage and produce more water to wells than consolidated rock (bedrock) aquifers .

- Well yields are a general indication of aquifer productivity. Information for large diameter wells is provided since it is assumed that 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.
- Natural aquifer recharge is a component of a basin's water budget that is difficult to quantify and is often estimated based on regional studies. This parameter is important in evaluating the safe and sustainable yields of an aquifer system.
- Aquifer storage is an estimate of the amount of water stored in an aquifer that may be available for future development and use.
- Groundwater level data show the depth to water in measured wells and changes in groundwater levels over time (hydrographs). Depth to water measurements are shown on mapped wells if there was a measurement taken during 2003-2004. Depths to water are an indication of how deep wells must be drilled in an area and potential costs to install and operate pumps. Hydrographs show the variability in groundwater depths at selected well sites and provide an indication of trends over time.
- Groundwater flow directions reflect the regional and long-term direction(s) of aquifer flow in a basin that may reflect important areas of aquifer recharge and discharge. Local and temporary flow conditions, as may be caused by pumping, are generally not shown, however flow directions in some basins indicate how localized pumping has altered regional flow patterns.

Water Quality

Surface and groundwater quality data were compiled from a variety of sources as described in Volume 1 Section 1.3. The data presented for each basin are an indication of areas where water quality exceedences have occurred and may affect current and future supplies. Additional areas of concern may 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 ADEQ Aquifer Protection Permit Programs). It is important to note also that the exceedences shown may or may not reflect current surface and groundwater quality conditions or the quality of water currently used in the basin.

Cultural Water Demand

Cultural water demand can be an important component of a basin's water budget and may include well pumpage and/or surface water diversions for municipal, industrial and agricultural (irrigation) uses. Listed in a table for each basin are average annual water demands for the period 1971 through 2003 and the number of new water supply wells drilled over this period. Also listed in the tables are population estimates and projections for the basin. Without mandatory metering and reporting of water uses, accurate demand data were not available for all basins or for all years, and uses were often estimated. Annual water demand estimates were averaged over a 3- or 5- year time period to provide an indication of trends but avoid a focus on potentially inaccurate years when data were incomplete. The location of major cultural water uses are shown on a map of each basin based on a 2004 land cover study by the USGS that was supplemented, as needed and known, by the Department.

Effluent generation data were compiled from several sources and presented for each basin. Effluent is potentially an important renewable resource for some areas, although its reuse may be difficult to achieve both logistically and economically, e.g. where a potential user is far from the wastewater treatment plant.

Water Adequacy Determinations

Developers of subdivisions outside AMAs are required to obtain a determination from the Department of whether there is sufficient water of adequate quality 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, water providers may apply for adequacy designations for their entire service area. In the planning area the service areas of the Empirita Water Company and the Cities of Benson, Douglas, Willcox, and Safford have been designated as having an adequate water supply. If a subdivision is to be served water from one of these water providers, then a separate adequacy determination is not required.

Water adequacy and inadequacy determinations are tabulated and shown on maps for subdivisions not served by a designated water provider. Data are presented for each basin and include the name and location of the subdivisions, the number of proposed building lots, the date and result of the Department's determination, the reason(s) for inadequate determinations, and the water provider if listed at the time of the adequacy application. Among the reasons cited by the Department for inadequate determinations is a physical or legal lack of water, water quality concerns, and/or insufficient data for the Department to make its determination.

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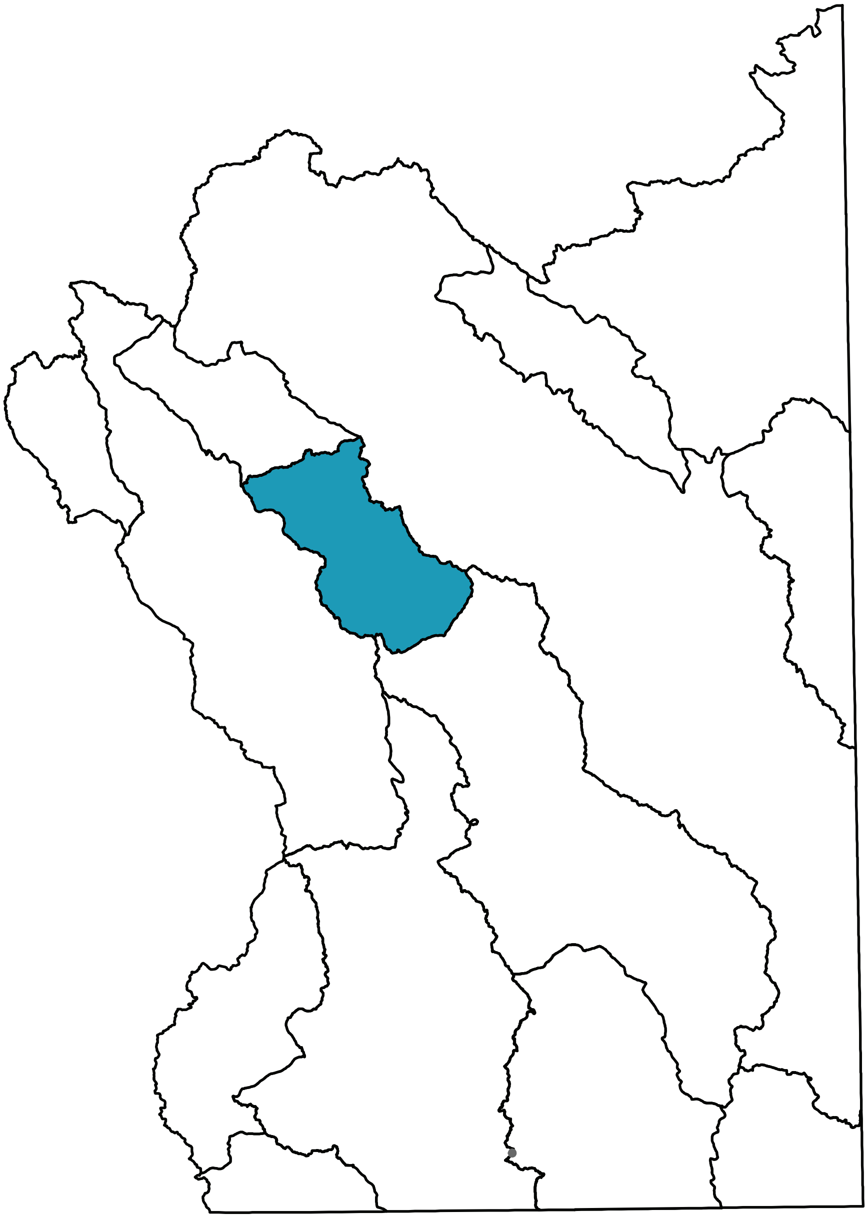
Section 3.1
Aravaipa Canyon Basin

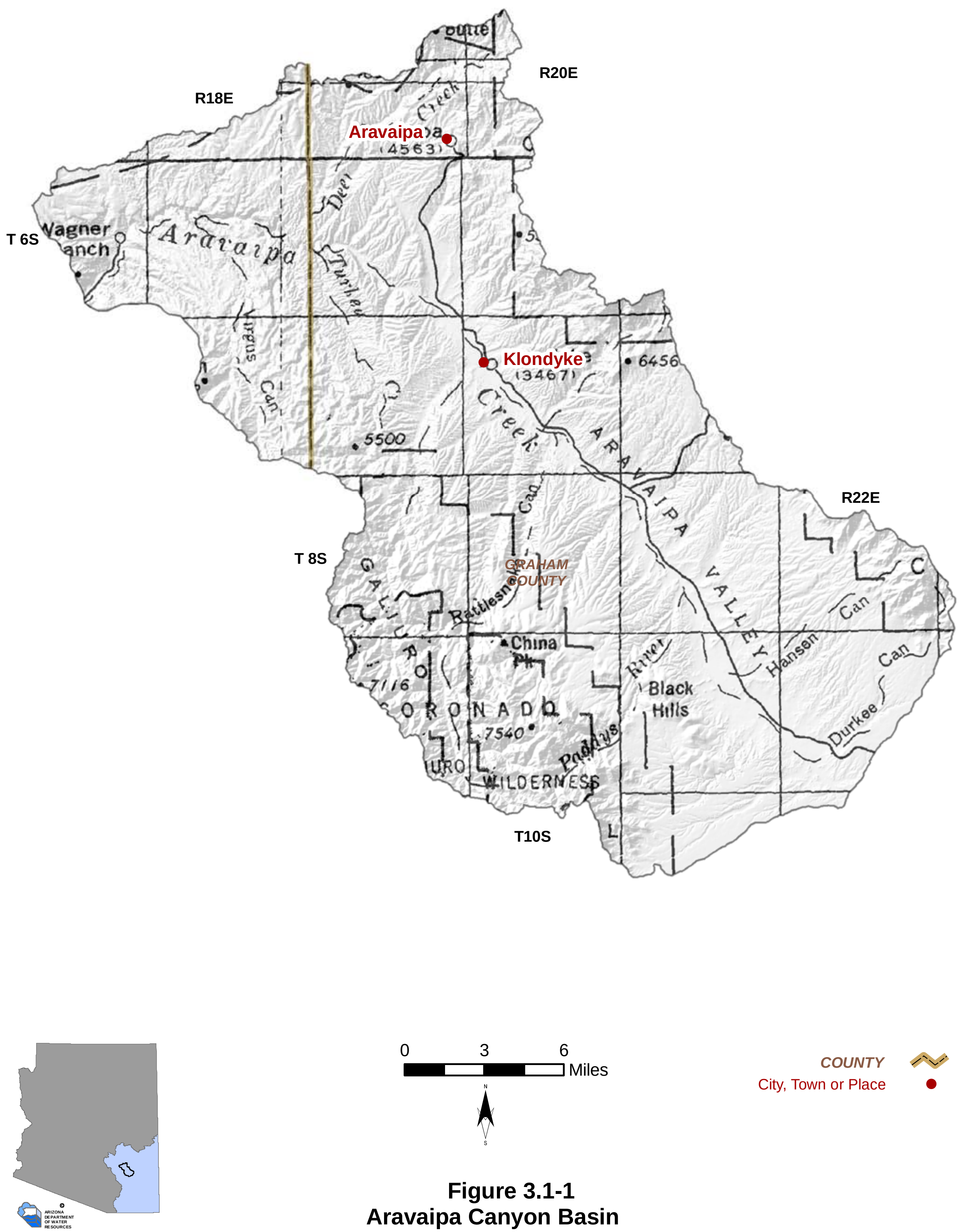


3.1.1 Geography of the Aravaipa Canyon Basin

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 sparsely populated basin is characterized by medium-elevation mountain ranges, canyons, valleys and grasslands.

- Principal geographic features shown on Figure 3.1-1 are:
    - Principal basin communities of Klondyke and Aravaipa
    - Aravaipa Creek, which runs north-south through Klondyke and turns west north of Klondyke where it enters Aravaipa Canyon
    - Galiuro Mountains southwest of Klondyke, which contain the highest point in the basin at 7,540 feet
    - Black Hills south of Klondyke
    - Aravaipa Valley south of Klondyke

- Not well shown on Figure 3.1-1 are the Santa Teresa Mountains west of Aravaipa and Klondyke on the western boundary of 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 a relative abundance of state trust lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

State Trust Land

- 38.3% of the land in this basin 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 for livestock grazing.

National Forest and Wilderness

- 25.6% of the land is federally owned and managed as national forest and wilderness.
- All forest lands in the basin, although they are not contiguous, are in the Safford Ranger District of the Coronado National Forest.
- The western most national forest land contains a portion of the Galiuro Wilderness Area.
- Land uses include grazing, recreation and timber production.

U.S. Bureau of Land Management (BLM)

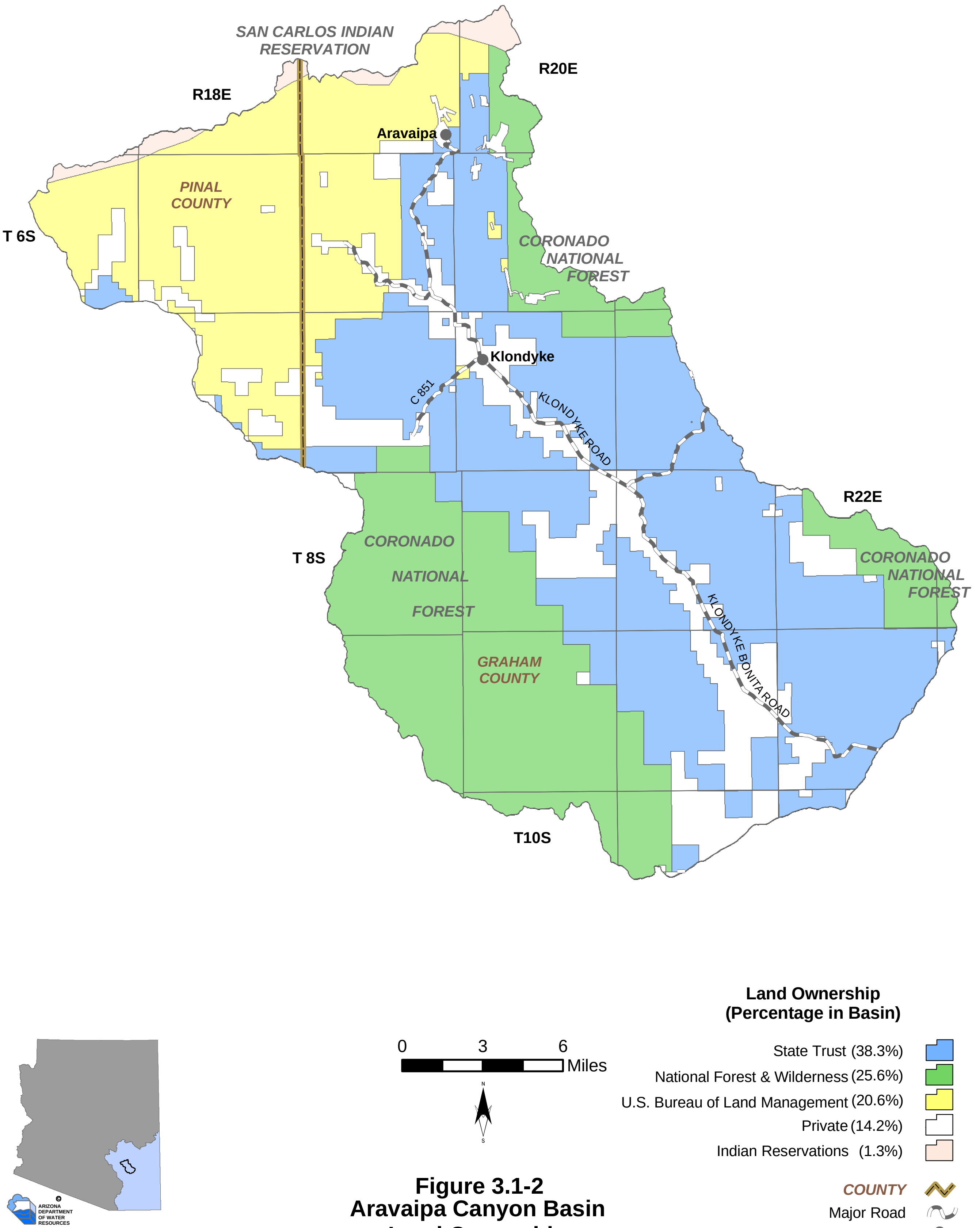
- 20.6% of the land is federally owned and managed by the Safford Field Office of the Bureau of Land Management.
- All BLM lands are in a block in the northwestern portion of the basin.
- Just over a quarter of the BLM land in the basin, 18,970 acres, is managed as the Aravaipa Canyon Wilderness located in T6S and T7S, R18E.
- Land uses include recreation and grazing.

Private

- 14.2% of the land is private.
- Private land is interspersed throughout state trust, national forest and BLM lands.
- Most of the private land is along the major roads.
- There are a number of private land in-holdings in the BLM land and one in the national forest land on the northeastern boundary of the basin.
- Primary land uses are domestic, ranching and farming.

Indian Reservations

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



Source: ALRIS , 2004

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 Coop Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. The precipitation figures shown in Figure 3.1-3 are from the Spatial Climatic Analysis Service at Oregon State University. A description of this and other climate data sources and methods is found in Volume 1, Section 1.3.3.

Average Annual Precipitation

- Average annual precipitation is as high as 26 inches in the Galiuro Mountains in the southwestern portion of the basin.
- Average annual precipitation is as low as 16 inches in the Aravaipa Canyon area in the northwestern portion of the basin.
- In general, precipitation increases as the elevation increases in this basin.
- The range of 14 inches between areas of highest and lowest precipitation recorded is common for the planning area.

Table 3.1-1. Climate Data for the Aravaipa Canyon 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
None									

Source: WRCC, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

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

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

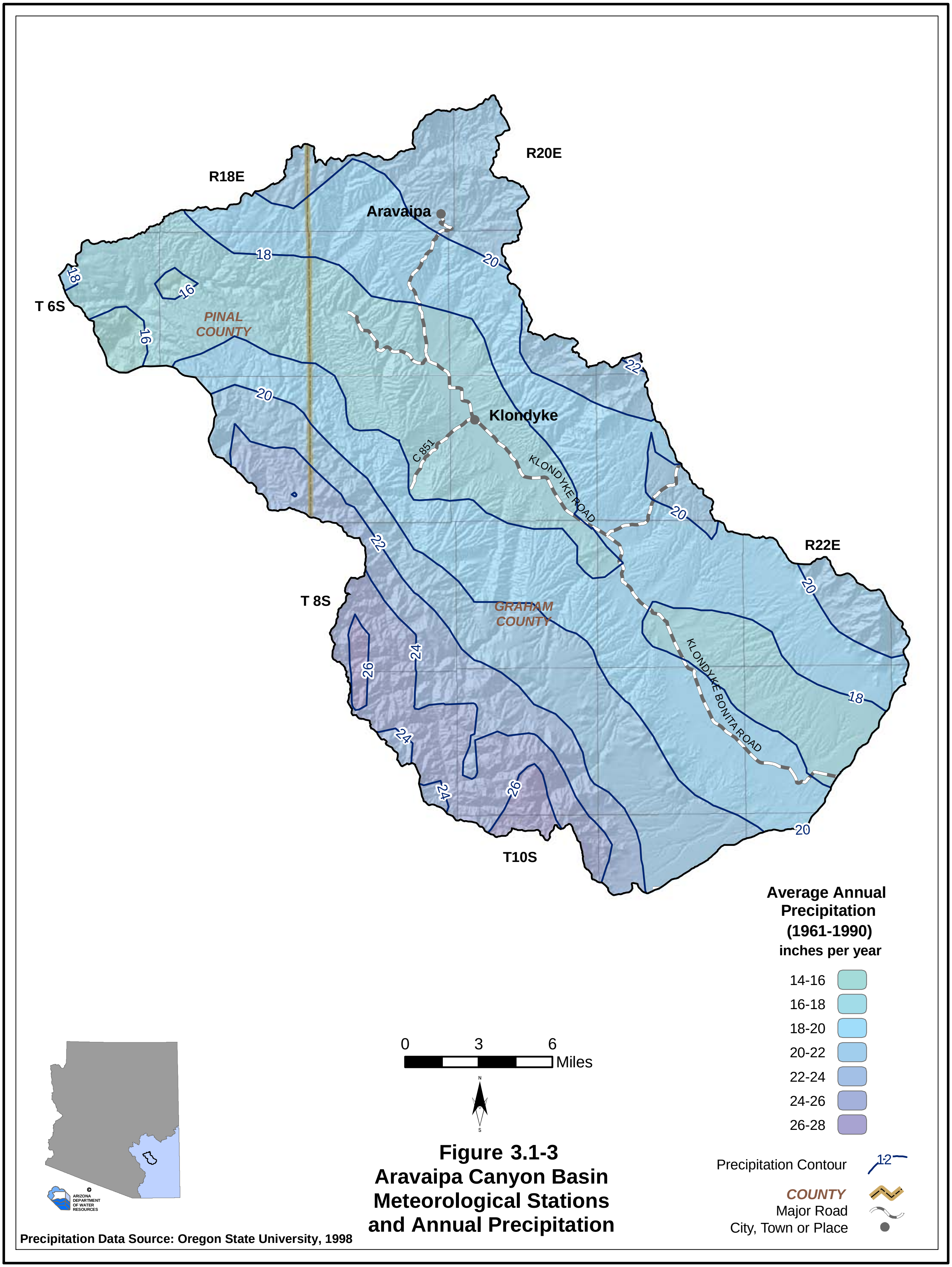


Figure 3.1-3
Aravaipa Canyon Basin Meteorological Stations and Annual Precipitation

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 3.1-4. The USGS annual runoff contours as well as stream channels are shown on Figure 3.1-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Reservoirs and Stockponds

- Refer to Table 3.1-4.
- Surface water is stored or could be stored in four small reservoirs in the basin.
- Total maximum storage for two of the small reservoirs is 117 acre-feet. Total surface area for the other two small reservoirs is 38 acres.
- There are an estimated 349 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.1-4.
- Average annual runoff varies from 0.5 inches per year along Aravaipa Creek to one inch per year in the southwestern portion of the basin.

Table 3.1-2 Streamflow Data for the Aravaipa Canyon Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	
None													

Table 3.1-3 Flood ALERT Equipment in the Aravaipa Canyon Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.1-4 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)[1]

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					

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

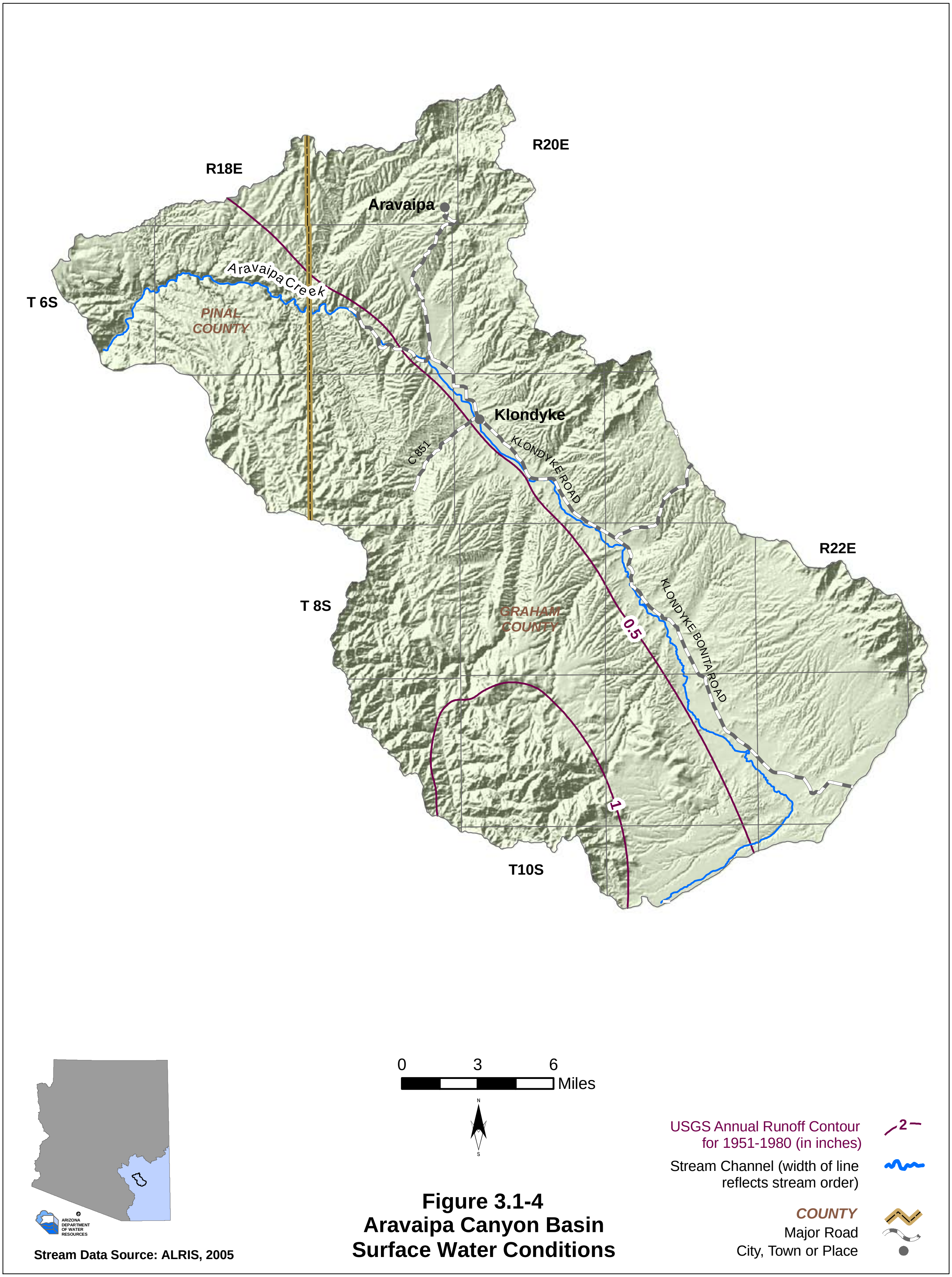


Figure 3.1-4
Aravaipa Canyon Basin
Surface Water Conditions

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 3.1-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.1-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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.
- There are six major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time.
- Listed discharge rates may not be indicative of current conditions. Some of the measurements were taken prior to 1990. For example, the most recent measurements for two major springs, Jackson and Saltuna, were less than 10 gpm. Three major and 10 minor spring measurements post-date 1990.
- All but one major spring is located in the vicinity of Aravaipa Canyon. The greatest discharge rate was measured at Hanging Spring, 100 gpm.
- All but one of the major springs discharges 30 gpm or less.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.1-5. There are 15 minor springs identified in this basin.
- The total number of springs identified by the USGS varies from 87 to 116, depending on the database reference.

Table 3.1-5 Springs in the Aravaipa Canyon Basin

A. Major Springs (10 gpm or greater):

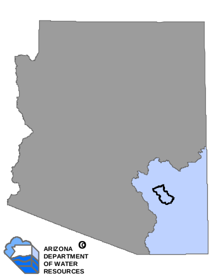
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Hanging	325507	1102620	100	04/1987
2	Goat	325250	1102743	30	11/2002
3	Jackson	325121	1102618	30[3]	11/1999
4	Saltuna[2]	325439	1102715	15[3]	04/1987
5	Warm	325901	1102224	15	11/1/2002
6	McRae	325230	1102704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

B. Minor Springs (1 to 10 gpm):

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

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

Notes:
[1]Most recent measurement identified by ADWR
[2]Spring not displayed on current USGS topo map
[3]Most recent measurement < 10 gpm
[4]Location approximated by ADWR
[5]Most recent measurement < 1 gpm



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

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 3.1-6. 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.1-6 and Figure 3.1-6.
- Major aquifers in the basin include recent stream alluvium and basin fill.
- The recent stream alluvium is the primary source of water in the basin.
- Flow direction is generally from southeast to northwest.

Well Yields

- Refer to Table 3.1-6 and Figure 3.1-8.
- As shown on Figure 3.1-8 well yields in this basin range from less than 100 gallons per minute (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 3.1-6.
- Principal sources of recharge are mountain-front recharge, streambed infiltration of runoff and direct infiltration of rainfall.
- Natural recharge estimates range from 7,000 acre-feet per year to 16,700 acre-feet per year. The most recent estimate is from a 1994 ADWR study.

Water in Storage

- Refer to Table 3.1-6.
- Storage estimates for this basin range from five million to 5.1 million acre-feet to a depth of 1,200 feet.
- The predevelopment storage estimate is five million acre-feet.

Water Level

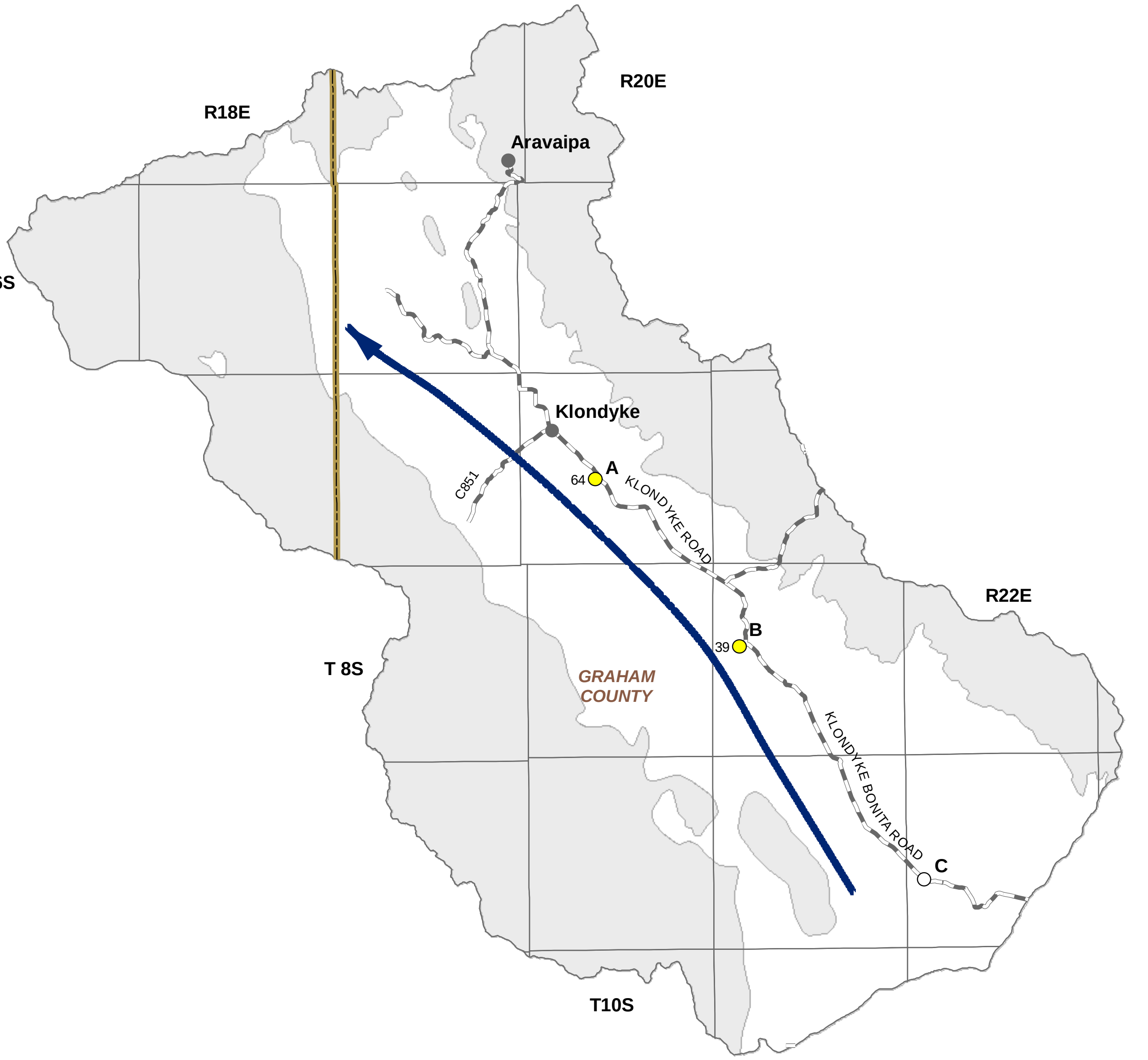
- Refer to Figure 3.1-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures three index wells in this basin.
- In 1996, the year of the last water level sweep, 60 wells were measured.

- There are two wells with water depth reported in 2003-2004. The wells are along the Klondyke and Klondyke-Bonita Roads and measure 39 feet and 64 feet to water.
- Hydrographs corresponding to selected wells shown on Figure 3.1-6 but covering a longer time period are shown in Figure 3.1-7.

Table 3.1-6 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:	NA	Measured by ADWR and/or USGS
	Range 2-1,500 Median 350 (36 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	1500	ADWR (1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	7,000 - 16,700	ADWR (1994)
	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 1994)
	5,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	NA	Arizona Water Commission (1975)
Current Number of Index Wells:	3	
Date of Last Water-level Sweep:	1996 (60 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate



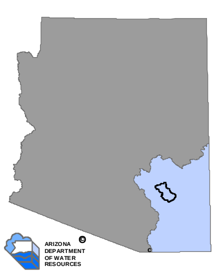
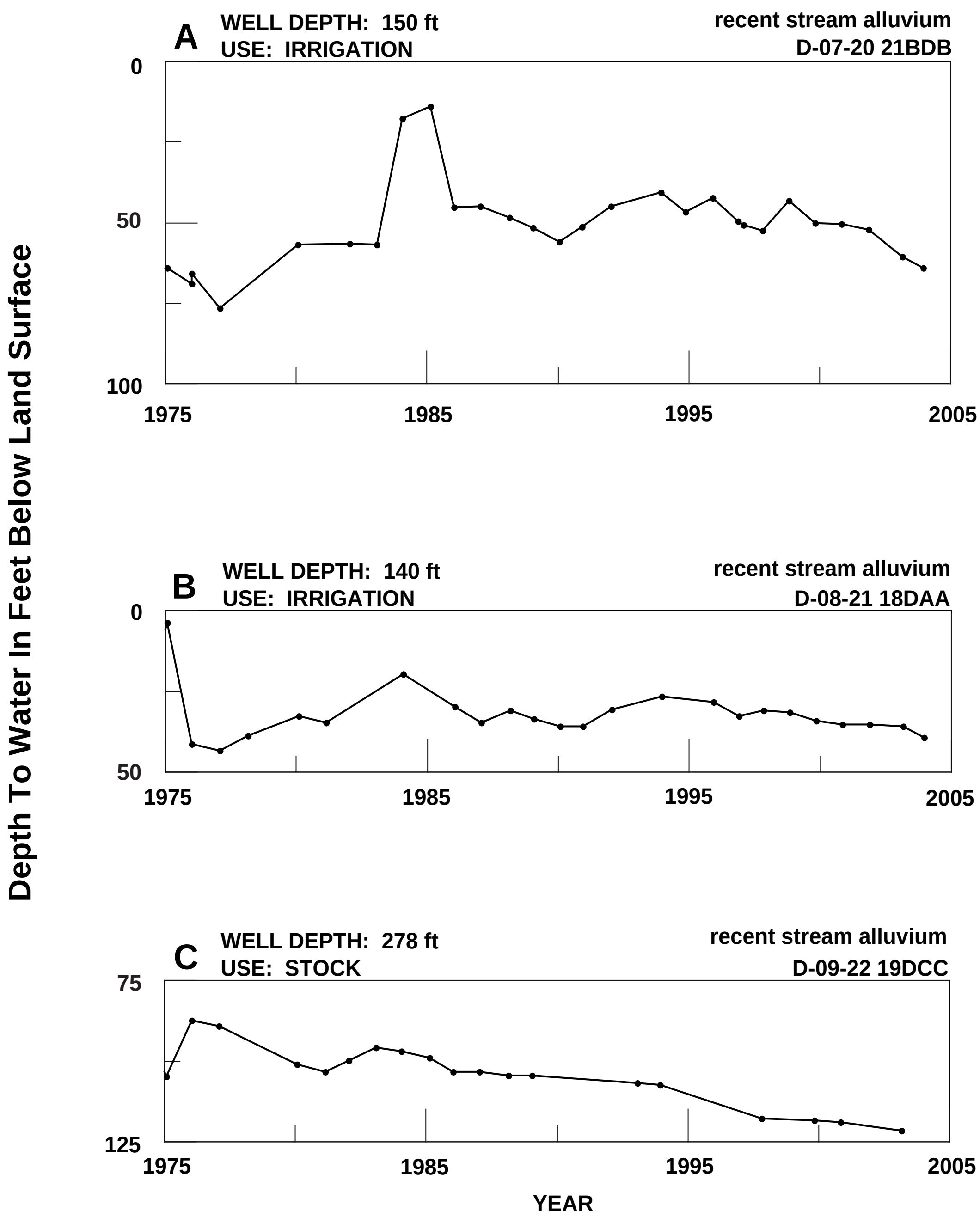


Figure 3.1-6
Aravaipa Canyon Basin
Groundwater Conditions

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



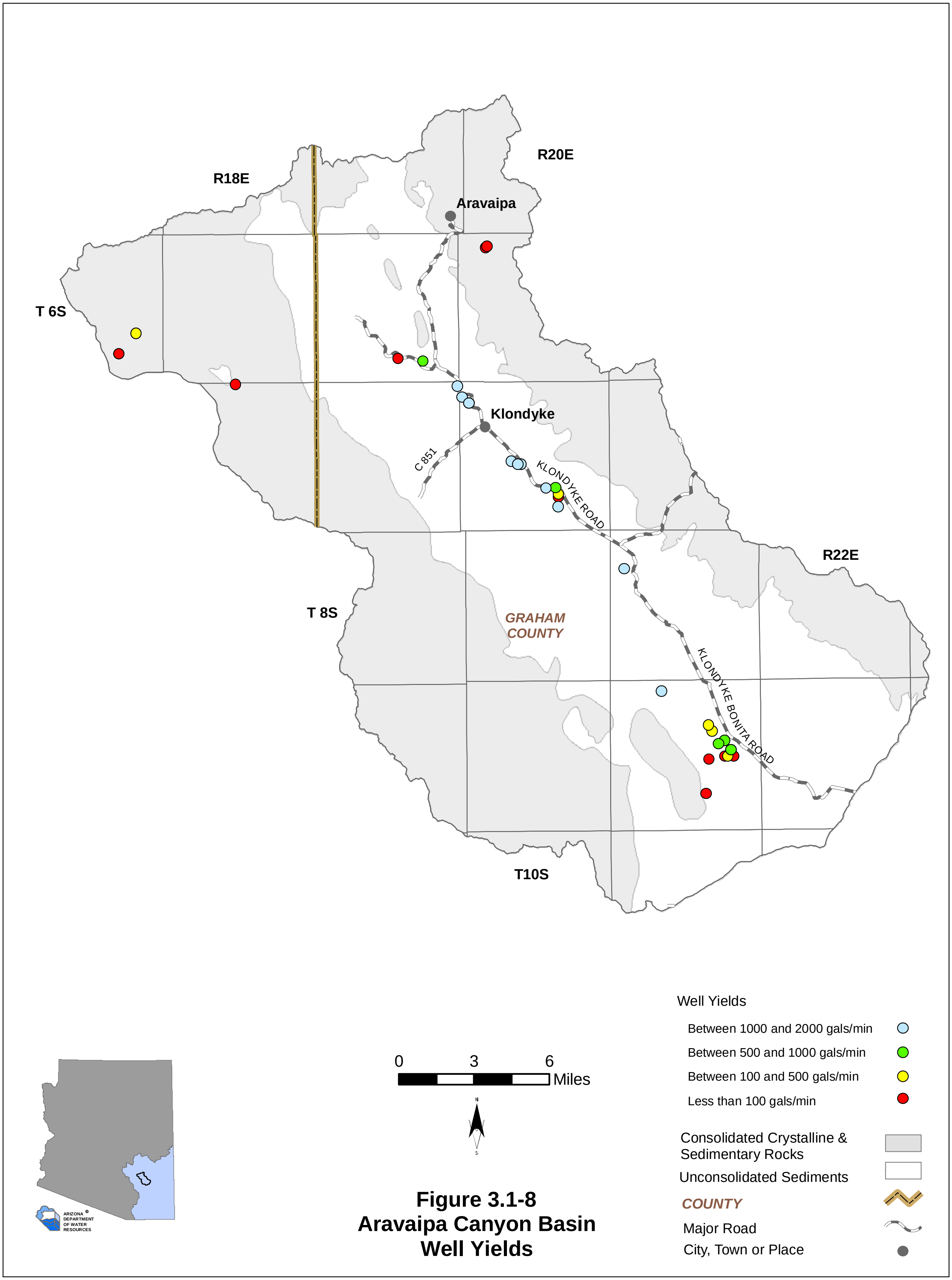


Figure 3.1-8
Aravaipa Canyon Basin
Well Yields

3.1.7 Water Quality of the Aravaipa Canyon Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.1-7. There are no data on impaired lakes and streams in this basin. Figure 3.1-9 shows the location of exceedences keyed to Table 3.1-7A. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.1-7A.
- Drinking water standard exceedences have been reported for eight wells in the basin.
- The parameter most frequently exceeded in the sites measured in this basin was arsenic. Other parameters exceeded included nitrates, beryllium, cadmium, copper, lead and fluoride.
- All areas where the parameter for arsenic was exceeded are along the Klondyke and Klondyke-Bonita Roads.

Table 3.1-7 Water Quality Exceedences in the Aravaipa Canyon Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

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]
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
NO3 = Nitrates
Pb = Lead

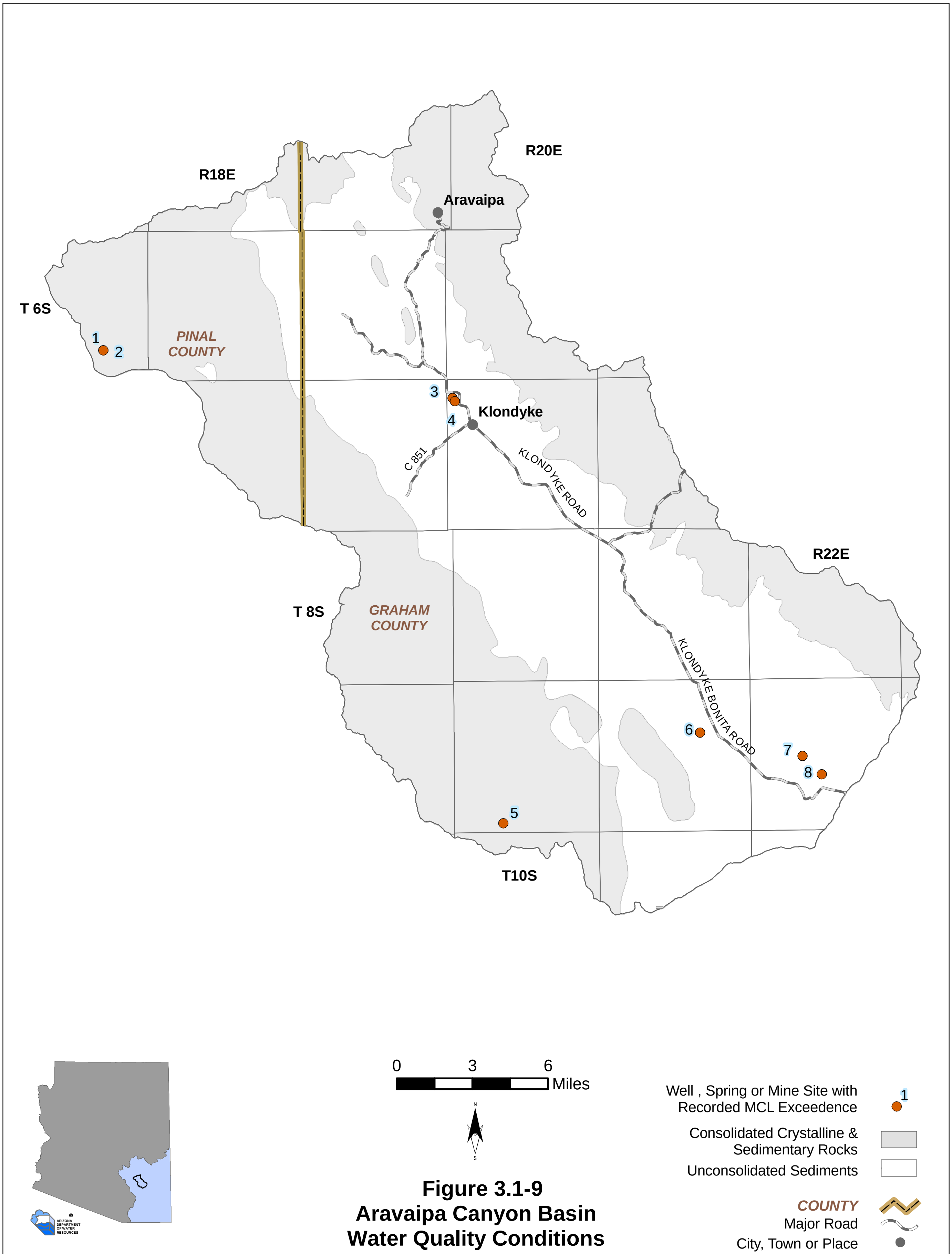


Figure 3.1-9
Aravaipa Canyon Basin
Water Quality Conditions

3.1.8 Cultural Water Demands 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 3.1-8. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.1-8 and Figure 3.1-10.
- Population remained virtually unchanged from 1980 to 2000. Projections suggest a slight increase in growth rate through 2050.
- Overall groundwater pumping is decreasing with an average of less than 1,300 acre-feet pumped per year in the period from 2001 – 2003.
- Information on surface water diversions is only available for the period of 1991 – 2003. During this period all surface water diversions have been for agriculture and were less than 1,000 acre-feet per year.
- Municipal and industrial demand is minimal in this basin, less than 300 acre-feet per year.
- Total agricultural demand in the basin is less than 2,000 acre-feet per year.
- 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 2003 there were about 205 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 32 wells with a pumping capacity of more than 35 gallons per minute.

Table 3.1-8 Cultural Water Demands in the Aravaipa Canyon Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="7">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>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">171[2]</td><td rowspan="10">29[2]</td><td colspan="3" rowspan="5">3,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994)</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">3,000</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>74</td></tr>
<tr><td>1981</td><td>79</td><td rowspan="5">1</td><td rowspan="5">1</td><td colspan="3" rowspan="5">2,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>85</td></tr>
<tr><td>1983</td><td>90</td></tr>
<tr><td>1984</td><td>96</td></tr>
<tr><td>1985</td><td>101</td></tr>
<tr><td>1986</td><td>107</td><td rowspan="5">5</td><td rowspan="5">1</td><td colspan="3" rowspan="5">2,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>112</td></tr>
<tr><td>1988</td><td>118</td></tr>
<tr><td>1989</td><td>123</td></tr>
<tr><td>1990</td><td>129</td></tr>
<tr><td>1991</td><td>129</td><td rowspan="5">5</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td><td rowspan="13">USGS (2005) ADWR (2005)</td></tr>
<tr><td>1992</td><td>130</td></tr>
<tr><td>1993</td><td>131</td></tr>
<tr><td>1994</td><td>131</td></tr>
<tr><td>1995</td><td>132</td></tr>
<tr><td>1996</td><td>133</td><td rowspan="5">15</td><td rowspan="5">1</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5"><1,000</td></tr>
<tr><td>1997</td><td>133</td></tr>
<tr><td>1998</td><td>134</td></tr>
<tr><td>1999</td><td>134</td></tr>
<tr><td>2000</td><td>135</td></tr>
<tr><td>2001</td><td>141</td><td rowspan="3">5</td><td rowspan="3">0</td><td rowspan="3"><300</td><td rowspan="3">NR</td><td rowspan="3"><1,000</td><td rowspan="3">NR</td><td rowspan="3">NR</td><td rowspan="3"><1,000</td></tr>
<tr><td>2002</td><td>146</td></tr>
<tr><td>2003</td><td>152</td></tr>
<tr><td>2010</td><td>191</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>214</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>240</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2040</td><td>269</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>302</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">ADDITIONAL WELLS:[3]</td><td>3</td><td></td><td colspan="7"></td></tr>
<tr><td colspan="2">TOTALS:</td><td>205</td><td>32</td><td colspan="7"></td></tr>
</table>

Notes:
NR - Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.1-9 Effluent Generation in the Aravaipa Canyon 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	Discharge to Another Facility	Groundwater Recharge			
No Wastewater Treatment Facilities Identified by ADWR in this Basin														

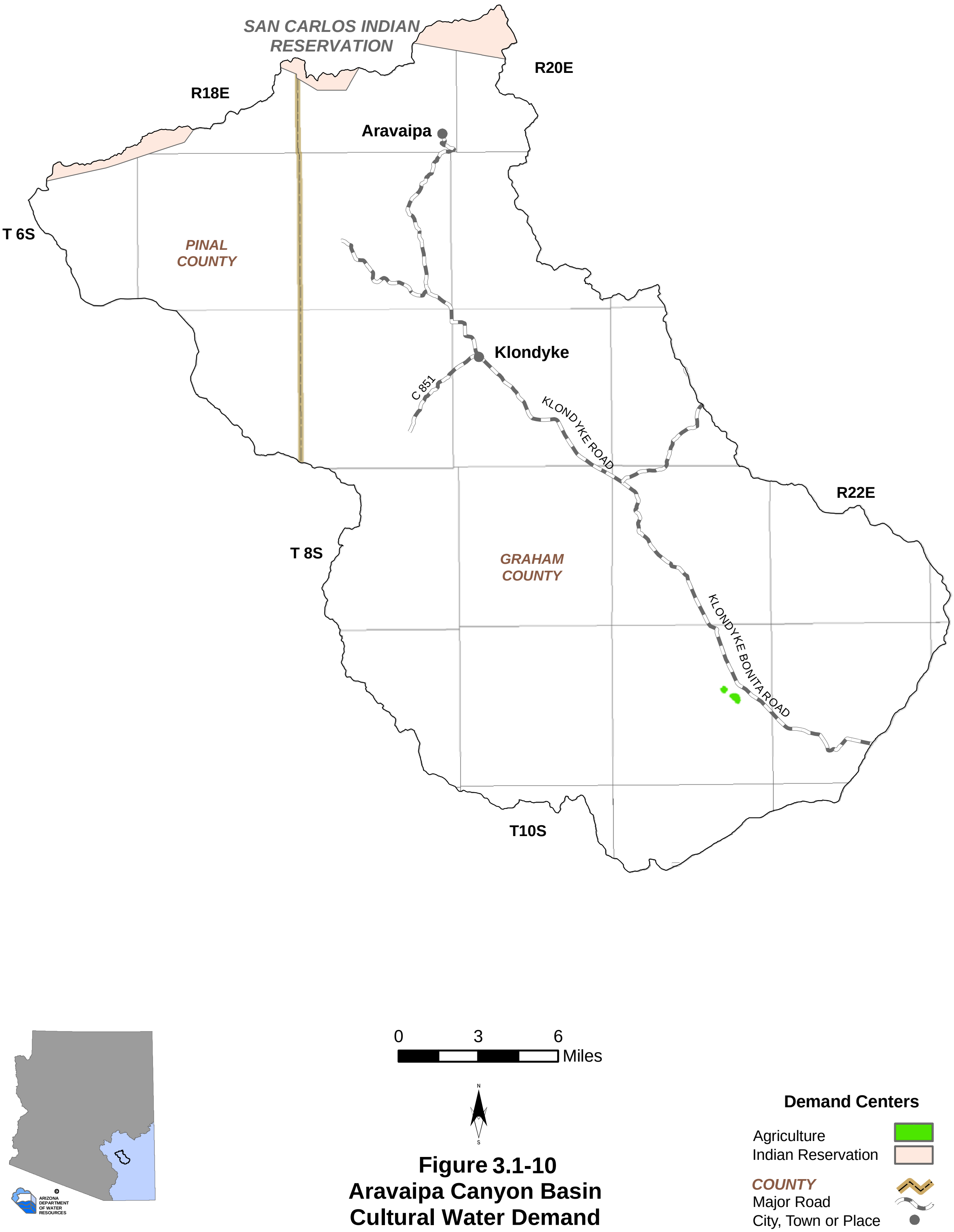


Figure 3.1-10
Aravaipa Canyon Basin
Cultural Water Demand

Primary Data Source: USGS National Gap Analysis Program, 2004

3.1.9 Water Adequacy Determinations in the Aravaipa Canyon Basin

There are no water adequacy applications on file with the Department as of May, 2005 for the Aravaipa Canyon Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 3.1-10 Adequacy Determinations in the Aravaipa Canyon Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
No subdivisions on file with ADWR at this time											

ARAVAIPA CANYON
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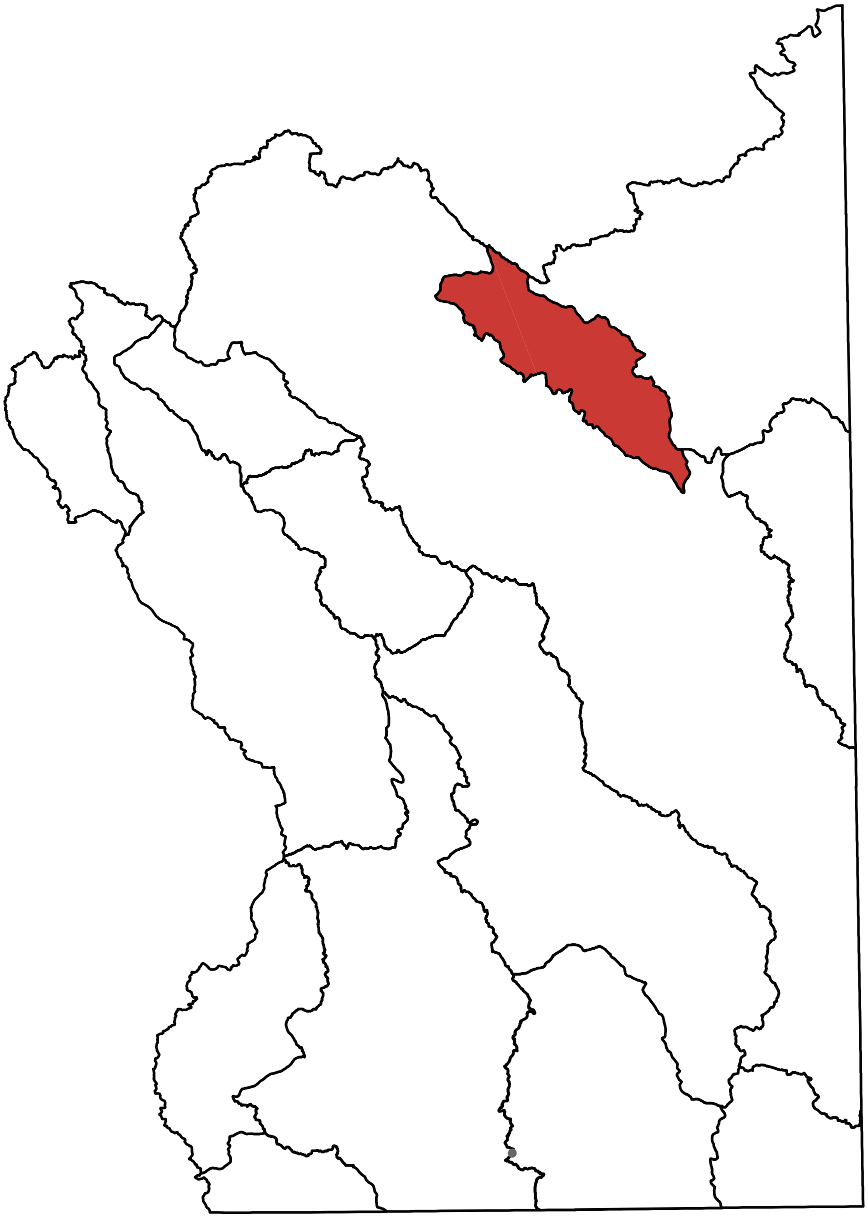
Aravaipa Canyon Basin Index to Section 3.0

Section 3.2
Bonita Creek Basin

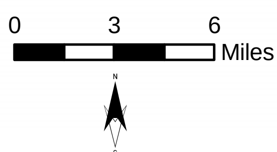


3.2.1 Geography of the Bonita Creek Basin

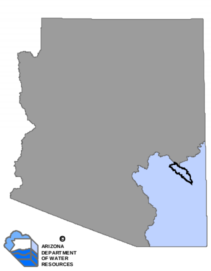
The Bonita Creek Basin is a relatively small, 457 square mile basin in the northeast portion of the planning area. Geographic features and principal communities are shown on Figure 3.2-1. The basin is characterized by medium-high elevation plains and mountain ranges as well as grasslands and woodland forests.

- Principal geographic features shown on Figure 3.2-1 are:
    - Principal basin communities of Arsenic Tubs and Bonita Camp, both with very small populations
    - 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
    - Nantac Rim along the northern boundary, with the highest point in the basin at 7,292 feet

- Not well shown on Figure 3.2-1 are the Gila Mountains along the southern boundary of the basin.



City, Town or Place



Base Map: USGS 1:500,000, 1981

Figure 3.2-1
Bonita Creek Basin
Geographic Features

3.2.2 Land Ownership in the Bonita Creek Basin

Land ownership, including the percentage of ownership in each category, is shown for the Bonita Creek Basin in Figure 3.2-2. The principal features of land ownership in this basin are the significant 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, Section 1.3.8.

The San Carlos Apache Indian Reservation was established in 1871, and covers three counties, Gila, Graham and Pinal. This basin includes 403 of the 2,867 square mile reservation. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

Indian Reservations

- 88.4% of the land in this basin is under ownership of the San Carlos Apache Tribe.
- The Reservation in this basin includes two small communities, Arsenic Tubs and Bonita Camp.
- Primary land uses are domestic and grazing.

U.S. Bureau of Land Management (BLM)

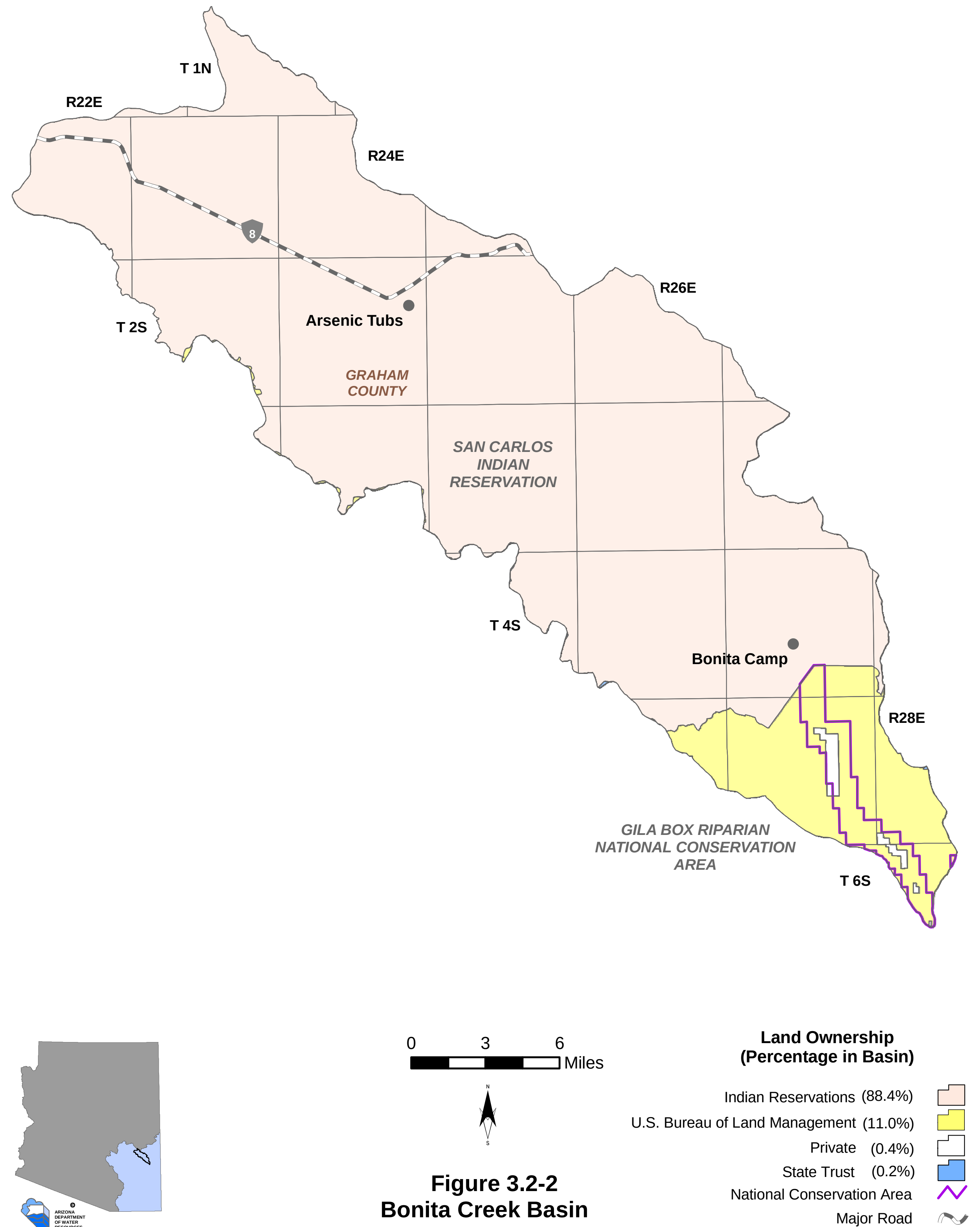
- 11.0% of the land is federally owned and managed by the Safford Field Office of the Bureau of Land Management
- The basin contains a portion of the Gila Box National Conservation Area in T5S, R27E and T6S, R28E.
- The majority of the BLM land is in the southern portion of the basin, however, there are a few very small portions of BLM land along the western boundary of the basin in T2S, R23E; T3S, R24E and T4S, R25E.
- Primary land use is grazing.

Private

- 0.4% of land is privately held.
- All private lands in this basin are in-holdings within BLM land.
- Primary land uses are domestic and grazing.

State Trust

- 0.2% of land in this basin is held in trust for public schools.
- The very small portion of state trust land can be found on the southeast basin boundary, T6S, R28E and on the western basin boundary T4S, R25E.
- Primary land use is grazing.



Source: ALRIS , 2004
Bureau of Land Management, 1999

**Figure 3.2-2
Bonita Creek Basin
Land Ownership**

3.2.3 Climate of the Bonita Creek Basin

The Bonita Creek Basin does not contain any NOAA/NWS Coop Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. The precipitation figures shown in Figure 3.2-3 are from the Spatial Climatic Analysis Service at Oregon State University. A description of this and other climate data sources and methods is found in Volume 1, Section 1.3.3.

Average Annual Precipitation

- Average annual precipitation is as high as 24 inches along the Nantac Rim in the northeastern part of the basin.
- Average annual precipitation is as low as 10 inches at the southern tip of the basin where the Gila Mountains meet the San Simon Valley.
- Precipitation generally decreases from north to south in the basin.
- The range of 14 inches between areas of highest and lowest precipitation recorded is common for the planning area.

Table 3.2-1. Climate Data for the Bonita Creek 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
None									

Source: WRCC, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

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

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

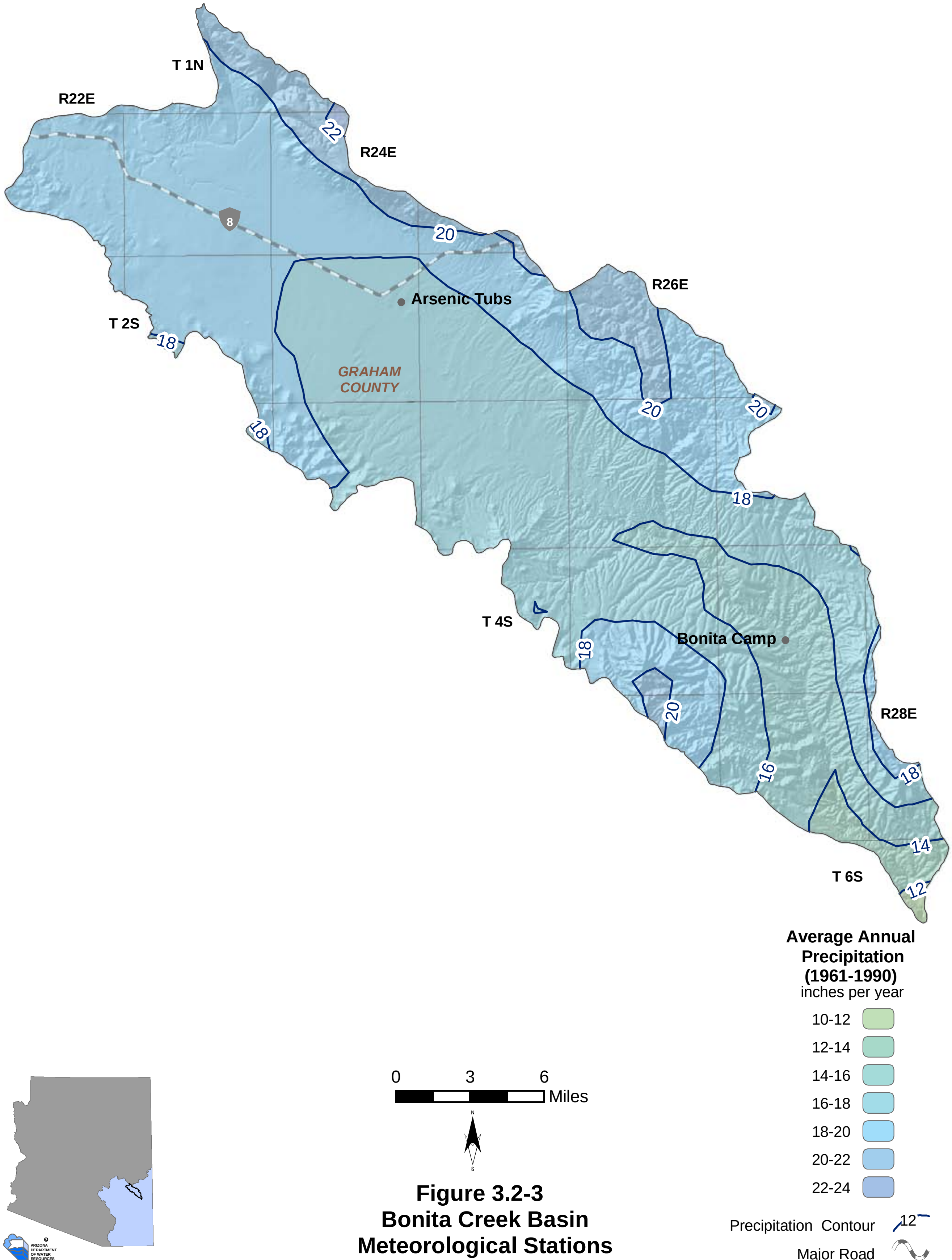


Figure 3.2-3
Bonita Creek Basin
Meteorological Stations
and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

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 3.2-2. 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 3.2-4 The location of streamflow gages, using the USGS number, is shown on Figure 3.2-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.2-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.2-2.
- Data from one station located at Bonita Creek are shown on the table and on Figure 3.2-4.
- The average seasonal flow as a percentage of annual flow is highest in the Winter (January-March) and lowest in the Spring (April-June).
- Winter flow constitutes over half of the annual flow.
- Maximum annual flow was 60,395 acre-feet in 1993 and minimum annual flow was 2,129 acre-feet in 2000. There are 21 years of annual flow record for this station.

Reservoirs and Stockponds

- Refer to Table 3.2-4.
- Surface water is stored or could be stored in one large and 16 small reservoirs in the basin.
- Total maximum surface area for the large reservoir is 59 acres.
- The reservoir is used for fish and wildlife and as a water supply.
- Total maximum storage for two of the small reservoirs is 289 acre-feet. Total surface area for the other 14 small reservoirs is 121 acres.
- There are an estimated 24 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.2-4.
- Average annual runoff is 0.5 inches per year in this basin.

Table 3.2-2 Streamflow Data for the Bonita Creek Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	NA	8/1981-current	58	8	14	20	2,129 (2000)	5,424	9,553	60,395 (1993)	21

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

Notes:
NA=Not available to ADWR
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

Table 3.2-3 Flood ALERT Equipment in the Bonita Creek Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.2-4 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

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

Stream Data Source: ALRIS, 2005

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 3.2-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.2-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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.
- 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.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.2-5. There are four minor springs identified in this basin.
- The total number of springs identified by the USGS varies from 37 to 41, depending on the database reference.

Table 3.2-5. Springs in the Bonita Creek Basin

A. Major Springs (10 gpm or greater):

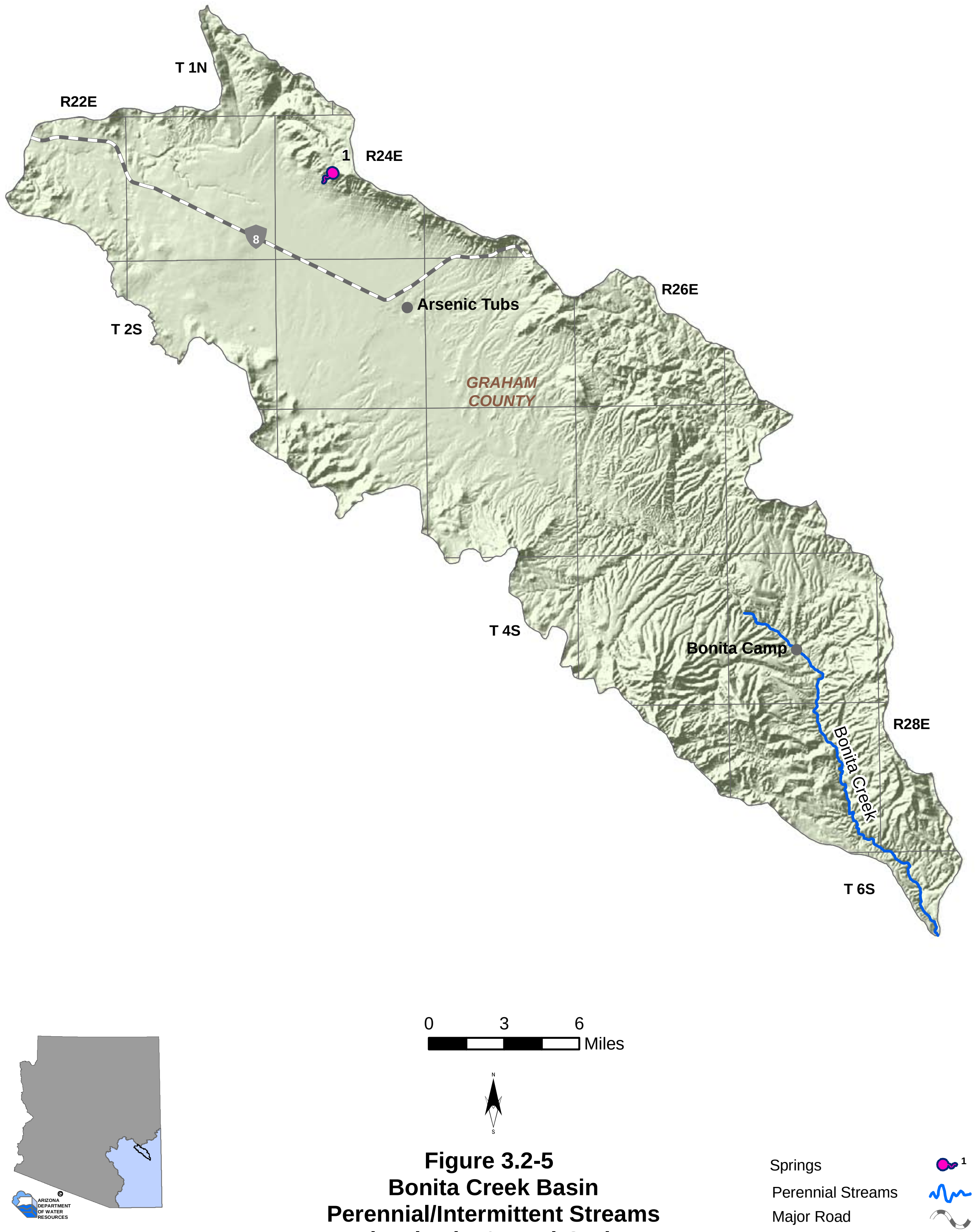
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Tule	332036	1095338	20	3/20/1951

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

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



Stream Data Source: AGFD, 1993 & 1997

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

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 3.2-6. 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers
- Refer to Table 3.2-6 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 of the basin.

Well Yields
- Refer to Table 3.2-6 and Figure 3.2-7.
- As shown on Figure 3.2-7 well yields in this basin range from less than 100 gallons per minute (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.
- Other data sources indicate lower yields.

Natural Recharge
- Refer to Table 3.2-6.
- The only natural recharge estimate for this basin is 9,000 acre-feet per year. This estimate is from 1986.

Water in Storage
- Refer to Table 3.2-6.
- There are three storage estimates for this basin, ranging from one million acre-feet to two million acre-feet. The most recent estimate, from a 1994 ADWR study, indicates the basin has 1.3 million acre-feet in storage to a depth of 1,200 feet.
- The predevelopment storage estimate is one million acre-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.
- There are no recorded well sweeps in this basin.
- There are three wells with water depth reported in 2003-2004. Water level change data is not available. All wells are in the same area near Bonita Creek and the depth to water ranges from four feet to 12 feet.

Table 3.2-6 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:	NA	Measured by ADWR and/or USGS
	Range 3-1,426 Median 1,144.5 (14 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	280	ADWR (1994)
	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 (1994)
	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:	N/A	

Notes:
NA = Not Available
[1]Predevelopment Estimate

Figure 3.2-6
Bonita Creek Basin
Groundwater Conditions

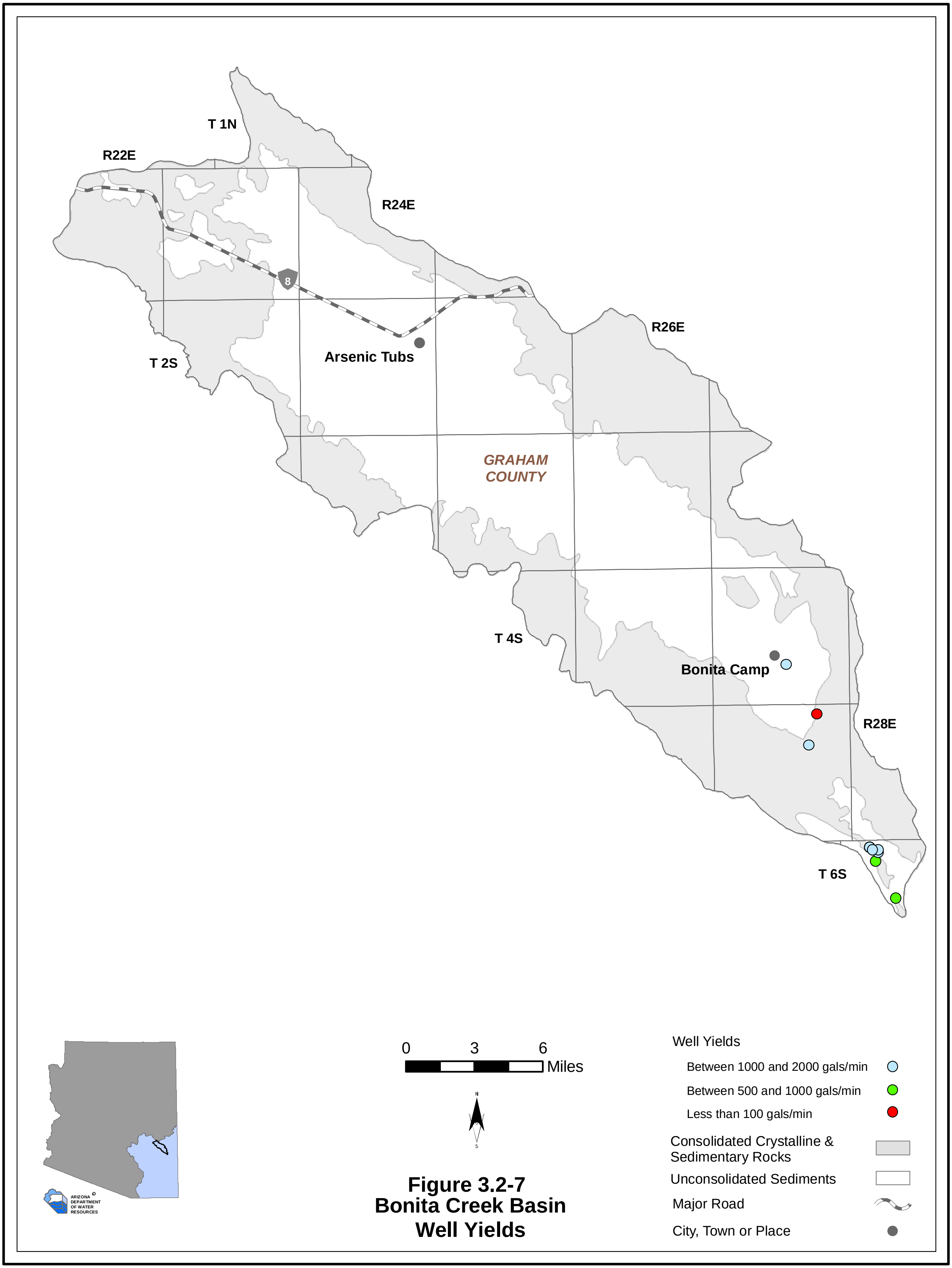


Figure 3.2-7
Bonita Creek Basin
Well Yields

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, Section 1.3.18.

Table 3.2-7 Water Quality Exceedences in the Bonita Creek Basin

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard
		Township	Range	Section	
None identifed by ADWR at this time					

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						

3.2.8 Cultural Water Demands 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 3.2-8. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.2-8 and Figure 3.2-8.
- Population in this basin is very small with 21 residents in 2000. Projections suggest a slight increase in population through 2050.
- Overall groundwater pumping is relatively constant between 1971 and 2003 with an average of 3,200 acre-feet per year in the period from 2001-2003.
- 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.
- All water use in this basin is groundwater, there are no recorded surface water diversions.
- The only municipal demand center (USGS, 2004) is located near Highway 8 in T1S, R23E.
- As of 2003 there were five registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 17 wells with a pumping capacity of more than 35 gallons per minute. This is the smallest number of registered wells in a planning area basin.

Table 3.2-8 Cultural Water Demands in the Bonita Creek Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971										
1972										
1973				3,100[3]			NR			
1974										
1975		4[2]	17[2]							
1976										
1977										
1978				3,100[3]			NR			
1979										
1980	5									USGS (2005)
1981	7									
1982	8									
1983	10	0	0	3,100[3]			NR			
1984	11									
1985	13									
1986	14									
1987	16									
1988	17	0	0	3,100[3]			NR			
1989	19									
1990	20									
1991	20									
1992	20									
1993	21	0	0	2,700	NR	NR	NR			
1994	21									
1995	21									
1996	21									
1997	21									USGS (2005)
1998	21	1	0	3,300	NR	NR	NR			
1999	21									
2000	21									
2001	21									
2002	21	0	0	3,200	NR	NR	NR			
2003	21									
2010	22									
2020	23									
2030	24									
2040	25									
2050	26									
	WELL TOTALS:	**5**	**17**							

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[1] Does not include evaporation losses from stockponds and reservoirs.
[3] Estimated based on average demand 1991-2003

Table 3.2-9 Effluent Generation in the Bonita Creek 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	Discharge to Another Facility	Groundwater Recharge			
No Wastewater Treatment Facilities Identified by ADWR in this Basin														

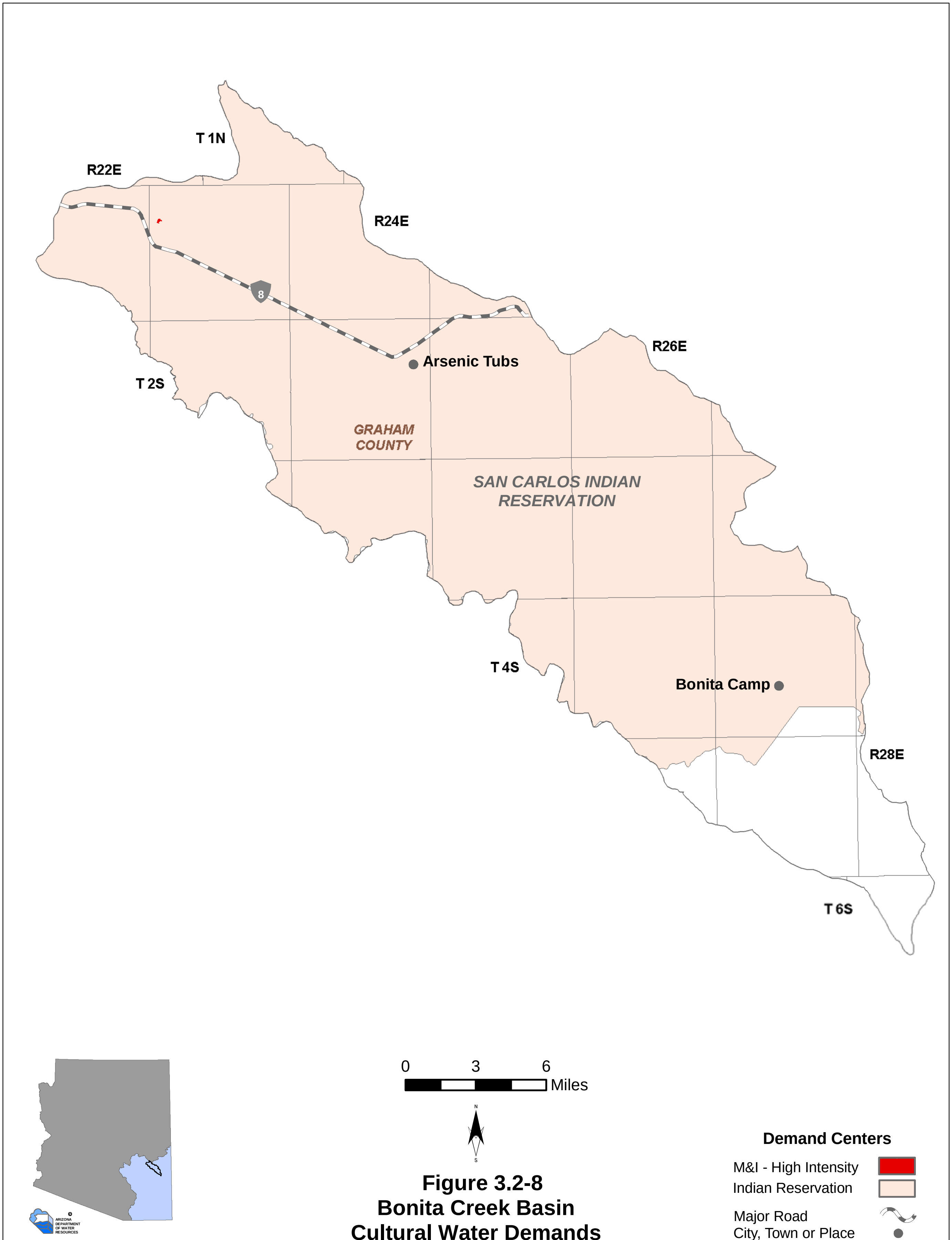


Figure 3.2-8
Bonita Creek Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

3.2.9 Water Adequacy Determinations in the Bonita Creek Basin

There are no water adequacy applications on file with the Department as of May, 2005 for the Bonita Creek Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 3.2-10 Adequacy Determinations in the Bonita Creek Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
No subdivisions on file with ADWR at this time											

BONITA CREEK BASIN

References and Supplemental Reading

References

A

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*All references marked with an asterisk contain information that was directly used in the basin summaries, tables or maps.

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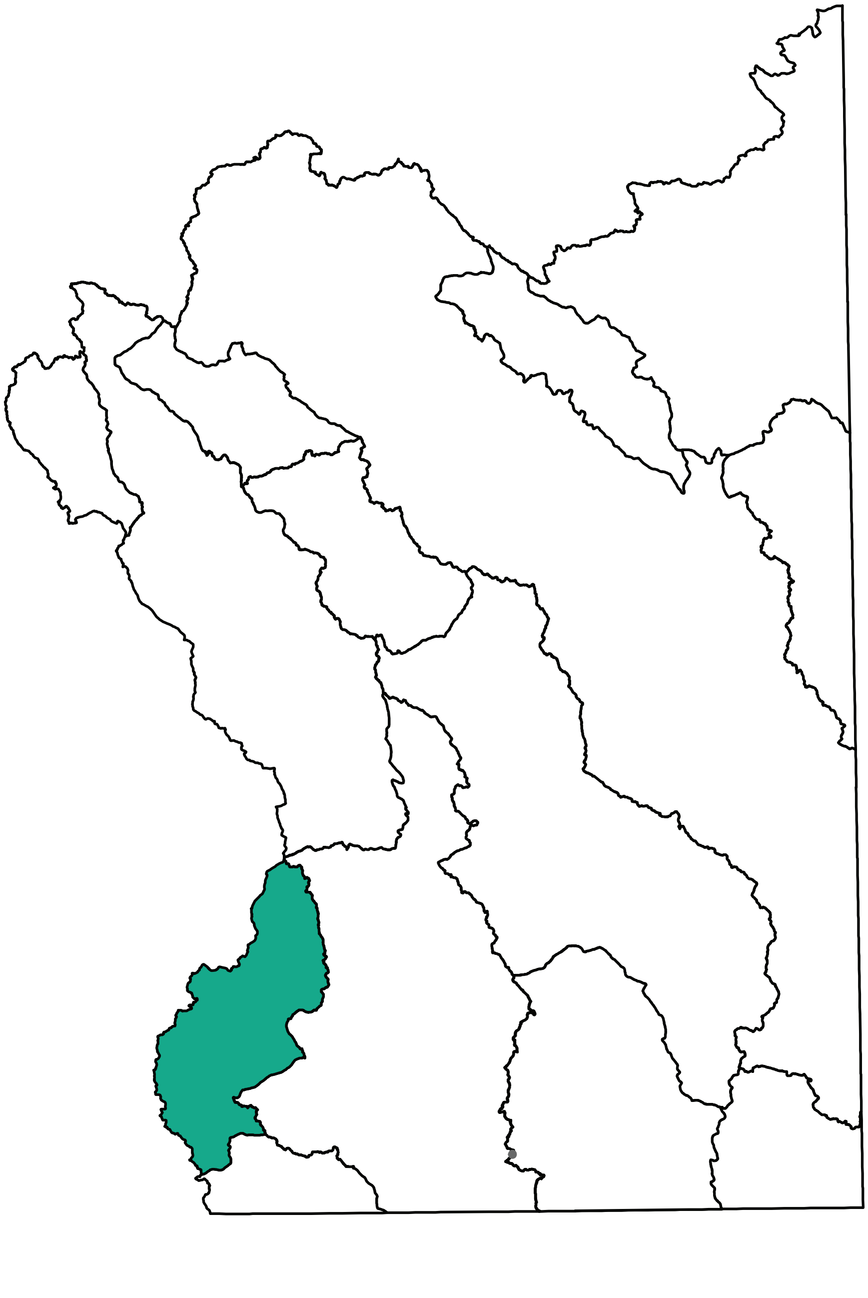
Bonita Creek Basin Index to Section 3.0

Section 3.3
Cienega Creek Basin

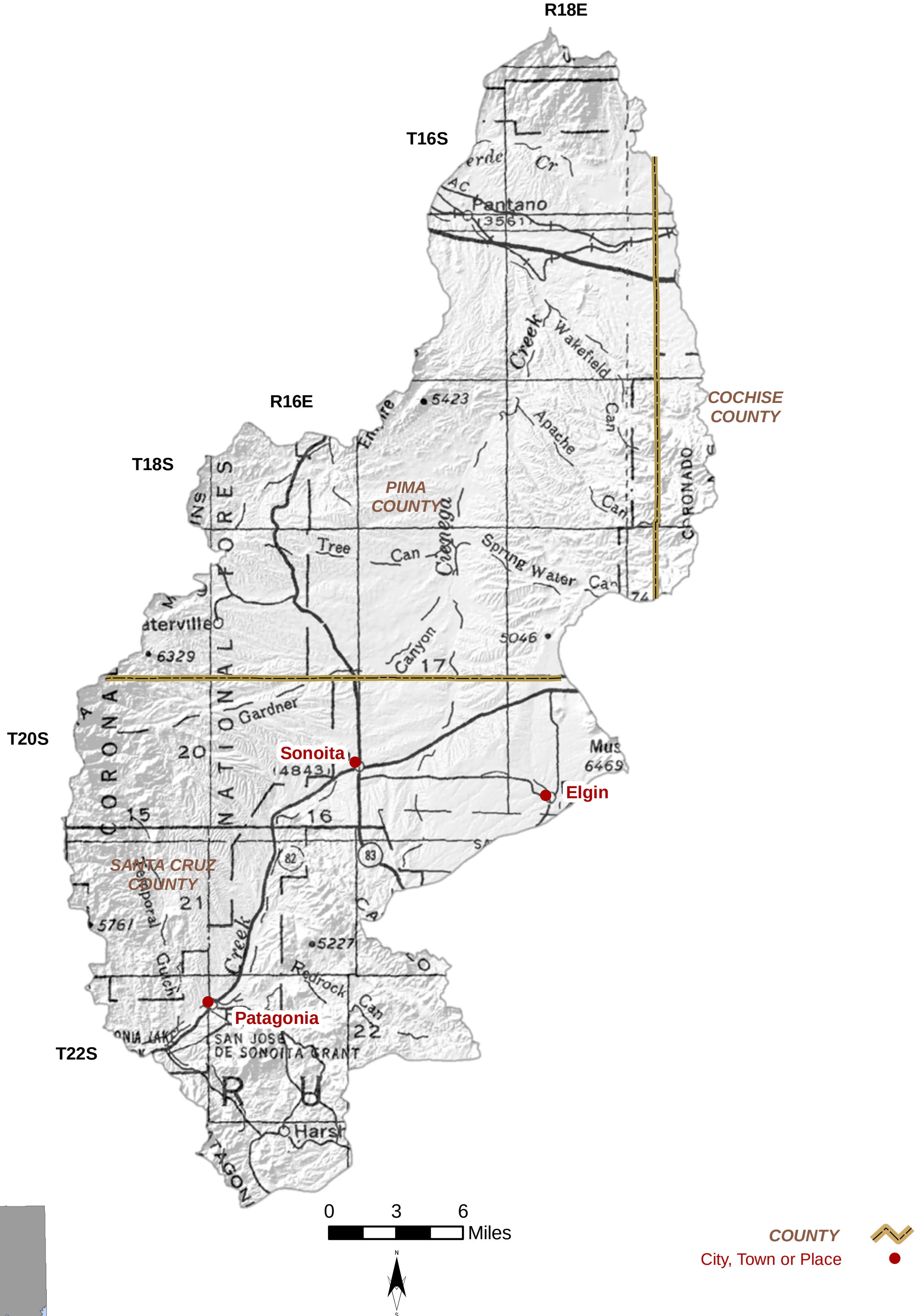


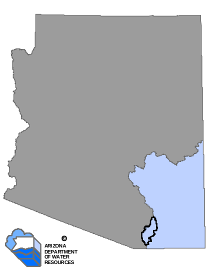
3.3.1 Geography of the Cienega Creek Basin

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.

- Principal geographic features shown on Figure 3.3-1 are:
    - Principal basin communities of Patagonia, Sonoita and Elgin
    - Cienega Creek, a spring-fed perennial creek that begins in T21S, R17E and flows 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

- Not well shown on Figure 3.3-1 are:
    - Santa Rita Mountain range along the southwestern boundary, which include Mt. Wrightson, the highest point in the basin at 9,453 feet
    - Empire Mountains in the northwest
    - Whetstone Mountains in the northeast
    - Patagonia Mountains on the southwestern boundary





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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

National Forest and Wilderness
- 41.4% of land is federally owned and managed as national forest and wilderness.
- 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 west of Patagonia and Sierra Vista Ranger District east of Patagonia and northeast of Sonoita.
- A portion of the Mt. Wrightson Wilderness area is located in T19S and T20S, R15E.
- Primary land uses are grazing, recreation and timber production.

State Trust
- 23.5% 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.

Private
- 23.2% 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.

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 the Las Cienegas National Conservation Area, a 42,000 acre area north of Sonoita along Cienega Creek.
- Primary land uses are recreation and grazing.

Parks, Monuments, Historical and Recreational Sites
- 0.1% is federally owned and managed by the National Park Service.
- All park lands in this basin are in a very small portion of Saguaro National Park at the northern tip in T17S, R18E.
- Primary land use is recreation.

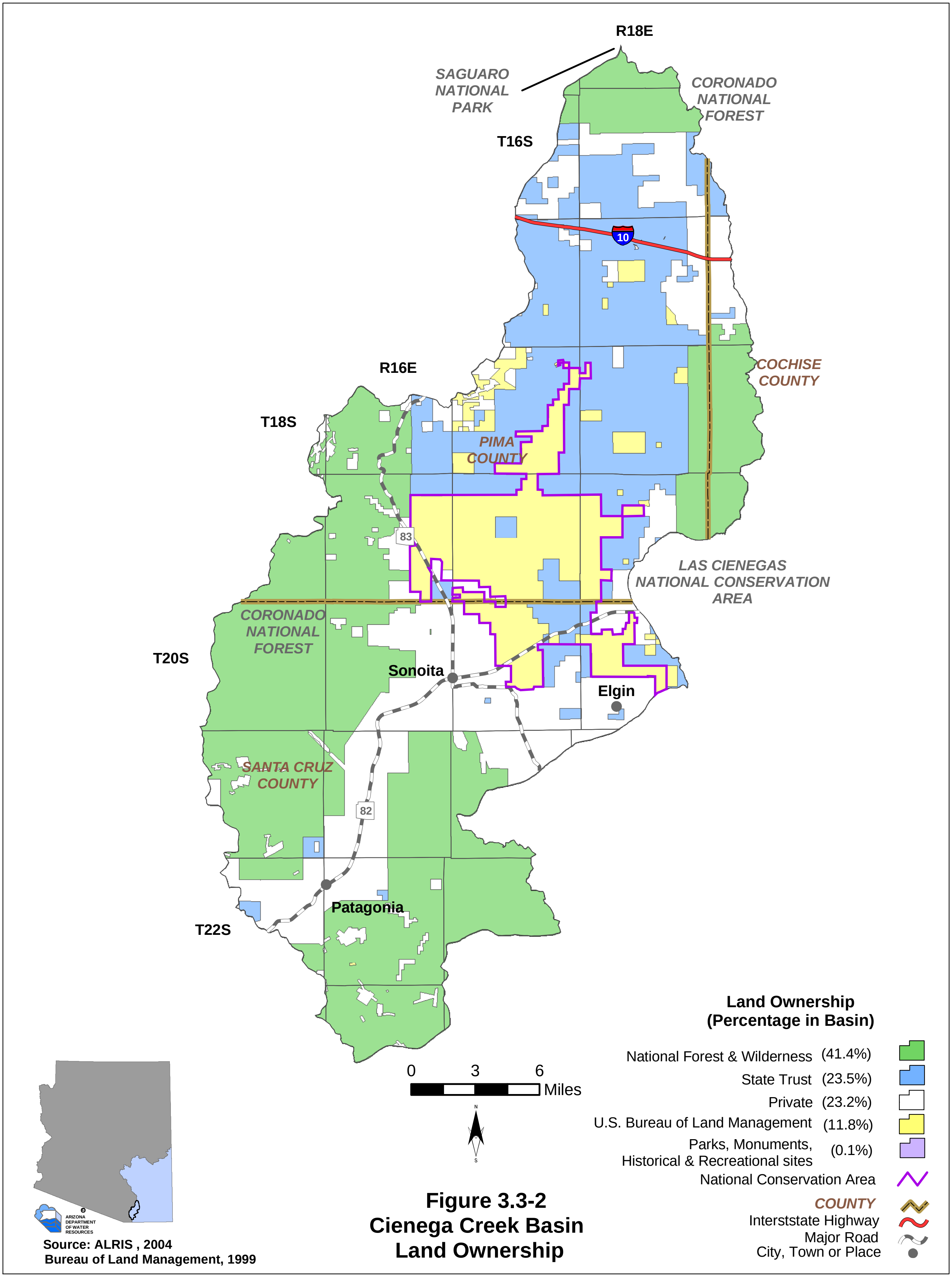


Figure 3.3-2
Cienega Creek Basin
Land Ownership

3.3.3 Climate of the Cienega Creek Basin

The Cienega Creek Basin does not contain any NOAA/NWS Coop Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. The precipitation figures shown in Figure 3.3-3 are from the Spatial Climatic Analysis Service at Oregon State University. A description of this and other climate data sources and methods is found in Volume 1, Section 1.3.3.

Average Annual Precipitation

- Average annual precipitation is as high as 40 inches in the vicinity of McCleary Peak in the Santa Rita Mountains.
- Average annual precipitation is as low as 16 inches at the Mescal Arroyo north of Interstate 10.
- Rainfall in this basin increases as elevation increases with the highest precipitation occurring in the Santa Rita Mountains.
- Compared to other basins in the planning area, the Cienega Creek Basin has a high overall average annual precipitation with the lowest averages higher than 14 inches.
- The range of 26 inches between areas of highest and lowest precipitation recorded is larger than most other basins in the planning area.

Table 3.3-1 Climate Data for the Cienega Creek 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
None									

Source: WRCC, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

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

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

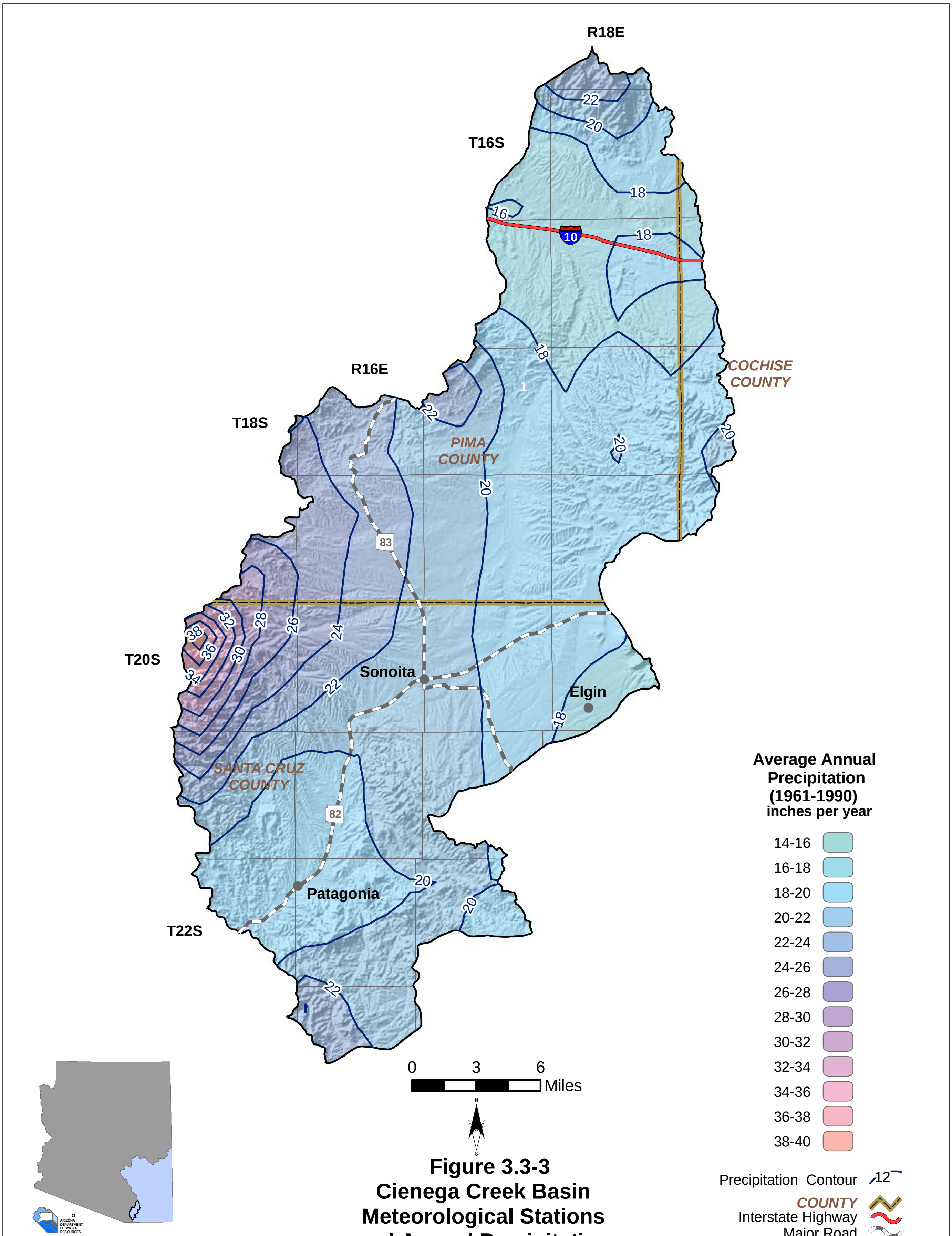


Figure 3.3-3
Cienega Creek Basin
Meteorological Stations
and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

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 3.3-2. Flood ALERT equipment in the basin as of September 2004 is shown on Table 3.3-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 3.3-4. The location of streamflow gages, using the USGS number, is shown on Figure 3.3-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.3-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.3-2.
- Data from two stations located at Cienega Creek are shown on the table and on Figure 3.3-4.
- One station was discontinued in 1975 and the other station contains less than three years of data, therefore no statistics were run.
- The average seasonal flow for the discontinued Pantano station is highest in the Summer (July-September) when 93% of the annual average seasonal flow occurs. The average seasonal flow is lowest in the Spring (April-June) and the Fall (October-December).
- Maximum annual flow was 4,496 acre-feet in 1974 and minimum annual flow was 608 acre-feet in 1968 at the station near Pantano.

Flood ALERT Equipment

- Refer to Table 3.3-3.
- There are seven stations in the basin as of October 2005, all but one is located in Pima County.
- Four stations are precipitation only, one station is a weather station, one station is a precipitation/stage station and one is a repeater/precipitation station.

Reservoirs and Stockponds

- Refer to Table 3.3-4.
- Surface water is stored or could be stored in four small reservoirs in the basin.
- Total maximum storage for two of the small reservoirs is 68 acre-feet. Total surface area for the other two small reservoirs is 10 acres.
- There are an estimated 426 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.3-4.
- Average annual runoff is two inches per year in the northwestern portion of the basin and decreases to 0.5 inches per year in the central and southern part of the basin.

Table 3.3-2 Streamflow Data for the Cienega Creek Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	Undetermined	NA	10/2001- current	No statistics run, less than 3 years data								2
9484560	Cienega Creek near Pantano	289	4,890	3/1968-9/1975 (discontinued)	5	1	93	1	608 (1969)	1,408	1,919	4,496 (1974)	6

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

Notes:
NA= Not available to ADWR
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

Table 3.3-3 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

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

Table 3.3-4 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)[1]

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					

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

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

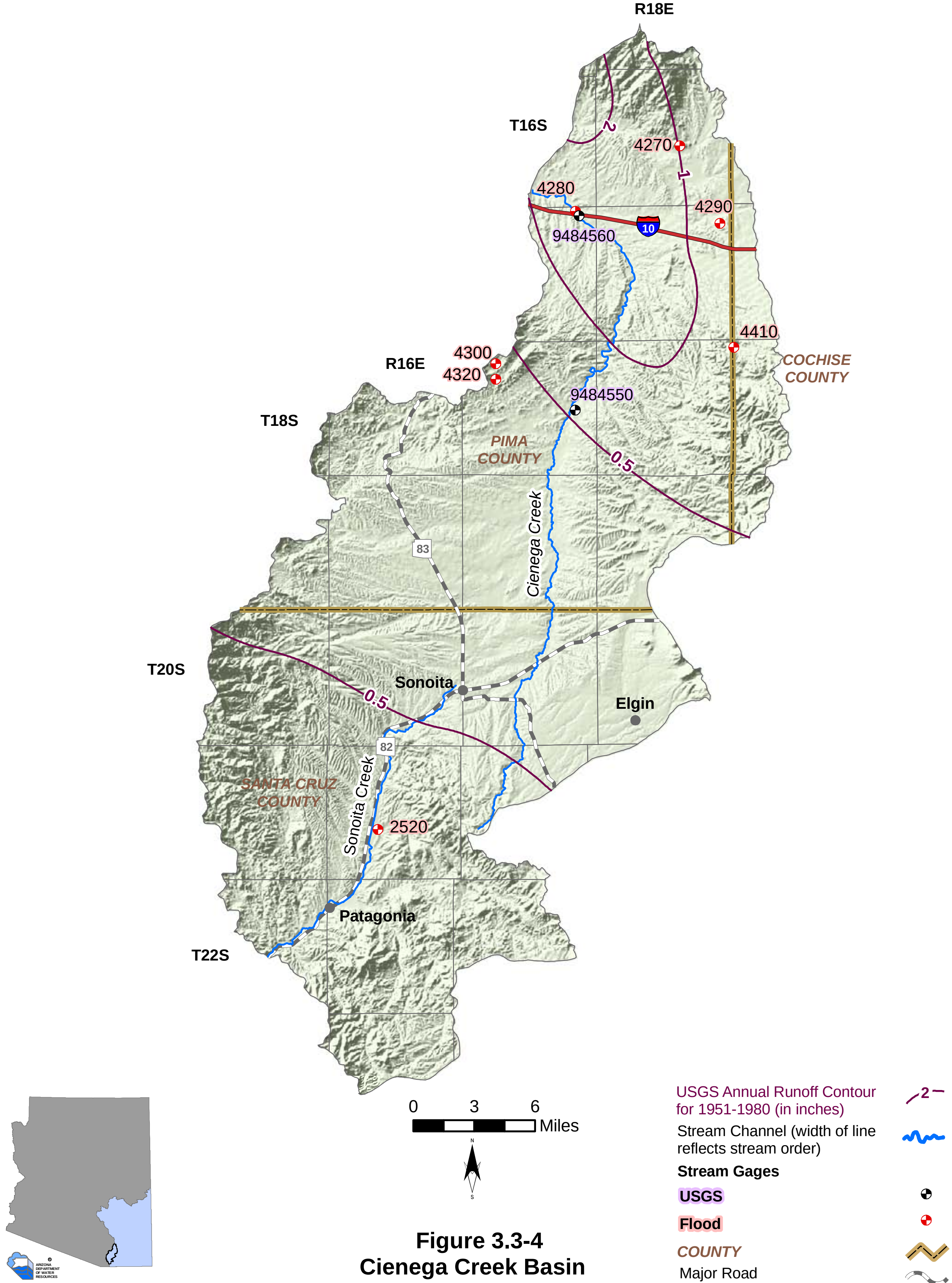
D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

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



Stream Data Source: ALRIS, 2005

Figure 3.3-4
Cienega Creek Basin
Surface Water Conditions

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 3.3-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.3-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are three streams with perennial reaches, Sonoita Creek, Cienega Creek and Redrock Canyon. Perennial reaches of Sonoita Creek and Redrock Canyon are located in the southern portion of the basin and perennial reaches of Cienega Creek are located in the north-central portion of the basin. There is also a perennial reach of Cienega Creek just north of Interstate 10 on the northwest boundary.
- There are a number of intermittent streams as well as intermittent reaches of perennial streams in the basin.
- There are seven major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time.
- Listed discharge rates may not be indicative of current conditions. All of the spring measurements in the basin were taken prior to 1983.
- The major springs are located throughout most of the basin. The greatest discharge rates are south of Sonoita (Monkey, 430 gpm and Cottonwood, 150 gpm).
- Most of the major springs discharge 40 gpm or greater.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.3-5. There are two minor springs identified in this basin.
- The total number of springs identified by the USGS is 78.

Table 3.3-5 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

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

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

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

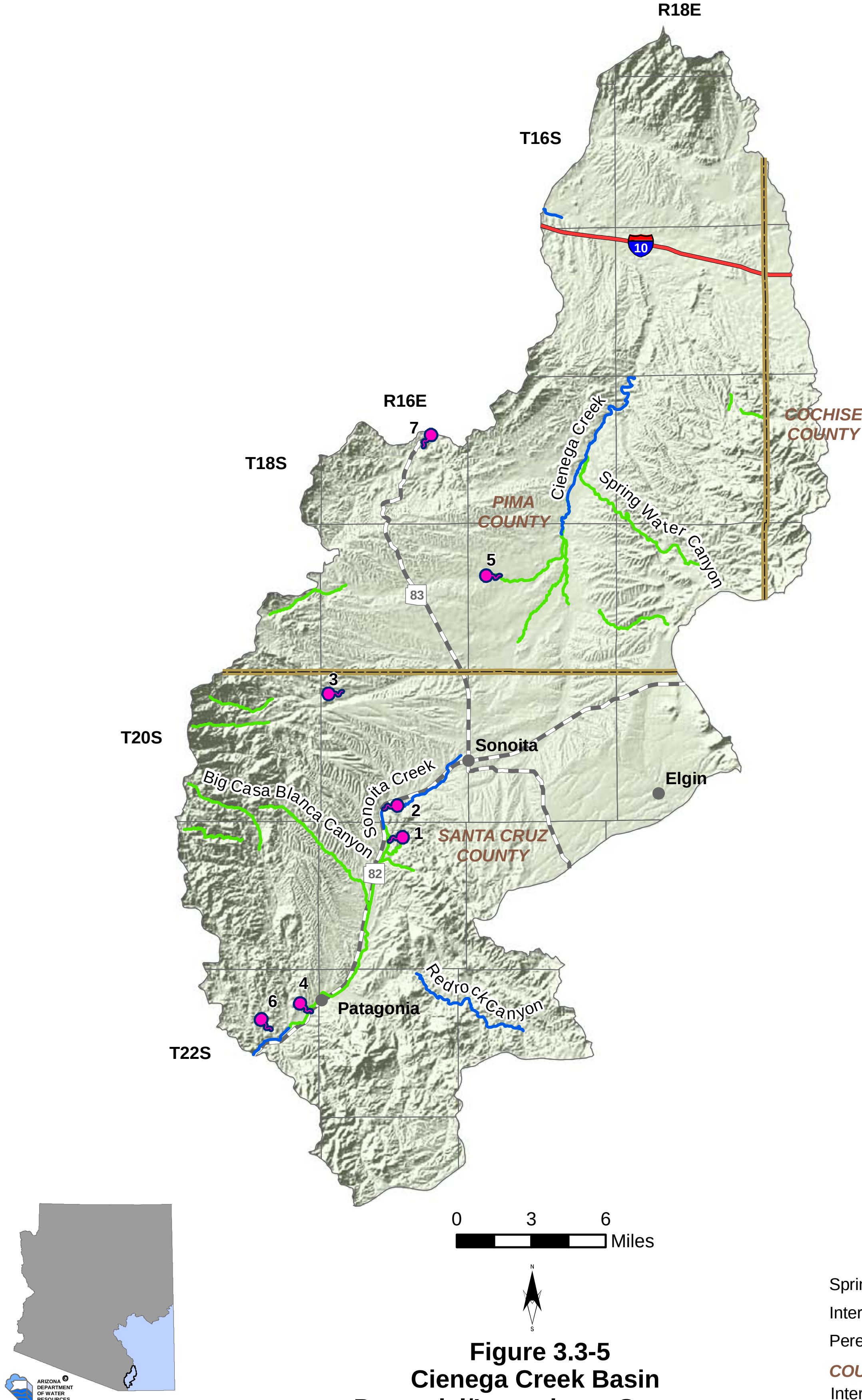


Figure 3.3-5
Cienega Creek Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

Springs
Intermittent Streams
Perennial Streams
COUNTY
Interstate Highway
Major Road
City, Town or Place

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 3.3-6. 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. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.3-6 and Figure 3.3-6.
- Major aquifers in the basin include recent stream alluvium and basin fill.
- The basin consists of three groundwater sections, upper Cienega Creek, lower Cienega Creek and Sonoita Creek.
- In the central valley, in the upper Cienega Creek section, the principal aquifer is the basin fill alluvium.
- From “the Narrows” south of Interstate 10 where the central valley narrows to the northern basin boundary in the lower Cienega Creek section, 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, in the Sonoita Creek section, 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 3.3-6 and Figure 3.3-8.
- As shown on Figure 3.3-8 well yields in this basin range from less than 100 gallons per minute (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.
- Well yields vary throughout the basin.

Natural Recharge

- Refer to Table 3.3-6.
- There are two natural recharge estimates for this basin, 11,000 acre-feet per year and 8,500 to 25,500 acre-feet per year. The latter, from a 1994 ADWR study, is the most recent.

Water in Storage

- Refer to Table 3.3-6.
- There are three storage estimates for this basin, ranging from 5.1 million acre-feet to 11 million acre-feet. The most recent estimate, from a 1994 ADWR study, indicates the basin has 5.1 million acre-feet in storage to a depth of 1,200 feet.
- The predevelopment storage estimate is six million acre-feet.

Water Level

- Refer to Figure 3.3-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 13 index wells in this basin.
- In 2005, the year of the last water level sweep, 13 wells were measured.
- The deepest recorded water level in 2003-2004 is 207 feet in Sonoita and the shallowest is 21 feet in the vicinity of Elgin.
- Hydrographs corresponding to selected wells shown on Figure 3.3-6 but covering a longer time period are shown in Figure 3.3-7.

Table 3.3-6 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	
Well Yields, in gal/min:	N/A	Measured by ADWR and/or USGS
	Range 25-600 Median 250 (35 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 2-1,500	ADWR (1994)
	Range 0-2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet:	8,500 - 25,500	ADWR (1994)
	11,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	5,100,000 (to 1,200 ft)	ADWR (1994)
	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:	13	
Date of Last Water-level Sweep:	2005 (118 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate

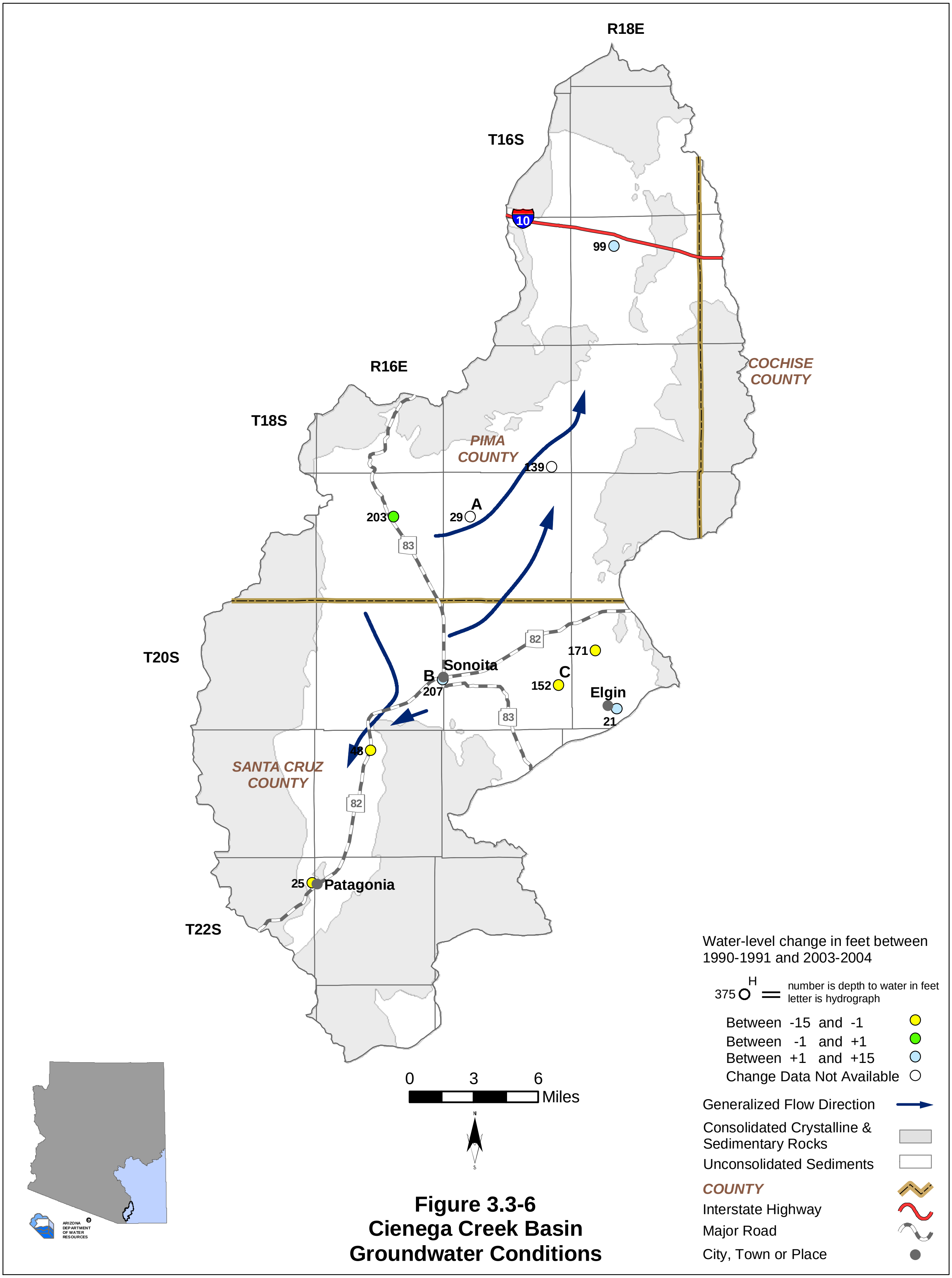
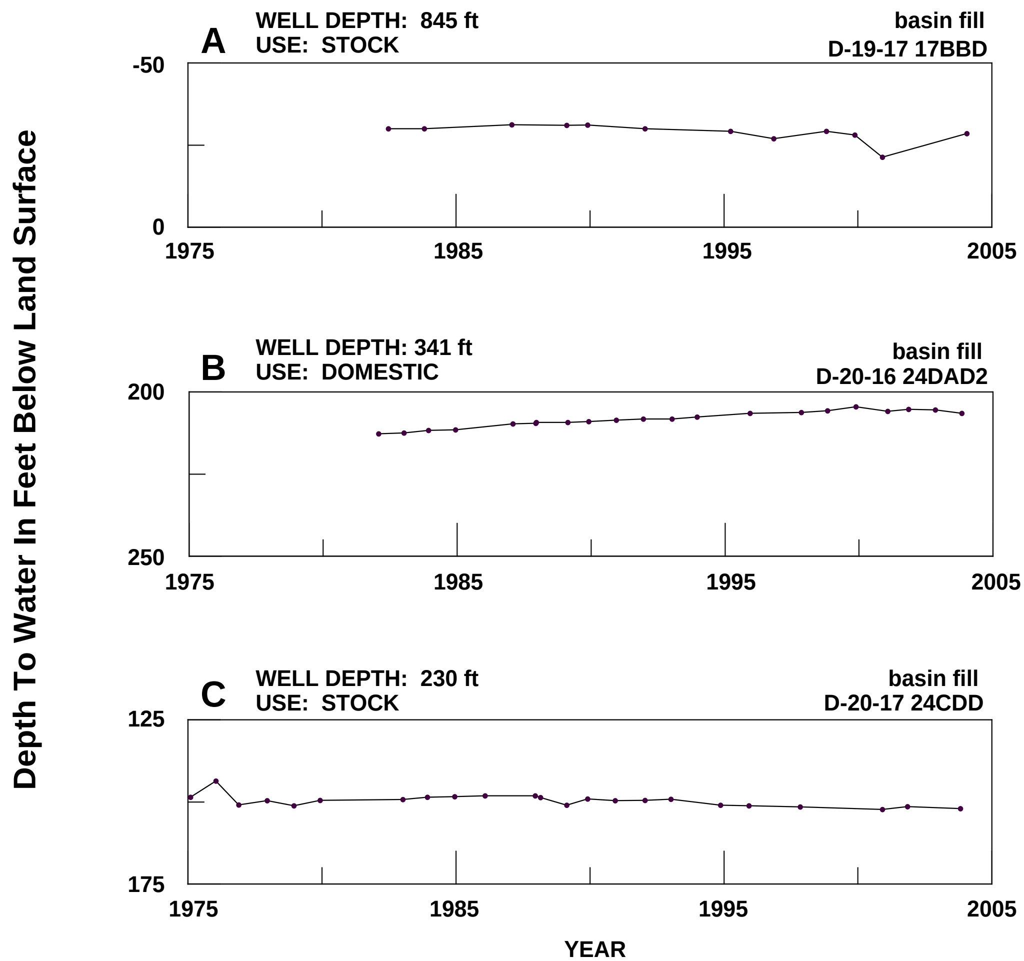


Figure 3.3-6
Cienega Creek Basin
Groundwater Conditions

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



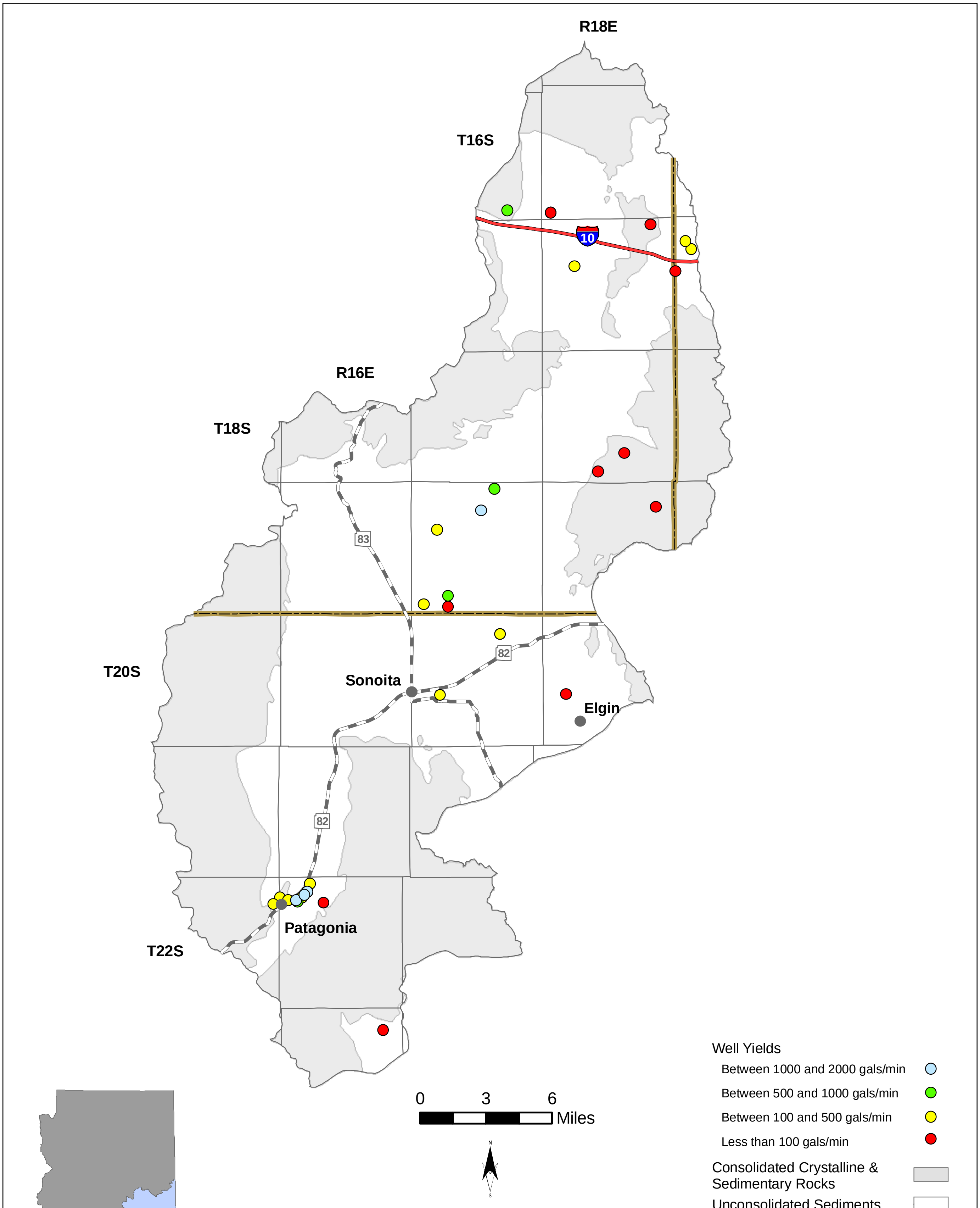


Figure 3.3-8
Cienega Creek Basin
Well Yields

3.3.7 Water Quality of the Cienega Creek Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.3-7A. 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 3.3-7B. Figure 3.3-9 shows the location of exceedences and impairment keyed to Table 3.3-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.3-7A.
- Drinking water standard exceedences in wells, springs and at mine sites have been reported for 46 sites in the basin.
- The parameters most frequently exceeded in the sites measured in this basin were cadmium and copper. Almost all of these sites are in the vicinity of Patagonia.
- Other parameters that were commonly exceeded in the sites measured in this basin were arsenic, fluoride and lead.

Lakes and Streams

- Refer to Table 3.3-7B.
- Water quality standards were 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.
- The longest impaired reach was 14 miles of Harshaw Creek.
- 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. No implementation plans or activities are occurring at this time.
- There is one small portion of Sonoita Creek in the vicinity of Patagonia that is effluent dependent.

Table 3.3-7 Water Quality Exceedences in the Cienega Creek Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

Table 3.3-7 Water Quality Exceedences in the Cienega Creek Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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

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

Table 3.3-7 Water Quality Exceedences in the Cienega Creek Basin[1]

B. Lakes and Streams (con't.)

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]
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, Zn
d	Stream	Headwaters of unnamed tributary of Endless Mine tributary to Harshaw Creek	2	NA	A&W, PBC	Cu, pH
e	Stream	Humbolt Canyon	2	NA	A&W, FBC, FC	Cd, Cu, pH, Zn

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/Nitrite
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

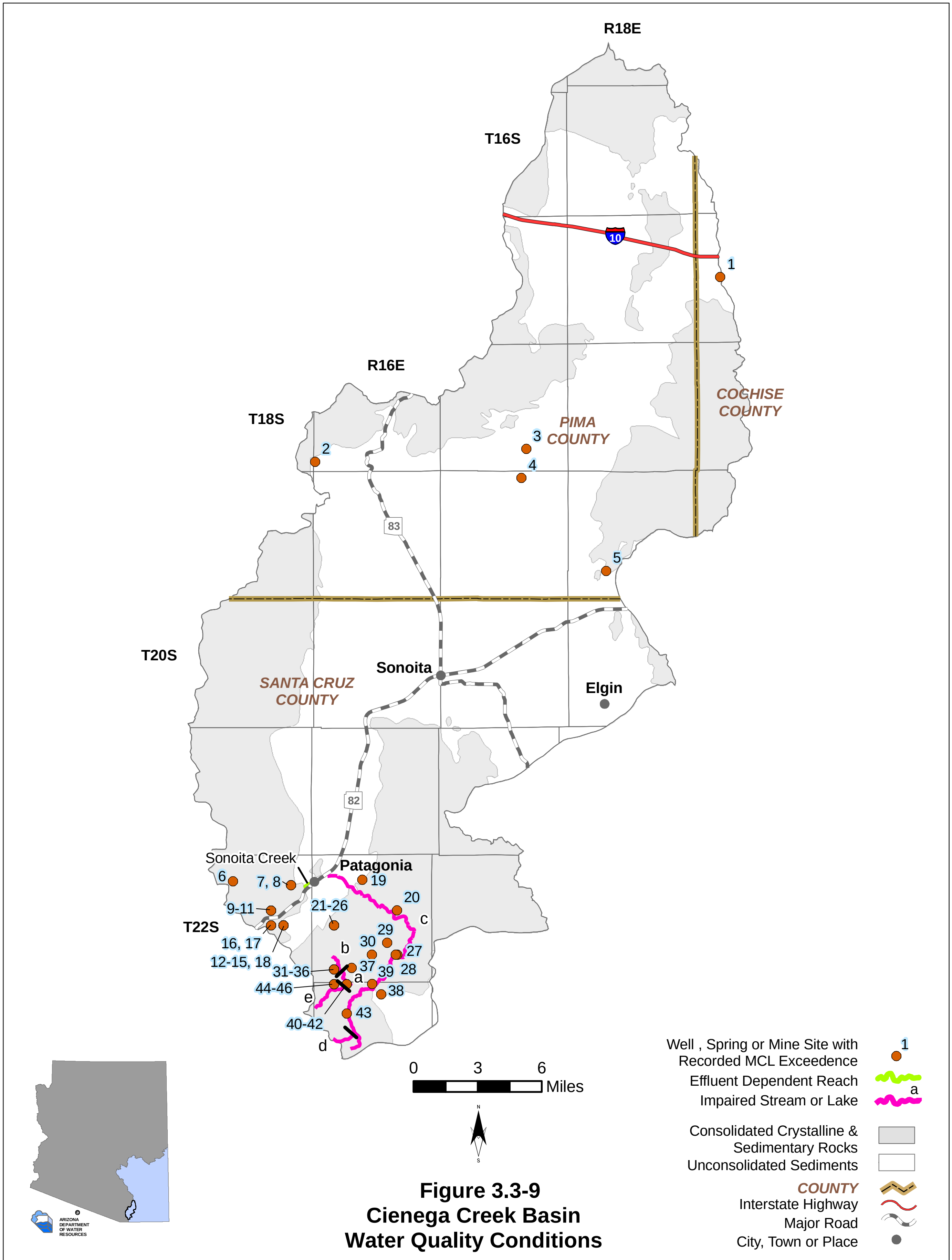


Figure 3.3-9
Cienega Creek Basin
Water Quality Conditions

3.3.8 Cultural Water Demands 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 3.3-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.3-9. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.3-8 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 4,108 in 2000. Projections suggest a higher rate of growth through 2050.
- Overall groundwater pumping is estimated to be comparable to historic pumping with an annual average of about 1,200 acre-feet per year from 2001-2003.
- 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 acre-feet per year and industrial demand less than 300 acre-feet per year.
- Agricultural demand has also remained relatively constant since 1992 with less than 500 acre-feet per year. The only agricultural demand center shown on the map is located along Highway 83 in T21S, R16E.
- In addition to the agricultural demand center shown on the map there are approximately 160 acres of vineyards in this basin. Most vineyards are located in the Elgin area and all are irrigated with groundwater.
- As of 2003 there were 1,831 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 99 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 3.3-9.
- 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 3.3-8 Cultural Water Demands in the Cienega Creek Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) 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>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">897[2]</td><td rowspan="10">79[2]</td><td colspan="3" rowspan="5">1,200</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994) USGS (2005)</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">1,200</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>1,695</td></tr>
<tr><td>1981</td><td>1,792</td><td rowspan="5">186</td><td rowspan="5">3</td><td colspan="3" rowspan="5">1,200</td><td colspan="3" rowspan="5">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">173</td><td rowspan="5">5</td><td colspan="3" rowspan="5">1,200</td><td colspan="3" rowspan="5">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>2,806</td><td rowspan="5">213</td><td rowspan="5">3</td><td rowspan="5">500</td><td rowspan="5"><300</td><td rowspan="5">500</td><td colspan="3" rowspan="5">NR</td><td rowspan="13">USGS (2005) ADWR (2005)</td></tr>
<tr><td>1992</td><td>2,951</td></tr>
<tr><td>1993</td><td>3,096</td></tr>
<tr><td>1994</td><td>3,240</td></tr>
<tr><td>1995</td><td>3,385</td></tr>
<tr><td>1996</td><td>3,529</td><td rowspan="5">229</td><td rowspan="5">5</td><td rowspan="5">550</td><td rowspan="5"><300</td><td rowspan="5">500</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>3,674</td></tr>
<tr><td>1998</td><td>3,819</td></tr>
<tr><td>1999</td><td>3,963</td></tr>
<tr><td>2000</td><td>4,108</td></tr>
<tr><td>2001</td><td>4,160</td><td rowspan="3">63</td><td rowspan="3">4</td><td rowspan="3">600</td><td rowspan="3"><300</td><td rowspan="3">500</td><td colspan="3" rowspan="3">NR</td></tr>
<tr><td>2002</td><td>4,212</td></tr>
<tr><td>2003</td><td>4,265</td></tr>
<tr><td>2010</td><td>4,630</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>4,681</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>4,854</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2040</td><td>5,160</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>5,650</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">ADDITIONAL WELLS:[3]</td><td>70</td><td></td><td colspan="7"></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>1,831</td><td>99</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.3-9 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 Irrigation	Wildlife Area	Discharge to Another Facility	Groundwater Recharge	Current	Projected		
Patagonia WWTF	Town of Patagonia	Patagonia	945	73	Sonoita Creek							Secondary	Adv.Trt.I	NA	2000

Notes:
NA: Data not currently available to ADWR
WWTF: Wastewater Treatment Facility
Adv. Tr. I: Advance Treatment Level I

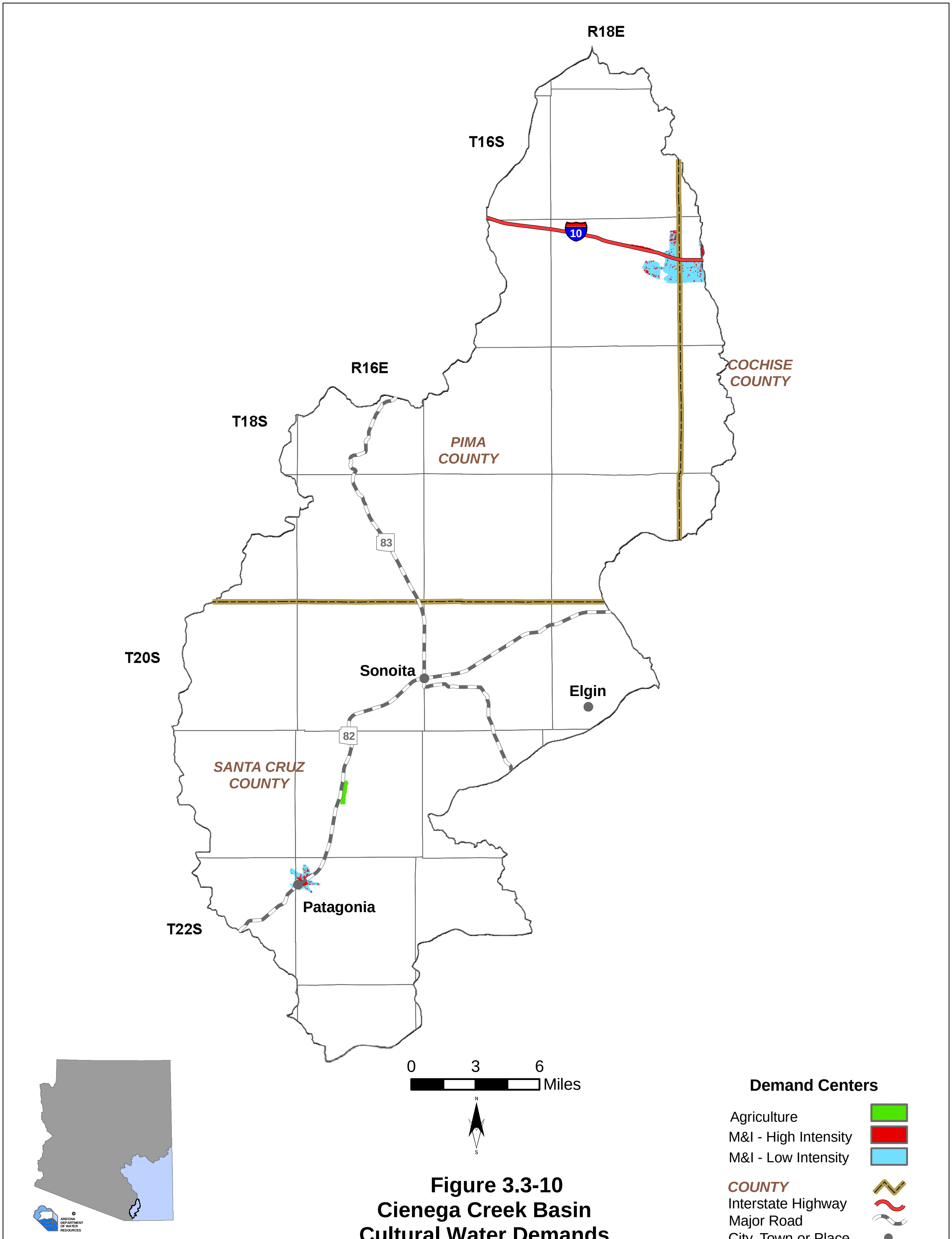


Figure 3.3-10
Cienega Creek Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

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 3.3-10. Figure 3.3-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

- A total of 12 water adequacy determinations have been made through May, 2005.
- Eight determinations of inadequacy have been made, all in the vicinity of Sonoita and Patagonia.
- All eight 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 inadequacy determination was also due to poor water quality.
- 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	172	20	12

Table 3.3-10 Adequacy Determinations in the Cienega Creek 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	Empirita Highlands at the J - 6 Ranch	Cochise	17 South	19 East	19	91	22-400432	Adequate		12/08/00	Anderson Water Company
2	Mesa, The	Santa Cruz	22 South	16 East	7, 18	NA		Inadequate	A1	06/22/89	Dry Lot Subdivision
3	Mescal Lakes # 4, 5	Cochise	17 South	19 East	7, 8	117		Adequate		08/21/73	Verde Utilities
4	Ranch Oasis	Santa Cruz	20 South	17 East	19, 20	13	22-300122	Inadequate	A1	03/22/96	Dry Lot Subdivision
5	Red Mountain Mesas Development	Santa Cruz	22 South	16 East	7, 18	44		Inadequate	A1	04/01/81	Unformed Homeowners Association
6	Red Rock Acres	Santa Cruz	22 South	16 East	5, 8, 9	29		Inadequate	A1	07/07/82	Redrock Acres Homeowners Association
7	Rolling Hills Subdivision Lots 1 - 61	Cochise	17 South	19 East	7	61	22-400866	Adequate		01/24/03	Mescal Lakes Water System
8	Sonoita Estates	Santa Cruz	20 South	17 East	28, 33	NA		Inadequate	A1	12/18/89	Dry Lot Subdivision
9	Sonoita Hills	Santa Cruz	20 South	17 East	20, 29, 32	31		Inadequate	A1	10/10/94	Dry Lot Subdivision
10	Sonoita Meadows	Santa Cruz	20 South	16 East	25	24		Inadequate	A1	04/11/84	Dry Lot Subdivision
11	Starr View Estates	Santa Cruz	20 South	17 East	20	20		Adequate		08/06/79	Dry Lot Subdivision
12	Valley of Thousand Oaks	Santa Cruz	22 South	15 East	24	11		Inadequate	A1, C	10/16/80	Subdivision Wells

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 determination.

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

NA= Data not currently available to ADWR

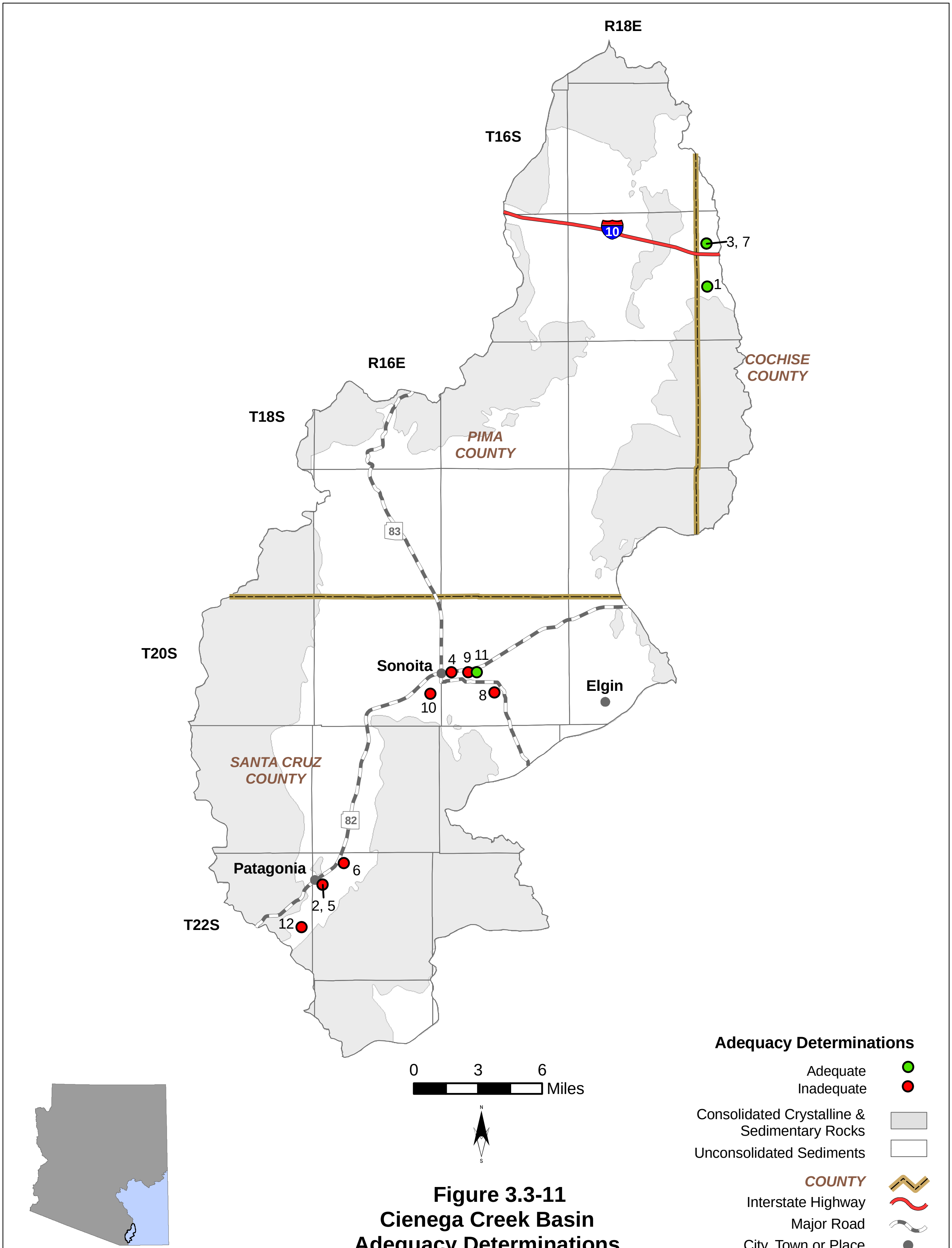


Figure 3.3-11
Cienega Creek Basin
Adequacy Determinations

CIENEGA CREEK BASIN

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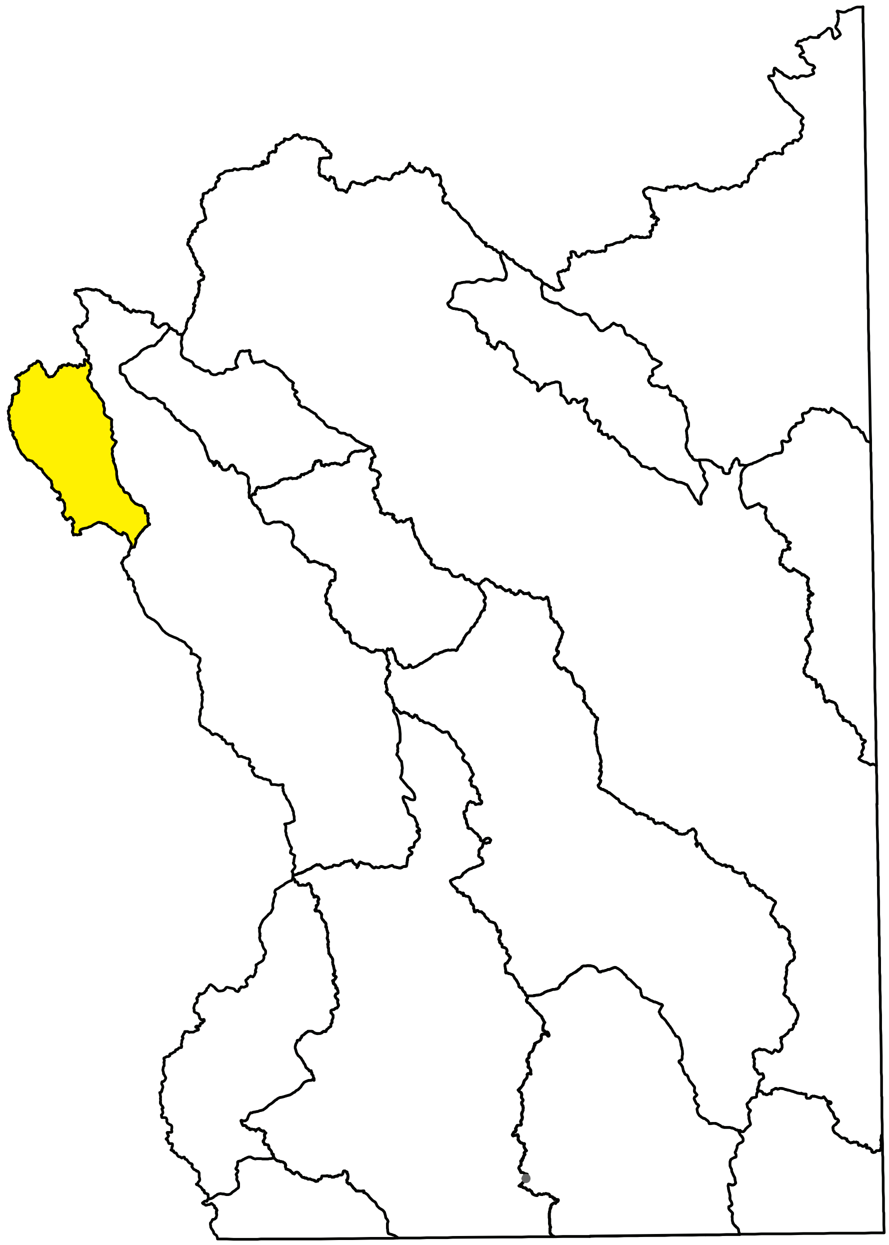
Cienega Creek Basin Index to Section 3.0

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, canyons and desert scrub vegetation.

- Principal geographic features shown on Figure 3.4-1 are:
    - Principal basin locations of Cochran and Beehive Tank. This basin does not contain any documented population centers, therefore two prominent places are used as geographic references.
    - Gila River, which runs 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

- Not well shown on Figure 3.4-1 are the Ninety-Six Hills along the southwest boundary, which include the highest point in the basin at 4,420 feet.

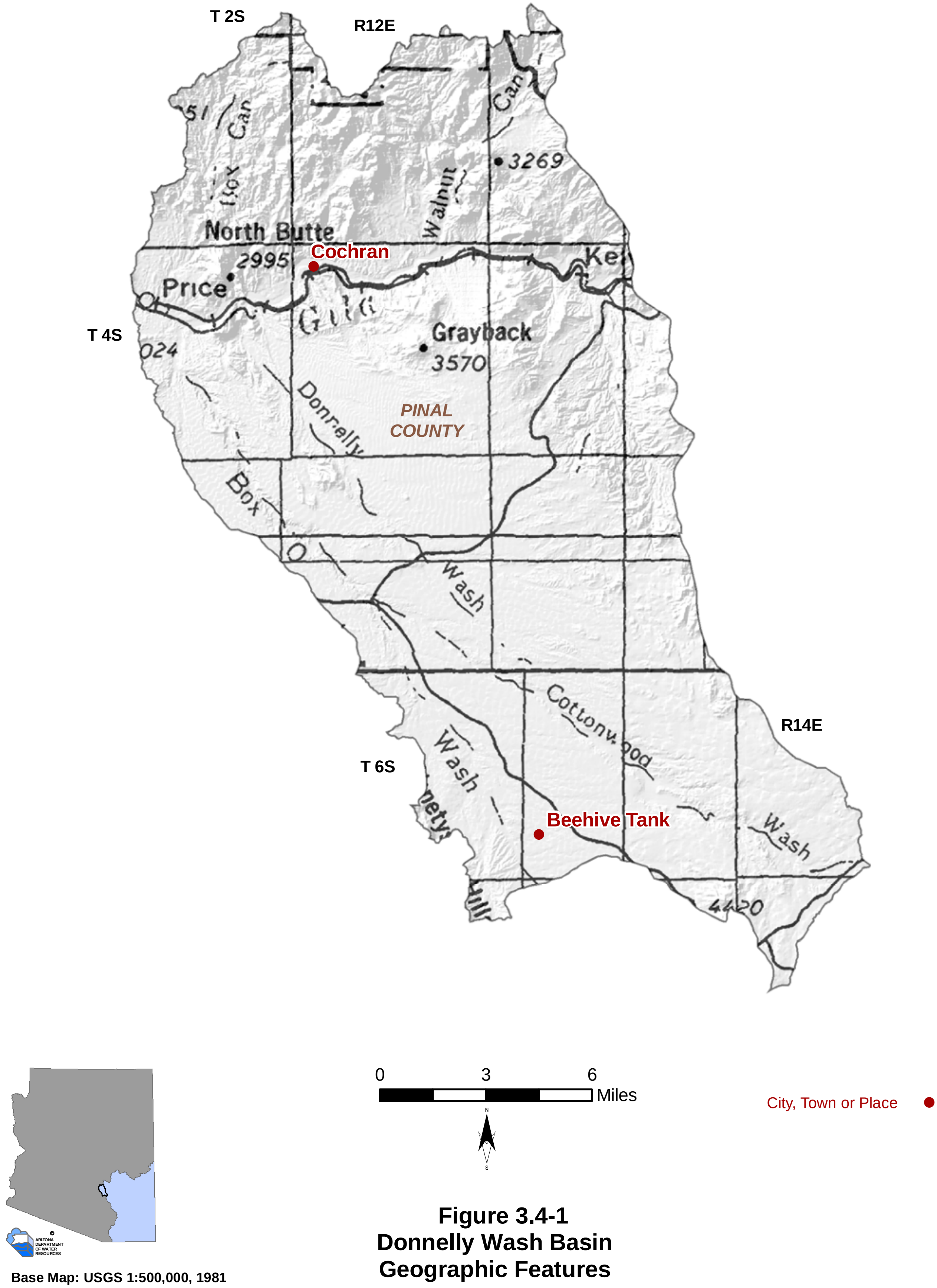


Figure 3.4-1
Donnelly Wash Basin
Geographic Features

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, the band of Bureau of Reclamation land and the scattered Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest 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 Bureau of Land Management.
- 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 and Wilderness

- 1.6% of the land is federally owned and managed as national forest and wilderness.
- The basin includes the Globe Ranger District in the Tonto National Forest.
- Primary land uses are grazing and recreation.

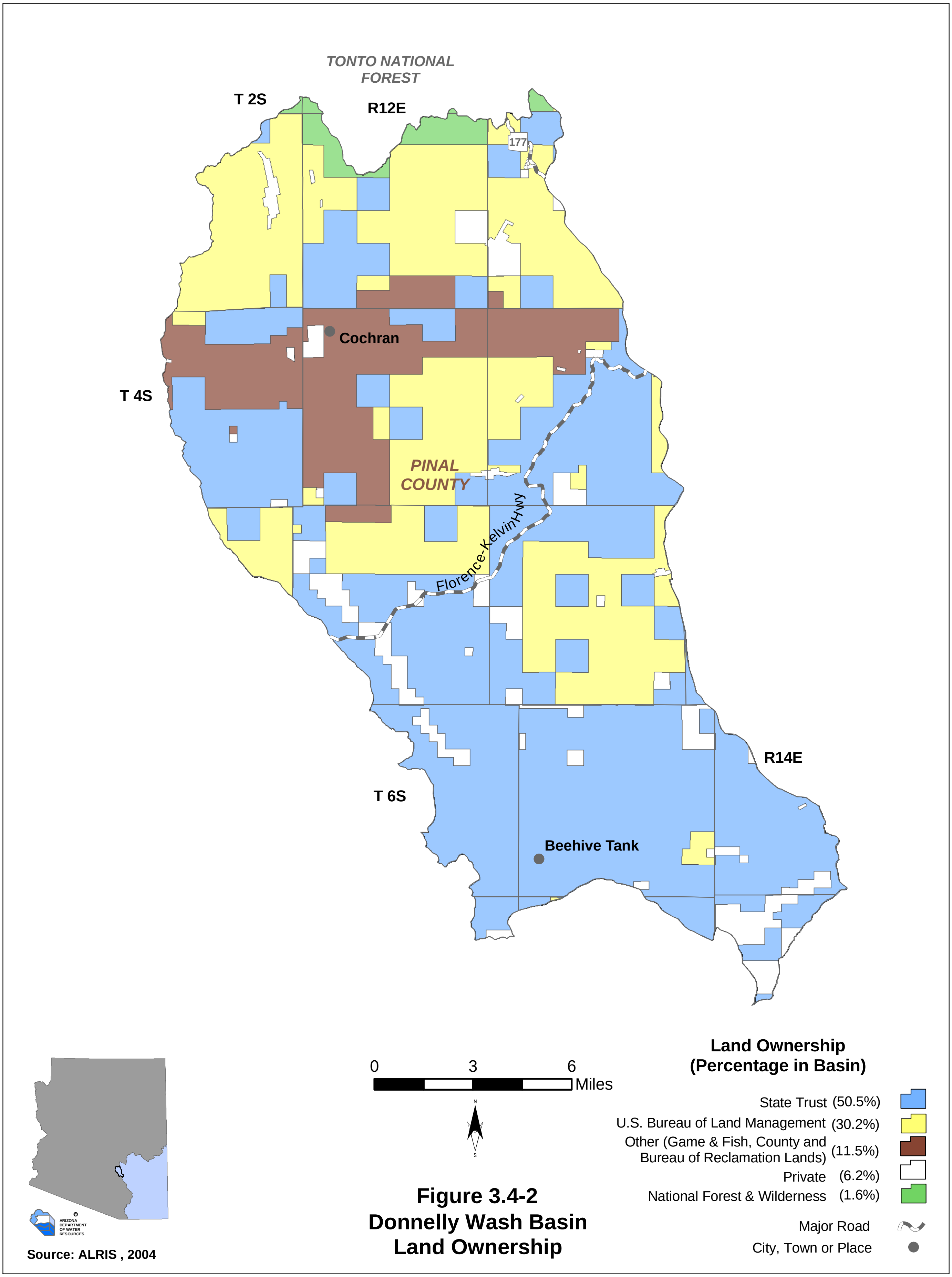


Figure 3.4-2
Donnelly Wash Basin
Land Ownership

3.4.3 Climate of the Donnelly Wash Basin

The Donnelly Wash Basin does not contain any NOAA/NWS Coop Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. The precipitation figures shown in Figure 3.4-3 are from the Spatial Climatic Analysis Service at Oregon State University. A description of this and other climate data sources and methods is found in Volume 1, Section 1.3.3.

Average Annual Precipitation

- Average annual precipitation is as high as 20 inches at the northeastern-most tip of the basin.
- Average annual precipitation is as low as 12 inches in the vicinity of the Gila River.
- Rainfall is lowest in and around the Gila River and increases north and south of the River.
- This basin contains a relatively small range of precipitation, only about 12 inches separates areas of highest precipitation from the lowest.

Table 3.4-1. Climate Data for the Donnelly 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
None									

Source: WRCC, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

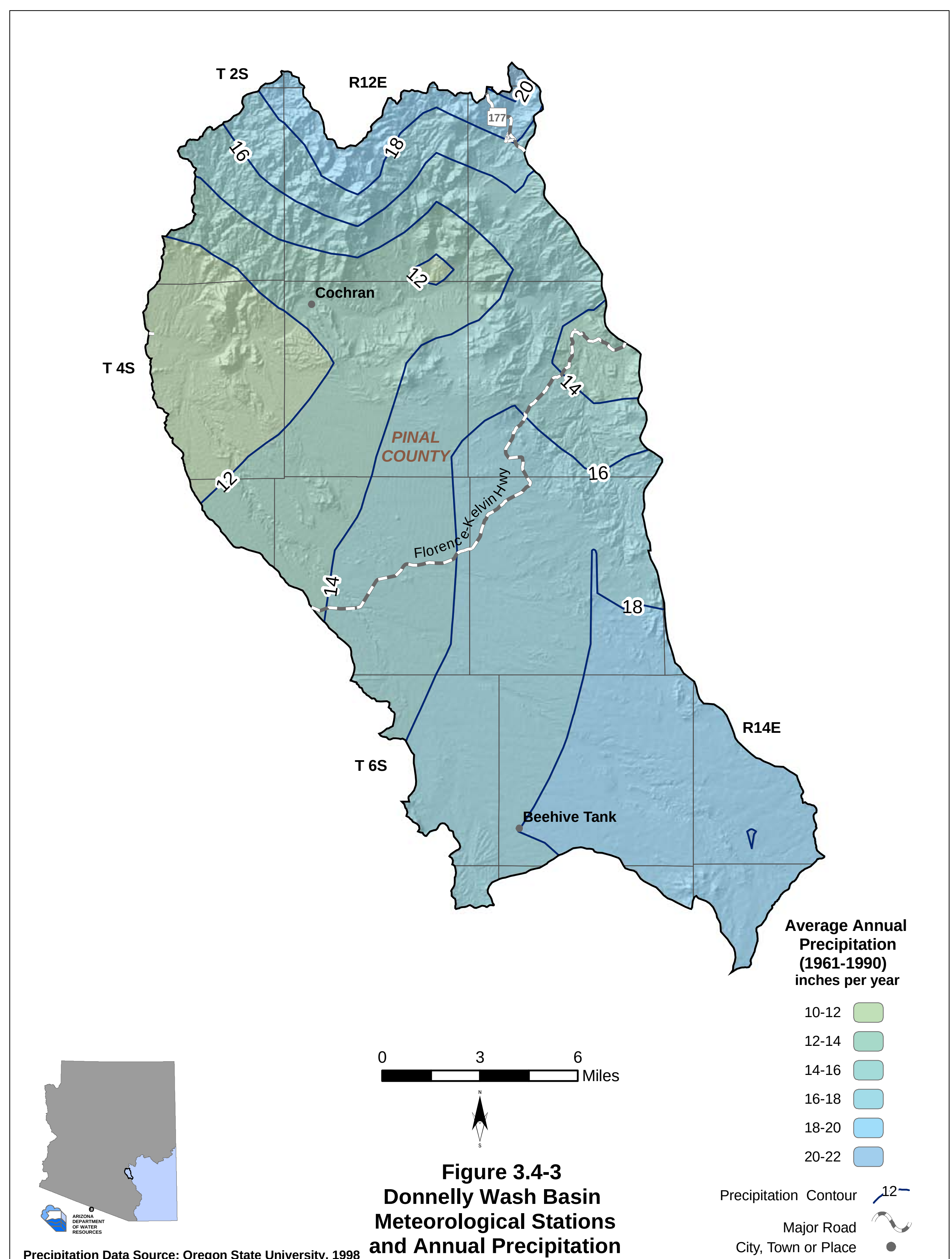
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005



Precipitation Data Source: Oregon State University, 1998

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 3.4-4. The USGS annual runoff contours as well as stream channels are shown on Figure 3.4-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Reservoirs and Stockponds

- Refer to Table 3.4-4.
- Surface water is stored or could be stored in two small reservoirs in the basin.
- Total surface area for the reservoirs is 10 acres.
- There are an estimated 89 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.4-4.
- Average annual runoff is 0.5 inches per year in this basin.

Table 3.4-2 Streamflow Data for the Donnelly Wash Basin

Station Number	USGS Station Name	Contributing Drainage Area (in mi^2)	Mean Basin 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	
None													

Table 3.4-3 Flood ALERT Equipment in the Donnelly Wash Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.4-4 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)[1]

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					

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

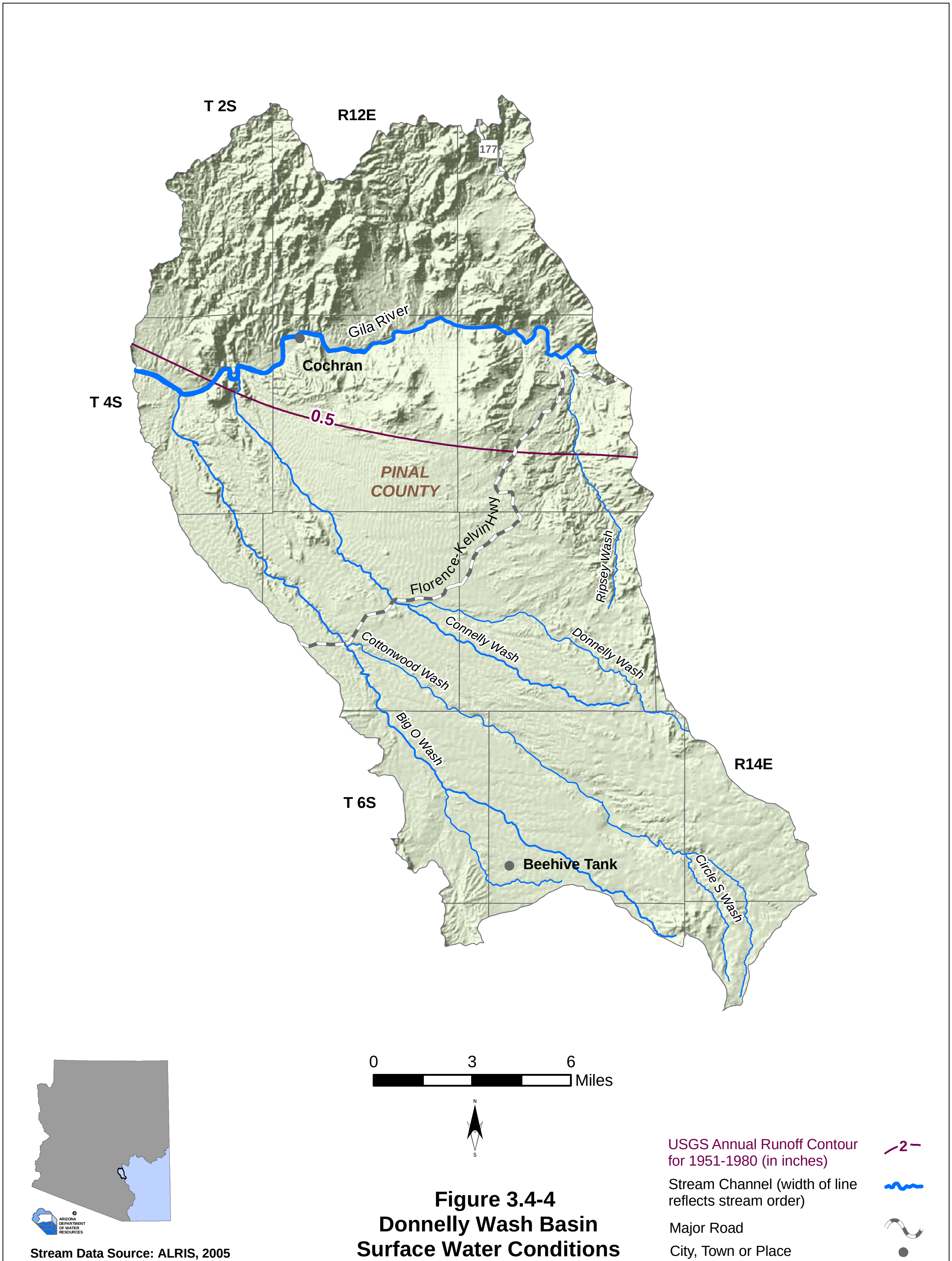


Figure 3.4-4
Donnelly Wash Basin
Surface Water Conditions

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. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are no perennial streams in this basin.
- There are a number of intermittent streams, including the Gila River, in the northern portion of the basin. The Gila River is considered an intermittent stream because its flow is controlled by releases from Coolidge Dam to meet legal obligations.
- No major or minor springs have been identified by the Department at this time.
- The total number of springs identified by the USGS varies from 12 to 14, depending on the database reference.

Table 3.4-5 Springs in the Donnelly Wash Basin

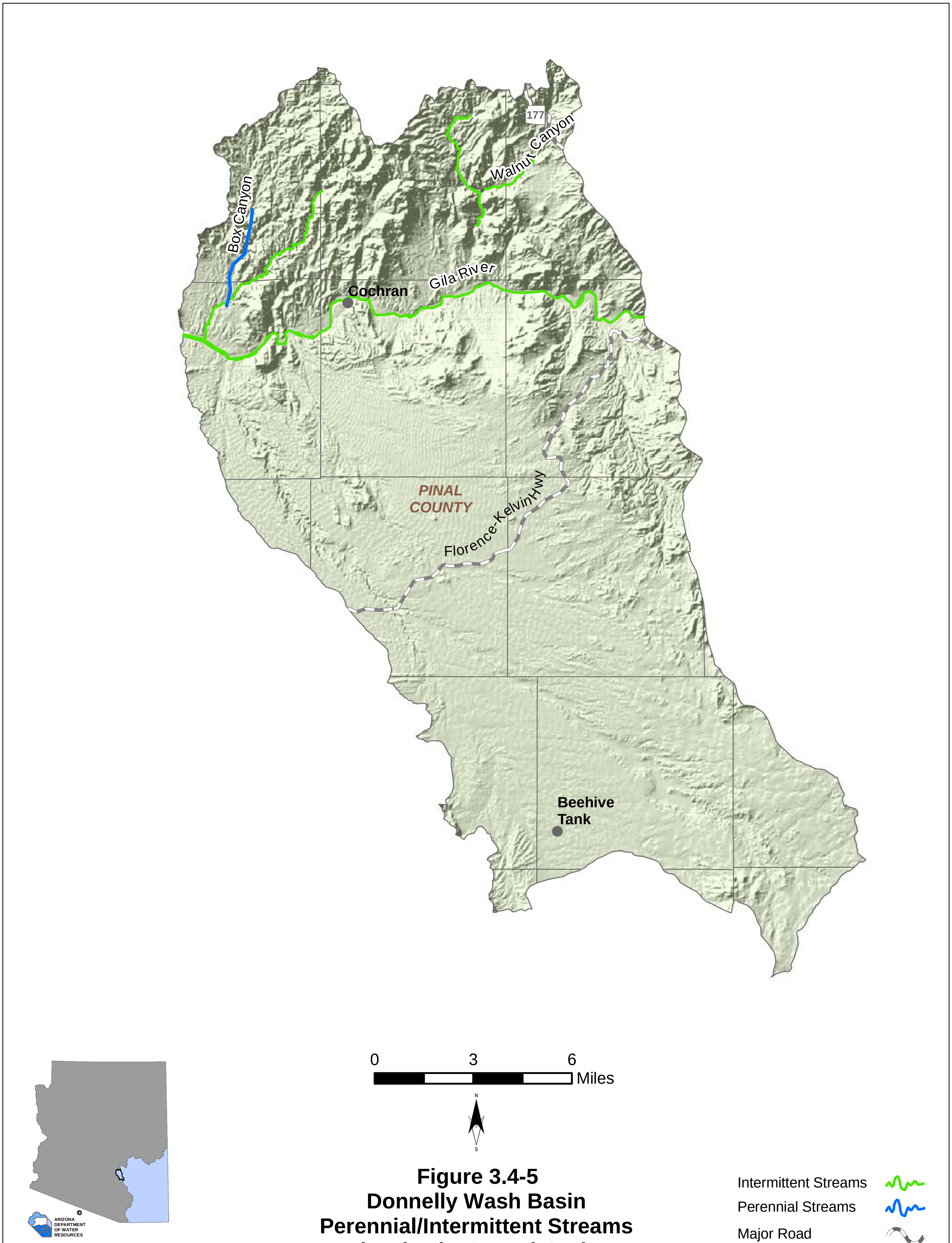
A. Major Springs (10 gpm or greater):

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, 2005 and NHD, 2006): 12 to 14



Stream Data Source: AGFD, 1993 & 1997

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

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 3.4-6. 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.4-6 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 3.4-6 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 3.4-6.
- The only natural recharge estimate for this basin is 3,000 acre-feet per year. This estimate is from 1986.

Water in Storage

- Refer to Table 3.4-6.
- There are three storage estimates for this basin, ranging from 140,000 acre-feet to two million acre-feet to a depth of 1,200 feet. The most recent estimate, from a 1994 ADWR study, indicates the basin has 140,000 acre-feet in storage to a depth of 1,200 feet.
- The predevelopment storage estimate is less than one million acre-feet.

Water Level

- Refer to Figure 3.4-6. Water level is shown for a well measured in 2003-2004.
- There are no index wells in this basin.
- In 1996, the year of the last water level sweep, 25 wells were measured.
- 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 3.4-6 Groundwater Data for the Donnelly Wash Basin

Basin Area, in square miles:	293	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	NA	Measured by ADWR and/or USGS
	Range 3 - 2,600 Median 62.5 (4 wells reprted)	Reported on registration forms for large (> 10-inch) diameter wells
	NA	ADWR (1990 and 1994)
	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 (1994)
	<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:
NA = Not Available
[1]Predevelopment Estimate

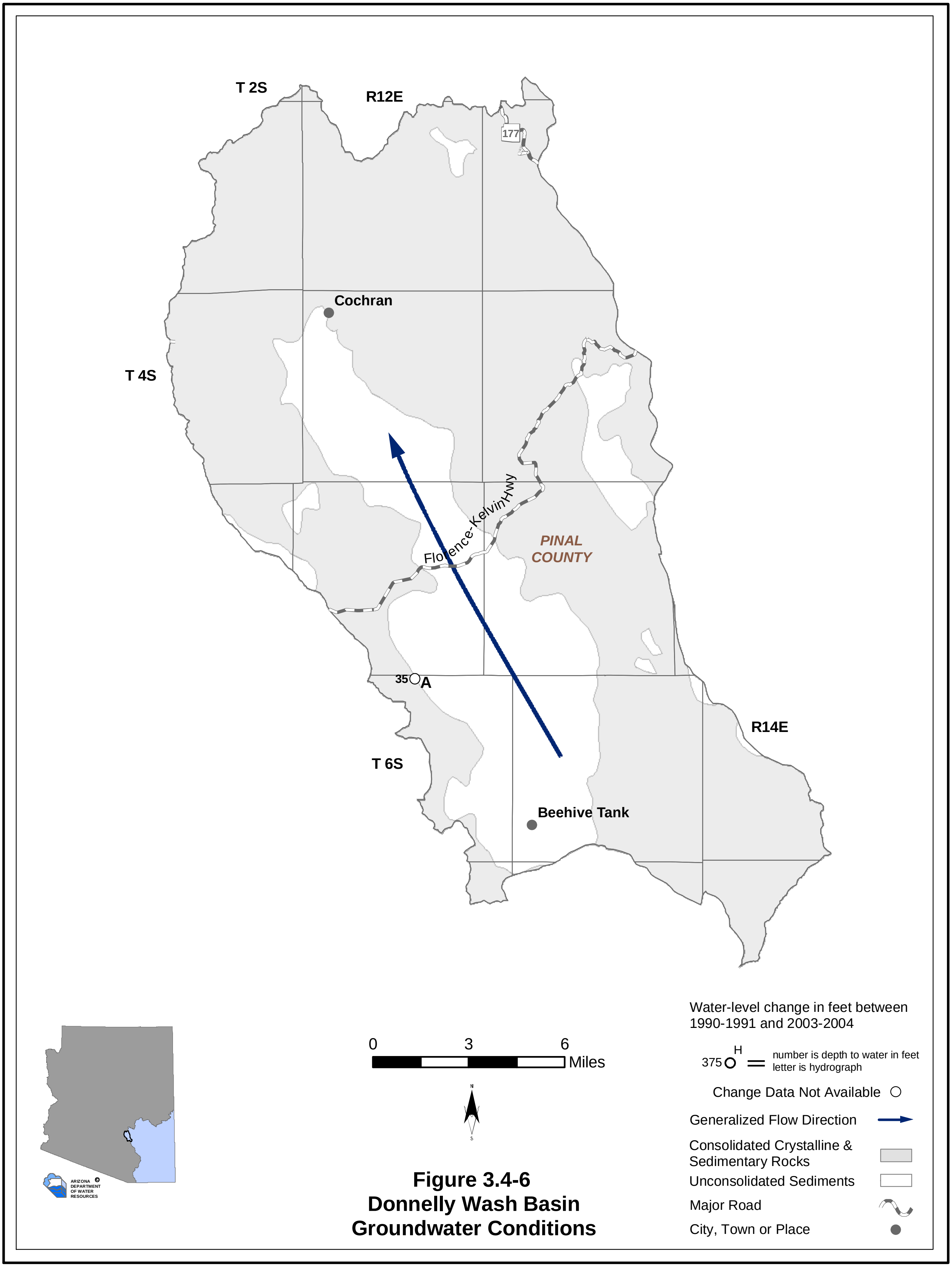
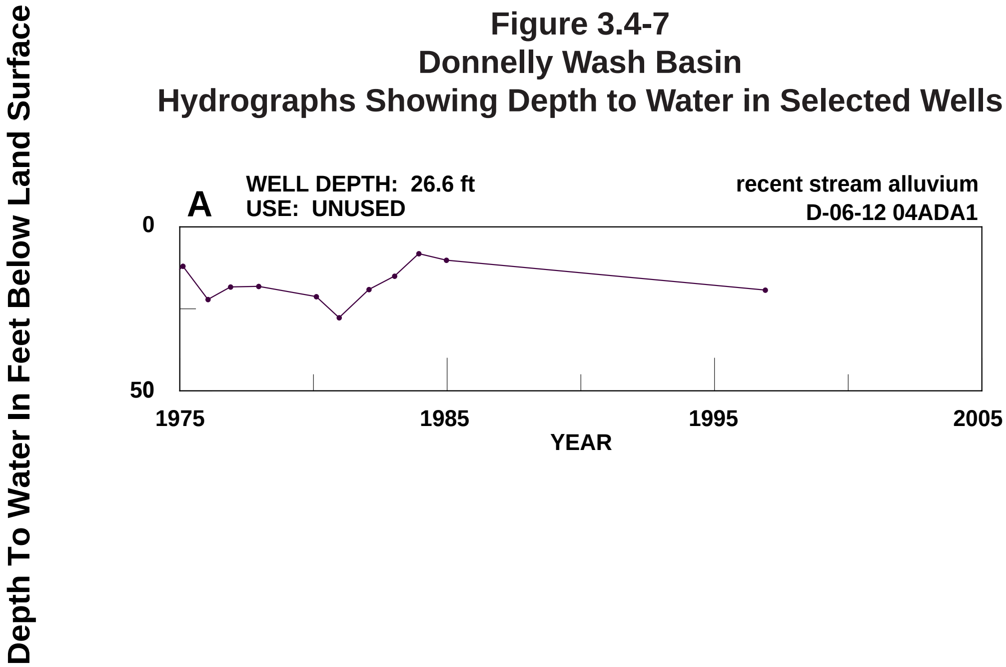


Figure 3.4-6
Donnelly Wash Basin
Groundwater Conditions

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



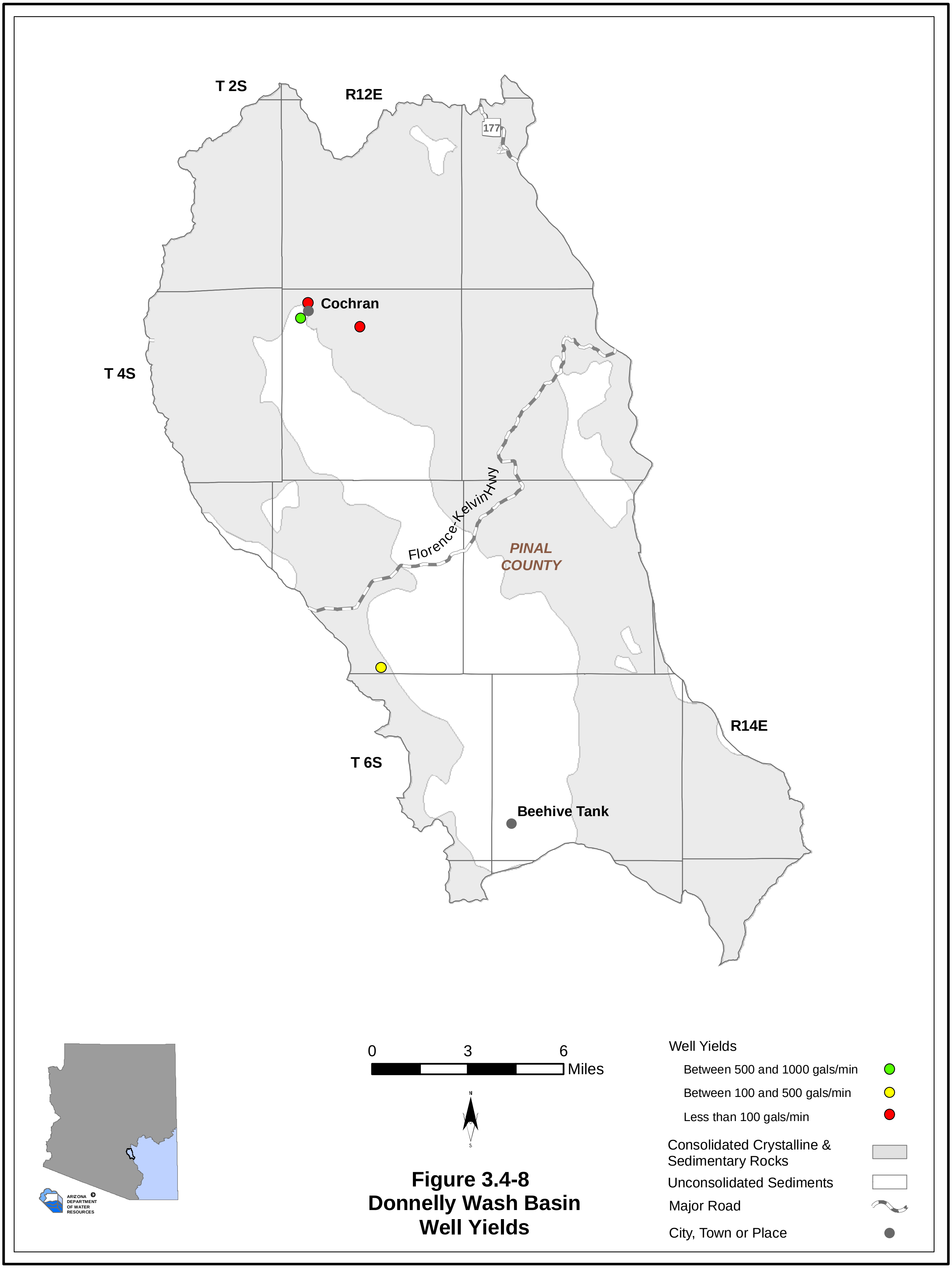


Figure 3.4-8
Donnelly Wash Basin
Well Yields

3.4.7 Water Quality of the Donnelly Wash Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.4-7A. There are no data on impaired lakes and streams in this basin. Figure 3.4-9 shows the location of exceedences keyed to Table 3.4-7A. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.4-7A.
- Drinking water standard exceedences in wells and springs have been reported for five sites in the basin.
- Three of the water standard exceedences were at wells and two were at springs.
- The parameters exceeded in the sites measured in this basin were arsenic, fluoride and nitrates. The sites are distributed throughout the basin.

Table 3.4-7 Water Quality Exceedences in the Donnelly Wash Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

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/Nitrite

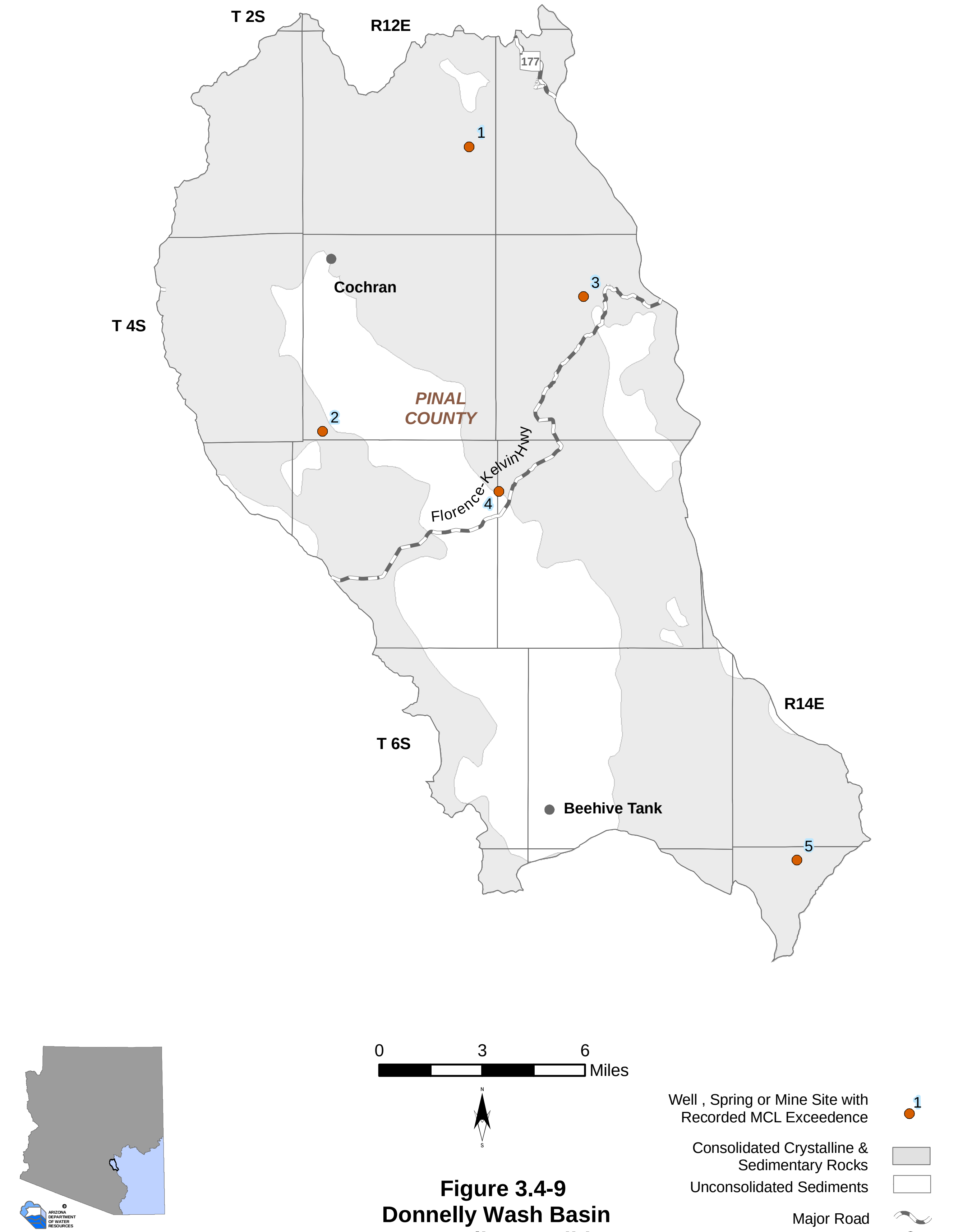


Figure 3.4-9
Donnelly Wash Basin
Water Quality Conditions

3.4.8 Cultural Water Demands 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 3.4-8. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.4-8.
- Population in this basin is small, with 165 residents in 2000. Projections suggest an increase in population through 2050.
- Groundwater pumping remained constant from 1971 to 2003 with less than 300 acre-feet pumped per year.
- 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 and is minimal, less than 300 acre-feet per year.
- As of 2003 there were 112 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and seven wells with a pumping capacity of more than 35 gallons per minute.

Table 3.4-8 Cultural Water Demands in the Donnelly Wash Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) 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>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
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<tr><td>1972</td><td></td></tr>
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<tr><td>1994</td><td>132</td></tr>
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<tr><td>1996</td><td>143</td><td rowspan="5">12</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="3">5</td><td rowspan="3">0</td><td rowspan="3"><300</td><td rowspan="3">NR</td><td rowspan="3">NR</td><td colspan="3" rowspan="3">NR</td></tr>
<tr><td>2002</td><td>173</td></tr>
<tr><td>2003</td><td>177</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>2040</td><td>325</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>365</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">ADDITIONAL WELLS:[3]</td><td>1</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>112</td><td>7</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.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.5-9 Effluent Generation in the Donnelly Wash 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	Discharge to Another Facility	Groundwater Recharge			
No Wastewater Treatment Facilities Identified by ADWR in this Basin														

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 3.4-10. 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1

- One water adequacy determination has been made in this basin through May, 2005.
- This determination was of inadequacy near the center of the basin south of the Florence-Kelvin Highway
- The reason for determination of inadequacy for this 59 lot subdivision is unknown at this time because the Department was unable to locate records.

Table 3.4-10 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.

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 determination.

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

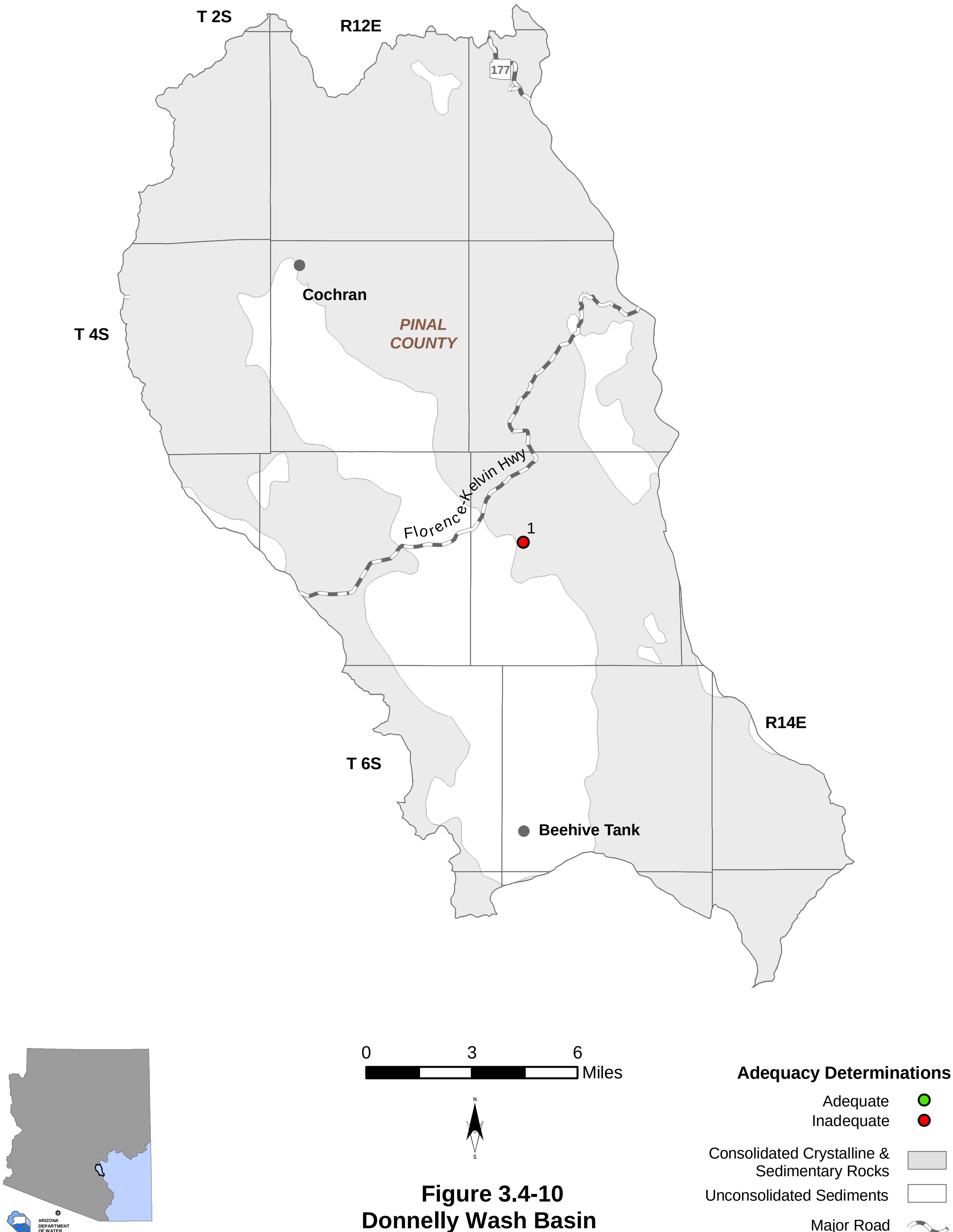

Figure 3.4-10
Donnelly Wash Basin
Adequacy Determinations

DONNELLY WASH BASIN
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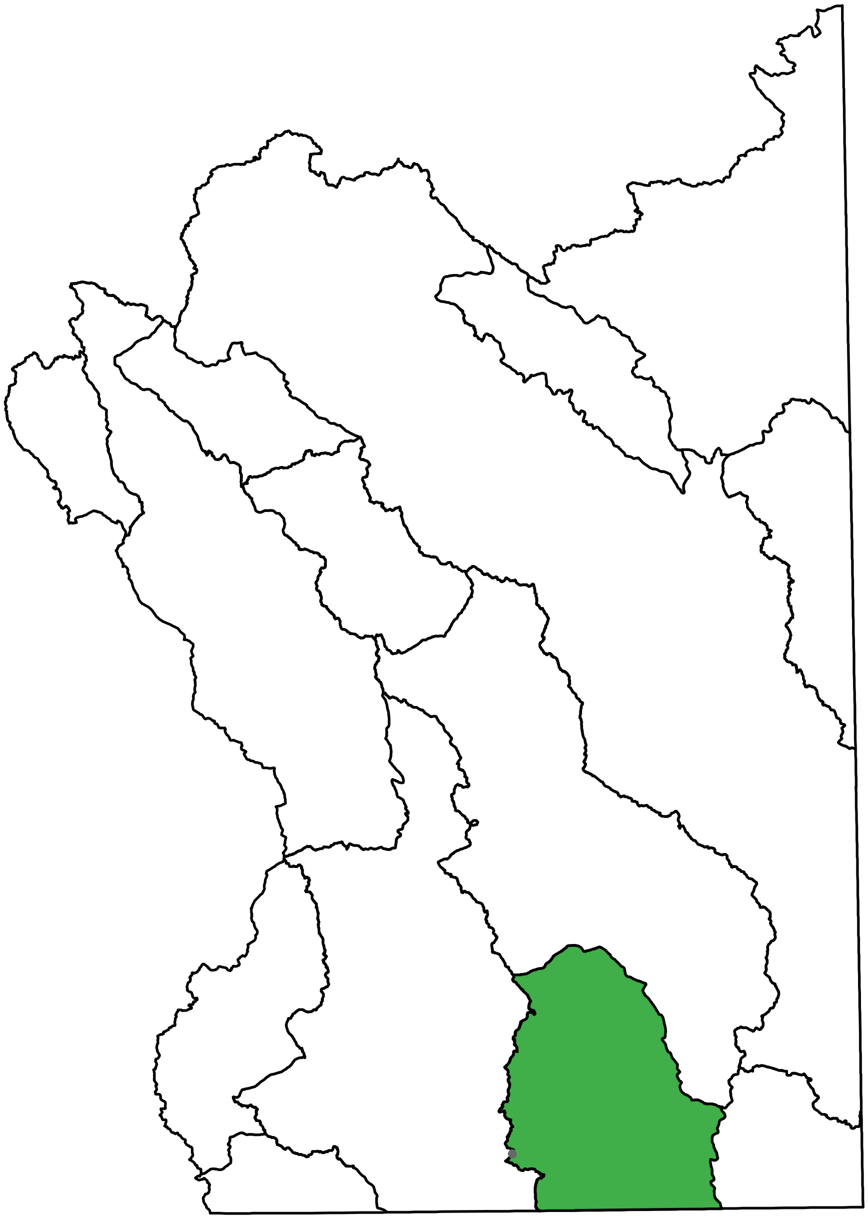
Donnelly Wash Basin to Section 3.0

Section 3.5
Douglas Basin

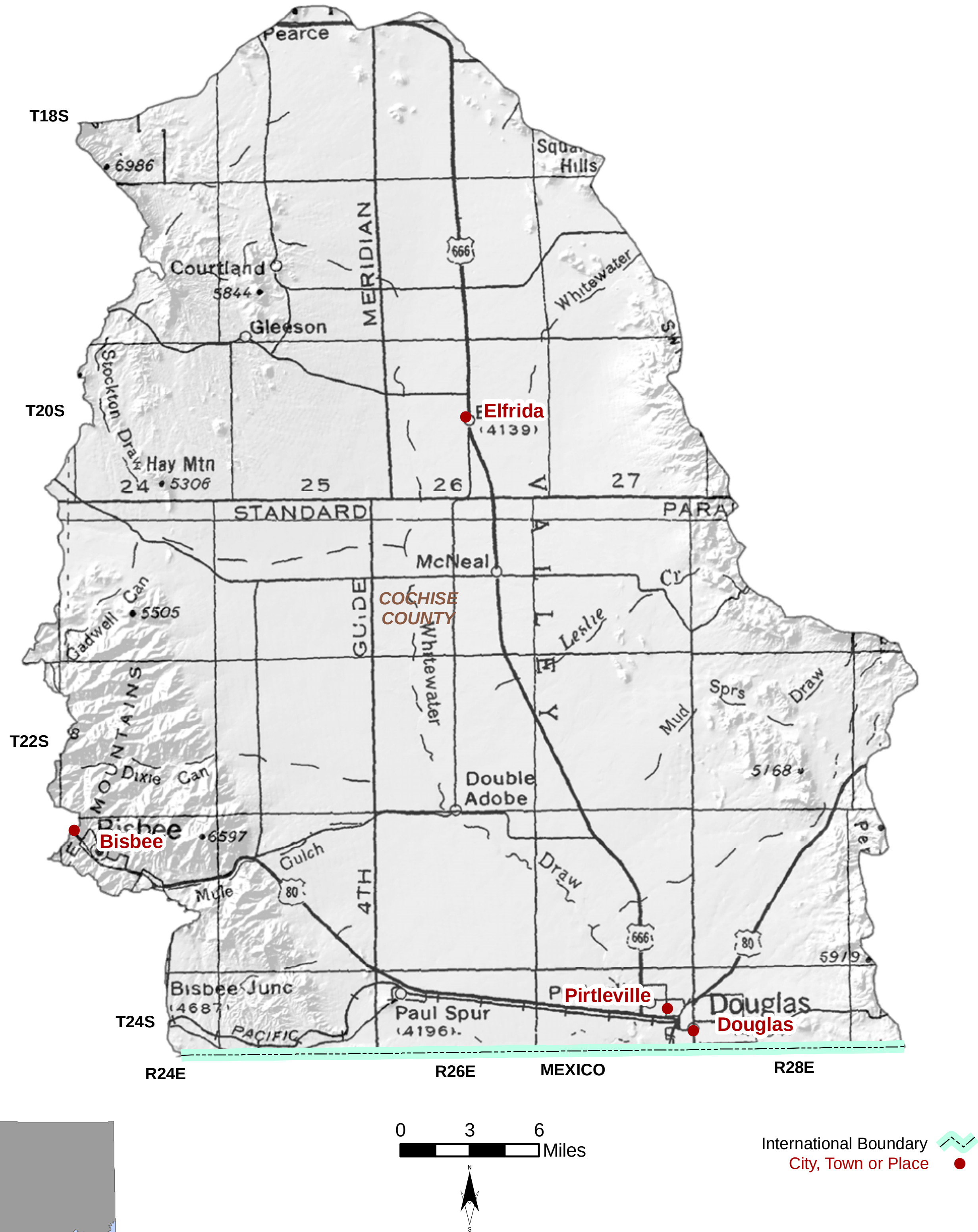


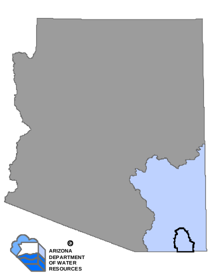
3.5.1 Geography of the Douglas Basin

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, grasslands and desert scrub vegetation.

- Principal geographic features shown on Figure 3.5-1 are:
  - Principal basin communities of Douglas, Bisbee, Pirtleville and Elfrida
  - Whitewater Draw running north-south down the center of the basin to Douglas

- Not well shown on Figure 3.5-1 are:
  - Sulphur Springs Valley running north-south down the center of the basin
  - Mule Mountains along the southwestern basin boundary near Bisbee
  - Dragoon Mountains west of Elfrida, which include the highest point in the basin at 6,966 feet
  - Perilla Mountains east of Elfrida and Douglas





Base Map: USGS 1:500,000, 1981

Figure 3.5-1
Douglas Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

Private
- 62.6% of the land is held privately.
- The largest concentration of private lands 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 Bureau of Land Management.
- 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 and Wilderness
- 0.7% of land is federally owned and managed as national forest and wilderness.
- 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.

U.S. Fish and Wildlife Service
- 0.4% of land is federally owned and managed by the U.S. Fish and Wildlife Service
- All Fish and Wildlife Service 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.

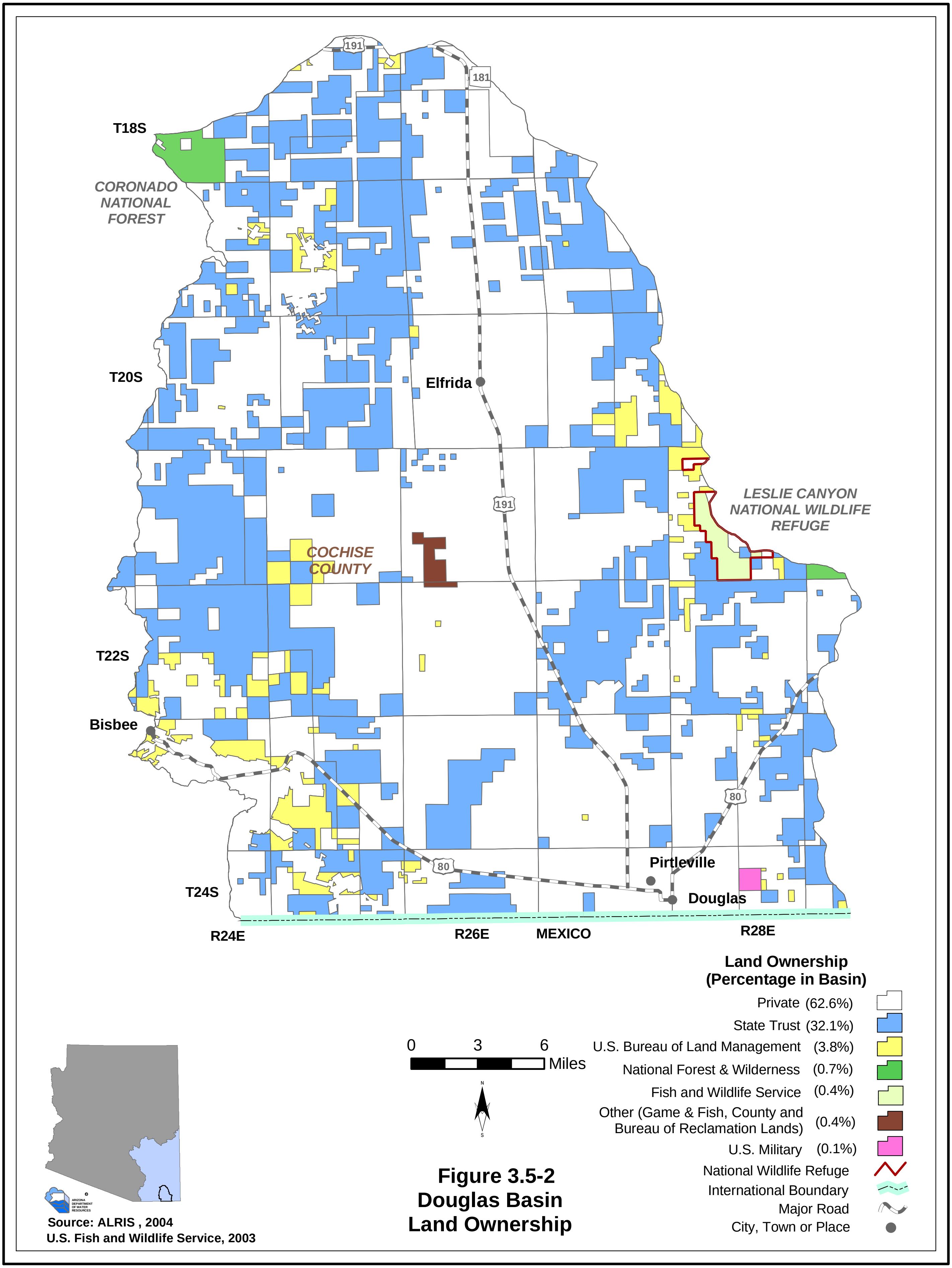


Figure 3.5-2
Douglas Basin
Land Ownership

Source: ALRIS , 2004
U.S. Fish and Wildlife Service, 2003

3.5.3 Climate of the Douglas Basin

Climate data from NOAA/ NWS Coop Network stations are complied in Table 3.5-1 and their locations are shown on Figure 3.5-3. The Douglas Basin does not contain Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.5-1.
- There are four NOAA/NWS Coop network climate stations in the basin.
- Of the four stations, data from different periods of record may be used as shown. The variety of dates may be due to discontinued measurements, date of installation or other availability issues.
- All four stations are concentrated in the southern portion of the basin.
- Station elevations range from 4,040 at Douglas to 5,350 feet at Bisbee.
- Maximum average temperatures occur in July and range from 76.5°F at Bisbee to 80.4°F at Douglas Smelter.
- Minimum temperatures for all four stations are about 46°F.
- Average annual precipitation is varied with the highest, 22.75 inches, at Bisbee and the lowest, 13.76 inches, at Douglas FAA AP.
- All stations report highest average precipitation in the summer (July - September) and lowest in the spring (April – June).
- 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.
- Precipitation increases as elevation increases in this basin. The range of 16 inches between areas of highest and lowest precipitation recorded is common for the planning area.

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, 2003.

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			

Source: WRCC, 2003.

C. AZMET:

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

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

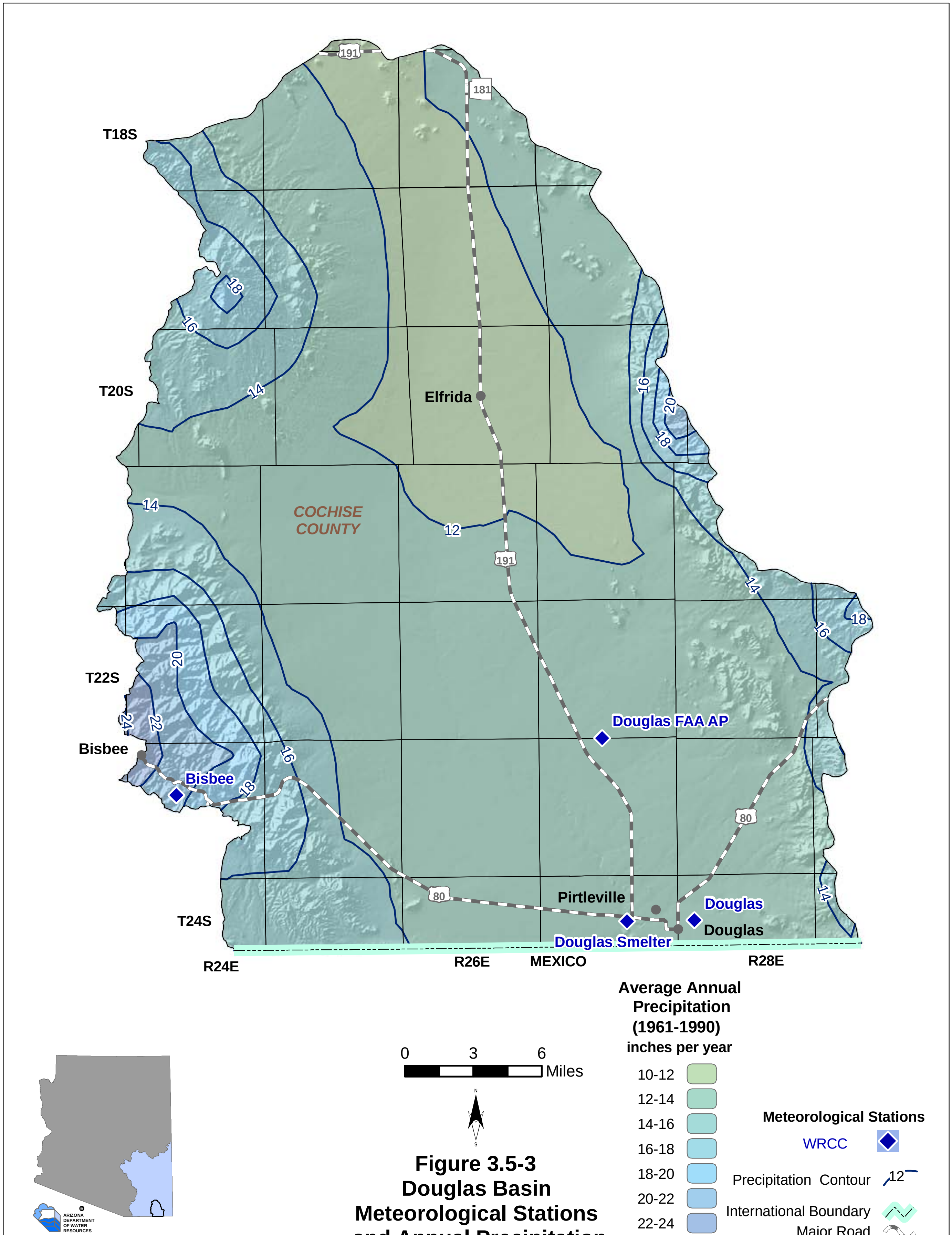


Figure 3.5-3
Douglas Basin
Meteorological Stations
and Annual Precipitation

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 3.5-4. The location of streamflow gages, using the USGS number, is shown on Figure 3.5-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.5-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.5-2.
- Data from one station located at Whitewater Draw are shown on the table and on Figure 3.5-4.
- The average seasonal flow as a percentage of annual flow is highest in the Summer (July-September) and lowest in the Winter (January-March) and Spring (April-June).
- Summer flow constitutes 89% of the annual flow.
- Maximum annual flow was 22,304 acre-feet in 1980 and minimum annual flow was 232 acre-feet in 1955. There are 46 years of annual flow record from this station.

Reservoirs and Stockponds

- Refer to Table 3.5-4.
- Surface water is stored or could be stored in three small reservoirs in the basin.
- Total maximum surface area for these reservoirs is 28 acres.
- There are an estimated 254 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.5-4.
- Average annual runoff varies from 0.2 inches per year east and north of Whitewater Draw to one inch per year west of Whitewater Draw.

Table 3.6-2 Streamflow Data for the Douglas Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq.miles)	Mean Basin 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	4,740	1/1912-current	2	2	89	7	232 (1980)	5,960	6,533	22,304 (1955)	46

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

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

Table 3.5-3 Flood ALERT Equipment in the Douglas Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.5-4 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)[1]

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					

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

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

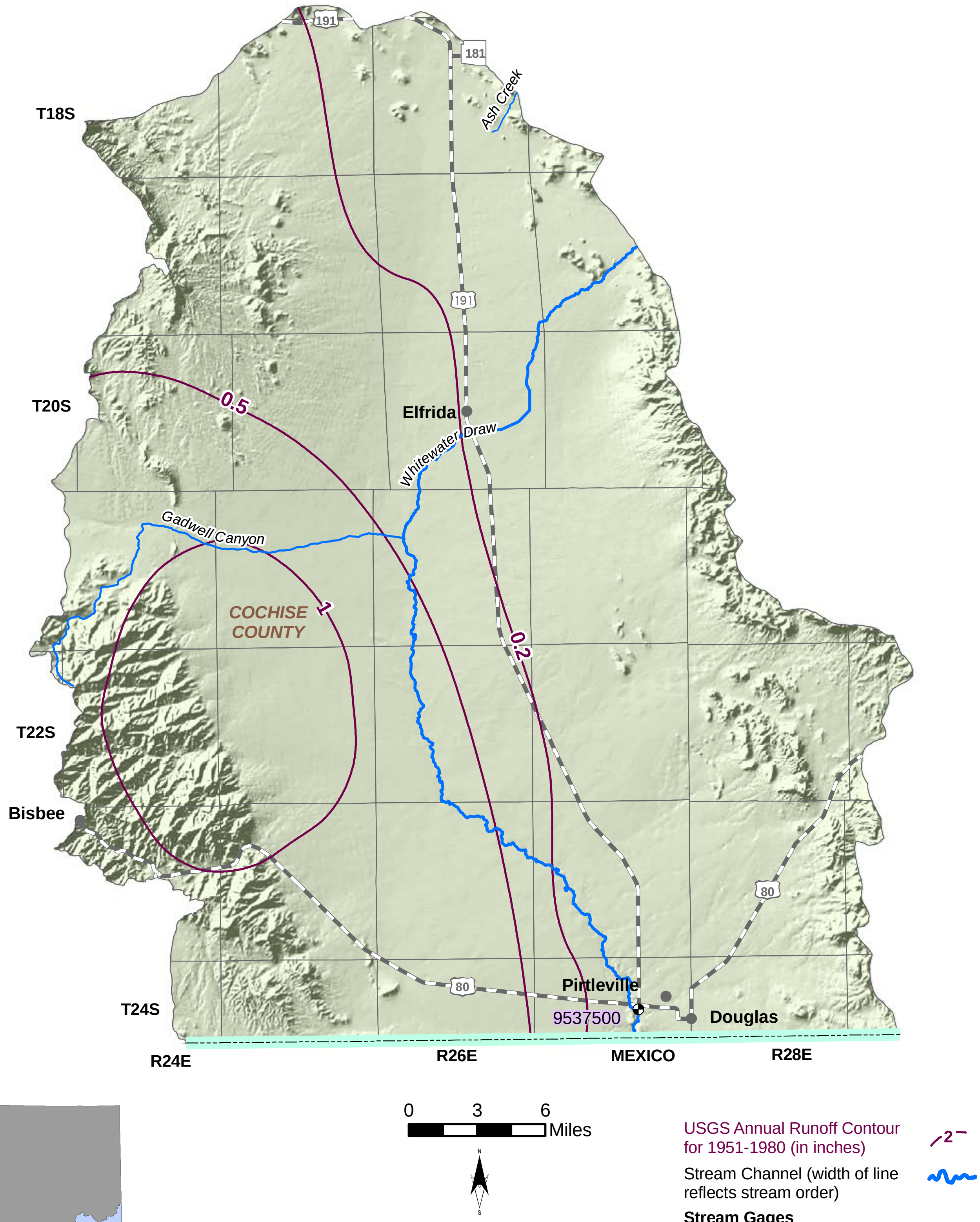
D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

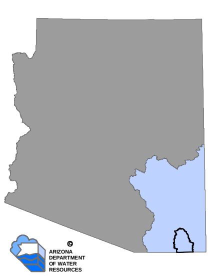
Total number: 3
Total surface area: 28 acres

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

Total number: 254 (from water right filings)

Notes:
[1]Capacity data not available to ADWR





Stream Data Source: ALRIS, 2005

Figure 3.5-4
Douglas Basin
Surface Water Conditions

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 3.5-5. There are no major springs in this basin. The locations of perennial and intermittent streams are shown on Figure 3.5-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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 6 to 10, depending on the database reference. This is the smallest number of springs in a basin in the planning area.

Table 3.5-5 Springs in the Douglas Basin

A. Major Springs (10 gpm or greater):

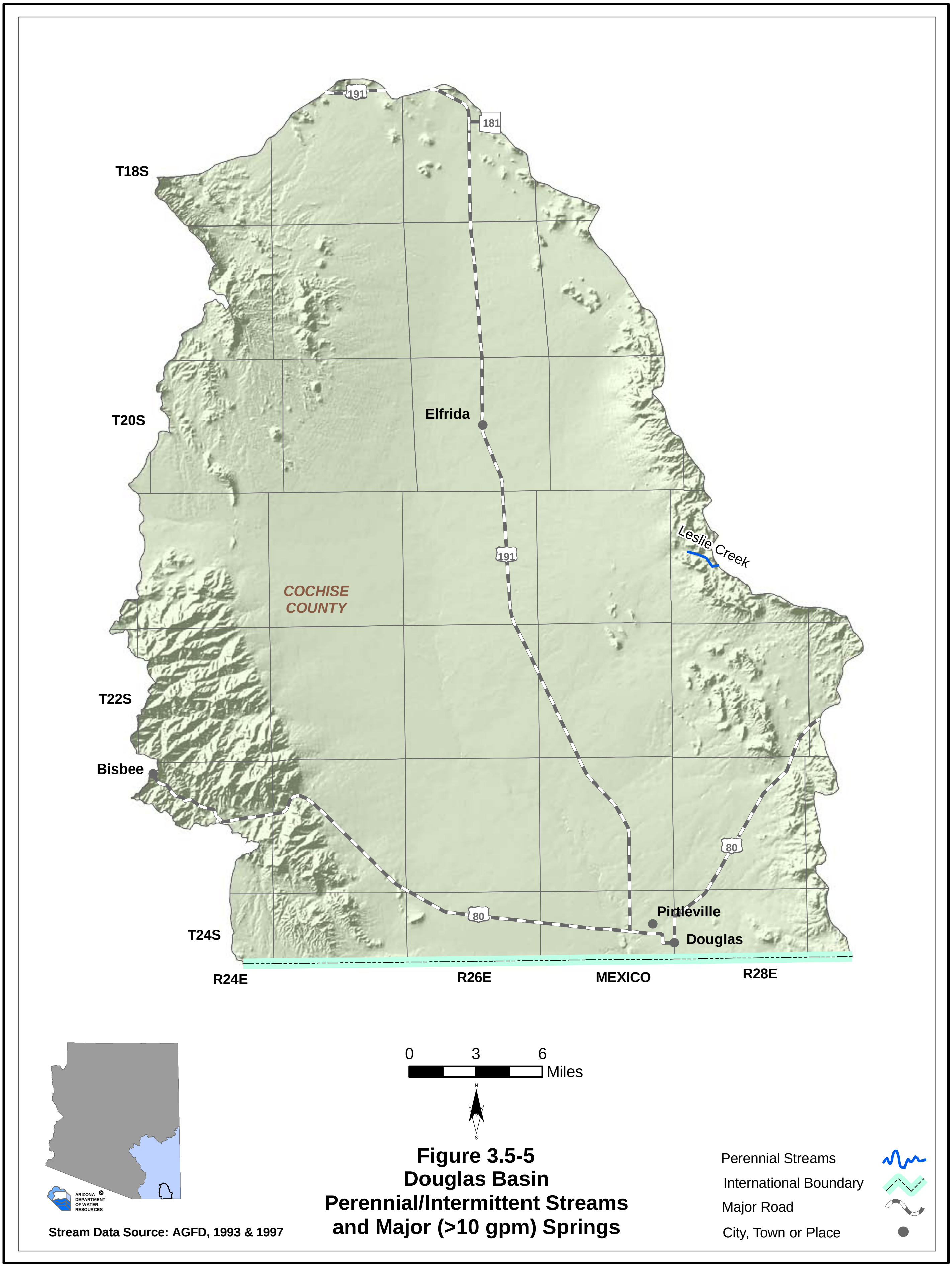
Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

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	On or before 1982

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

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



Stream Data Source: AGFD, 1993 & 1997

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 3.5-6. 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.5-6 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 and east to west south of Elfrida

Well Yields

- Refer to Table 3.5-6 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 3.5-6.
- The principal source of recharge for this basin is mountain-front precipitation.
- There are three natural recharge estimates for this basin ranging from 15,500 acre-feet per year to 22,000 acre-feet per year. The most recent estimate is 15,500 acre-feet per year and is from 1995.

Water in Storage

- Refer to Table 3.5-6.
- There are three storage estimates for this basin, ranging from 26 million acre-feet to 32 million acre-feet. The most recent estimate, from a 1994 ADWR study, indicates the basin has 32 million acre-feet in storage to a depth of 1,200 feet.
- The predevelopment storage estimate is 30 million acre-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.
- In 2004, the year of the last water level sweep, 387 wells were measured.
- The deepest recorded water level in 2004-2004 in the basin is 337 feet north of Elfrida and the shallowest is 65 feet northwest of Pirtleville.
- The area of most significant decline is north of Elfrida. A few wells southwest of Elfrida have water level rises of more than a foot.
- Hydrographs corresponding to selected wells shown on Figure 3.5-6 but covering a longer time period are shown in Figure 3.5-7.

Table 3.5-6 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 and/or USGS
	Range 3 - 2,600 Median 600 (656 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 50 - 2,000	ADWR (1990 and 1994)
	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 (1994)
	20,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	32,000,000 (to 1,200 ft)	ADWR (1994)
	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 (387 wells measured)	

Notes:
[1]Predevelopment Estimate

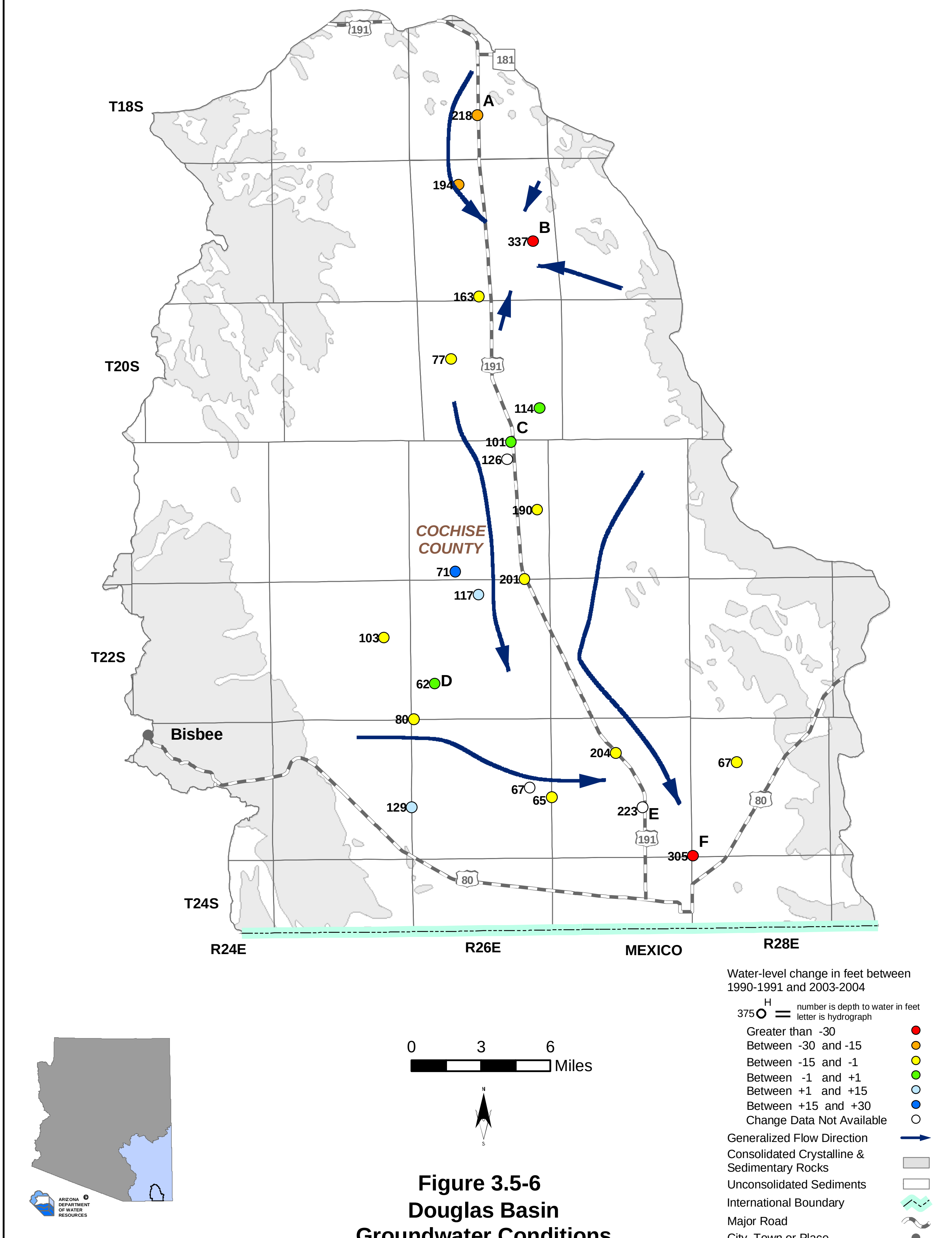


Figure 3.5-6
Douglas Basin
Groundwater Conditions

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

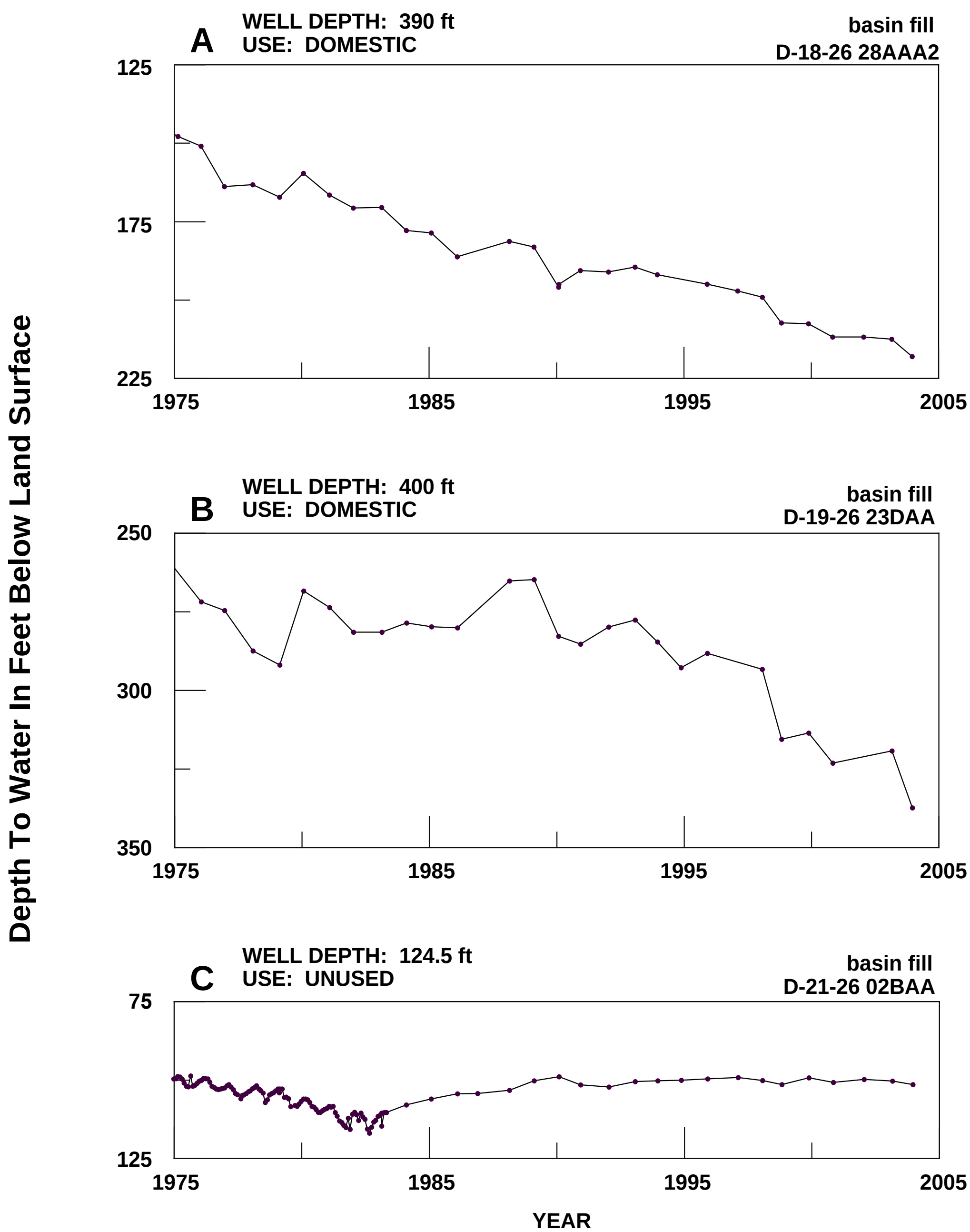
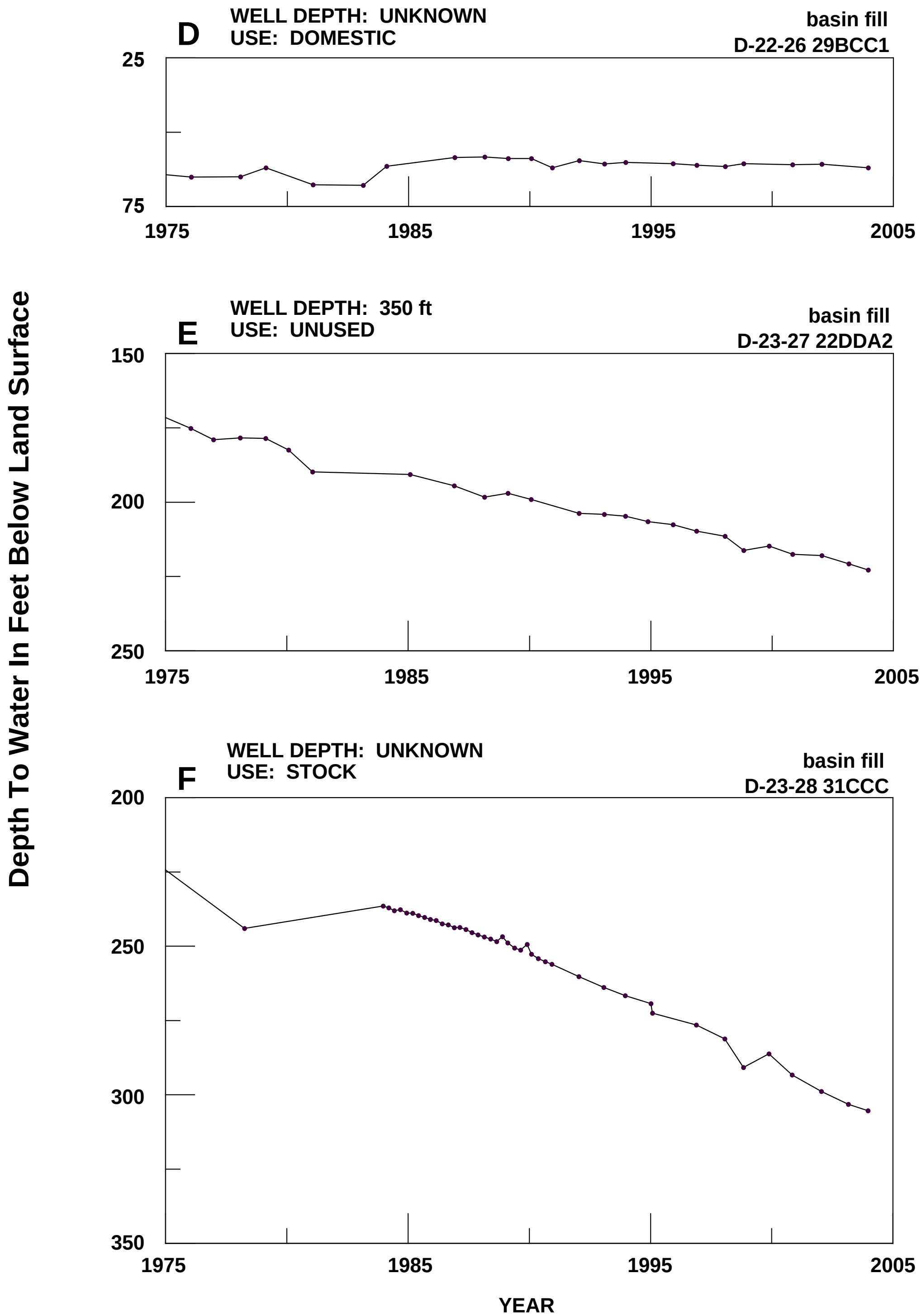


Figure 3.5-7 (Con't.)
Douglas Basin
Hydrographs Showing Depth to Water in Selected Wells



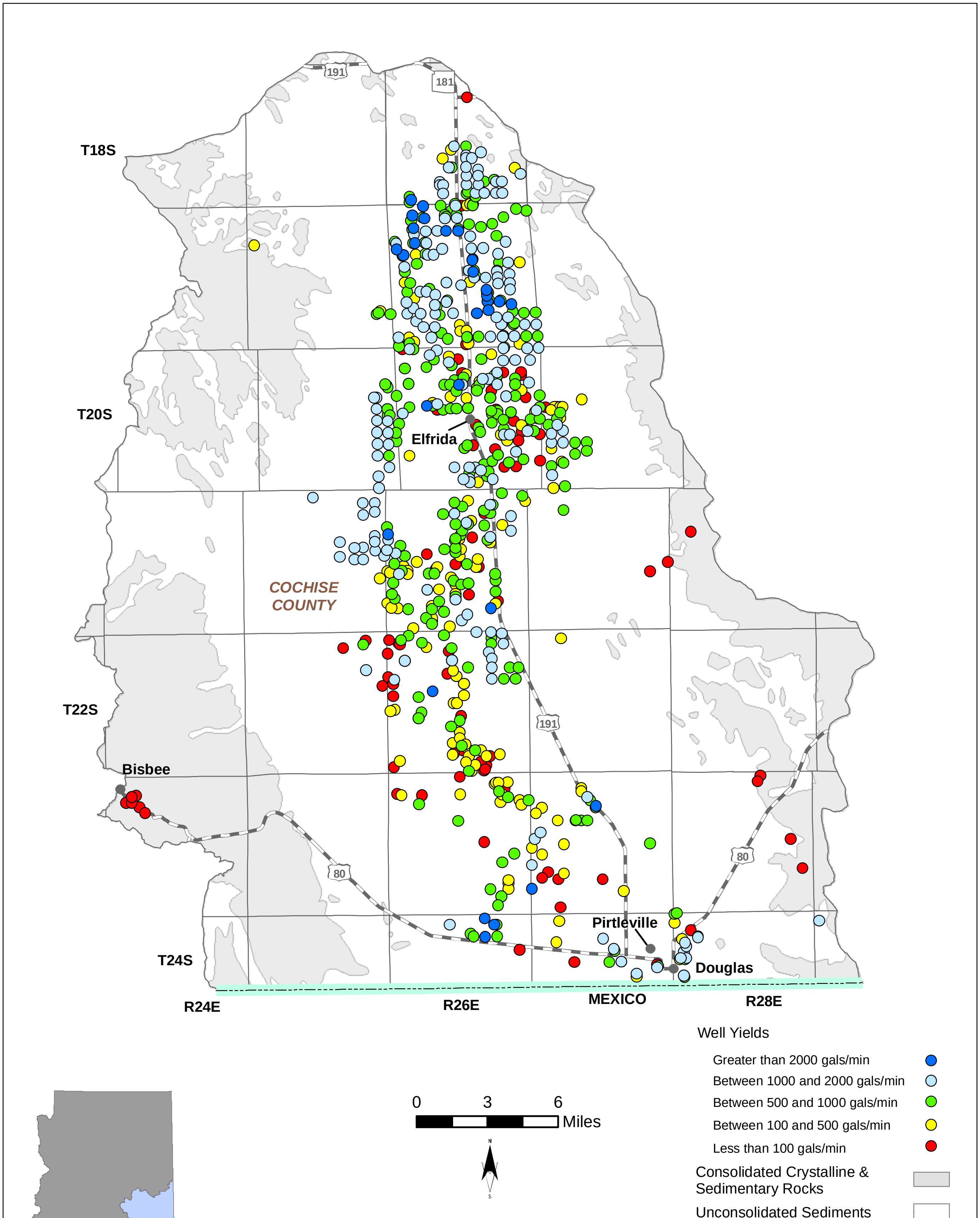


Figure 3.5-8
Douglas Basin
Well Yields

3.5.7 Water Quality of the Douglas Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.5-7A. 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 3.5-7B. Figure 3.5-9 shows the location of exceedences and impairment keyed to Table 3.5-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.5-7A.
- Drinking water standard exceedences have been reported for 49 wells in the basin.
- North of Elfrida the parameter exceeded in almost all of the sites measured was fluoride.
- South of Elfrida the most common parameter exceeded in the sites measured was arsenic.
- The parameters most frequently exceeded in this basin were fluoride and arsenic.
- Another parameter commonly exceeded in this basin was nitrate.

Lakes and Streams

- Refer to Table 3.5-7B.
- 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.
- There is one reach of Mule Gulch, in the vicinity of Bisbee, that is effluent dependent.
- 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.

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

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

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

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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

Table 3.5-7 Water Quality Exceedences in the Douglas Basin[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

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/Nitrite
pH = Measurement of acidity or alkalinity
Zn = Zinc
[3] A&W = Aquatic & Wildlife

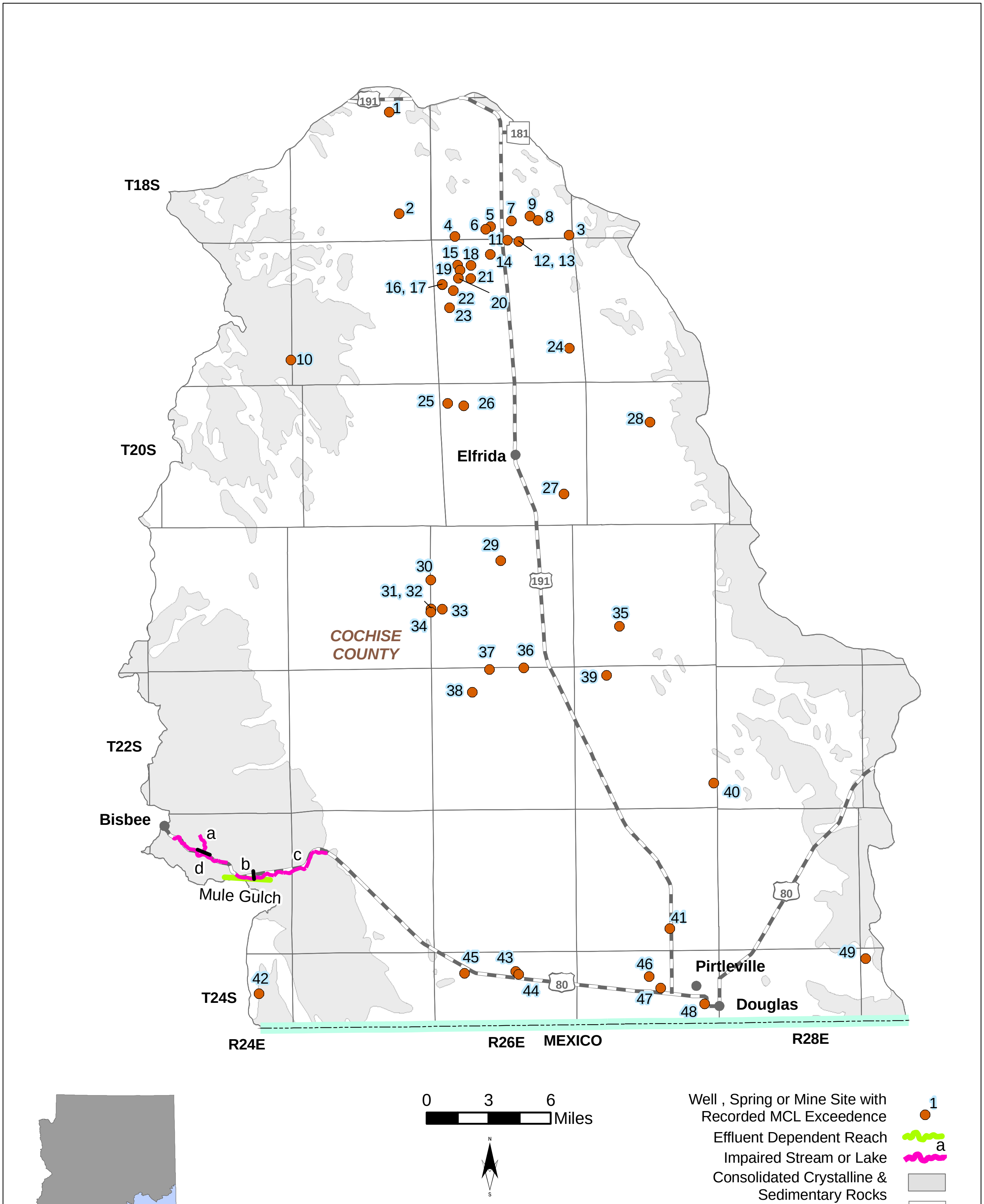


Figure 3.5-9
Douglas Basin
Water Quality Conditions

3.5.8 Cultural Water Demands 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 3.5-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.5-9. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.5-8 and Figure 3.5-10.
- Population increased by an average of 500 people per year between 1980 and 2000. Projections suggest a more rapid growth rate through 2050.
- 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.
- All water use in this basin is groundwater, there are no surface water diversions on record.
- 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.
- Over three-fourths of the water demand in this basin is for agriculture.
- 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 2003 there were 1,647 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 679 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 3.5-9.
- 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 3.5-8 Cultural Water Demands in the Douglas Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) 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>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">1,072[2]</td><td rowspan="10">644[2]</td><td colspan="3" rowspan="5">110,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994)</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">90,000</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>16,600</td></tr>
<tr><td>1981</td><td>17,359</td><td rowspan="5">107</td><td rowspan="5">21</td><td colspan="3" rowspan="5">61,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>18,119</td></tr>
<tr><td>1983</td><td>18,878</td></tr>
<tr><td>1984</td><td>19,637</td></tr>
<tr><td>1985</td><td>20,397</td></tr>
<tr><td>1986</td><td>21,156</td><td rowspan="5">117</td><td rowspan="5">5</td><td colspan="3" rowspan="5">38,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>21,915</td></tr>
<tr><td>1988</td><td>22,674</td></tr>
<tr><td>1989</td><td>23,434</td></tr>
<tr><td>1990</td><td>24,193</td></tr>
<tr><td>1991</td><td>24,396</td><td rowspan="5">97</td><td rowspan="5">3</td><td rowspan="5">5,400</td><td rowspan="5">NR</td><td rowspan="5">33,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="13">USGS (2005)</td></tr>
<tr><td>1992</td><td>24,598</td></tr>
<tr><td>1993</td><td>24,801</td></tr>
<tr><td>1994</td><td>25,003</td></tr>
<tr><td>1995</td><td>25,206</td></tr>
<tr><td>1996</td><td>25,408</td><td rowspan="5">168</td><td rowspan="5">3</td><td rowspan="5">6,200</td><td rowspan="5">NR</td><td rowspan="5">37,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>25,611</td></tr>
<tr><td>1998</td><td>25,813</td></tr>
<tr><td>1999</td><td>26,016</td></tr>
<tr><td>2000</td><td>26,218</td></tr>
<tr><td>2001</td><td>26,994</td><td rowspan="3">61</td><td rowspan="3">3</td><td rowspan="3">5,700</td><td rowspan="3">NR</td><td rowspan="3">48,000</td><td colspan="3" rowspan="3">NR</td></tr>
<tr><td>2002</td><td>27,770</td></tr>
<tr><td>2003</td><td>28,546</td></tr>
<tr><td>2010</td><td>33,979</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>34,267</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>34,850</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2040</td><td>35,547</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>36,524</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">ADDITIONAL WELLS:[3]</td><td>25</td><td></td><td colspan="7"></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>1,647</td><td>679</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.4-9 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 Irrigation	Wildlife Area	Discharge to Another Facility	Groundwater Recharge			
Douglas WWTF	Douglas Water & Sewer	Douglas	18,044	1,367	Mexico							Secondary	NA	2000

Notes:
NA: No data currently available to ADWR
WWTF: Wastewater Treatment Facility

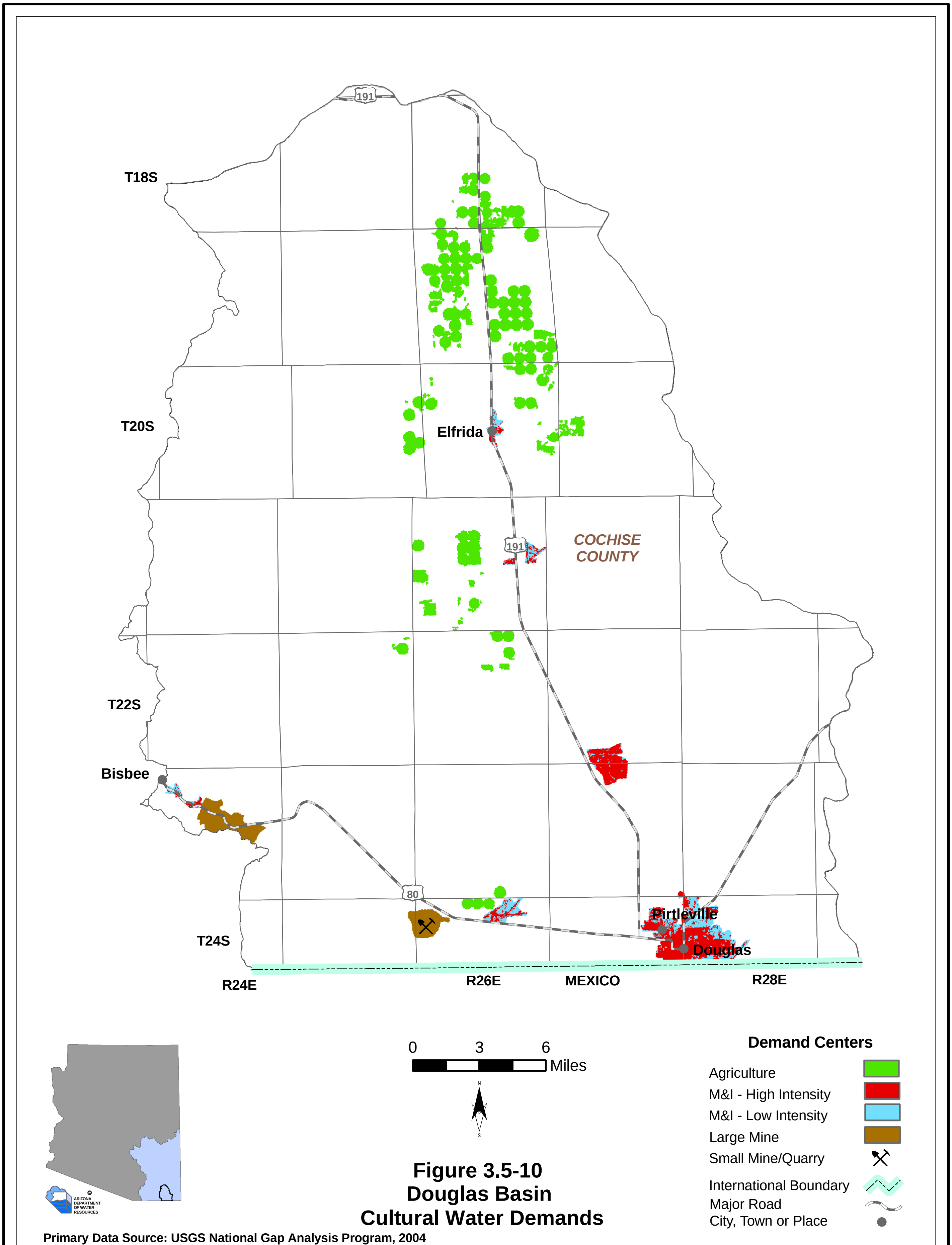


Figure 3.5-10
Douglas Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

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 3.5-10. 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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

- Six water adequacy determinations have been made in this basin through May, 2005.
- Three determinations of inadequacy have been made, one in the vicinity of Bisbee and two in the northern portion of the basin.
- All three determinations of inadequacy were made because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination.
- All lots receiving an adequacy determination are in Cochise County. Of the 315 lots, 65 lots or 18% were determined to be adequate.

Table 3.5-10 Adequacy Determinations in the Douglas 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	Cochise Industrial Park	Cochise	23 South	27 East	35	22		Adequate		08/11/81	Dry Lot Subdivision
2	Harbour Property	Cochise	21 South	26 East	2	33		Adequate		02/04/82	Dry Lot Subdivision
3	Pueblo Court Condominiums	Cochise	23 South	24 East	7	10		Inadequate	A1	02/04/88	Arizona Water Company
4	Rancho Alegre Estates, 1-10	Cochise	24 South	28 East	15	10	22-400051	Adequate		04/21/99	Dry Lot Subdivision
5	Sunsites Ranches	Cochise	18 South	24 East	14, 22, 24	26	22-300037	Inadequate	A1	07/28/95	Dry Lot Subdivision
6	Sunsites Ranches, Units Two & Four	Cochise	19 South	26 East	1, 13, 24, 25	314	22-300157	Inadequate	A1	07/09/96	Dry Lot Subdivision
			19 South	27 East	28, 29, 30, 31, 32						
			20 South	27 East	4, 5, 6, 7, 9, 18, 29						

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 determination.

[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically unavaible;for groundwater, depth-to-water exceeds criteria)
3) Insufficient Infrastructure (distribution system is insufficient to meet demands or applicant proposed water hauling)

B. Legal (applicant failed to demonstrate a legal right to use the water or failed to demonstrate the provider's legal authority to serve the subdivision)
C. Water Quality
D. Unable to locate records

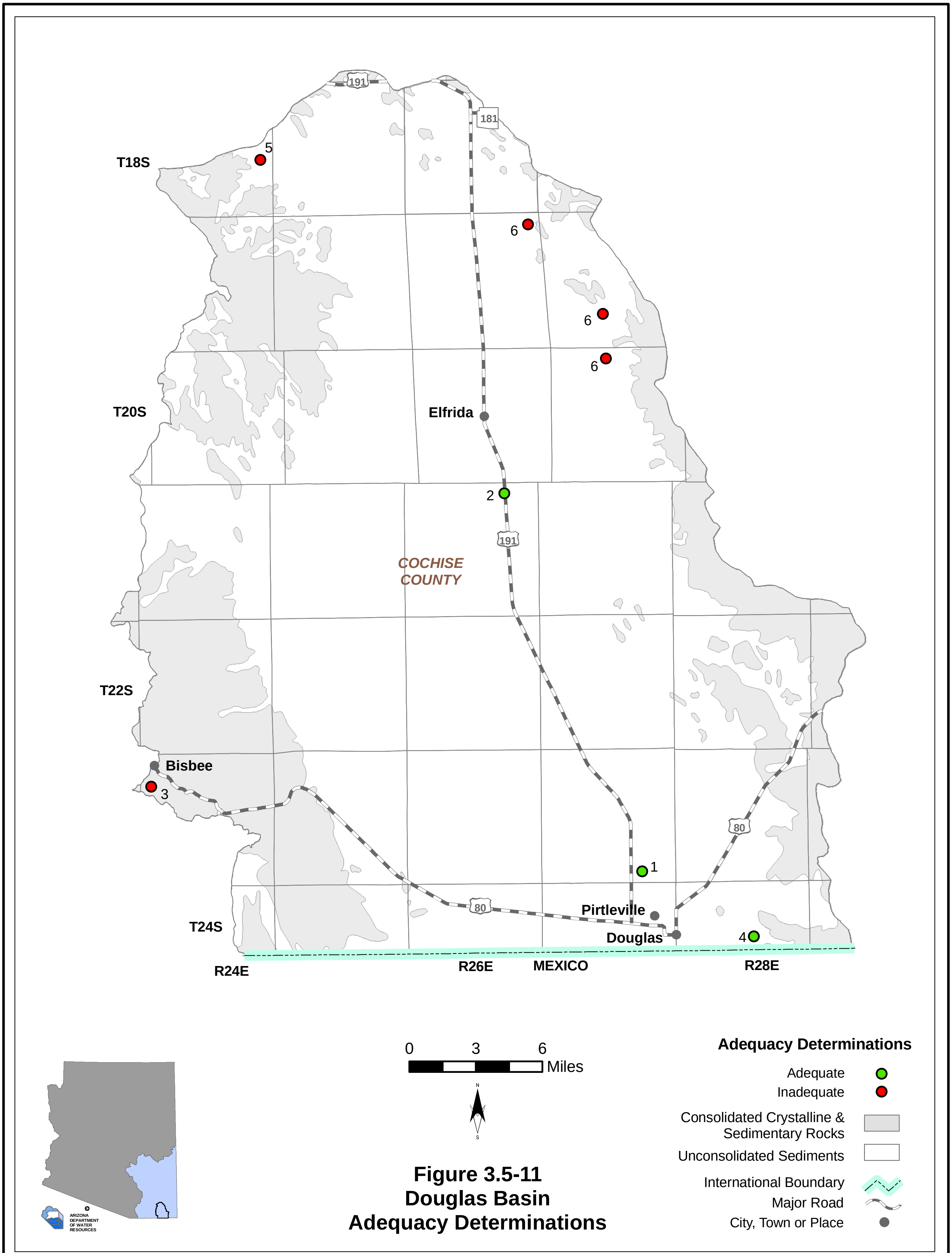


Figure 3.5-11
Douglas Basin
Adequacy Determinations

DOUGLAS BASIN
References and Supplemental Reading

References

A

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*_____, 2005, Impaired lakes and reaches: GIS cover, received January 2006.

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*_____, 2005, WWTP and permit files: Miscellaneous working files, received July 2005.

*_____, 2004, Water providers with arsenic concentrations in wells over 10ppb: Data file, received August 2004.

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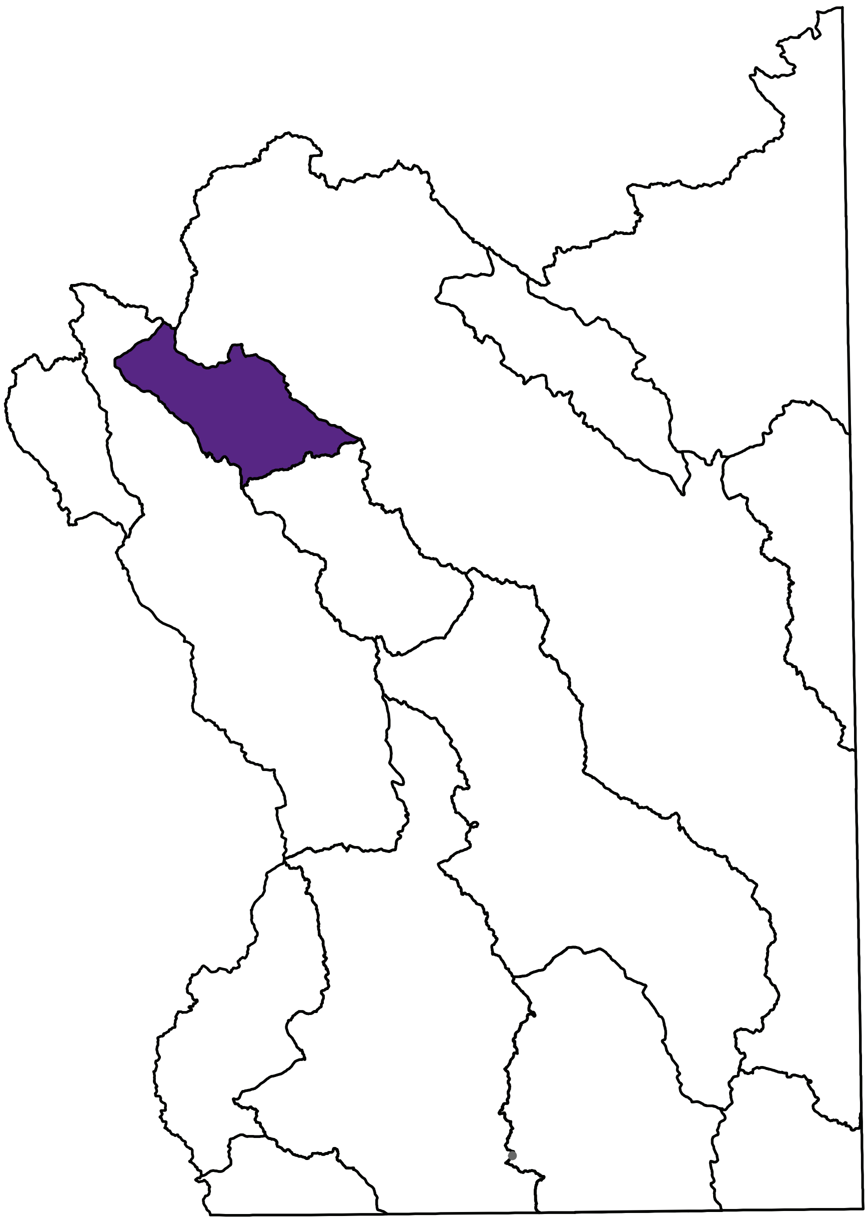
Douglas Basin Index to Section 3.0

Section 3.6
Dripping Springs Wash Basin

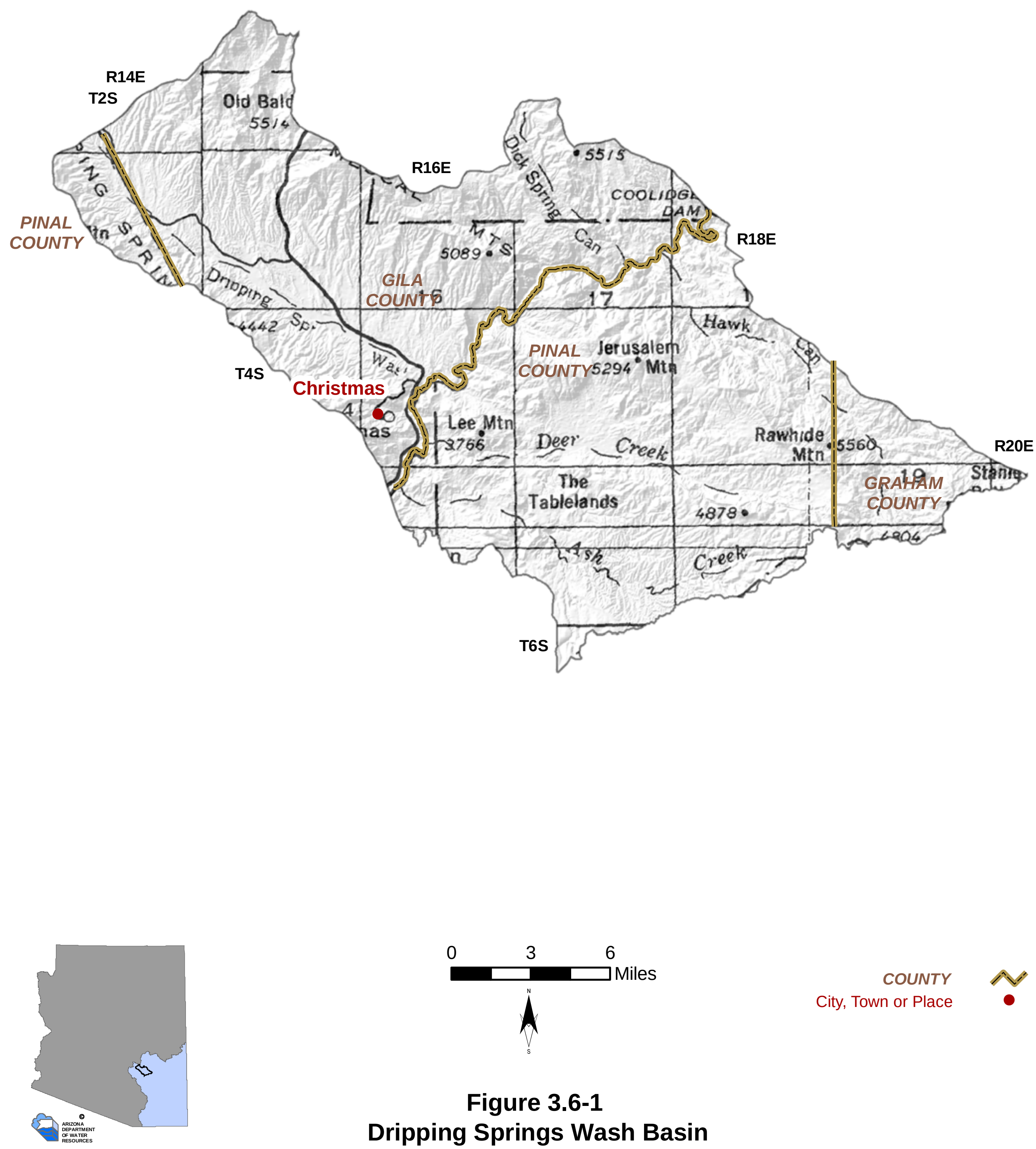


3.6.1 Geography of the Dripping Springs Wash Basin

The Dripping Springs Wash Basin is a small, 378 square mile basin in the northeastern 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, desert scrub, grassland and chaparral vegetation.

- Principal geographic features shown on Figure 3.6-1 include:
    - Principal basin community of Christmas, with a population of less than 100
    - The Tablelands, southeast of Christmas
    - 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

- Not well shown on Figure 3.6-1 are the Dripping Springs Mountains to the west, which include the highest point in the basin at 5,515 feet, and the Mescal Mountains to the east.



Base Map: USGS 1:500,000, 1981

Figure 3.6-1
Dripping Springs Wash Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

Indian Reservations

- 57.8% of the land is under ownership of the San Carlos Apache Tribe.
- The tribal lands contain a number of private in-holdings.
- 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 Bureau of Land Management.
- 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 Apace Indian Reservation.
- Primary land uses are mining, domestic and grazing.

National Forest and Wilderness

- 1.3% of land is federally owned and managed as national forest and wilderness.
- The portion of national forest in this basin is in the Tonto National Forest, Globe Ranger District.
- Primary land uses are grazing and recreation.

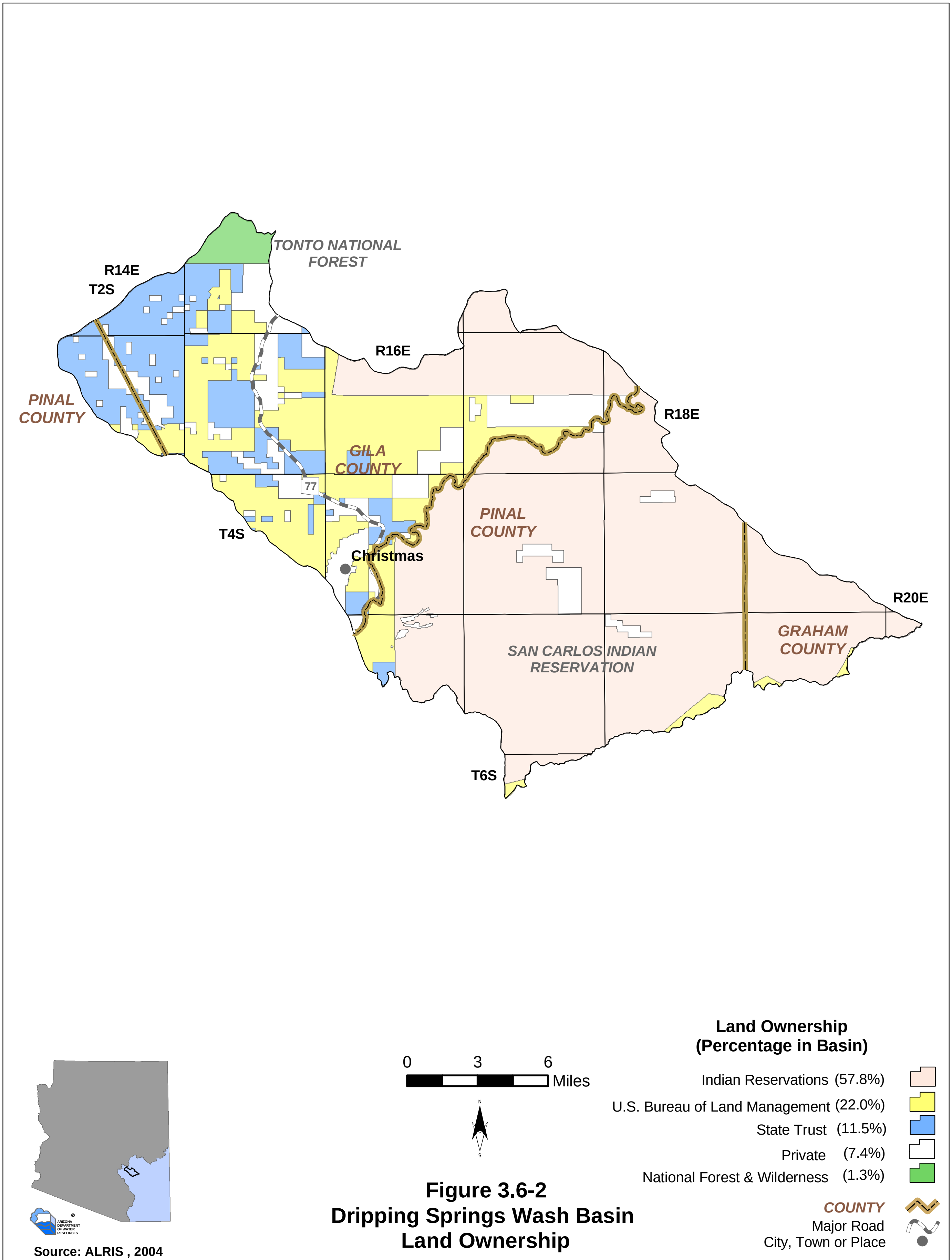


Figure 3.6-2
Dripping Springs Wash Basin
Land Ownership

3.6.3 Climate of the Dripping Springs Wash Basin

Climate data from NOAA/NWS Coop Network and Evaporation Pan stations are complied in Table 3.6-1 and their locations are shown on Figure 3.6-3. The Dripping Springs Wash Basin does not contain AZMET and SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.6-1A
- There is one NOAA/NWS Coop network climate station in the basin at San Carlos Reservoir located at 2,530 feet.
- Average maximum temperature at the station is 86.6°F and average minimum temperature is 46.4°F.
- Annual average precipitation at the station is 15.87 inches.
- Winter, summer and fall season precipitation is 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.
- Other precipitation data shows rainfall as high as 30 inches at the northernmost tip of the basin in the Dripping Springs Mountains, and as low as 12 inches in the vicinity of Christmas.
- Altitude is a factor in precipitation in this basin with rainfall generally increasing as elevation increases. The range of 28 inches between areas of highest and lowest precipitation recorded is relatively high for the planning area.

Evaporation Pan

- Refer to Table 3.6-1B
- There is one site in the basin, at San Carlos Reservoir located at 2,530 feet.
- Average annual pan evaporation from this site is 91.45 inches.
- The only other evaporation pan station in the planning area is at the Safford Agricultural Center, with an annual average evaporation of 98.05 inches at an elevation of 2,950 feet. Usually evaporation decreases as elevation increases, however, evaporation at the Safford pan is seven inches higher than the San Carlos Reservoir pan. Location of the evaporation pan and the period of record may be the reason for this discrepancy.

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, 2003.

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 Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

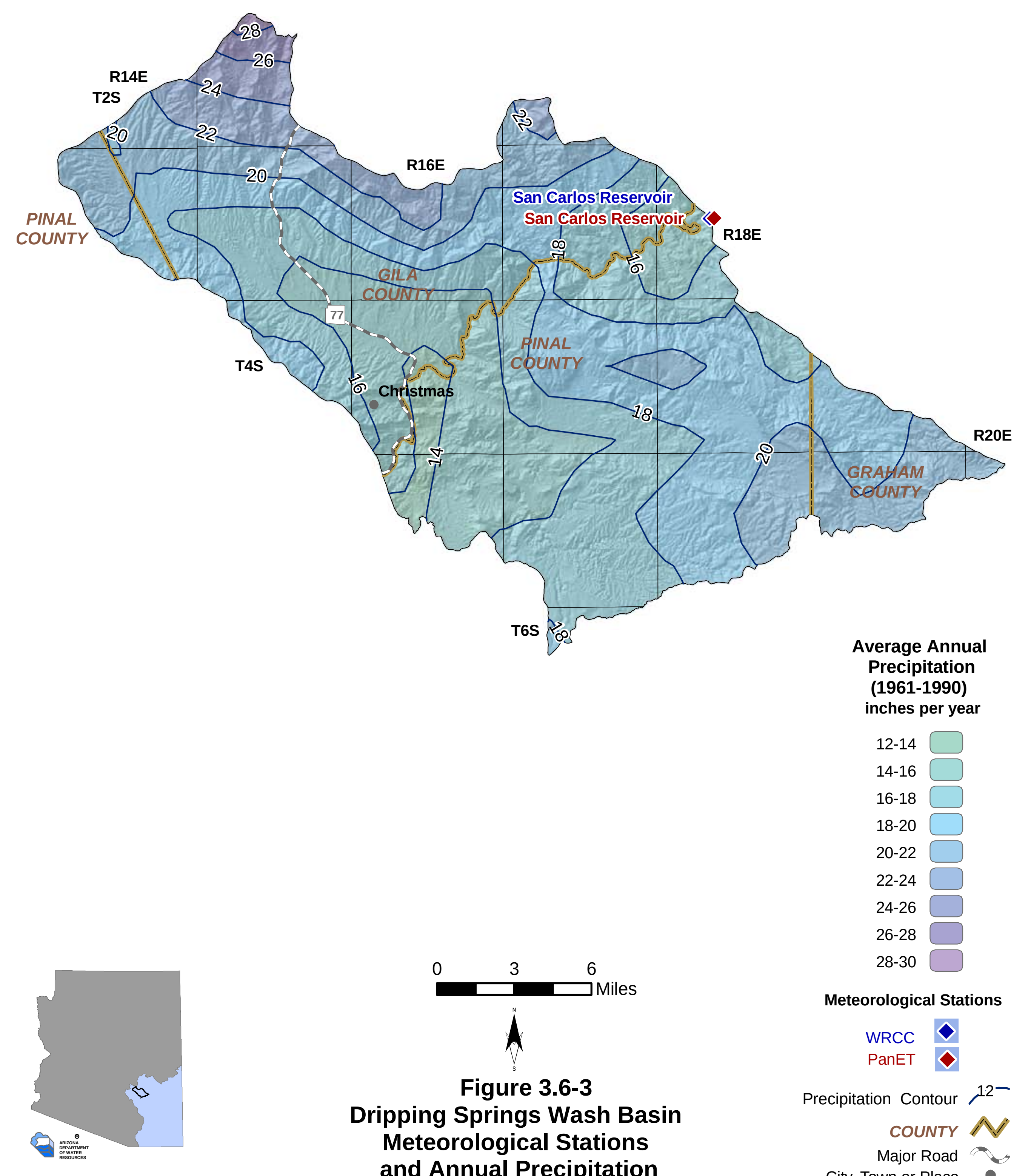


Figure 3.6-3
Dripping Springs Wash Basin Meteorological Stations and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

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 as of September 2004 is shown on Table 3.6-3. Reservoir and stockpond data are shown in Table 3.6-4. The location of streamflow gages, using the USGS number, is shown on Figure 3.6-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.6-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.6-2.
- Data from one station located at the Gila River below Coolidge Dam are shown on the table and on Figure 3.6-4.
- The average seasonal flow as a percentage of annual flow is similar in the Winter (January-March), Spring (April-June) and Summer (July-September). The similarity between seasons is primarily due to the controlled release of water 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. There are 90 years of annual flow record for this station.

Flood ALERT Equipment

- Refer to Table 3.6-3.
- There is one station in the basin as of October 2005 located at the streamflow gaging station on the Gila River below Coolidge Dam.
- This station is a precipitation/stage station.

Reservoirs and Stockponds

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

Runoff Contour

- Refer to Figure 3.6-4.
- Average annual runoff is 0.5 inches in this basin.

Table 3.5-2 Streamflow Data for the Dripping Springs Wash Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	NA	7/1899-current	29	28	31	12	27,590 (1929)	231,731	270,458	1,681,500 (1993)	90

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

Notes:
NA= Not available to ADWR
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

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

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)[1]

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					

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

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

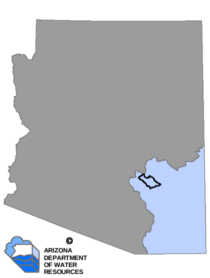
D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 0
Total surface area: 0 acres

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

Total number: 79 (from water right filings)

Notes:
[1]Capacity data not available to ADWR



Stream Data Source: ALRIS, 2005

0 3 6 Miles

USGS Annual Runoff Contour for 1951-1980 (in inches)
Stream Channel (width of line reflects stream order)
Stream Gages
USGS
Flood
COUNTY
Major Road
City, Town or Place

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. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There is one perennial stream, Mescal Creek, a tributary to the Gila River.
- The Gila River is considered an intermittent stream through this basin because its flow 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.
- Listed discharge rates may not be indicative of current conditions. Both of the major spring measurements were taken prior to 1985.
- Both major springs are located in the vicinity of the Gila River. The Mescal Warm Spring discharges 200 gpm and the Coolidge Dam Warm Spring discharges 165 gpm.
- There are no minor springs identified at this time.
- 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):

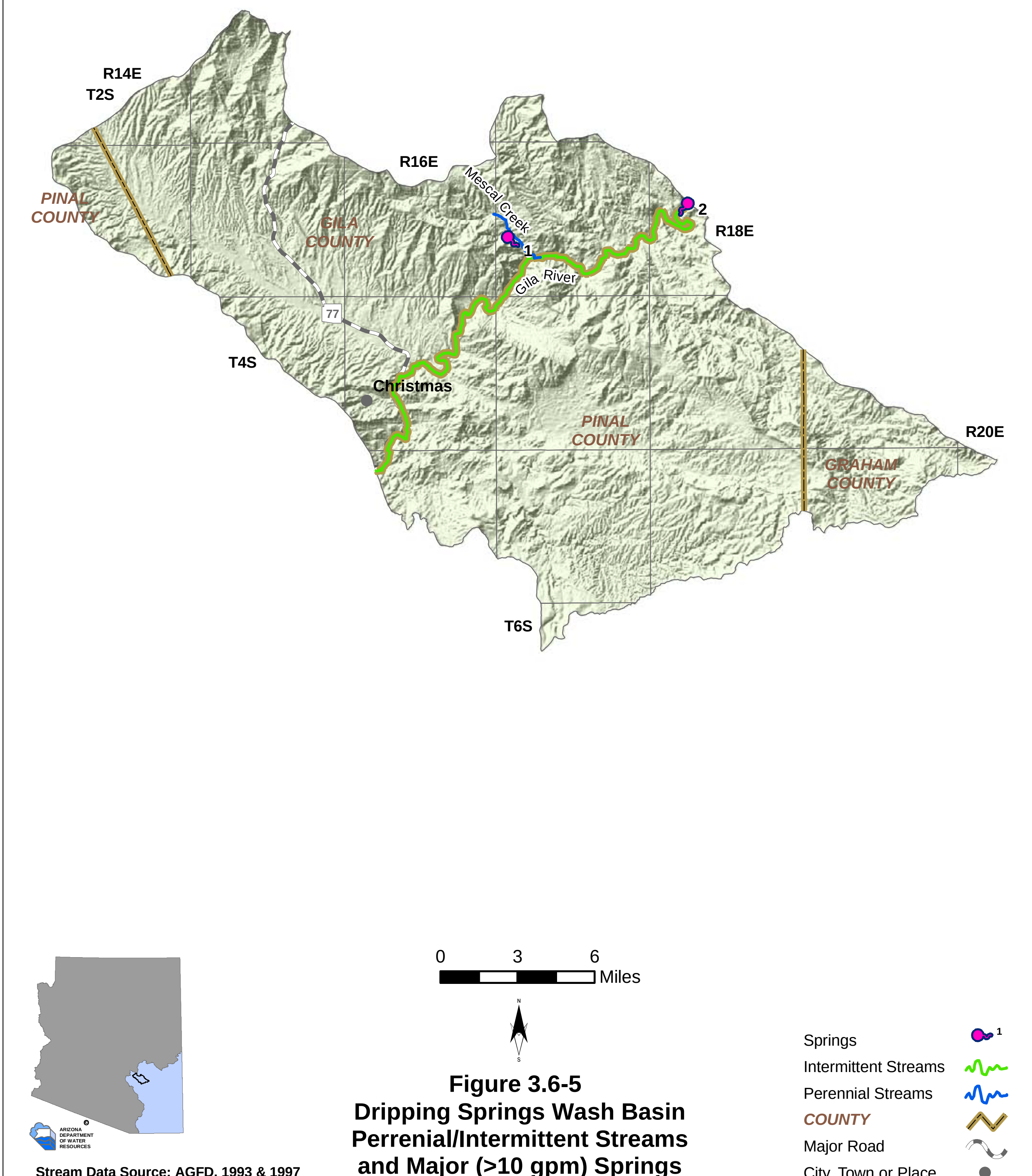
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Mescal Warm	330918	1103815	200	On or before 1982
2	Coolidge Dam Warm	331016	1103139	165	On or before 1982

B. Minor Springs (1 to 10 gpm):

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

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

Notes:
[1]Most recent measurement identified by ADWR



Stream Data Source: AGFD, 1993 & 1997

Figure 3.6-5
Dripping Springs Wash Basin
Perrenial/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 contains hydrographs for selected wells 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

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 gallons per minute (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.
- There are two natural recharge estimates for this basin of 3,000 acre-feet per year and 9,000 acre-feet per year. The former, from a 1994 ADWR study, is the most recent estimate.

Water in Storage

- Refer to Table 3.6-6.
- There are two storage estimates for this basin, 150,000 acre-feet and less than one million acre-feet to a depth of 1,200 feet.
- The predevelopment storage estimate is less than one million acre-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.
- In 1996, the year of the last water level sweep, 34 wells were measured.
- There are 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.
- A hydrograph corresponding to one well shown on Figure 3.6-6 but covering a longer time period is shown in Figure 3.6-7.

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:	NA	Measured by ADWR and/or USGS
	Range 12 - 1,200 Median 394.5 (12 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	<2	ADWR (1994)
	Range 0 - 500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	3,000	ADWR (1994)
	9,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	150,000 (to 1,200 ft)	ADWR (1994)
	<1,000,000[1]	Freethey and Anderson (1986)
	NA	Arizona Water Commission (1975)
Current Number of Index Wells:	2	
Date of Last Water-level Sweep:	1996 (34 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate

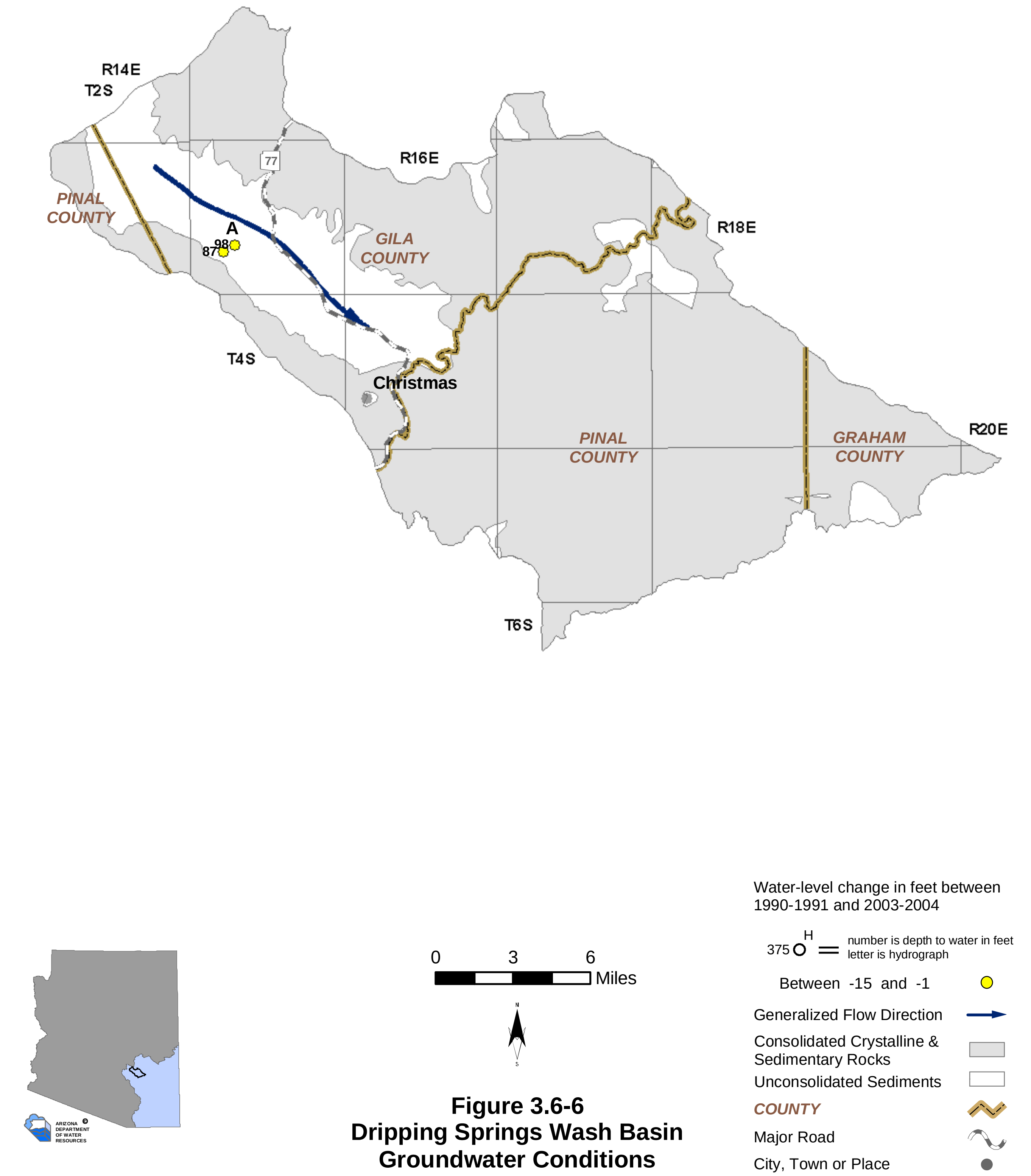
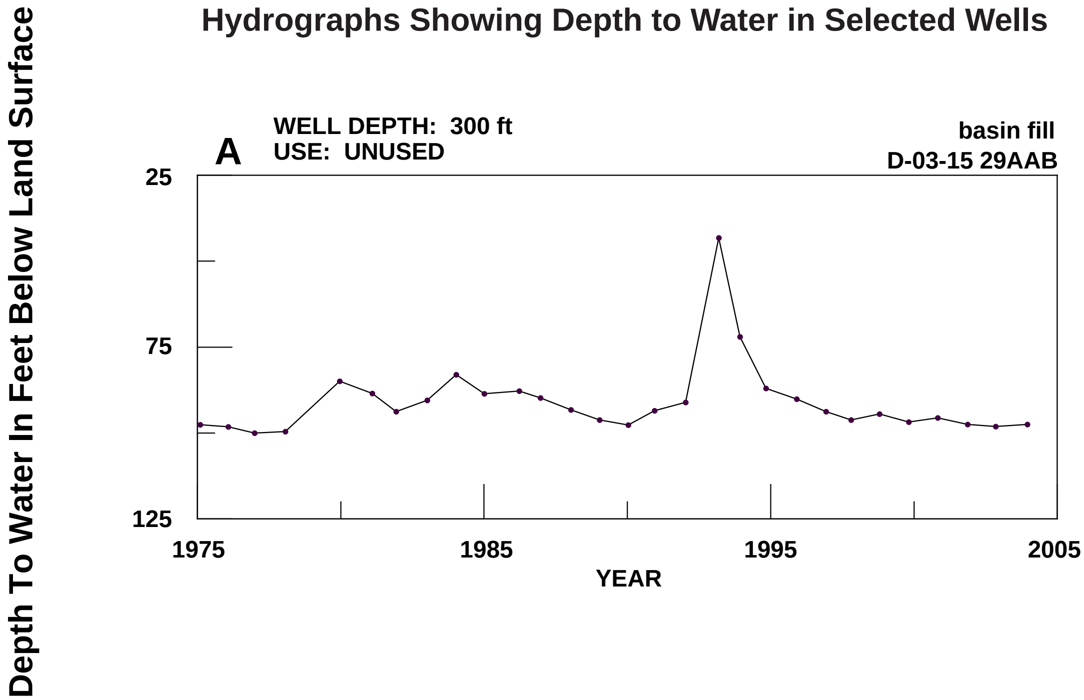


Figure 3.6-6
Dripping Springs Wash Basin
Groundwater Conditions

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



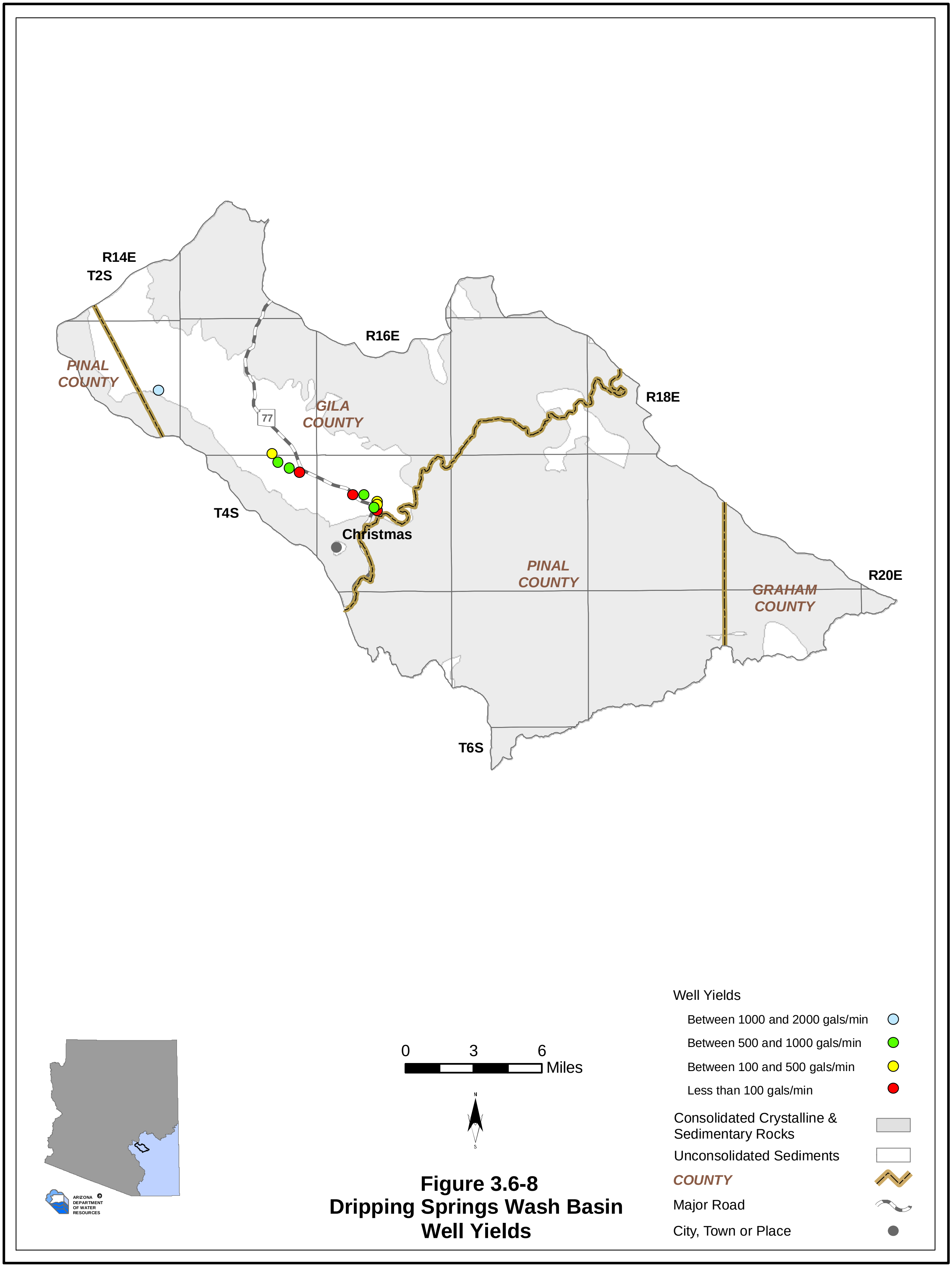


Figure 3.6-8
Dripping Springs Wash Basin
Well Yields

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, Section 1.3.18.

Table 3.6-7 Water Quality Exceedences in the Dripping Springs Basin

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard
		Township	Range	Section	
	None identified by ADWR at this time				

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
None identified by ADWR at this time						

3.6.8 Cultural Water Demands 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 3.6-8. Effluent generation including facility ownership and location is shown on Table 3.6-9. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.6-8 and Figure 3.6-10.
- Population decreased significantly between 1980 and 2003. Projected population was assumed to remain stable through 2050.
- Groundwater pumping has decreased since 1971 and remained constant from 1990 to 2003, with less than 300 acre-feet pumped per year during this time.
- All water use in this basin is groundwater, there are no surface water diversions reported.
- Municipal demand is less than 300 acre-feet per year.
- 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 2003 there were 124 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 24 wells with a pumping capacity of more than 35 gallons per minute.

Table 3.6-8 Cultural Water Demands in the Dripping Springs Wash Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) 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>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">85[2]</td><td rowspan="10">20[2]</td><td colspan="3" rowspan="5"><1,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994)</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">19</td><td rowspan="5">0</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">0</td><td rowspan="5">0</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">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><td rowspan="13">USGS (2005)</td></tr>
<tr><td>1992</td><td>209</td></tr>
<tr><td>1993</td><td>205</td></tr>
<tr><td>1994</td><td>201</td></tr>
<tr><td>1995</td><td>197</td></tr>
<tr><td>1996</td><td>193</td><td rowspan="5">5</td><td rowspan="5">1</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>189</td></tr>
<tr><td>1998</td><td>185</td></tr>
<tr><td>1999</td><td>181</td></tr>
<tr><td>2000</td><td>177</td></tr>
<tr><td>2001</td><td>63</td><td rowspan="3">1</td><td rowspan="3">1</td><td rowspan="3"><300</td><td rowspan="3">NR</td><td rowspan="3">NR</td><td colspan="3" rowspan="3">NR</td></tr>
<tr><td>2002</td><td>63</td></tr>
<tr><td>2003</td><td>63</td></tr>
<tr><td>2010</td><td>63</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>63</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>63</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2040</td><td>63</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>63</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">***ADDITIONAL WELLS:***[3]</td><td>**4**</td><td>**2**</td><td colspan="7"></td></tr>
<tr><td colspan="2">***WELL TOTALS:***</td><td>**124**</td><td>**24**</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.6-9 Effluent Generation in the Dripping Springs Wash 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	Discharge to Another Facility	Groundwater Recharge			
No Wastewater Treatment Facilities Identified by ADWR in this Basin														

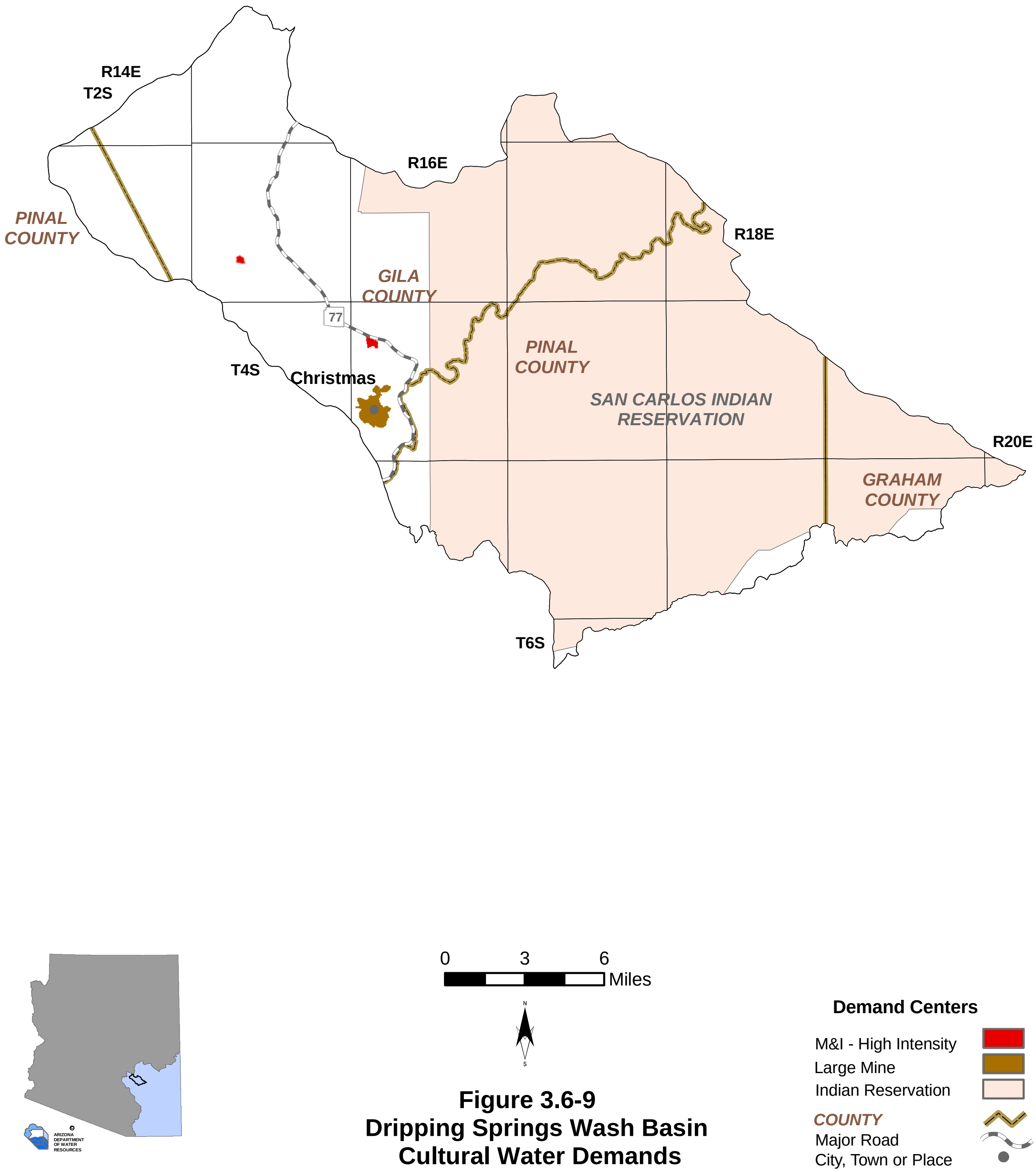


Figure 3.6-9
Dripping Springs Wash Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

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 May, 2005 for the Dripping Springs Wash Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 3.7-10 Adequacy Determinations in the Dripping Springs Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
No subdivisions on file with ADWR at this time											

DRIPPING SPRINGS BASIN
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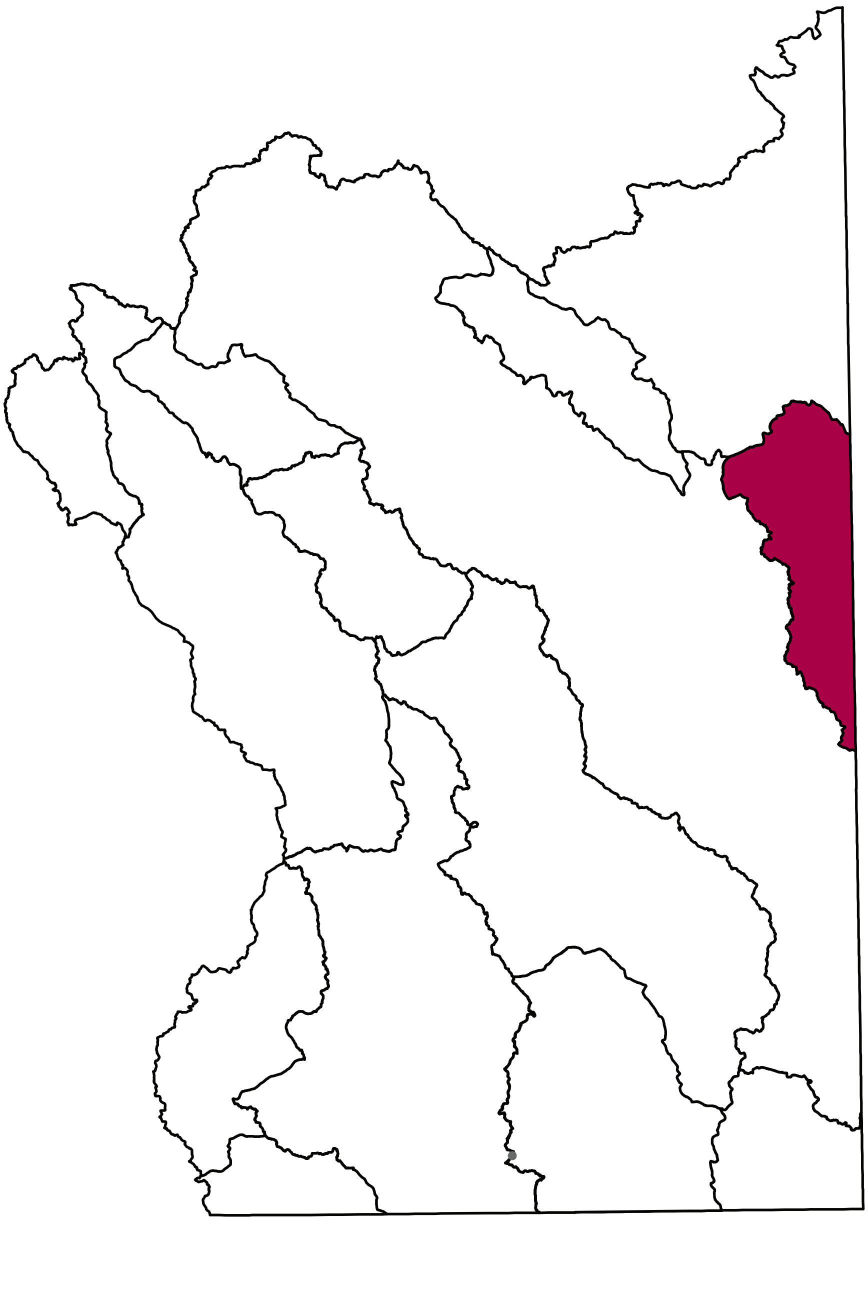
Dripping Springs Wash Index to Section 3.0

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, desert scrub and grassland vegetation.

- Principal geographic features shown on Figure 3.7-1 are:
  - Principal basin community of Duncan
  - 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

- Not well shown on Figure 3.7-1 are:
  - Big Lue Mountains along the northern boundary, which include the highest point in the basin at 7,022 feet
  - Summit Mountains along the northeastern boundary with New Mexico

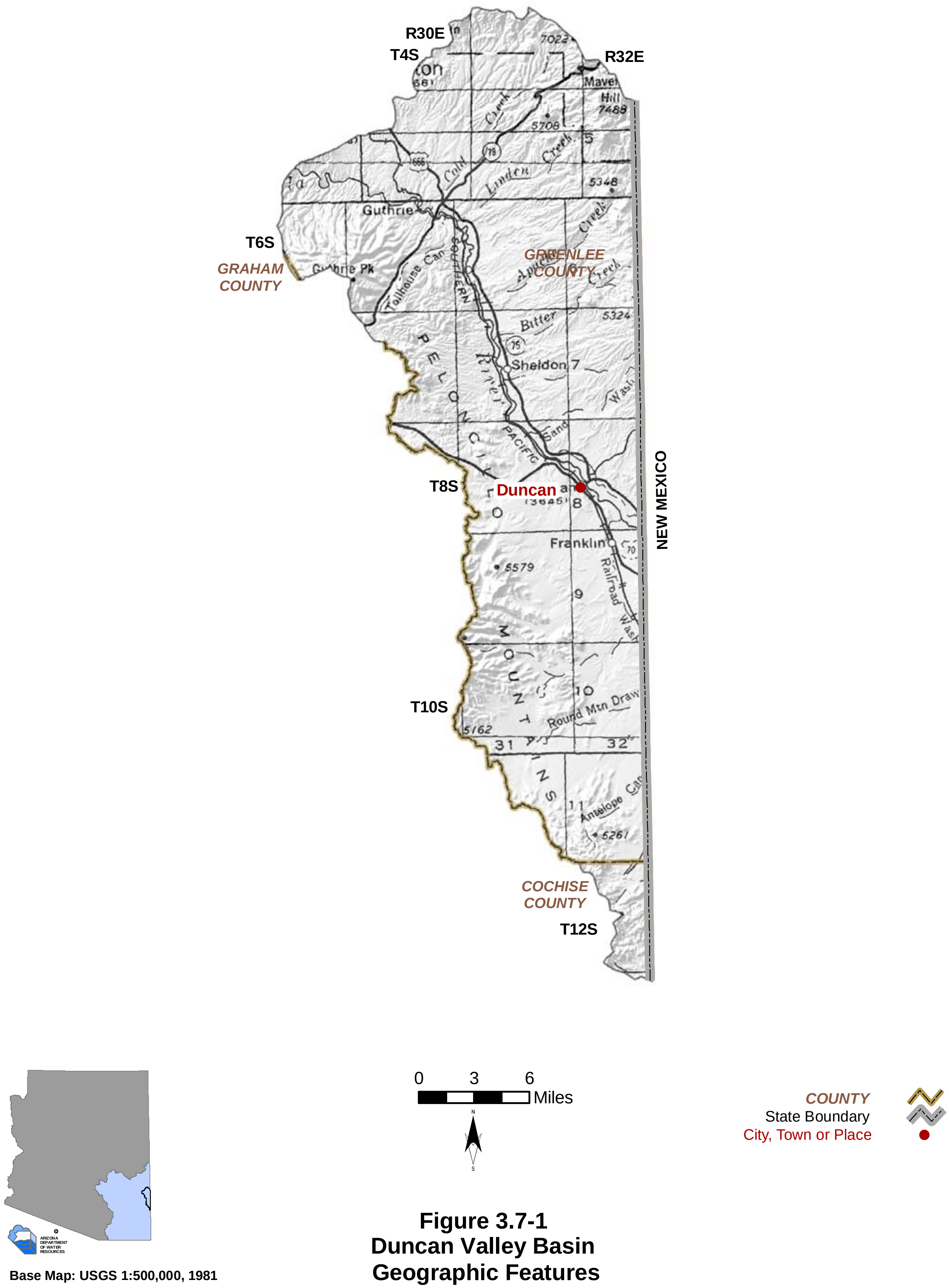


Figure 3.7-1
Duncan Valley Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest 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 Bureau of Land Management.
- There are two conservation 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.
- 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 and Wilderness

- 5.8% of land is federally owned and managed as national forest and wilderness.
- 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.

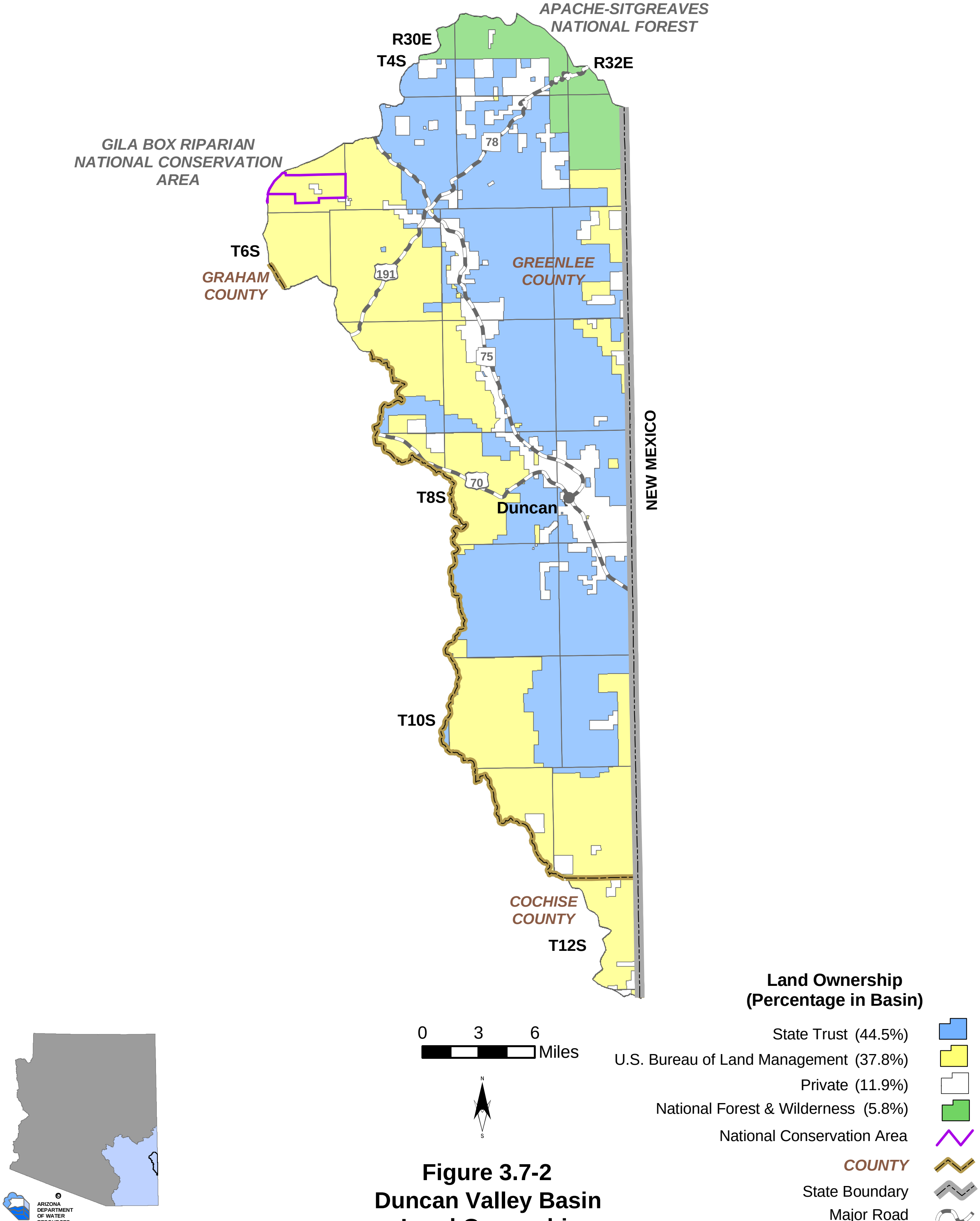


Figure 3.7-2
Duncan Valley Basin
Land Ownership

Source: ALRIS, 2004
Bureau of Land Mangement, 1999

3.7.3 Climate of the Duncan Valley Basin

Climate data from a NOAA/NWS Coop Network station is complied in Table 3.7-1 and the location is shown on Figure 3.7-3. The Duncan Valley Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.7-1A.
- There is one NOAA/NWS Coop network station in the basin at Duncan located at 3,660 feet.
- Average maximum temperature at the station is 80.2°F and average minimum temperature is 41.3°F.
- Annual average precipitation is 12.28 inches.
- 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).
- Other precipitation data shows rainfall as high as 20 inches in the Peloncillo Mountains and the Big Lue Mountains and as low as 12 inches in the vicinity of Duncan.
- In general, precipitation increases as the altitude increases. 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, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

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

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

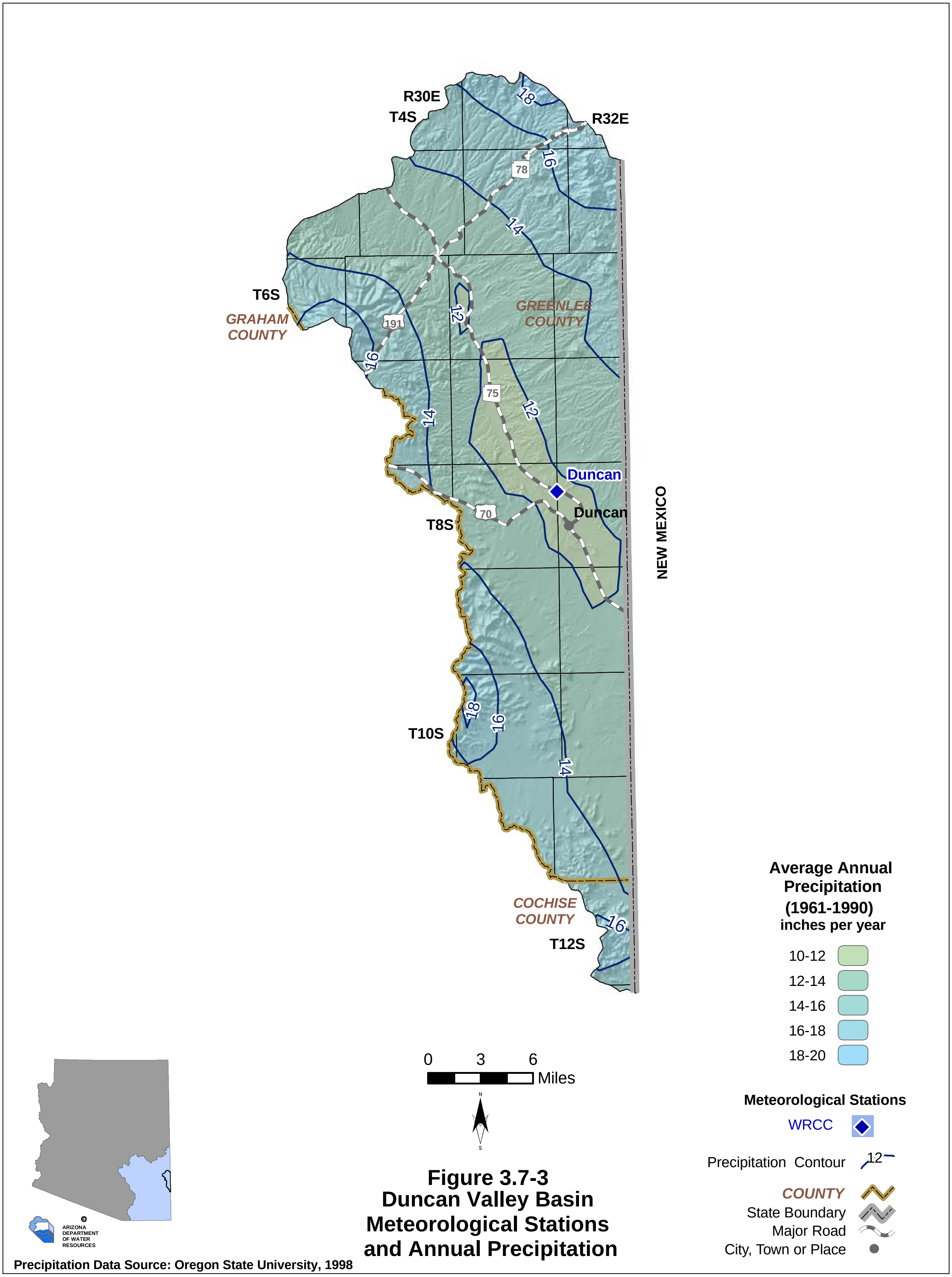


Figure 3.7-3
Duncan Valley Basin Meteorological Stations and Annual Precipitation

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 as of September 2004 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, using the USGS number, is shown on Figure 3.7-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.7-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.7-2.
- Data from two stations located at the Gila River are shown on the table and on Figure 3.7-4.
- The average seasonal flow as a percentage of annual flow is highest in the Winter (January-March) and lowest in the Spring (April-June).
- Only one station, Clifton, has more than one year 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. There are 69 years of annual flow record for this station.

Flood ALERT Equipment

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

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.
- The two small reservoirs have a total surface area of 38 acres.
- There are an estimated 373 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.7-4.
- Average annual runoff varies from 0.5 inches at the northern tip of the basin to 0.2 inches in the southern portion of the basin.

Table 3.7-2 Streamflow Data for the Duncan Valley Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	3,586	NA	11/02-current	No statistics run, less than 3 years data								1[1]
9442000	Gila River near Clifton	4,010	6,250	11/1910-current	39	16	23	22	17,670 (1956)	114,417	147,837	480,118 (1915)	69

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

Notes:
NA=Not available to ADWR
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
[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

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	Private	124	P	Landowner

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

Stream Data Source: ALRIS, 2005

Figure 3.7-4
Duncan Valley Basin
Surface Water Conditions

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. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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.
- Listed discharge rates may not be indicative of current conditions. Most of the measurements were taken prior to 1983. Only the minor spring measurement post-dates 1983.
- Both major springs are located in the northern portion of the basin. The greatest discharge rate was measured at Gillard Hot Spring, 30 gpm.
- 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.
- 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):

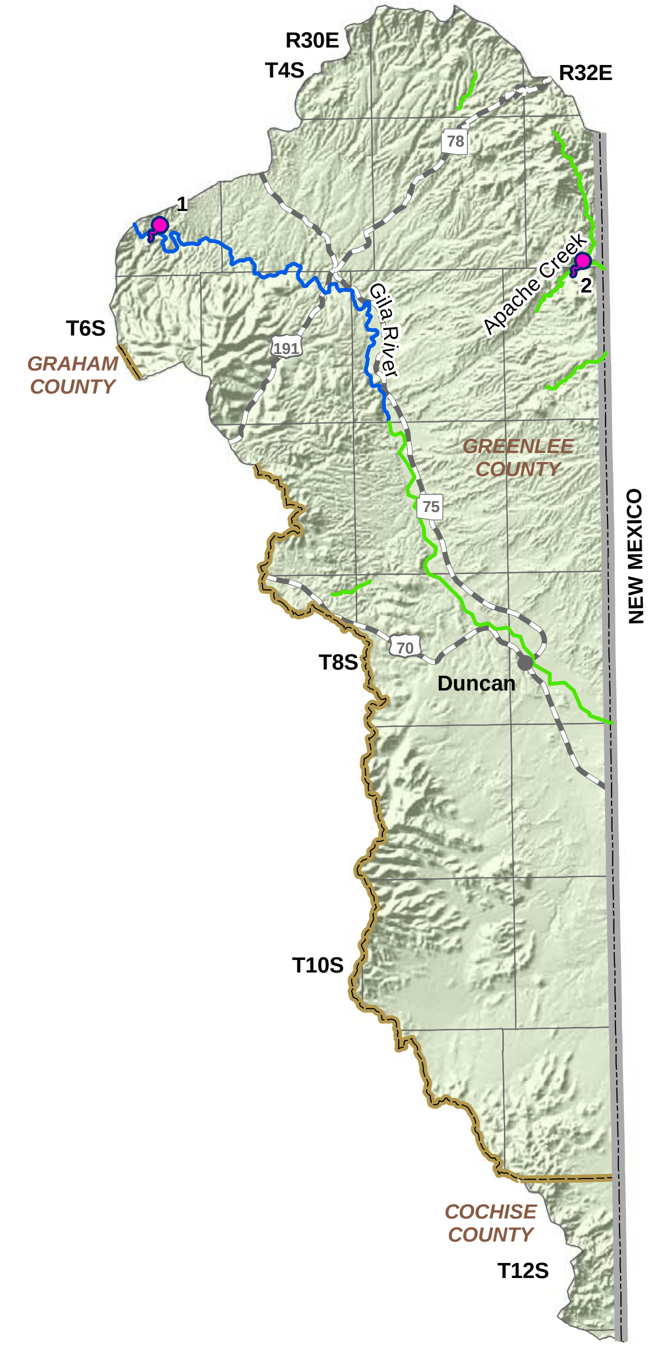
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Gillard Hot	325823	1092059	30	03/1981
2	Bert's Shack	325654	1090347	15	04/1981

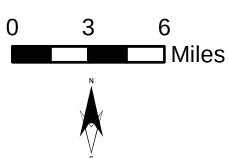
B. Minor Springs (1 to 10 gpm):

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

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

Springs
Intermittent Streams
Perennial Streams
COUNTY
State Boundary
Major Road
City, Town or Place

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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

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 gallons per minute (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.
- Well yields are varied in this basin.

Natural Recharge

- Refer to Table 3.7-6.
- There are three natural recharge estimates for this basin ranging from 6,000 acre-feet per year to 14,200 acre-feet per year. The latter, from a 1994 ADWR study, is the most recent.

Water in Storage

- Refer to Table 3.7-6.
- There are three storage estimates for this basin ranging from nine million acre-feet to 19 million acre-feet to a depth of 1,200 feet. The latter, from a 1994 ADWR study, is the most recent.
- The predevelopment storage estimate is nine million acre-feet.

Water Level

- Refer to Figure 3.7-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 12 index wells in this basin.
- In 1987, the year of the last water level sweep, 182 wells were measured.

- Depth to water varies in this basin with the deepest recorded water level measured during 2003-2004 at 504 feet at the northwestern basin boundary and the shallowest at 21 feet in the vicinity of Duncan.
- All recorded wells in this basin have declined between 1 and 15 feet between 1990-1991 and 2003-2004.
- Hydrographs corresponding to selected wells shown on Figure 3.7-6 but covering a longer time period are shown in Figure 3.7-7.

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:	NA	Measured by ADWR and/or USGS
	Range 4 - 4,000 Median 850 (165 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range few - 2,350	ADWR (1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	14,200	ADWR (1994)
	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 (1994)
	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:	12	
Date of Last Water-level Sweep:	1987 (182 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate

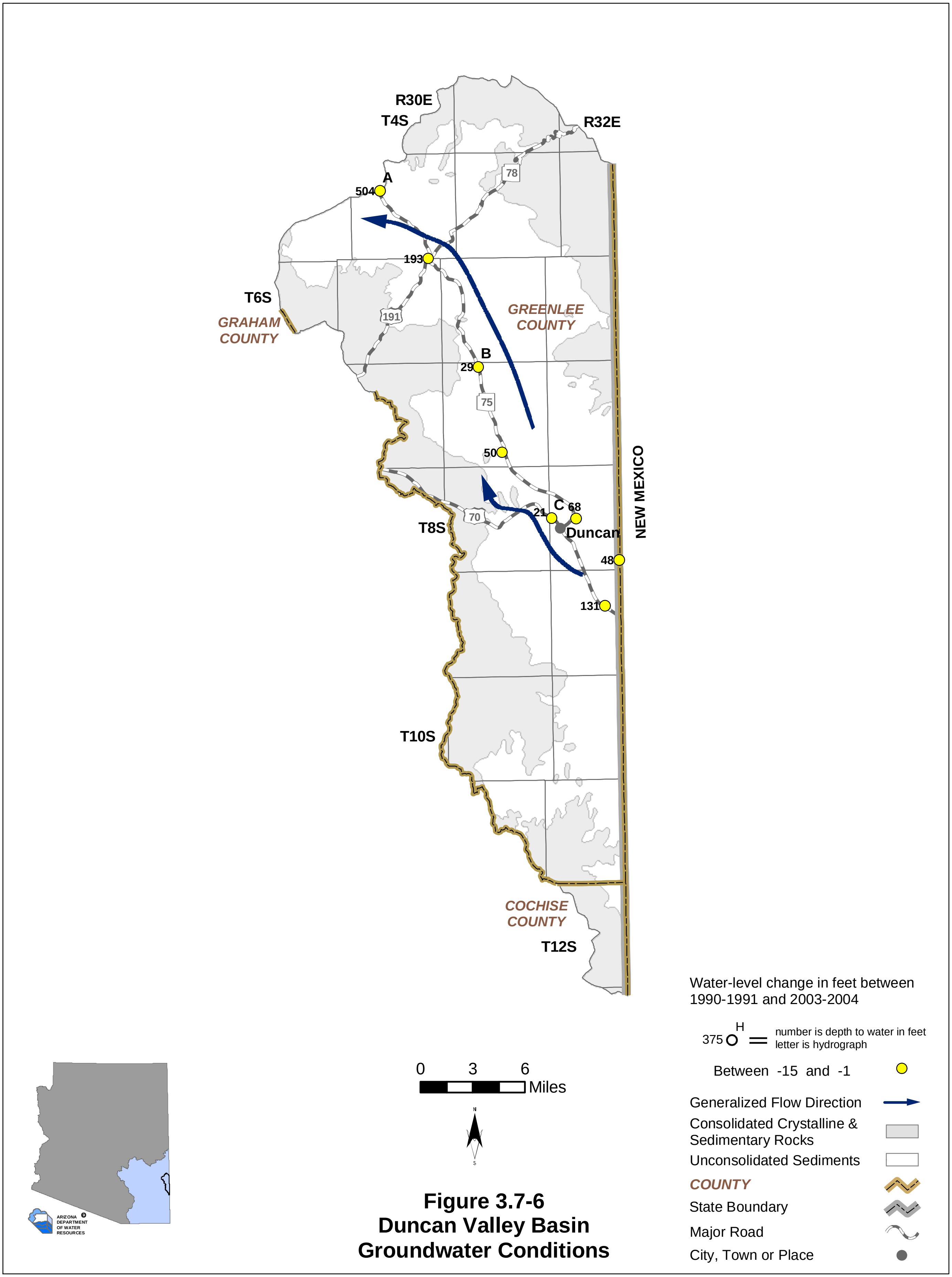
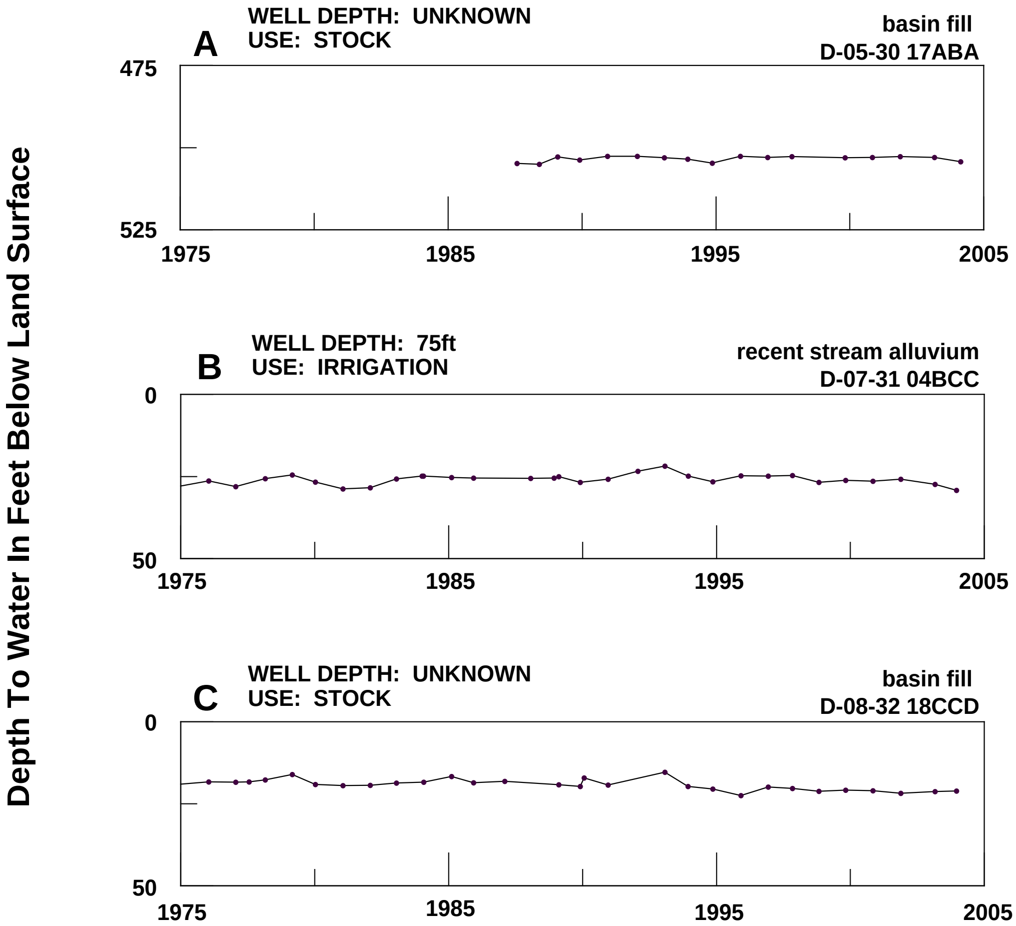


Figure 3.7-6
Duncan Valley Basin
Groundwater Conditions

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



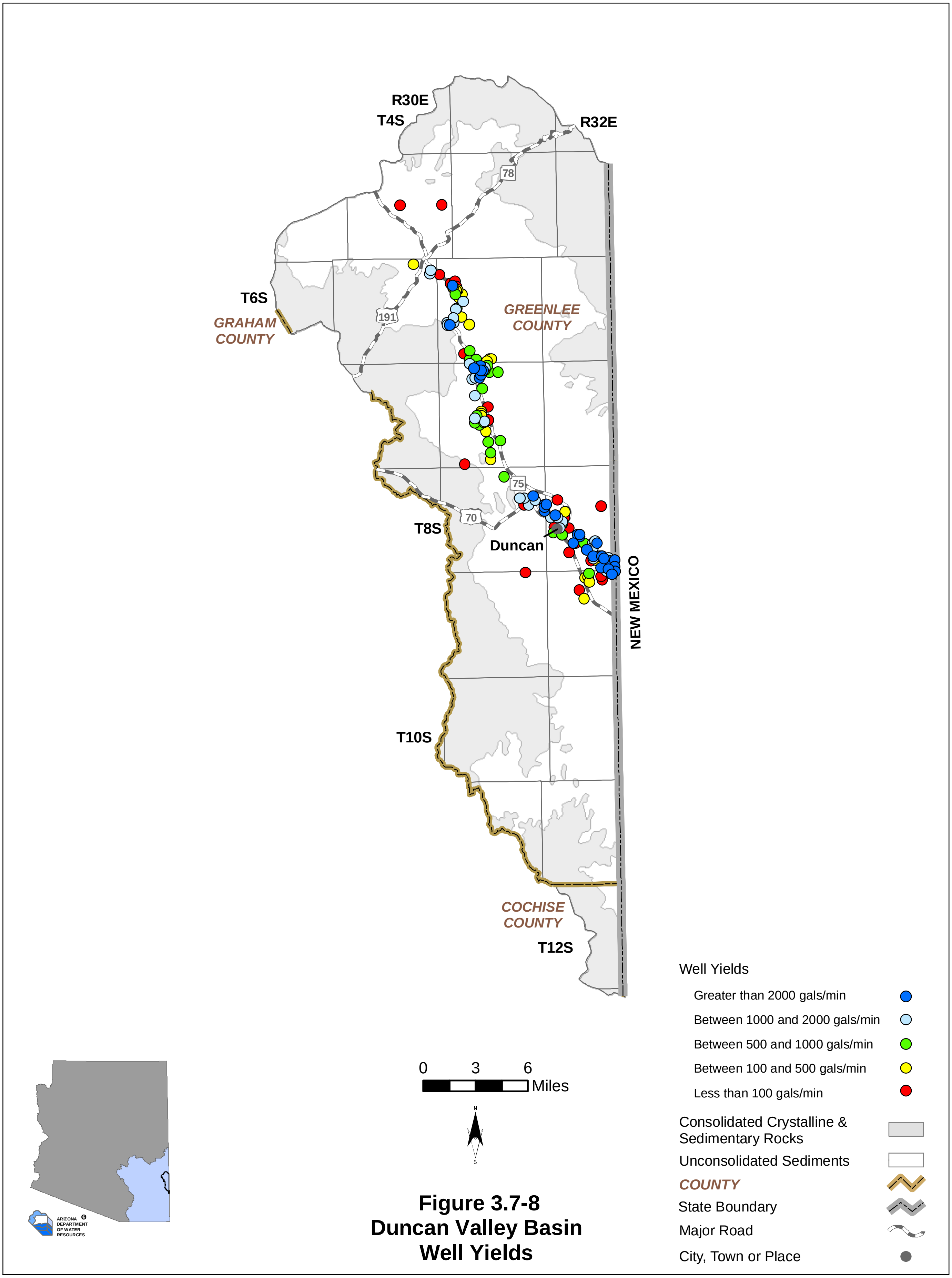


Figure 3.7-8
Duncan Valley Basin
Well Yields

3.7.7 Water Quality of the Duncan Valley Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded 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. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.7-7A.
- Drinking water standard exceedences have been reported for 37 wells in the basin.
- In the vicinity of Duncan almost all of the parameter exceedences in the sites measured were fluoride and arsenic.
- The parameter most frequently exceeded in this basin was arsenic.
- Other parameters exceeded in the sites measured in this basin included nitrate, total dissolved solids, mercury, cadmium and radionuclides.

Lakes and Streams

- 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.
- There are no Total Daily Maximum Load (TMDL) reports for this impaired reach.

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) Exceeding Drinking Water Standard[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

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

A. Wells, Springs and Mines (con't)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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

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

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/Nitrite
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
Se = Selenium
TDS = Total Dissolved Solids
[3] A&W = Aquatic and Wildlife

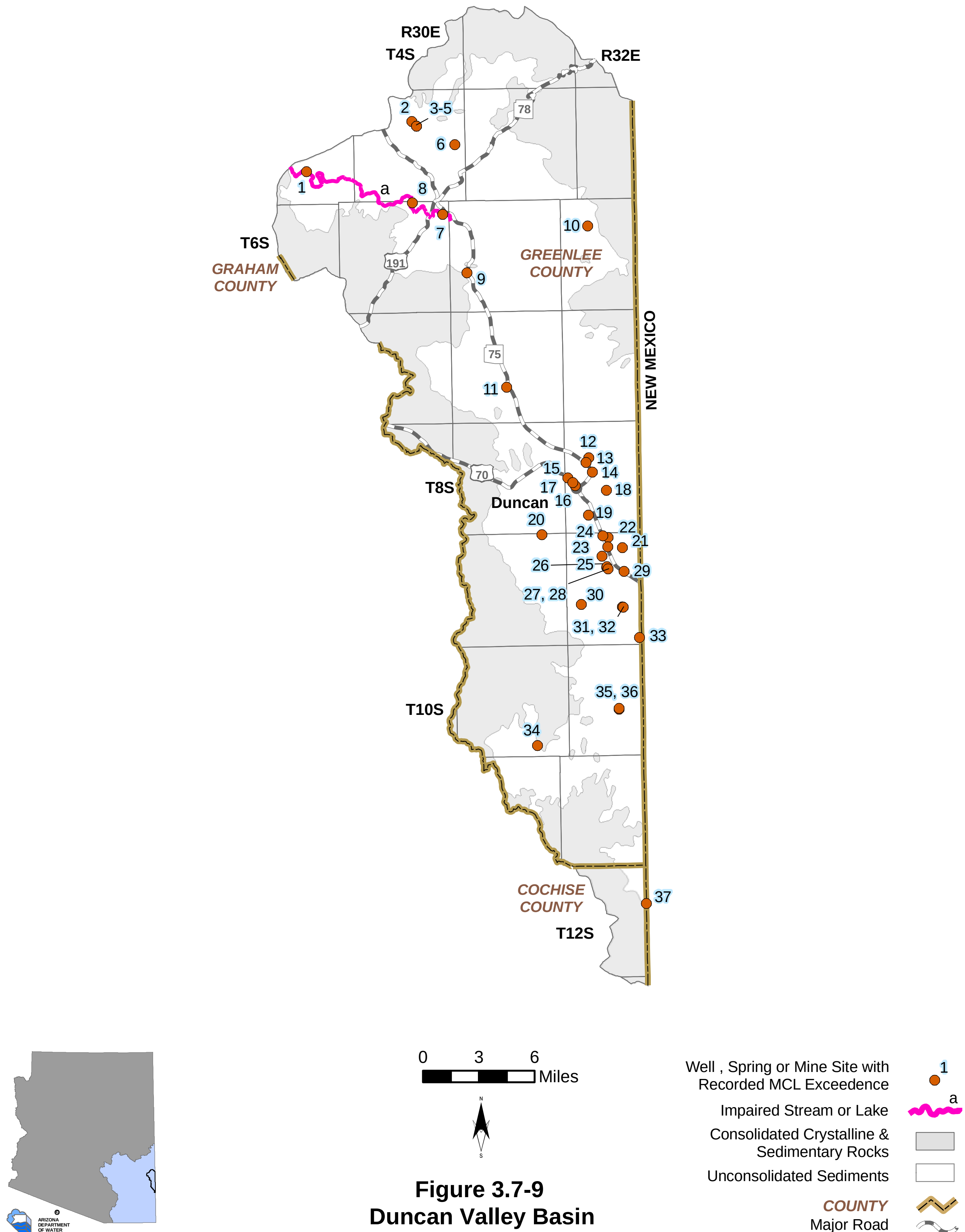


Figure 3.7-9
Duncan Valley Basin
Water Quality Conditions

3.7.8 Cultural Water Demands 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.7-8 and Figure 3.7-10.
- Population increased only minimally between 1980 and 2000. Projections suggest a more rapid growth rate through 2050.
- Total groundwater use has fluctuated between 1971 and 2003. The highest average annual groundwater use in this basin was from 1976 to 1980 at 24,000 acre-feet per year.
- Surface water diversions have also fluctuated between 1971 and 2003. The highest average annual surface-water diversions were from 1981 to 1985 at 22,000 acre-feet per year.
- Years with lower surface-water diversions coincide with years of increased groundwater use.
- All surface water demand between 1991 and 2003 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 acre-feet per year for the period from 1991-2003.
- Municipal demand has remained relatively constant as well, with an average of 650 acre-feet per year for the period from 2001-2003.
- As of 2003 there were 893 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 263 wells with a pumping capacity of more than 35 gallons per minute.

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.
- 45 acre-feet of effluent per year is generated by the facility and disposed of in an evaporation pond.

Table 3.7-8 Cultural Water Demands in the Duncan Valley Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) 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 $\le$ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">686[2]</td><td rowspan="10">245[2]</td><td colspan="3" rowspan="5">21,000</td><td colspan="3" rowspan="5">13,000</td><td rowspan="20">ADWR (1994)</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">24,000</td><td colspan="3" rowspan="5">16,000</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>3,225</td></tr>
<tr><td>1981</td><td>3,210</td><td rowspan="5">75</td><td rowspan="5">6</td><td colspan="3" rowspan="5">12,000</td><td colspan="3" rowspan="5">22,000</td></tr>
<tr><td>1982</td><td>3,195</td></tr>
<tr><td>1983</td><td>3,181</td></tr>
<tr><td>1984</td><td>3,166</td></tr>
<tr><td>1985</td><td>3,151</td></tr>
<tr><td>1986</td><td>3,136</td><td rowspan="5">18</td><td rowspan="5">4</td><td colspan="3" rowspan="5">7,000</td><td colspan="3" rowspan="5">20,000</td></tr>
<tr><td>1987</td><td>3,122</td></tr>
<tr><td>1988</td><td>3,107</td></tr>
<tr><td>1989</td><td>3,092</td></tr>
<tr><td>1990</td><td>3,077</td></tr>
<tr><td>1991</td><td>3,162</td><td rowspan="5">42</td><td rowspan="5">0</td><td rowspan="5">650</td><td rowspan="5">300</td><td rowspan="5">5,900</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5">21,500</td><td rowspan="13">USGS (2005) Gila Water Commis-sioner (2006)</td></tr>
<tr><td>1992</td><td>3,247</td></tr>
<tr><td>1993</td><td>3,332</td></tr>
<tr><td>1994</td><td>3,417</td></tr>
<tr><td>1995</td><td>3,502</td></tr>
<tr><td>1996</td><td>3,587</td><td rowspan="5">46</td><td rowspan="5">4</td><td rowspan="5">800</td><td rowspan="5">300</td><td rowspan="5">8,300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5">18,500</td></tr>
<tr><td>1997</td><td>3,672</td></tr>
<tr><td>1998</td><td>3,757</td></tr>
<tr><td>1999</td><td>3,842</td></tr>
<tr><td>2000</td><td>3,927</td></tr>
<tr><td>2001</td><td>3,948</td><td rowspan="3">15</td><td rowspan="3">4</td><td rowspan="3">650</td><td rowspan="3">300</td><td rowspan="3">11,500</td><td rowspan="3">NR</td><td rowspan="3">NR</td><td rowspan="3">14,500</td></tr>
<tr><td>2002</td><td>3,969</td></tr>
<tr><td>2003</td><td>3,989</td></tr>
<tr><td>2010</td><td>4,135</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>4,420</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>4,787</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2040</td><td>5,185</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>5,667</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">*ADDITIONAL WELLS:*[3]</td><td>11</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>893</td><td>263</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.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

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 Irrigation	Wildlife Area	Discharge to Another Facility	Groundwater Recharge			
Duncan WWTF	Town of Duncan	Duncan	600	45		X						Secondary	NA	2000

Notes:
NA: Data not currently available to ADWR
WWTF: Wastewater Treatment Facility

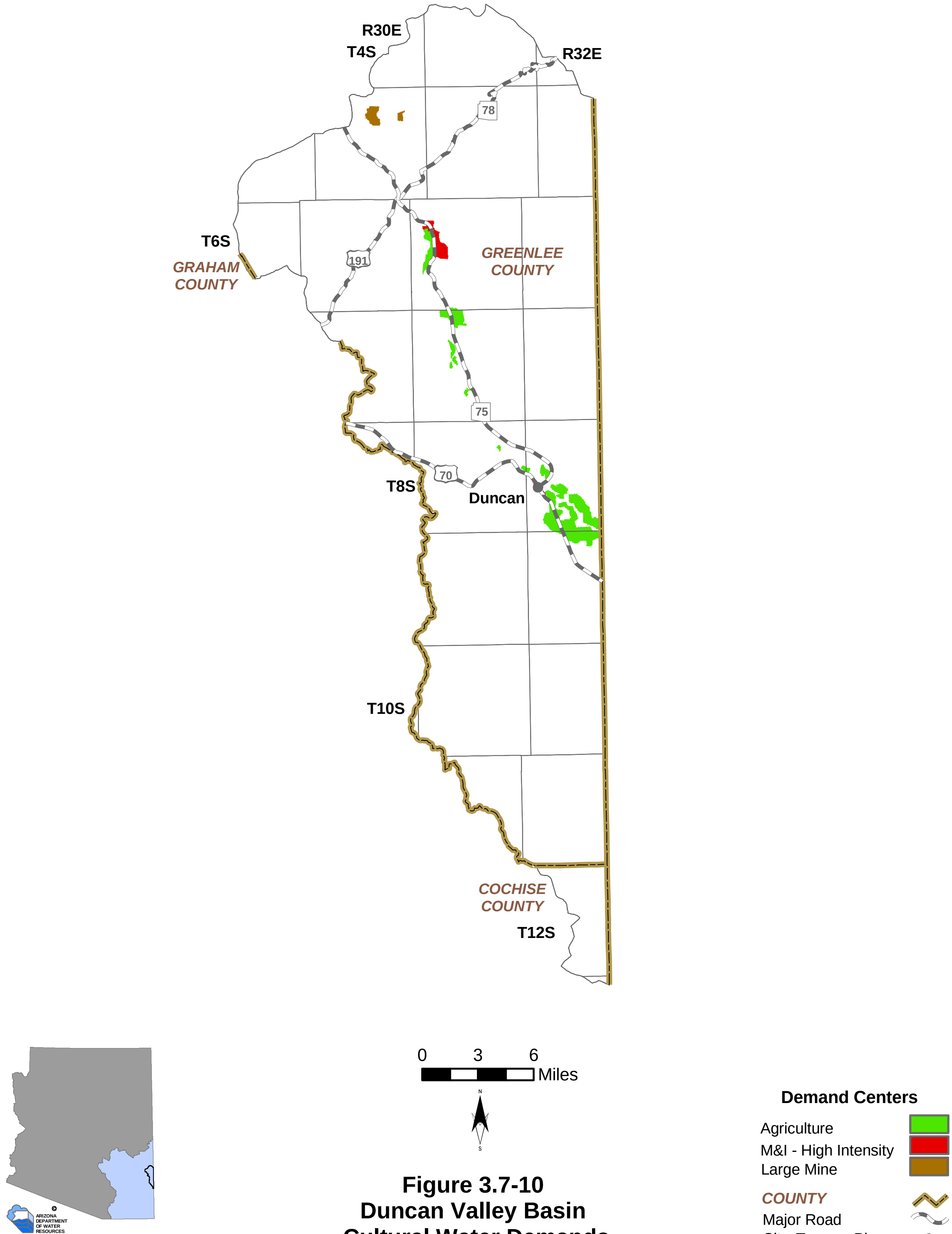


Figure 3.7-10
Duncan Valley Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

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 A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1

- Three water adequacy determinations have been made in this basin through May, 2005.
- One determination of inadequacy has been made in the northern portion of the basin near Highway 78.
- The determination of inadequacy was because the applicant chose not to submit necessary information and/or available hydrologic data was insufficient to make a determination.
- All lots receiving a water adequacy determination are in Greenlee County. Of the 263 lots, 61 lots or 23% were determined to be adequate.

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

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

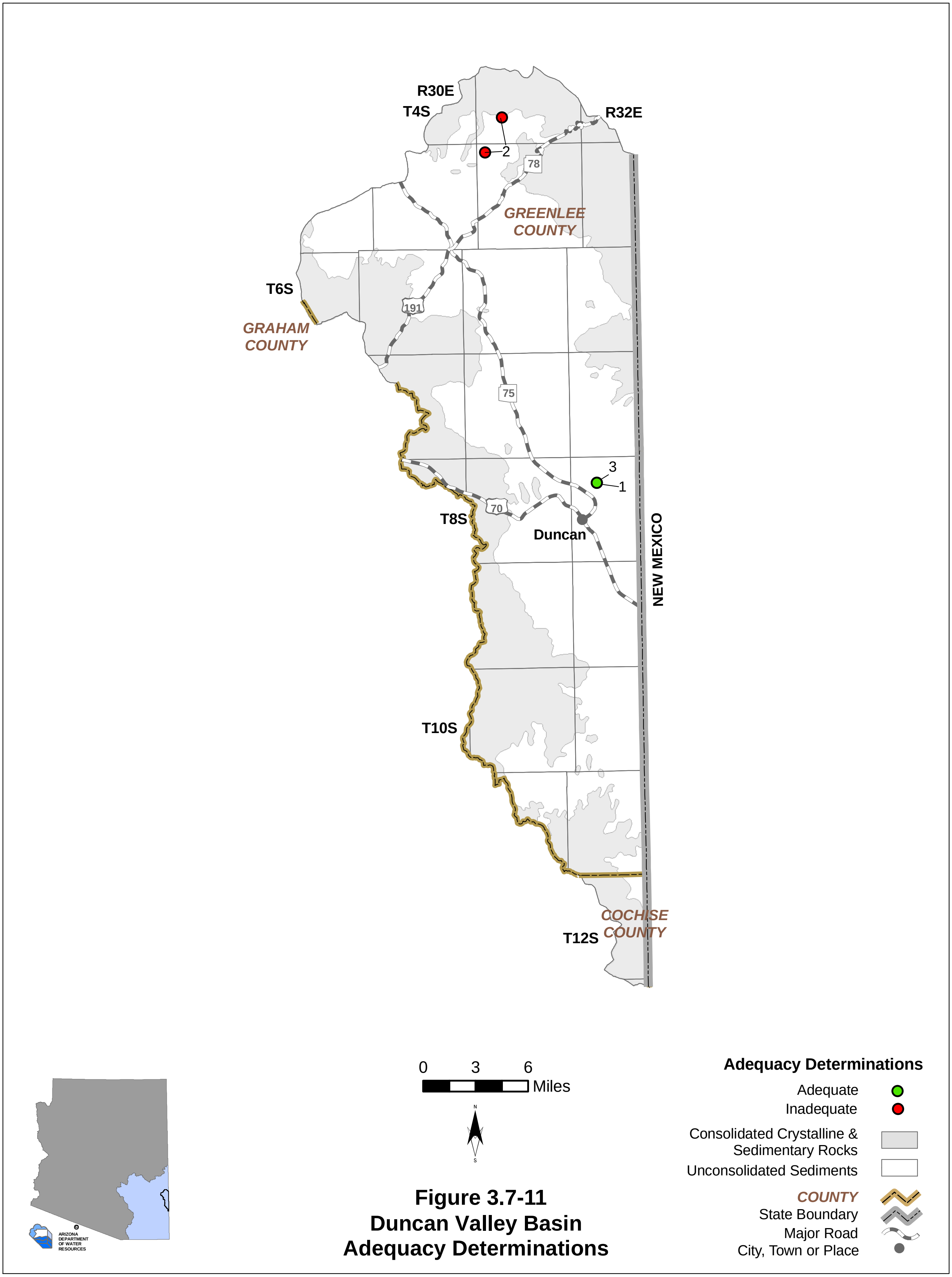


Figure 3.7-11
Duncan Valley Basin
Adequacy Determinations

DUNCAN VALLEY BASIN
References and Supplemental Reading

References

A

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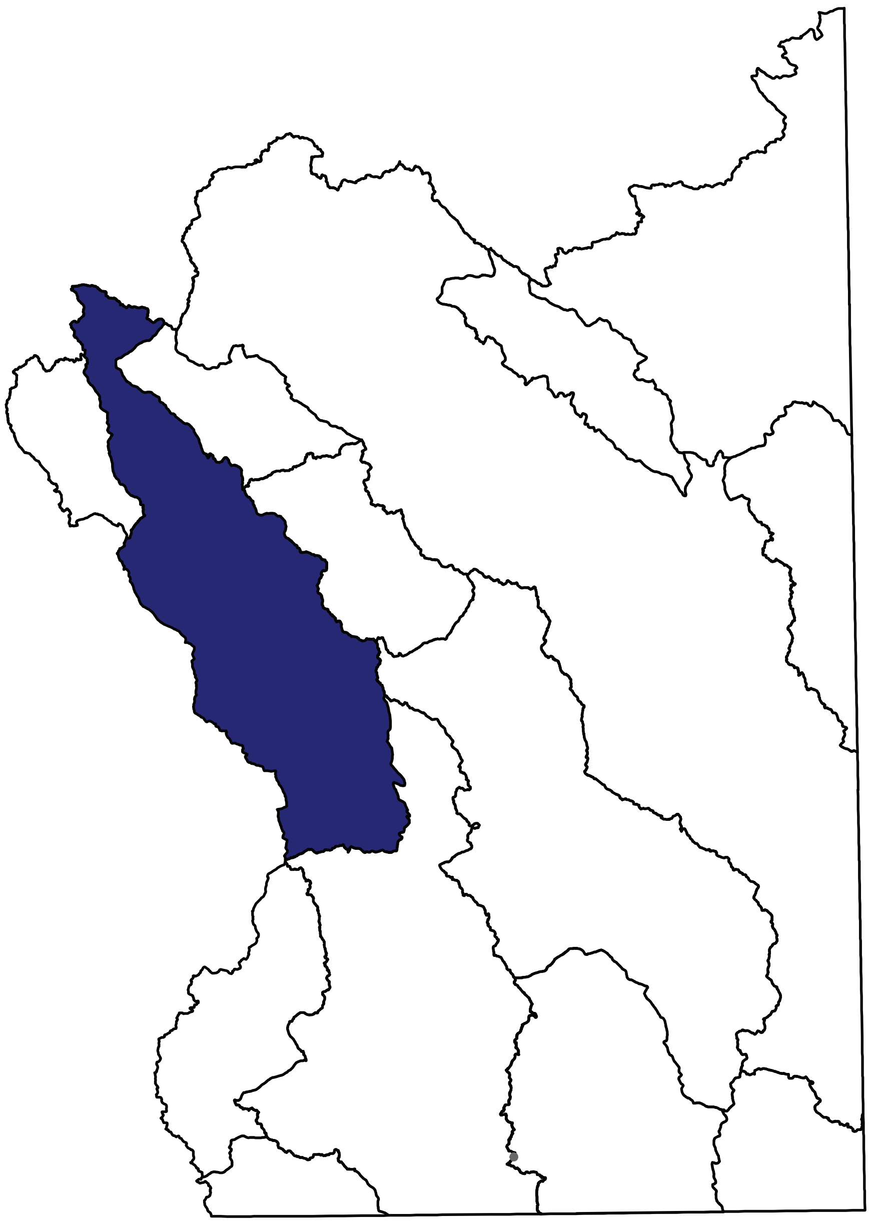
Duncan Valley Basin Index to Section 3.0

Section 3.8
Lower San Pedro Basin

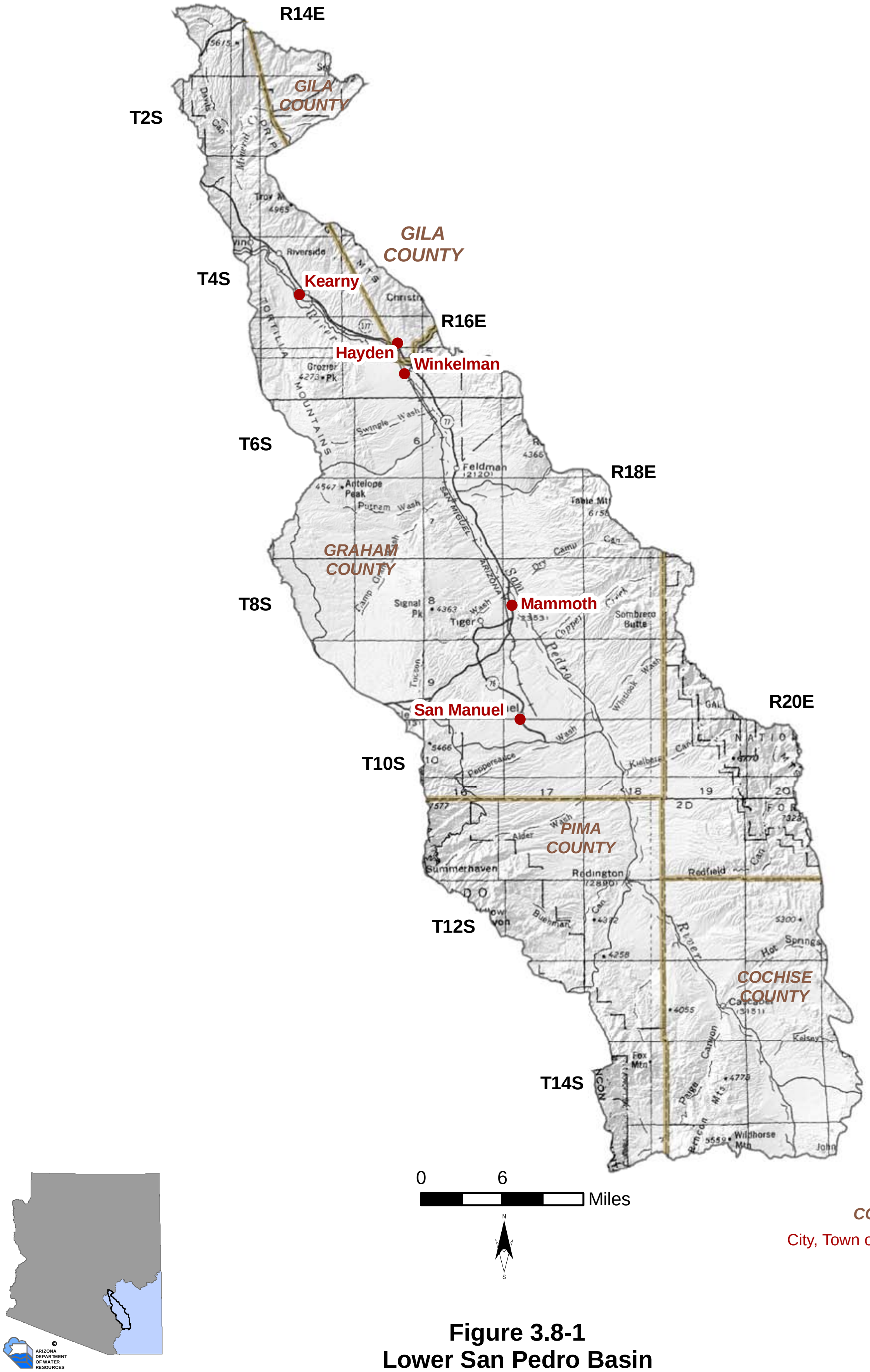


3.8.1 Geography of the Lower San Pedro Basin

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, washes and a diversity of vegetation types such as semi-desert grassland, evergreen woodland, desert scrub, chaparral and conifer forest.

- Principal geographic features shown on Figure 3.8-1 are:
    - Principal basin communities of Winkelman, Kearny, San Manuel, Mammoth and Hayden
    - Smaller basin communities of Redington and Cascabel in the southern half of the basin
    - 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

- Geographic features not well shown on Figure 3.8-1 are:
    - Santa Catalina Mountains to the west and southwest of San Manuel
    - Rincon Mountains along the southwestern boundary, which include the highest point in the basin at 7,960 feet
    - Dripping Springs Mountains to the northeast
    - Galiuro Mountains to the southeast.



Base Map: USGS 1:500,000, 1981

Figure 3.8-1
Lower San Pedro Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest 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 and Wilderness

- 15.3% of the land is federally owned and managed as national forest and wilderness.
- 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.
- 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 Bureau of Land Management.
- 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.
- Primary land uses are grazing and recreation.

Indian Reservations

- 1.6% of land is under ownership of the San Carlos Apache Tribe.
- The small portion of the San Carlos Apache Indian Reservation is located east of Dudleyville.
- Primary land use is grazing.

Parks, Monuments, Historical and Recreational Sites

- 0.8% of land is federally owned and managed by the National Park Service.
- A small portion of Saguaro National Park is in the southwestern corner of the basin.
- Primary land use is 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.

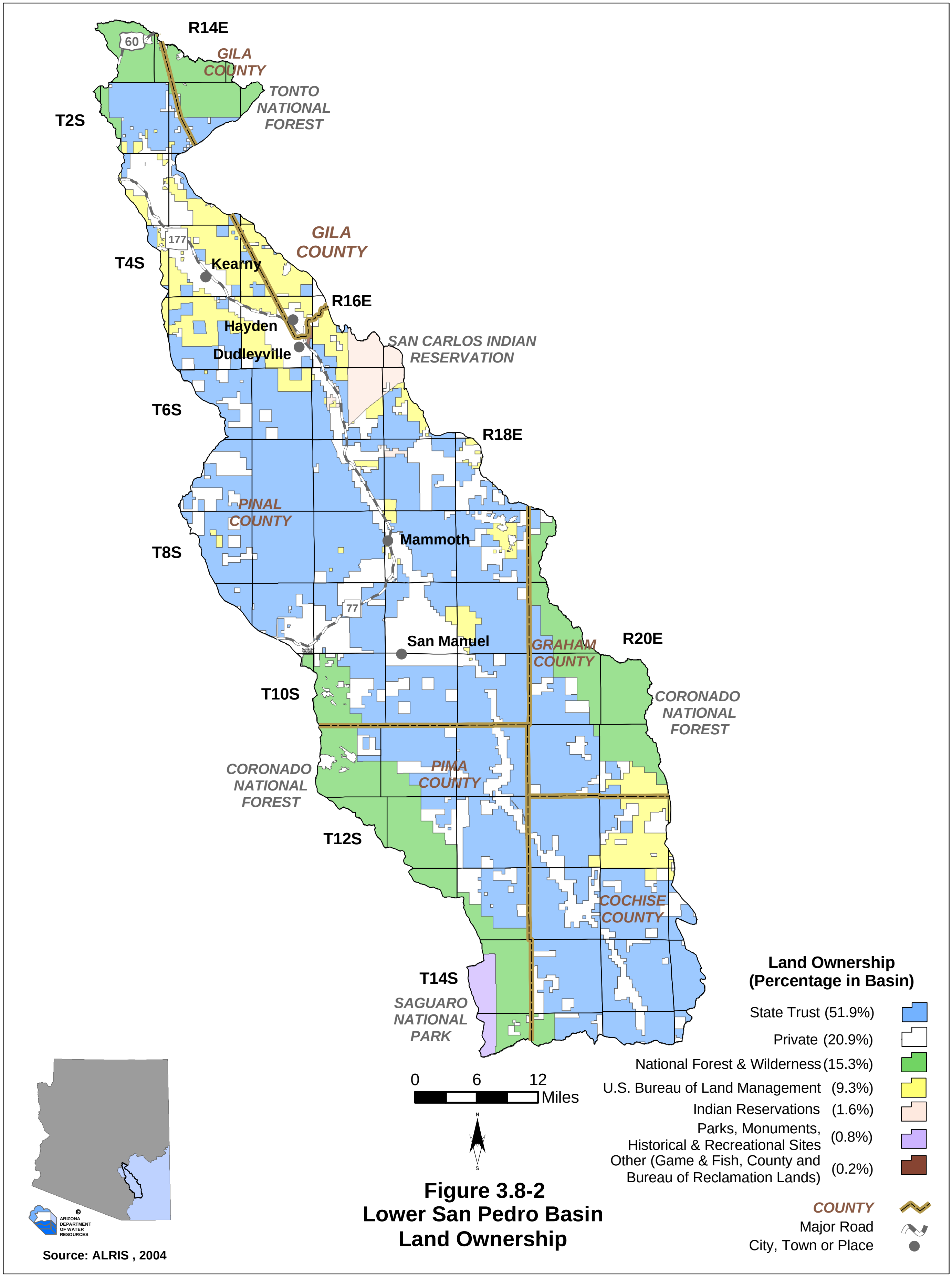


Figure 3.8-2
Lower San Pedro Basin
Land Ownership

3.8.3 Climate of the Lower San Pedro Basin

Climate data from NOAA/ NWS Coop Network stations are complied in Table 3.8-1 and their locations are shown on Figure 3.8-3. The Lower San Pedro Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.8-1A
- There are six NOAA/NWS Coop network climate stations in the basin.
- Of the six stations, data from different periods of record may be used as shown in the table. The variety of dates may be due to discontinued measurements, date of installation or other availability issues.
- The six stations are distributed throughout the basin.
- Station elevations range from 2,080 feet at Winkleman 6 S to 7,960 feet at Palisade Ranger Station in the Santa Catalina Mountains.
- Maximum average temperatures range from 64.9°F at Palisade Ranger Station to 86.4°F at Winkleman 6 S.
- Minimum average temperatures range from 34.5°F at Palisade Ranger Station to 47.6°F at Cascabel.
- Average annual precipitation is varied with the highest, 32.24 inches, at Palisade Ranger Station and the lowest, 14.33 inches, at Cascabel.
- All stations report highest average precipitation in the summer (July - September) and lowest in the spring (April – June).
- Additional precipitation data shows rainfall as high as 36 inches at the Santa Catalina Mountains southwest of San Manuel and as low as 14 inches at the San Pedro River Valley in the vicinity of Dudleyville.
- Precipitation increases as elevation increases in this basin. The range of 24 inches between areas of highest and lowest precipitation recorded is relatively high for the planning area.

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, 2003.

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			

Source: WRCC, 2003.

C. AZMET:

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

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

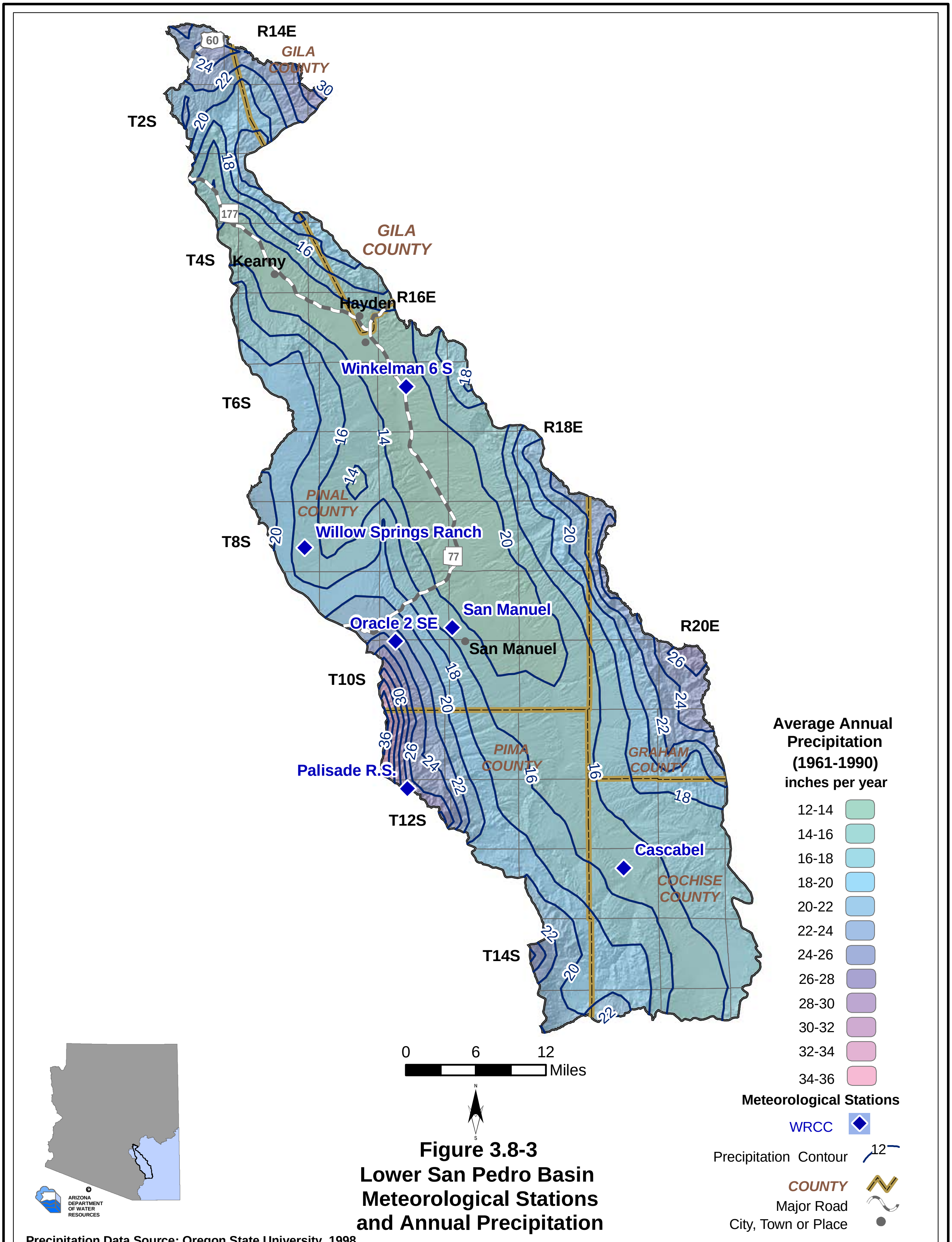


Figure 3.8-3
Lower San Pedro Basin
Meteorological Stations
and Annual Precipitation

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 as of September 2004 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, using the USGS number, is shown on Figure 3.8-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.8-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.8-2.
- Data from 11 stations, including eight discontinued stations, are shown on the table and on Figure 3.8-4.
- These stations are located on the Gila River, the San Pedro River, the Peck Canyon tributary and Aravaipa Creek.
- The average seasonal flow as a percentage of annual flow for most of the stations is highest in the Summer (July-September) and lowest in the Spring (April-June).
- High Winter (January-March) percentages were found at three stations and one station’s average seasonal flow is almost equal for the Winter, Spring and Summer due to the controlled release of water from Coolidge Dam.
- Maximum annual flow in this basin was 2,375,696 acre-feet in 1993 on the Gila River. Minimum annual flow was 17 acre-feet in 1969 on the Peck Canyon tributary.

Flood ALERT Equipment

- Refer to Table 3.8-3.
- There are four stations in the basin as of October 2005.
- Two stations are precipitation stations, one is a precipitation/stage station and one is a repeater/precipitation station.

Reservoirs and Stockponds

- Refer to Table 3.8-4.
- There are seven small reservoirs in this basin.
- Four of the small reservoirs have a maximum storage capacity of 360 acre-feet. The remaining three small reservoirs have a total surface area of 33 acres.
- There are an estimated 648 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.8-4.
- Average annual runoff varies from 0.5 inches per year in the vicinity of the San Pedro River to one inch per year on the eastern and western boundaries of the basin.

Table 3.8-2 Streamflow Data for the Lower San Pedro Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	NA	9/1917-9/1994 (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	4,660	1/1943-6/1998 (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	NA	7/1998-current	2	0	57	41	2,325 (2002)	13,451	19,491	48,736 (2000)	4
9472100	Peck Canyon Tributary near Redington	8	3,680	10/1967-9/1972 (discontinued)	0	3	90	8	17 (1969)	71	78	152 (1971)	4
9472500	San Pedro River near Mammoth	3,583	NA	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	4,530	5/1931-current	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	NA	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	4,520	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[1]	5,125	NA	1/1911-9/2004	31	23	23	14	56,398 (1961)	324,351	370675	2,375,969 (1993)	93

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

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
NA= Not available to ADWR
[1]Real-time gage

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

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)[1]

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					

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

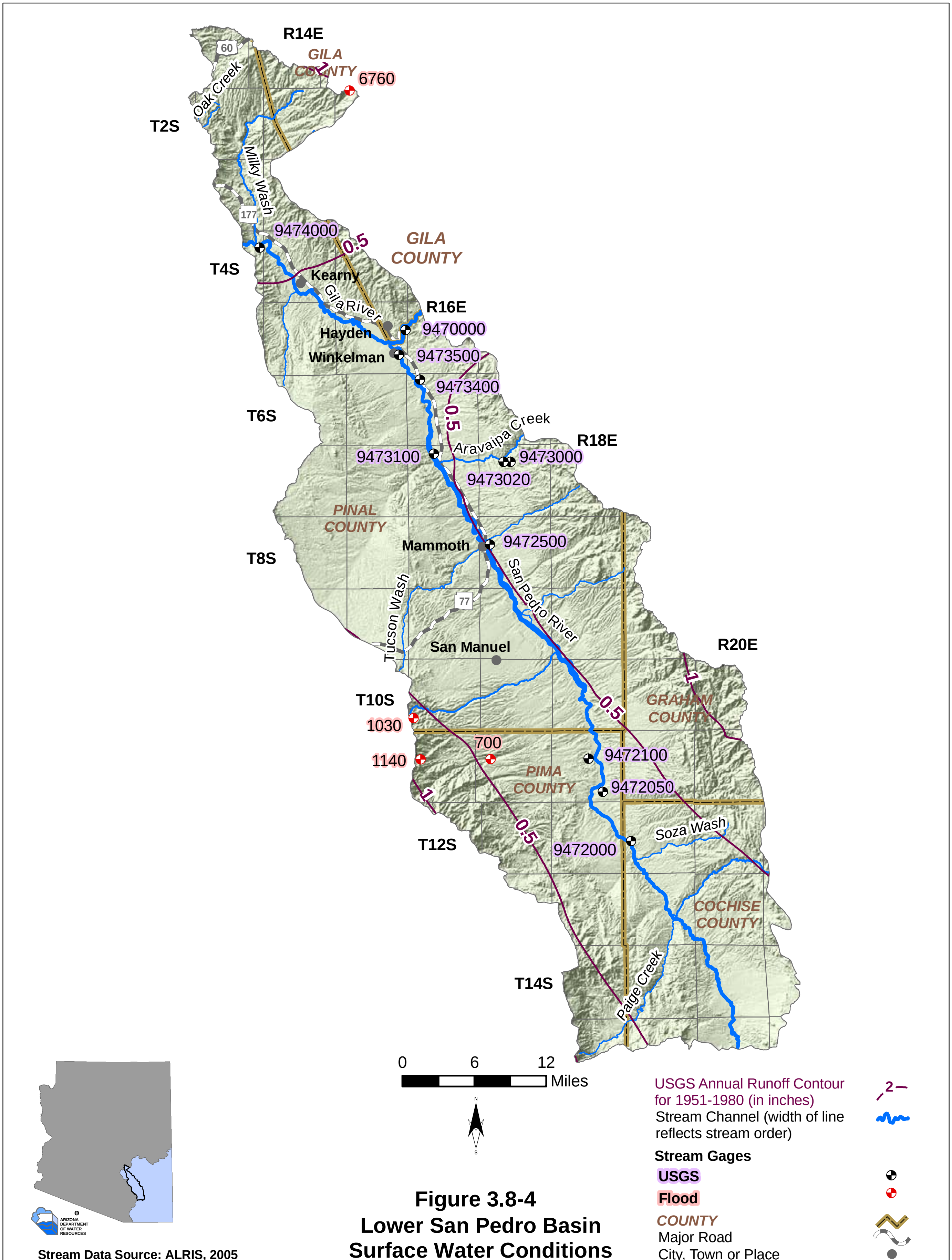


Figure 3.8-4
Lower San Pedro Basin
Surface Water Conditions

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 3.8-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are a number of perennial streams located throughout the basin.
- Numerous intermittent streams are also located throughout the basin.
- The San Pedro River is predominantly an intermittent stream in the basin with small sections where it is perennial south of Dudleyville and in the vicinity of the Pima County/Cochise County line.
- The Gila River through this basin is considered an intermittent stream because its flow is controlled by releases from Coolidge Dam to meet legal obligations.
- There are 14 major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time.
- Listed discharge rates may not be indicative of current conditions. Most of the measurements were taken prior to 1990 and many of the major spring measurements were taken in the 1950's. Only four minor spring measurements post-date 1990.
- There are two clusters of major springs, one north of Mammoth and the other in the southeastern portion of the basin. The greatest discharge rate was measured at the beginning of a perennial reach of the San Pedro River south of Dudleyville (Cooks Lake, 1,000 gpm).
- Over half of the major springs discharge less than 40 gpm.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.8-5. There are 31 minor springs identified in this basin.
- 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
14	Sycamore Saddle	324921	1102944	10[4]	08/1986

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
Davis	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

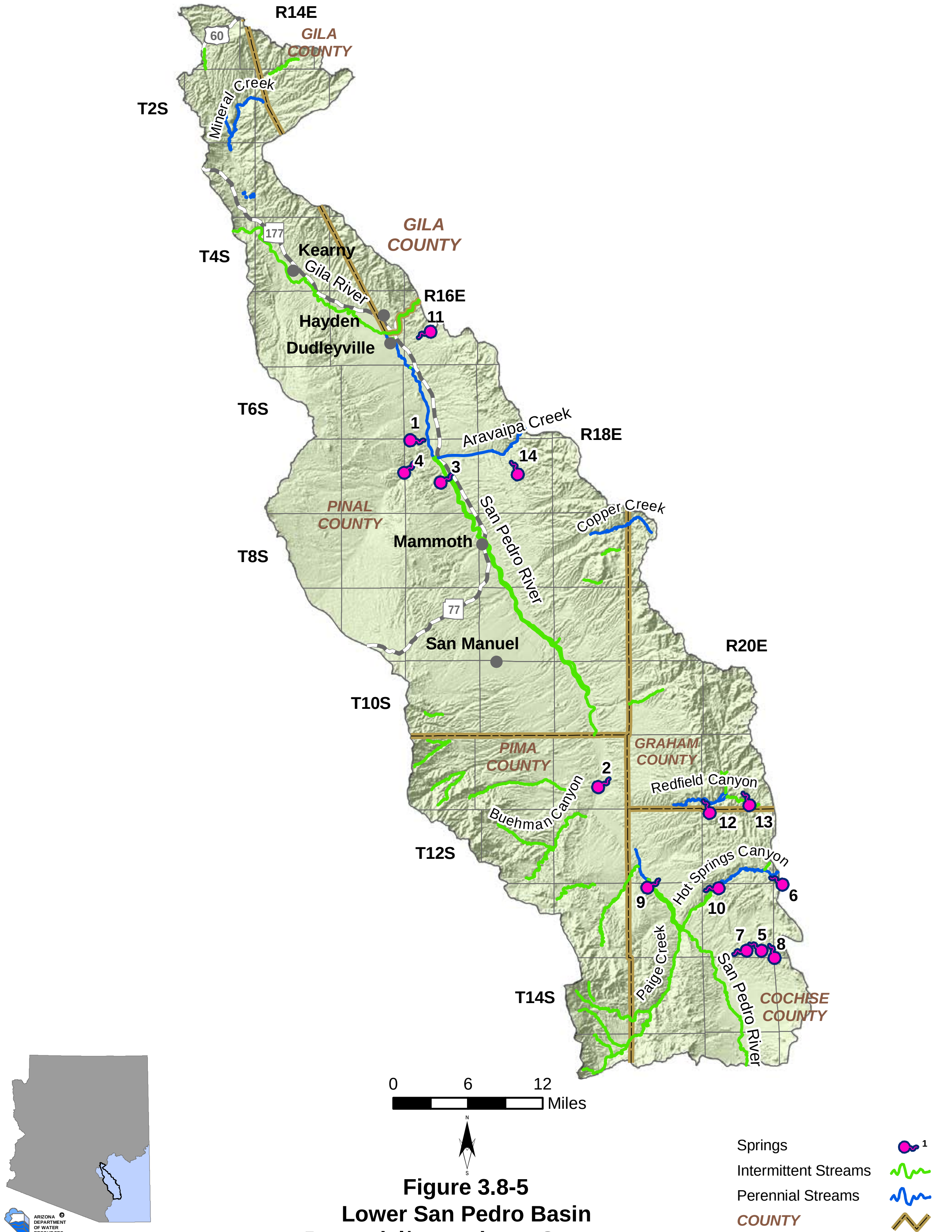
Table 3.8-5 Springs in the Lower San Pedro Basin (Con't)

B. Minor Springs (con't.):

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
Unnamed	325745	1103935	2	06/1950
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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 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]Most recent measurement < 10 gpm
[5]Most recent measurement < 1 gpm



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

Figure 3.8-5
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 3.8-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.8-7 contains hydrographs for selected wells shown on Figure 3.8-6. Figure 3.8-8 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.8-6 and Figure 3.8-6.
- The major aquifers in the basin are basin fill, consisting of younger basin fill, older basin fill and basal conglomerate, and recent stream alluvium and basin fill.
- 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.

Well Yields

- Refer to Table 3.8-6 and Figure 3.8-8.
- As shown on Figure 3.8-8 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 181 reported wells, indicates that the median well yield in this basin is 1,000 gpm.
- In general, well yields along the San Pedro River are high. All well yields in consolidated crystalline and sedimentary rocks are less than 100 gpm.

Natural Recharge

- Refer to Table 3.8-6.
- Principal sources of recharge in this basin are mountain-front recharge and streambed infiltration.
- There are three natural recharge estimates for this basin ranging from 24,000 acre-feet per year to 29,000 acre-feet per year. The latter, from a 1995 Anderson and Freethey study, is the most recent estimate.

Water in Storage

- Refer to Table 3.8-6. Water levels are shown for wells measured in 2003-2004.
- There are three storage estimates for this basin ranging from 11 million acre-feet to more than 27 million acre-feet. The most recent estimate, from ADWR reports in 1990 and 1994, indicates that estimated storage is between 12 million and 25.6 million acre-feet to a depth of 1,200 feet.
- The predevelopment water storage estimate is 11 million acre-feet.

Water Level

- Refer to Figure 3.8-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 19 index wells in this basin.
- In 1994, the year of the last water level sweep, 274 wells were measured.
- 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.
- The majority of water level changes between 1990-1991 and 2003-2004 have been a one foot to 15 feet decline.
- Hydrographs corresponding to selected wells shown on Figure 3.8-6 but covering a longer time period are shown in Figure 3.8-7.

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 1295 (10 wells measured)	Measured by ADWR and/or USGS
	Range 1 - 4,000 Median 1,000 (181 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 70 - 2,700	ADWR (1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	29,000	Anderson and Freethey (1995)
	25,000	ADWR (1994)
	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 1994)
	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:	1994 (274 wells measured)	

[1]Predevelopment Estimate

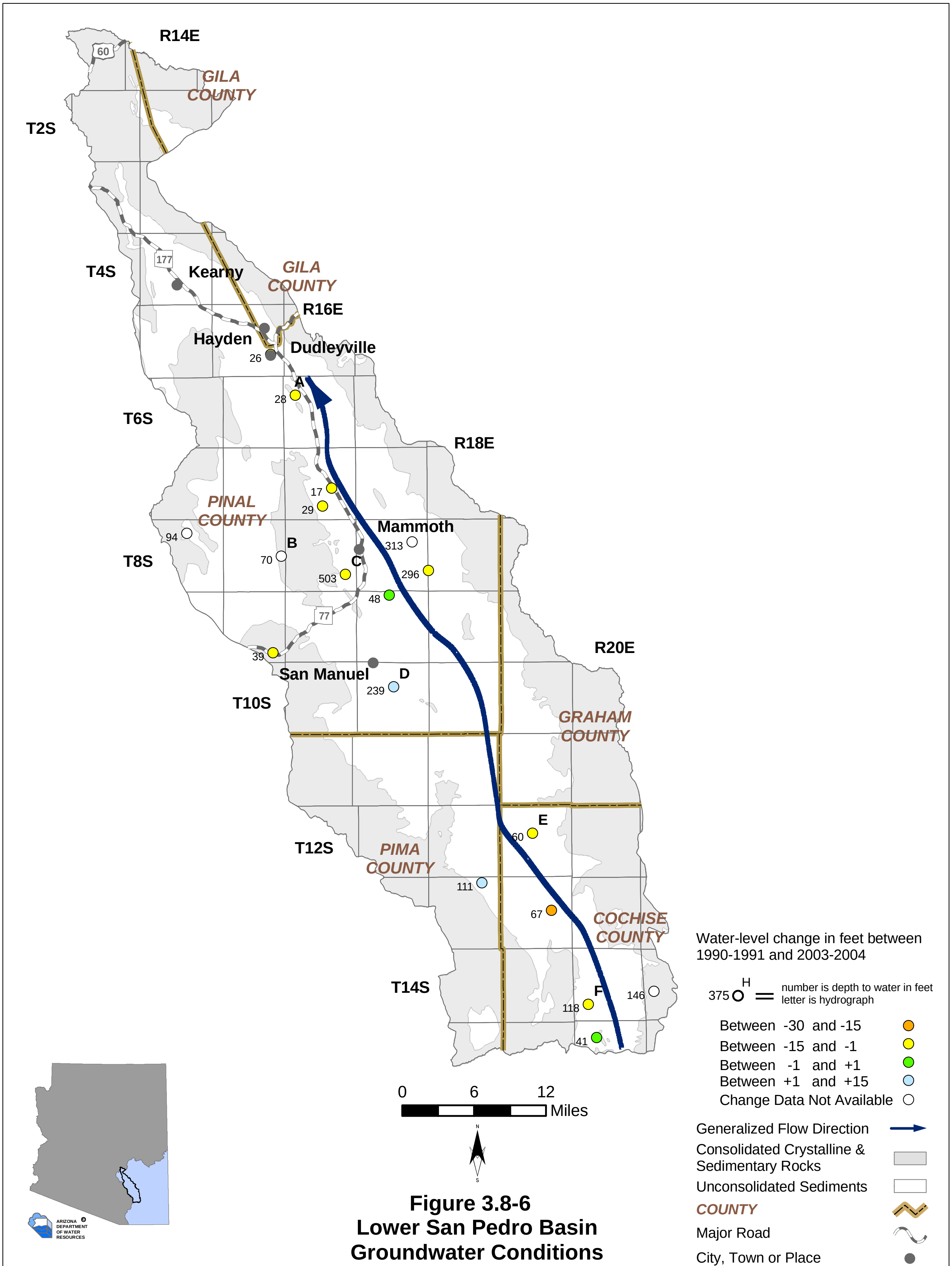


Figure 3.8-6
Lower San Pedro Basin
Groundwater Conditions

Figure 3.8-7
Lower San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

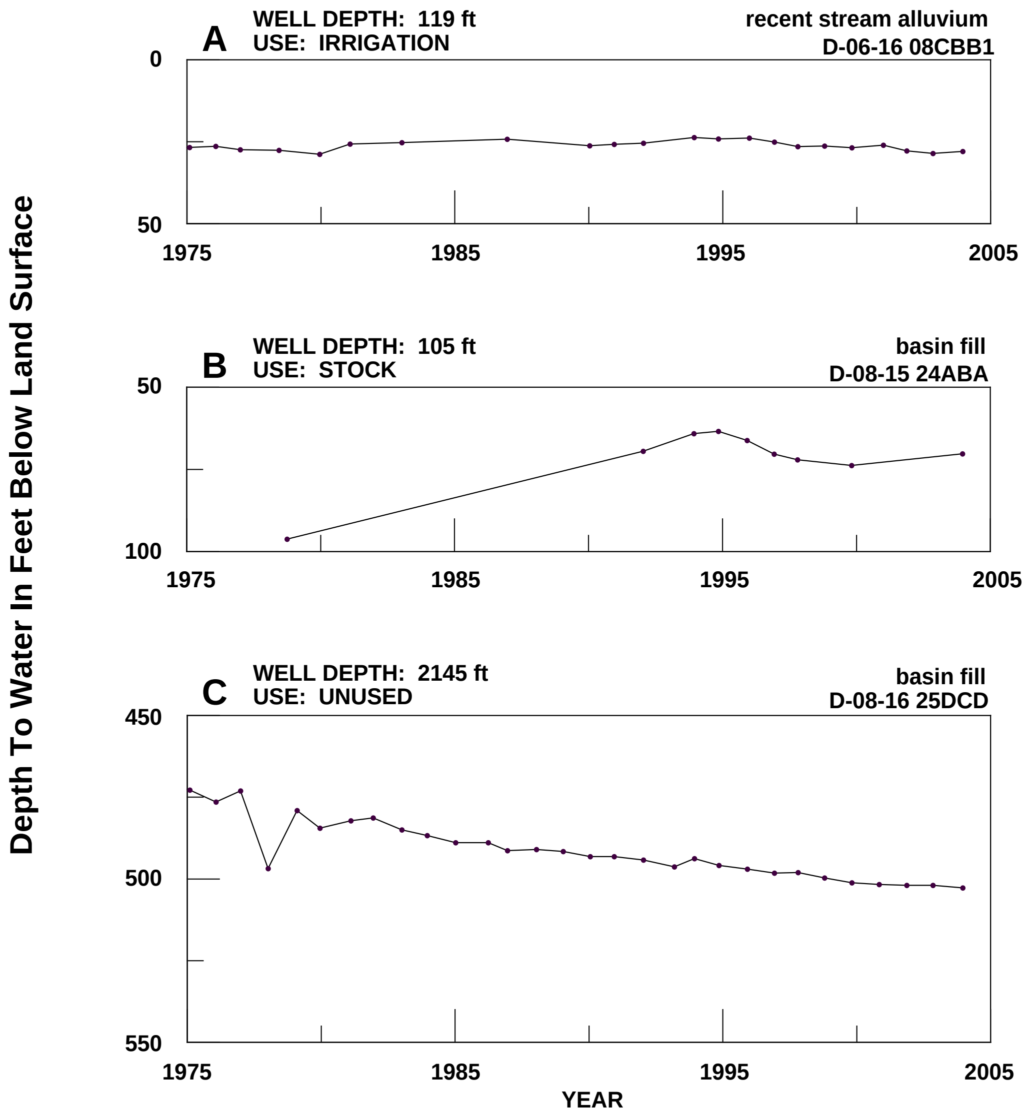
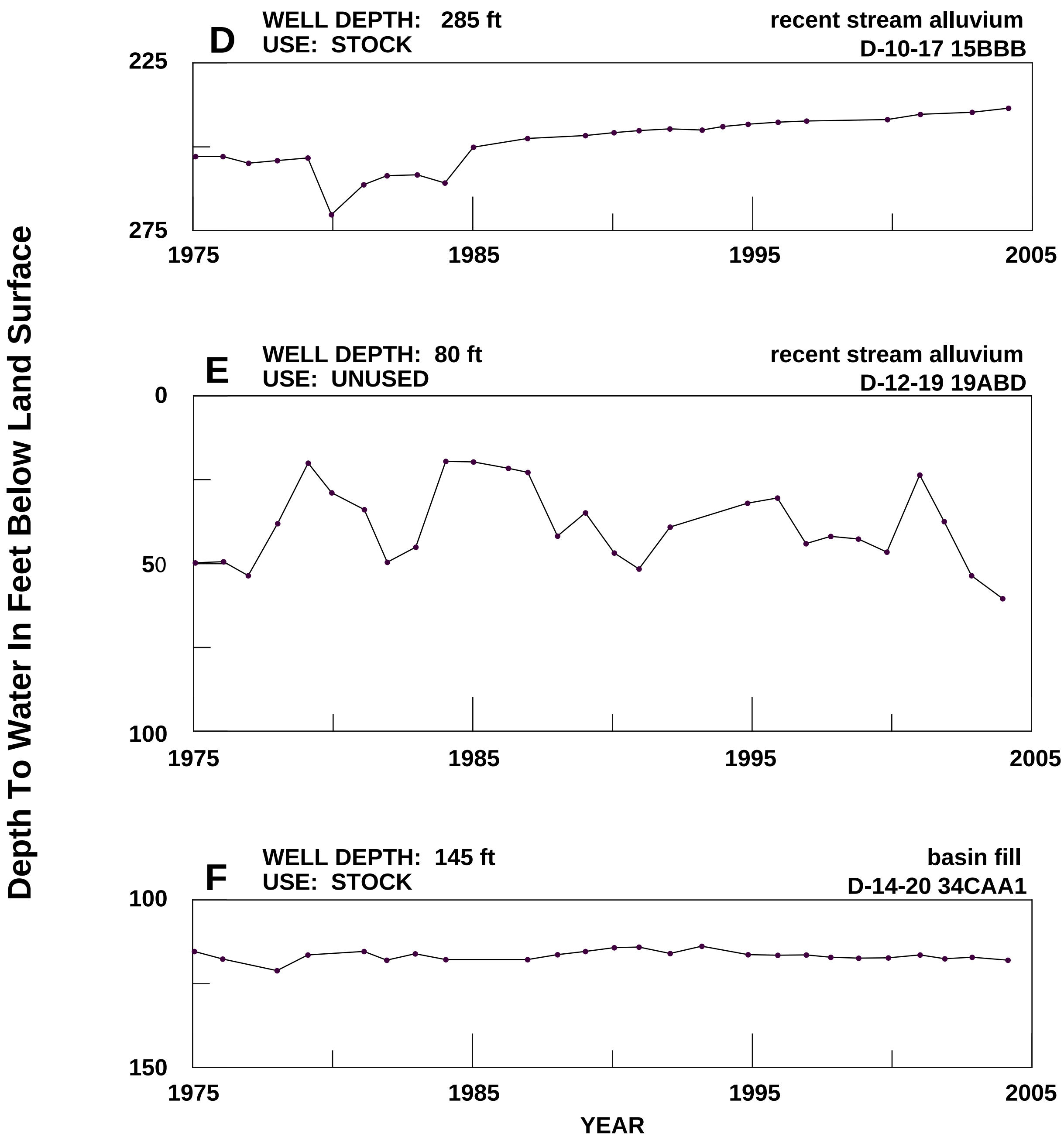


Figure 3.8-7 (Con't.)
Lower San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells



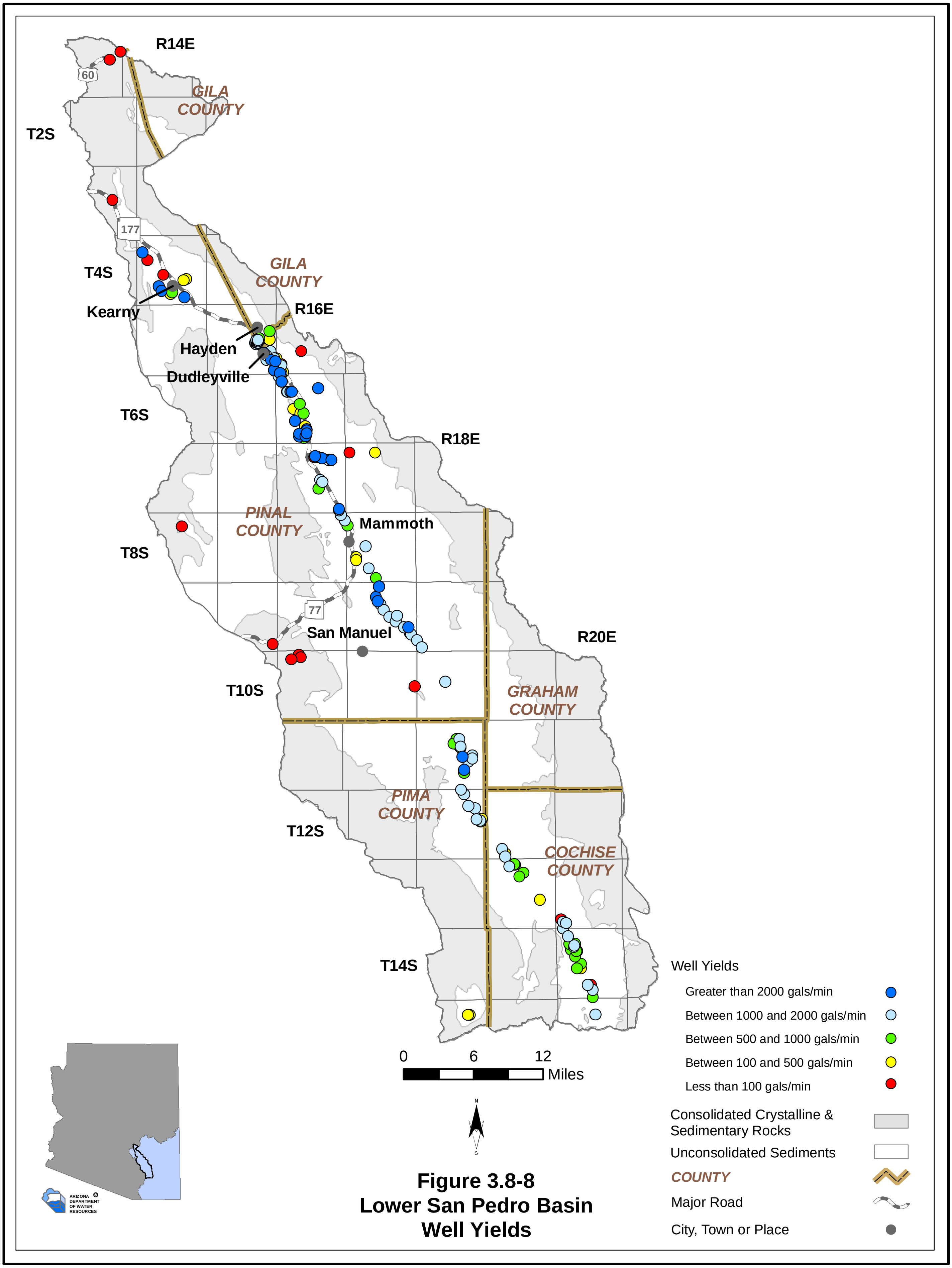


Figure 3.8-8
Lower San Pedro Basin
Well Yields

3.8.7 Water Quality of the Lower San Pedro Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded 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 3.8-9 shows the location of exceedences and impairment keyed to Table 3.8-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.8-7A.
- Drinking water standard exceedences were reported for 56 wells in the basin.
- Unlike most other basins there was a diverse assortment of parameters exceeding drinking water standards in this basin. The parameter most frequently exceeded in this basin was fluoride.
- In the vicinity of Hayden and Dudleyville the most frequently exceeded parameter in the sites measured was cadmium.
- In the vicinity of Mammoth the most frequently exceeded parameters in the sites measured were arsenic and fluoride.
- Other parameters that were commonly exceeded are nitrates, total dissolved solids, lead, antimony, beryllium and radionuclides.

Lakes and Streams

- 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.
- The longest impaired reach was 15 miles of the San Pedro River.
- Mineral Creek is part of the ADEQ water quality improvement effort called the Total Maximum Daily Load (TMDL) program. The TMDL report has not yet been completed for this stream, however, cleanup by the mining company ASARCO is ongoing.
- 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 River Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

Table 3.8-7 Water Quality Exceedences in the Lower San Pedro River Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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

Table 3.8-7 Water Quality Exceedences in the Lower San Pedro River Basin[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,

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/Nitrite
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

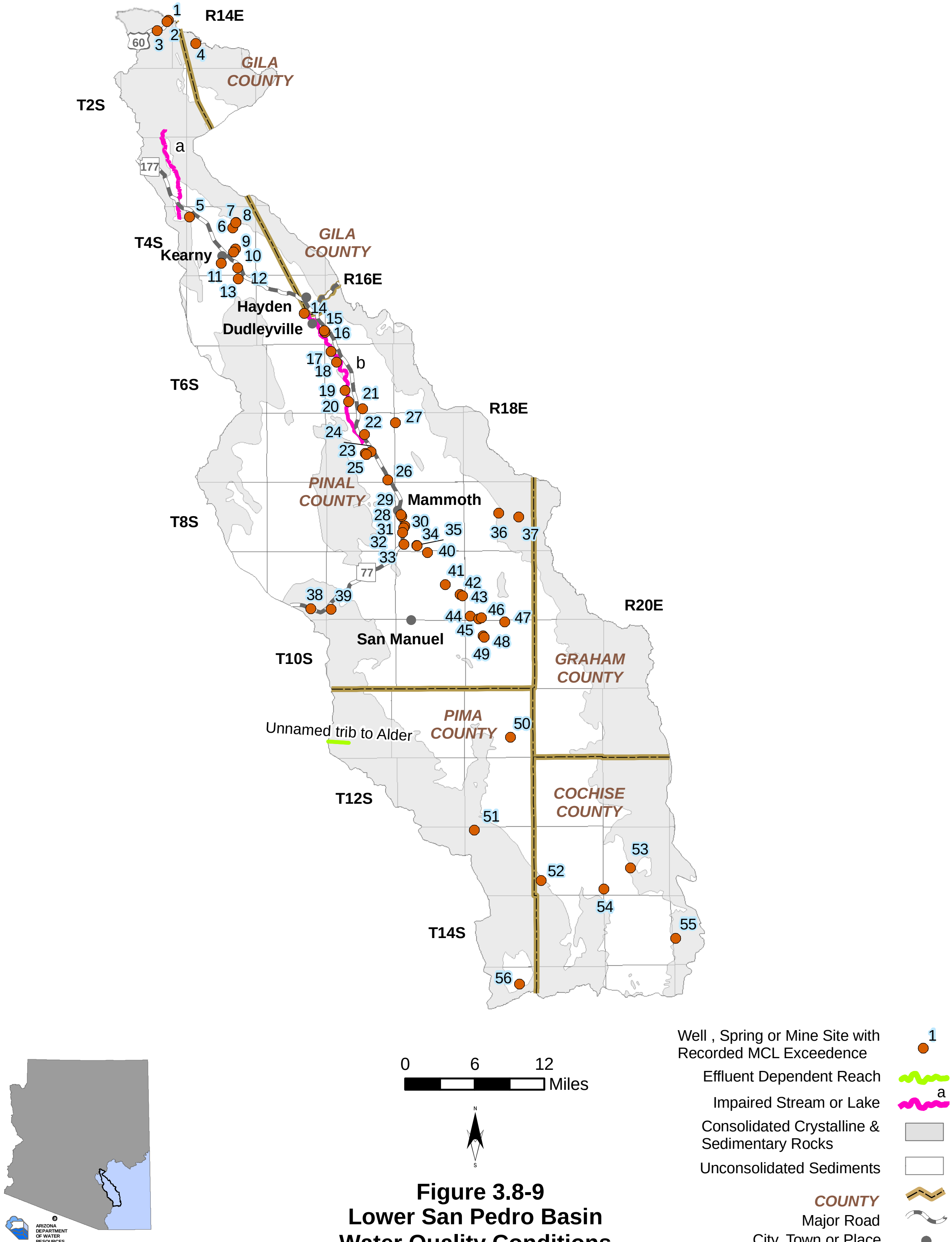


Figure 3.8-9
Lower San Pedro Basin
Water Quality Conditions

3.8.8 Cultural Water Demands 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 3.8-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.8-8 and Figure 3.8-10.
- Population decreased in this basin by about 340 residents a year from 1980 to 1990 and increased only minimally between 1991 and 2000. Projections suggest a more rapid growth rate through 2050.
- Total groundwater demand has decreased from 1971 to 2003 with an average of 32,000 acre-feet pumped per year in the period from 2001-2003.
- Surface water diversions have also decreased from 1971 to 2003 with less than 1,000 acre-feet diverted per year in the period from 1991 – 2003.
- All surface water demand between 1991 and 2003 has been for agriculture, however, over 90% of the agricultural water supply is groundwater.
- The majority of agricultural demand is along Highway 177, Highway 77 and along the San Pedro River in Pima and Cochise Counties.
- The largest single demand for groundwater is industrial with an average of 19,000 acre-feet per year pumped in the period from 2001-2003.
- Industrial water demand in this basin is the highest in the planning area.
- There are numerous mines in the basin. The active Ray Mine north of Kearney, 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 2,000 acre-feet per year pumped in the period from 2001-2003. 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 2003 there were 1,589 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 1,088 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 3.8-9.
- There are five wastewater treatment facilities in the basin.
- Almost 8,000 people are served by these facilities.
- 400 acre-feet of effluent per year are generated in this basin.

- One facility, the Kearney Wastewater Treatment Facility, discharges wastewater for irrigation.
- Discharge from one facility, the Mammoth Wastewater Treatment Facility, recharges the aquifer through an unlined impoundment. This facility is not permitted by the Department as an Underground Storage Facility.

Table 3.8-8 Cultural Water Demands in the Lower San Pedro Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971										
1972										
1973					56,000			6,000		
1974										
1975										
1976		1,142[2]	235[2]							
1977										
1978					56,000			6,000		
1979										
1980	19,300									ADWR (1994)
1981	18,960									
1982	18,620									
1983	18,279	68	18		47,000			6,000		
1984	17,939									
1985	17,599									
1986	17,259									
1987	16,919									
1988	16,578	86	9		40,000			6,000		
1989	16,238									
1990	15,898									
1991	15,968									
1992	16,037									
1993	16,107	112	6	2,500	18,500	13,000	NR	NR	<1,000	
1994	16,177									
1995	16,247									
1996	16,316									
1997	16,386									USGS (2005) ADWR (2005)
1998	16,456	97	1	2,500	14,000	13,000	NR	NR	<1,000	
1999	16,525									
2000	16,595									
2001	16,706									
2002	16,817	33	0	2,000	19,000	11,000	NR	NR	<1,000	
2003	16,929									
2010	17,707									
2020	21,124									
2030	23,786									
2040	25,665									
2050	27,333									
ADDITIONAL WELLS:[3]		**51**								
WELL TOTALS:		**1589**	**269**							

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

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 Irrigation	Wildlife Area	Discharge to Another Facility	Groundwater Recharge			
Hayden Collection Systems	Town of Hayden	Hayden	910	NA						Winkleman WWTP		NA		2003
Kearny STP	Town of Kearny	Kearny	2,550	179	X		X					Adv. Trt. II & Nutrient Removal	NA	2004
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			7,921	406										

Notes:
NA: Data currently not available to ADWR
WWTF: Wastewater Treatment Facility
WWTP: Wastewater Treatment Plant
SD: Sanitation District
STP: Sewage Treatment Plant
Adv. Tr. II: Advance treatment level II

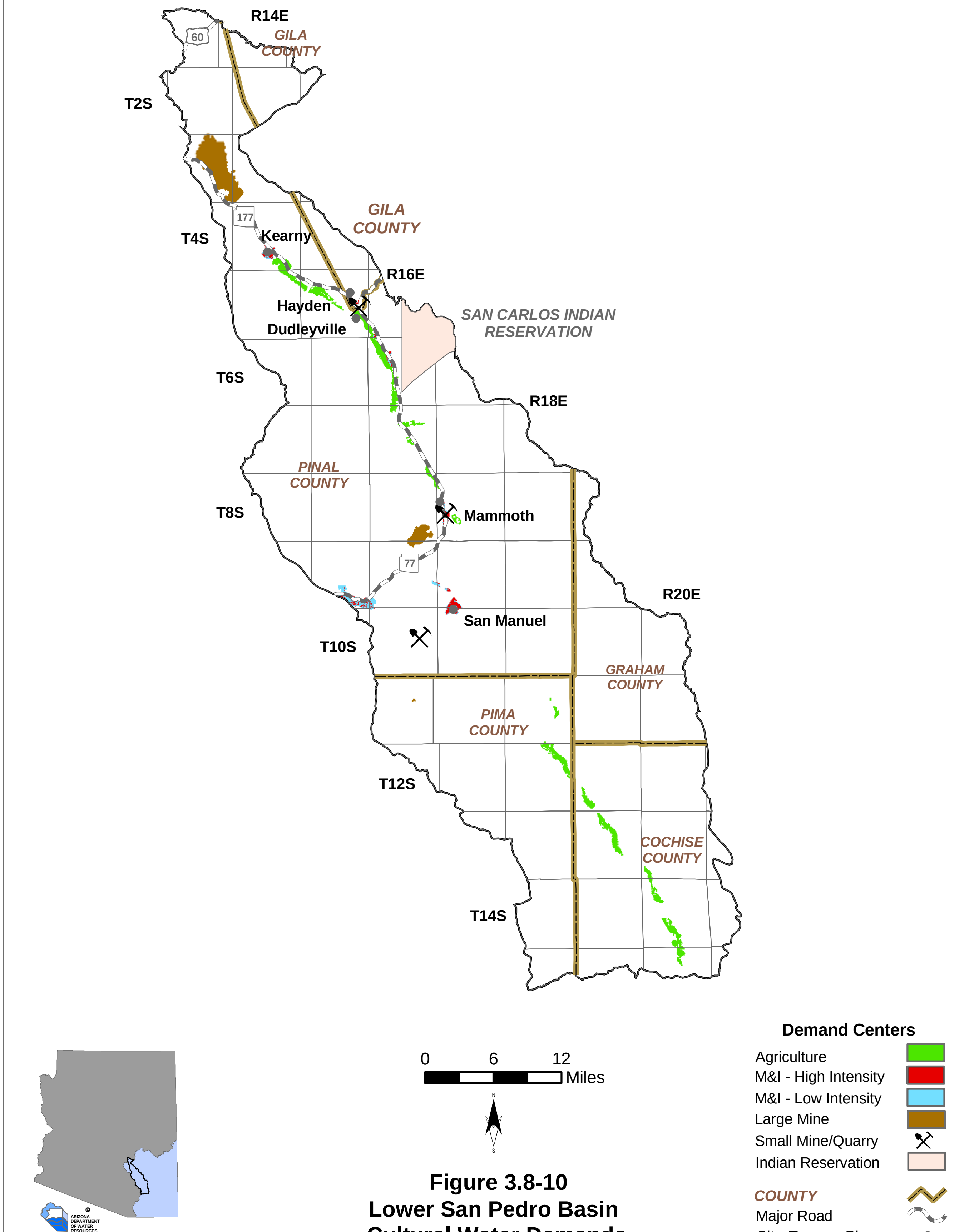


Figure 3.8-10
Lower San Pedro Basin
Cultural Water Demands

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 3.8-10. Figure 3.8-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1

- 11 water adequacy determinations have been made in this basin through May, 2005.
- Three determinations of inadequacy have been made. These determinations are scattered throughout the basin with one in the vicinity of San Manuel, one in the vicinity of Mammoth and the third at the northernmost tip of 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.
- The total number of lots receiving a water adequacy determination is not available. Available information by county is:

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	138+	138+	NA

Table 3.8-10 Adequacy Determinations in the Lower San Pedro 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	Aravaipa # 1	Pinal	7 South	16 East	9, 10	24		Adequate		01/27/75	Aravaipa Water Company
2	Cherry Valley	Pinal	10 South	16 East	6	26		Adequate		10/24/77	Arizona Water Company
3	Kearney Subdivision # 12	Pinal	4 South	14 East	22	13		Adequate		06/19/79	John W. Galbreath Development Corporation
4	Mammoth, Town of	Pinal	8 South	17 East	19	NA		Inadequate	A1	04/11/88	Town of Mammoth
5	Mountain Valley	Pinal	1 South	13 East	13	NA		Inadequate	A1	03/30/81	Dry Lot Subdivision
6	Oracle Mountain View Estates	Pinal	9 South	15 East	36	NA		Inadequate	A1	01/02/82	Arizona Water Company
7	Oracle Ranch Estates # 2	Pinal	9 South	15 East	26, 27	38		Adequate		08/16/79	Arizona Water Company
8	Rancho Robles	Pinal	9 South	15 East	35	17		Adequate		08/09/79	Arizona Water Company
9	San Manuel, Townsite	Pinal	9 South	17 East	31, 32	NA		Adequate		07/07/88	Arizona Water Company
10	Two O'Clock Hill	Pinal	9 South	15 East	35	20		Adequate		10/15/74	Arizona Water Company
11	Winkelman Terrace	Gila	5 South	15 East	13	7	22-300508	Adequate		08/25/98	Arizona Water Company & Community Wells

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 determination.

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

NA= Data not currently available to ADWR

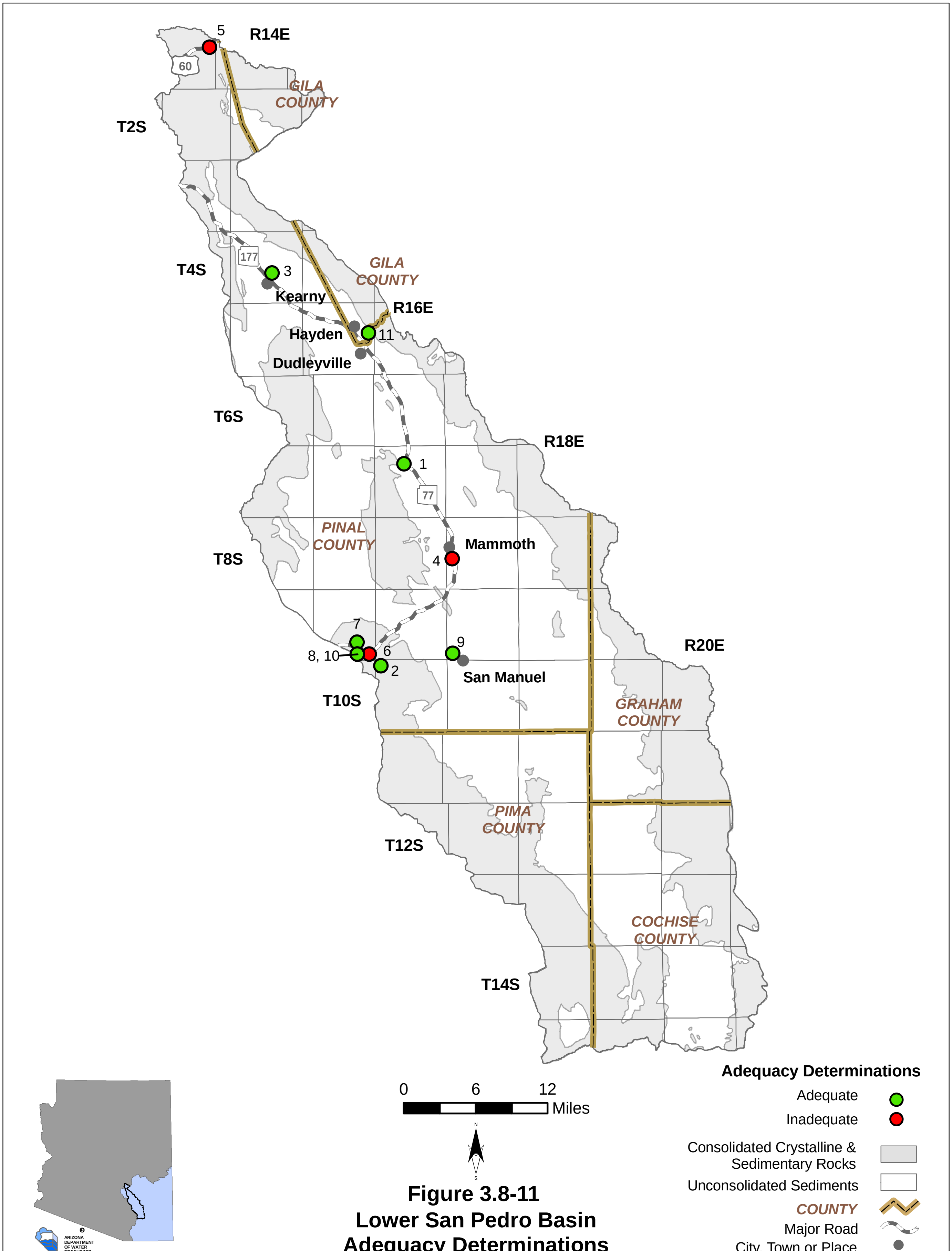


Figure 3.8-11
Lower San Pedro Basin
Adequacy Determinations

LOWER SAN PEDRO BASIN
References and Supplemental Reading

References

A

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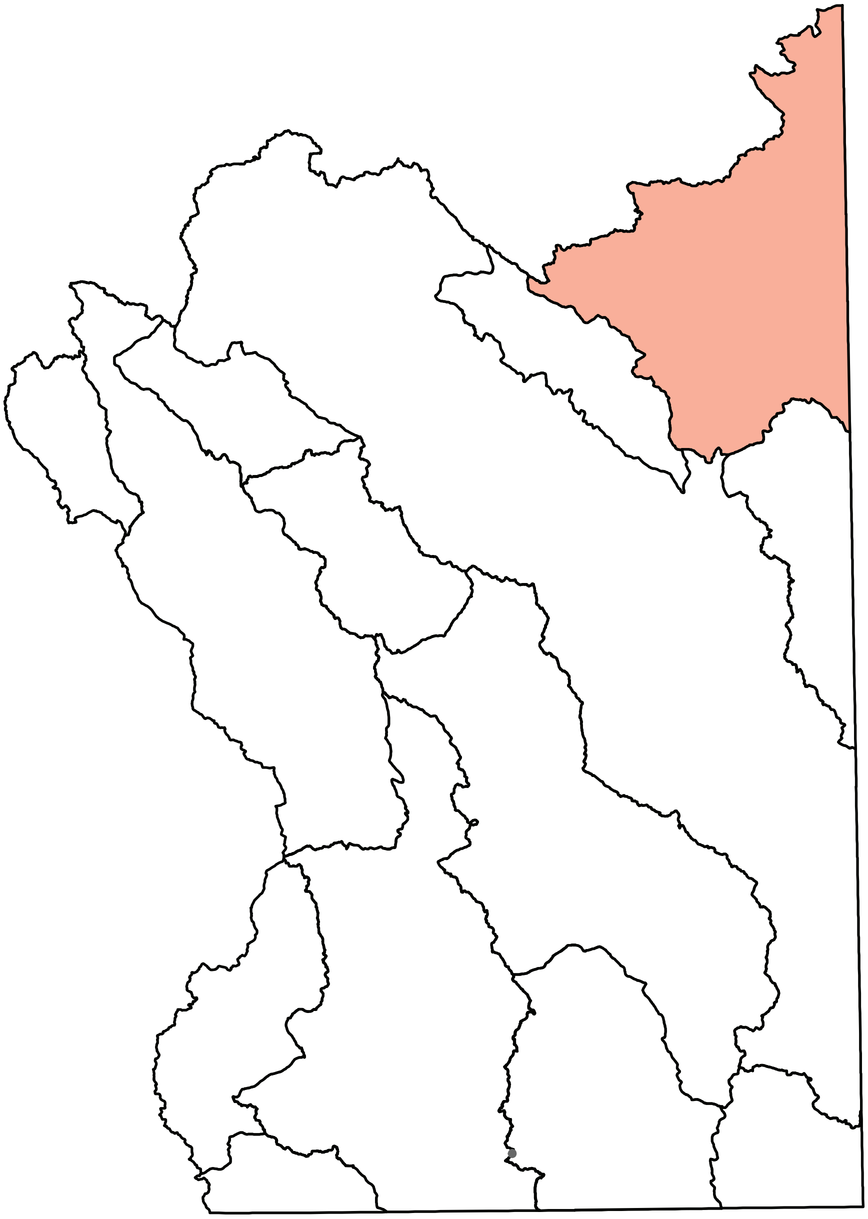
Lower San Pedro Index to Section 3.0

Section 3.9
Morenci Basin

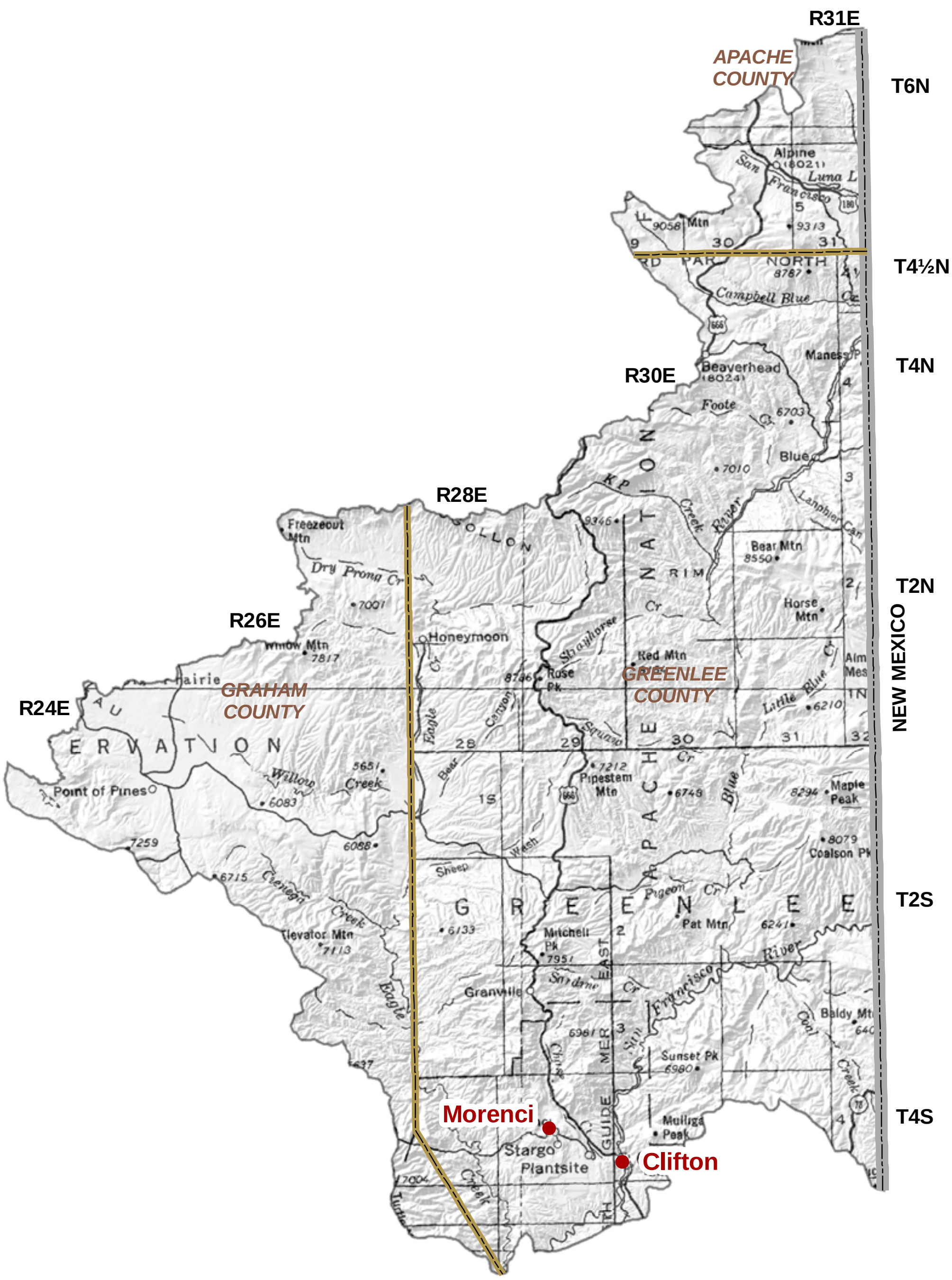


3.9.1 Geography of the Morenci Basin

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, grasslands, desert scrub, conifer forests and evergreen woodlands.

- Principal geographic features shown on Figure 3.9-1 are:
  - Principal basin communities of Clifton and Morenci
  - Smaller White Mountain community of Alpine in the extreme north and Point of Pines in the western portion of the basin
  - San Francisco River running from the west to the east in Apache County and from the east to the 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

- Not well shown on Figure 3.9-1 is the Mogollon Rim, which includes the highest point in the basin at 9,346 feet.



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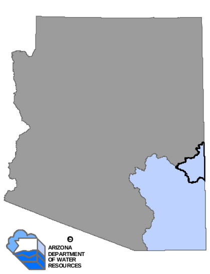


Base Map: USGS 1:500,000, 1981

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, Section 1.3.8.

A key land ownership feature of this basin is the large amount of National Forest Service land in the Apache-Sitgreaves National Forest. This basin contains a one-third of the two million acre forest. This forest is unique in Arizona because it contains more than 680 miles of rivers and streams and 34 lakes and reservoirs, more than any other Southwestern National Forest. The basin also includes the entire 172,762 acre Blue Range Primitive Area, the only primitive area in the United States (USFS, 2006). Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

National Forest and Wilderness

- 67.6% of the land is federally owned and managed as national forest and wilderness.
- 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.
- 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

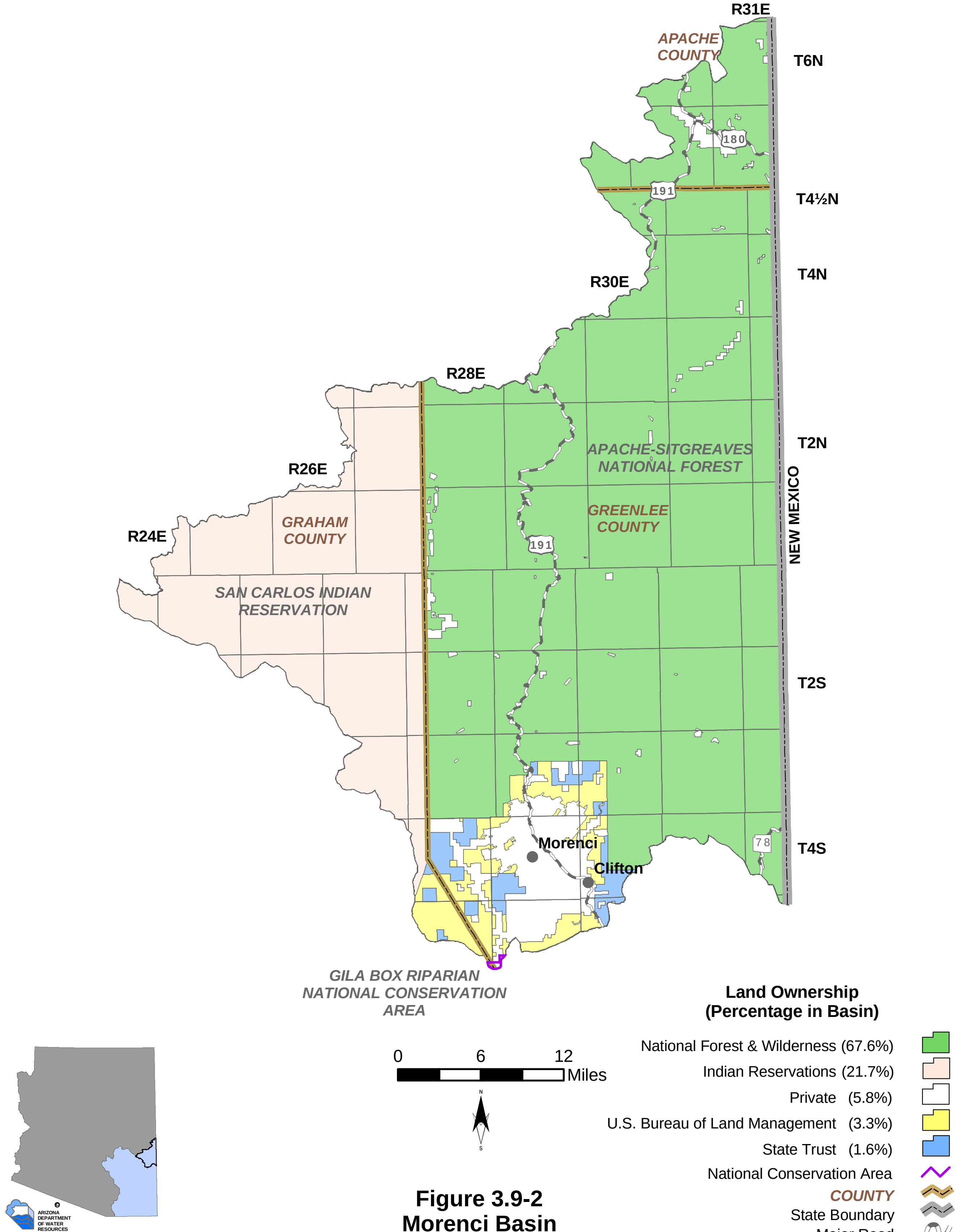
- 5.8% of land is private.
- The majority of private land is surrounding Morenci.
- Private in-holdings are scattered throughout the National Forest lands.
- Primary land uses are mining, domestic and commercial.

U.S. Bureau of Land Management (BLM)

- 3.8% of land is federally owned and managed by the Safford Field Office of the Bureau of Land Management.
- 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 Coop Network and SNOTEL/Snowcourse stations are complied in Table 3.9-1 and the locations are shown on Figure 3.9-3. The Morenci Basin does not contain Evaporation Pan and AZMET stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.9-1A.
- There are four NOAA/NWS Coop Network stations in the basin.
- Of the four stations, data from different periods of record may be used as shown. This may be due to discontinued measurements, date of installation or other availability issues.
- Stations are located throughout the basin.
- Station elevation ranges from 3,480 feet at Clifton to 8,050 feet at Alpine.
- Maximum average temperatures range from 61.6°F in Alpine to 84.7°F in Clifton.
- Minimum average temperatures range from 29.1°F in Alpine to 45.8°F in Clifton.
- Station precipitation varies with an annual average precipitation range of 13.29 inches in Morenci to 21.66 inches in Alpine.
- Three of the stations, Alpine, Blue and Clifton, report the highest average precipitation in the summer season (July –September). One station, Granville, reports highest average precipitation in the Fall (October – December).
- The driest season at all stations is spring (April – June).
- 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.
- Altitude is the principal factor in precipitation in this basin.* The range of 20 inches between areas of highest and lowest precipitation is relatively high for the planning area.

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 snow measurement sites in the basin. Snow pack is measured in inches of snow water content. Ten inches of fresh snow can contain as little as 0.10 inches of water or up to 4 inches depending on a number of factors. The majority of U.S. snows fall with a water-to-snow ratio of between 0.04 and 0.10. (NSIDC, 2006)
- The site elevation range is narrow, from 7,990 feet at Beaverhead SNOTEL to 8,500 feet at Nutrioso.
- Four sites, Beaverhead, Beaverhead SNOTEL, Coronado Trail and Hannagan Meadows, record highest snow pack in March. Two sites, Coronado Trail SNOTEL and Nutrioso,

* There is a discrepancy between the average annual precipitation shown on the map and the average annual precipitation indicated from the NOAA/NWS Coop station for the Granville area. The map shows precipitation between 22 and 24 inches for the area whereas the average annual precipitation at the station is 17.19 inches. This discrepancy may be caused by different periods of record displayed for the station and that used to construct the precipitation contours.

report highest snow pack in February.
- Highest average snow pack is 9.8 inches at Hannagan Meadows.
- In general there is a correlation between elevation and average snow pack in the month with the highest snow pack. Location of the site and the period of record affect snow pack accumulation averages.

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, 2003.

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			

Source: WRCC, 2003.

C. AZMET:

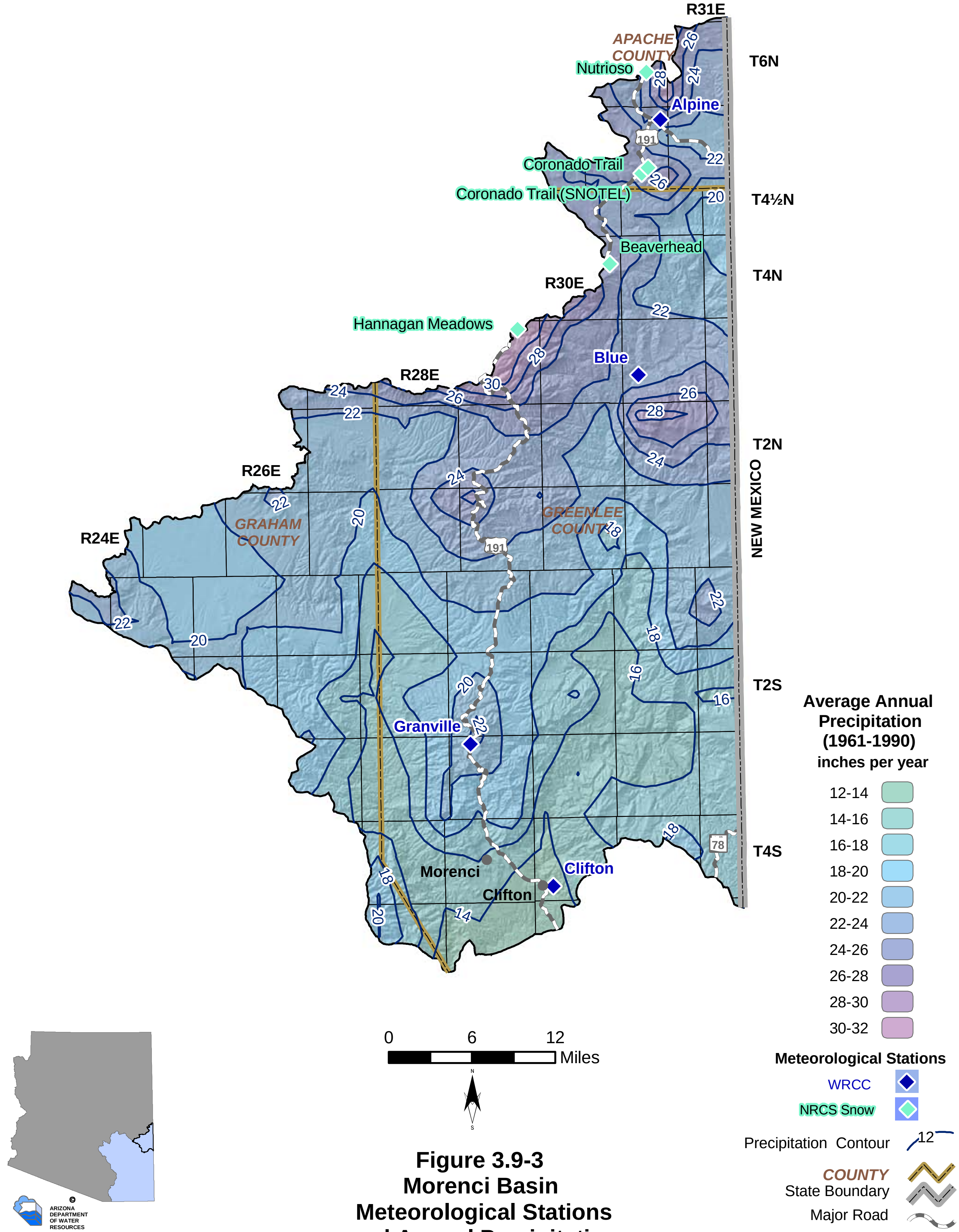
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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	1.5 *(25)*	2.7 *(65)*	2.8 *(66)*	1.2 *(62)*	0.4 *(1)*	0 *(0)*
Coronado Trail	8,350	1938 - current	1.4 *(27)*	2.8 *(67)*	*2.9 (67)*	1.0 *(63)*	0 *(1)*	0 *(0)*
Coronado Trail SNOTEL	8,400	1983 - current	1.8 *(22)*	3.1 *(22)*	3.0 *(22)*	0.4 *(21)*	0 *(22)*	0 *(22)*
Hannagan Meadows	9,090	1964 - 2000	4.5 *(23)*	7.3 *(36)*	9.8 *(36)*	9.3 *(36)*	8.1 *(36)*	0 *(0)*
Nutrioso	8,500	1938 - current	1.0 *(27)*	1.9 *(67)*	1.8 *(67)*	0.6 *(67)*	0 *(1)*	0 *(0)*

Source: Natural Resources Conservation Service, 2005



Precipitation Data Source: Oregon State University, 1998

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 as of September 2004 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, using the USGS number, is shown on Figure 3.9-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.9-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.9-2.
- Data from six stations, including three discontinued stations, are shown on the table and on Figure 3.9-2.
- These stations are located on the Blue River, the San Francisco River, Willow Creek and Eagle Creek.
- The average seasonal flow as a percentage of annual flow for most of the stations is highest in the Winter (January-March) and lowest in the Spring (April-June) or Summer (July-September).
- The two stations on Willow Creek report highest average seasonal flow in the Summer (July-September), however flows during the rest of the year are comparable to the summer flows.
- Maximum annual flow in this basin was 678,755 acre-feet in 1915 on the San Francisco River. 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.
- Four stations are precipitation stations, two stations are precipitation/stage stations and one station is a weather station.

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.
- Four of the small reservoirs have a maximum storage capacity of 1,327 acre-feet. The remaining 12 small reservoirs have a total surface area of 138 acres.
- There are an estimated 673 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.9-4.
- Average annual runoff increases from 0.5 inches in the vicinity of Clifton and Morenci to two inches as you move north toward the Mogollon Rim. Runoff is one inch in the far northern part of the basin.

Table 3.9-2 Streamflow Data for the Morenci Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	6,910	11/1967-current	39	22	14	25	9,487 (2002)	38,091	50,373	176,695 (1983)	30
9444500	San Francisco River at Clifton	2,763	6,880	10/1910-current	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	6,340	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	6,310	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	6,410	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	6,060	4/1944-current	49	14	15	22	12,311 (1953)	34,398	48,850	405,530 (1993)	58

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

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

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

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

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

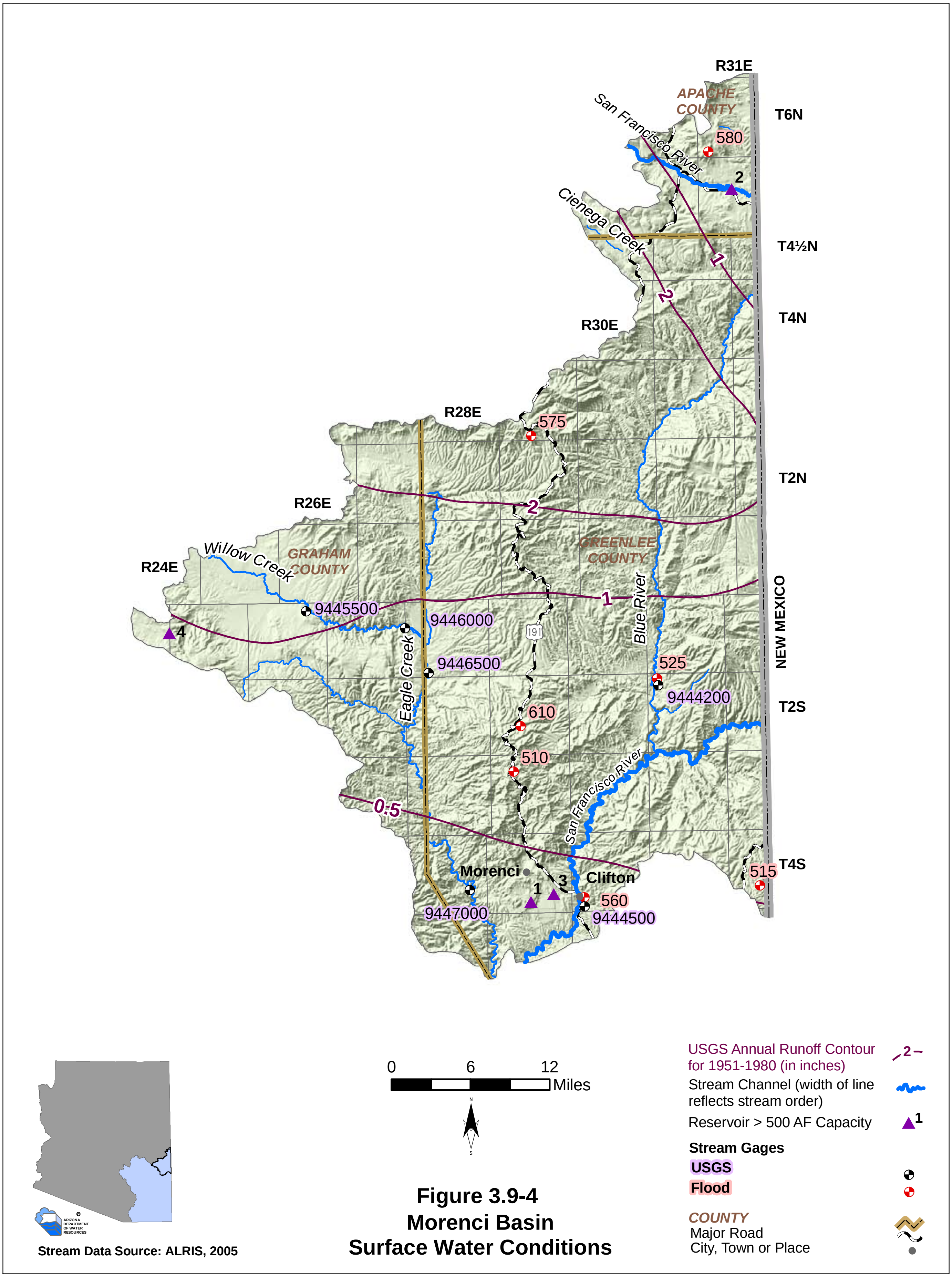


Figure 3.9-4
Morenci Basin
Surface Water Conditions

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 3.9-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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.
- Listed discharge rates may not be indicative of current conditions. All springs measurements are over 10 years old; seven springs were measured before 1982 and one has no date.
- Major springs are found throughout most of the basin. The greatest discharge rate was measured along the Blue River north of Clifton (unnamed spring, 200 gpm).
- Three-quarters of the major springs have discharges greater than or equal to 50 gpm.
- 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.
- 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):

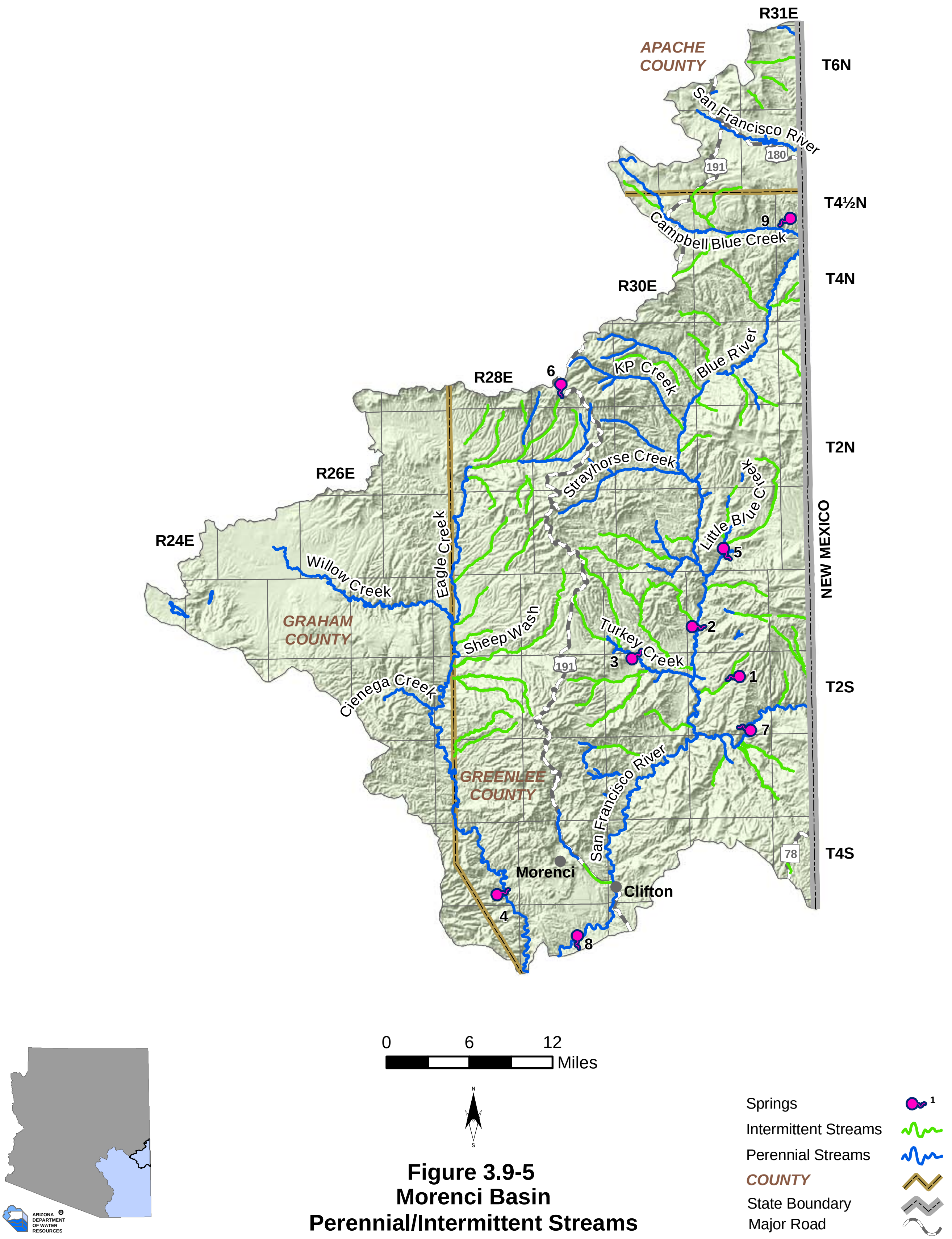
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Unnamed[2]	331603	1091053	200	6/16/1978
2	Unnamed[2]	331922	1091123	100	NA
3	Unnamed	331735	1091603	100	6/16/1978
4	Eagle Creek Hot	330249	1092623	50	On or before 1982
5	Hannah	332401	1090907	50	On or before 1982
6	KP Cienega (multiple)	333428	1092116	50	6/26/1973
7	Rock Basin	331302	1090748	20	On or before 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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 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 3.9-5
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 3.9-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.9-7 contains hydrographs for selected wells shown on Figure 3.9-6. Figure 3.9-8 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers
- Refer to Table 3.9-6 and Figure 3.9-6.
- 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 3.9-8.
- As shown on Figure 3.9-8 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 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 from a 1986 Freethey and Anderson study.

Water in Storage
- Refer to Table 3.9-6.
- The only storage estimate is a predevelopment estimate of 3 million acre-feet to a depth of 1,200 feet.

Water Level
- Refer to Figure 3.9-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures two index wells in this basin.
- In 1978, the year of the last water level sweep, six wells were measured.
- 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.
- Of the three recorded wells in the basin, water level in one has decreased between one and 15 feet, one has increased between 15 and 30 feet and the third lacks change data.
- Hydrographs corresponding to selected wells shown on Figure 3.9-6 but covering a longer time period are shown in Figure 3.9-7.

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:	NA	Measured by ADWR and/or USGS
	Range 2 - 5,900 Median 600 (53 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	NA	ADWR (1990 and 1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	15,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	NA	ADWR (1990 and 1994)
	3,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	NA	Arizona Water Commission (1975)
Current Number of Index Wells:	2	
Date of Last Water-level Sweep:	1978 (6 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate

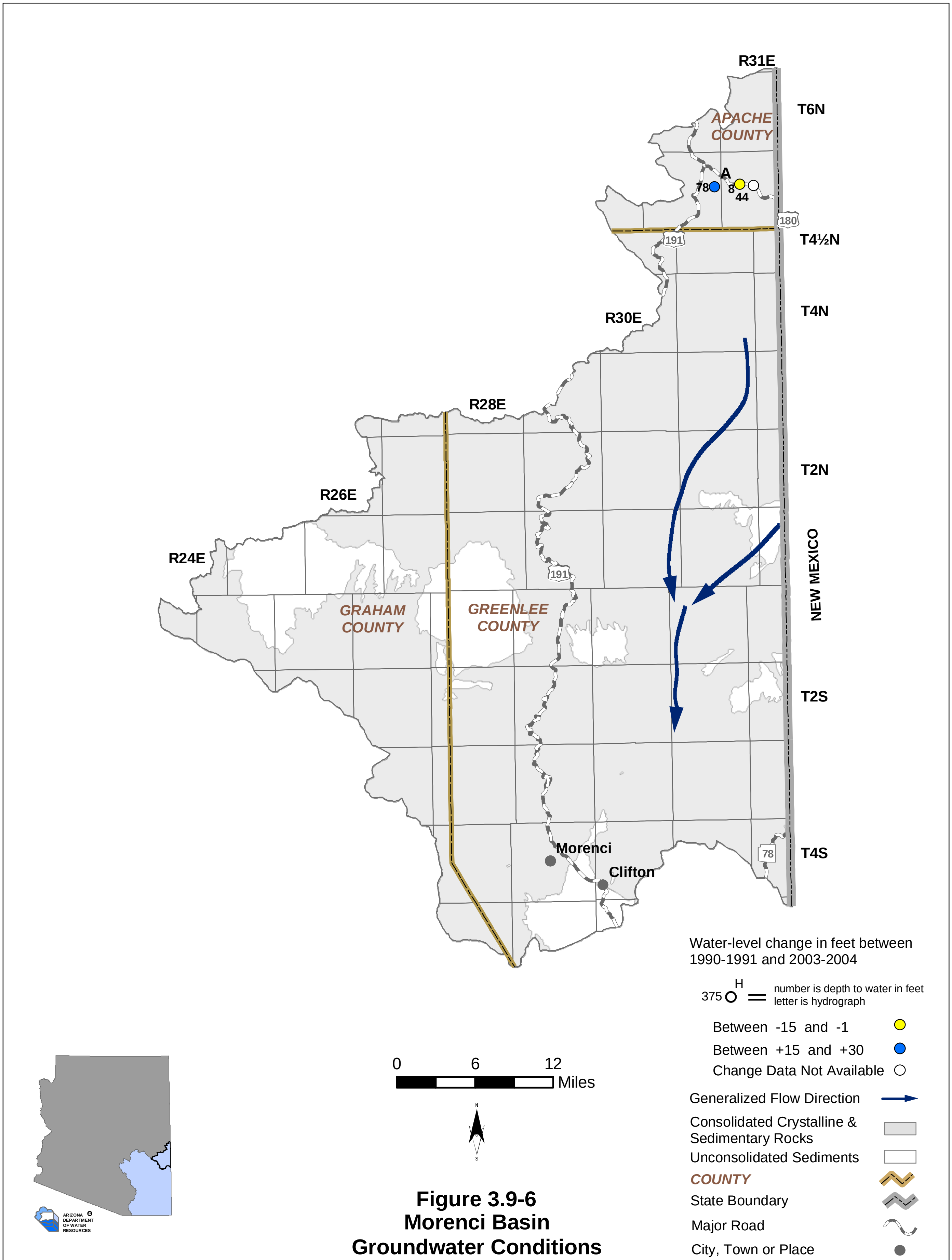
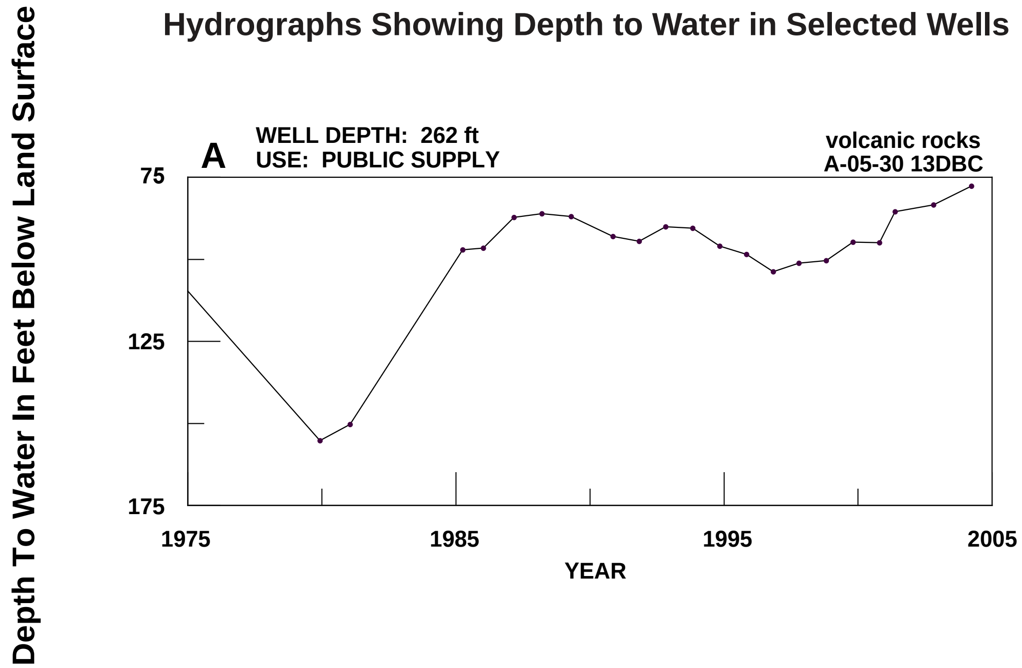


Figure 3.9-6
Morenci Basin
Groundwater Conditions

Figure 3.9-7
Morenci Basin
Hydrographs Showing Depth to Water in Selected Wells



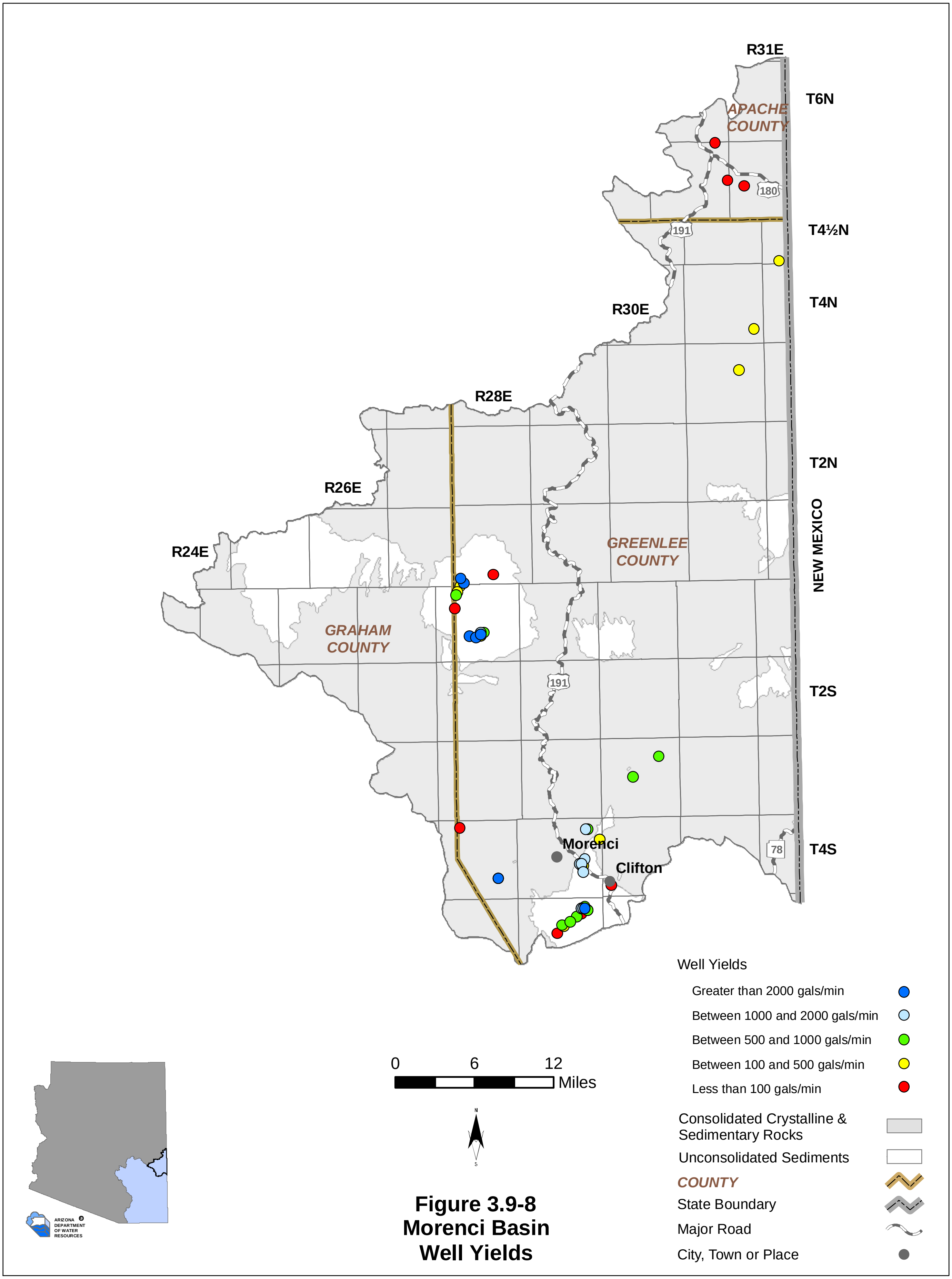


Figure 3.9-8
Morenci Basin
Well Yields

3.9.7 Water Quality of the Morenci Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded 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 3.9-9 shows the location of exceedences and impairment keyed to Table 3.9-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.9-7A.
- Drinking water standard exceedences have been reported for three wells in the basin.
- All wells are in the southern portion of the basin.
- Parameters exceeded in the sites measured in this basin included beryllium, cadmium, copper, fluoride, arsenic, lead and nitrates

Lakes and Streams

- 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, nitrates, phosphorus 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) Exceeding Drinking Water Standard[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

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, NO3, P, pH
b	Stream	San Francisco River (headwaters to New Mexico border)	13	NA	A&W	Sediment

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/Nitrite
P = Phosphorous
pH = measurement of acidity or alkalinity
[3] A&W = Aquatic and Wildlife
AgL = Agricultural Livestock Watering
FBC = Full Body Contact

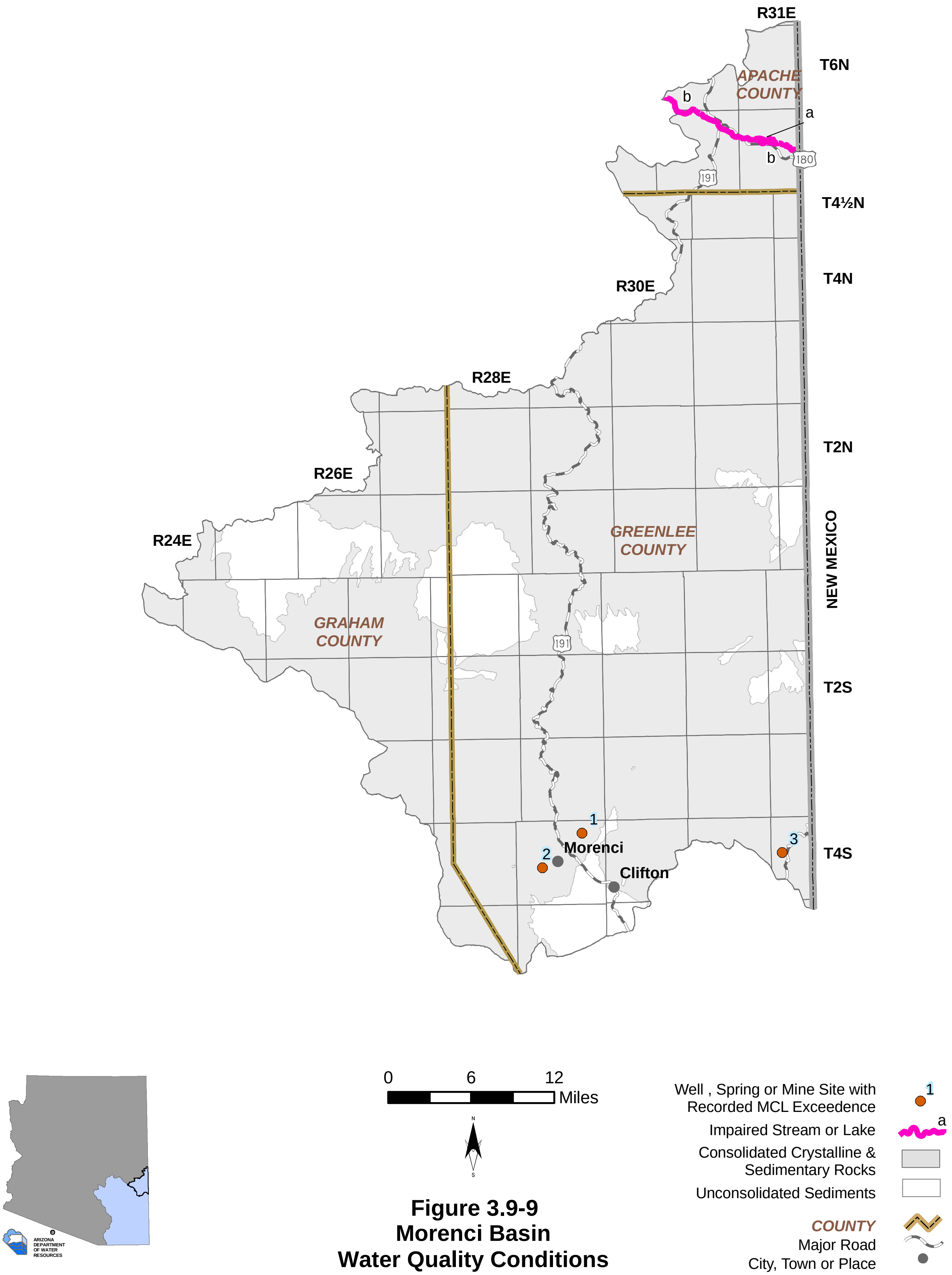


Figure 3.9-9
Morenci Basin
Water Quality Conditions

3.9.8 Cultural Water Demands 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 3.9-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.9-8 and Figure 3.9-10.
- Population decreased from 1980 to 2000. Projections suggest a slight increase in population through 2050.
- Total groundwater use has increased from 1971 to 2003 with an average of 11,500 acre-feet pumped per year in the period from 2001-2003.
- Historical surface-water diversions are not available for this basin, however, surface water diversions have decreased from 1991 to 2003 with 1,000 acre-feet diverted per year in the period from 1991 – 2003.
- All surface-water diversions between 1991 and 2003 were for municipal and industrial uses, however, over 90% of the municipal and industrial water supply is groundwater.
- Almost all municipal and industrial demand is in the vicinity of Clifton and Morenci.
- Also in the Morenci and Clifton area is the active Morenci Mine.
- There is no agricultural demand reported in this basin.
- As of 2003 there were 472 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 72 wells with a pumping capacity of more than 35 gallons per minute.

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 from the municipal facilities per year are generated in this basin and discharged into either an evaporation pond or a watercourse.

Table 3.9-8 Cultural Water Demands in the Morenci Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971										
1972										
1973				3,900			NR			
1974										
1975		251[2]	43[2]							
1976										
1977										
1978				4,700			NR			
1979										
1980	8,620									ADWR (1994) ADWR Show Low Lake Report (2005)
1981	8,284									
1982	7,948									
1983	7,612	70	7	5,100			NR			
1984	7,276									
1985	6,940									
1986	6,604									
1987	6,268									
1988	5,932	28	13	6,400			NR			
1989	5,596									
1990	5,260									
1991	5,229									
1992	5,199									
1993	5,169	33	1	15,500		NR	2,400		NR	
1994	5,139									
1995	5,108									
1996	5,078									
1997	5,048									USGS (2005) ADWR (2005)
1998	5,018	48	5	20,000		NR	2,100		NR	
1999	4,987									
2000	4,957									
2001	4,968									
2002	4,980	17	1	11,500		NR	1,000		NR	
2003	4,991									
2010	5,071									
2020	5,426									
2030	5,760									
2040	6,022									
2050	6,254									
ADDITIONAL WELLS: [3]		**25**	**2**							
WELL TOTALS:		**472**	**72**							

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[1] Does not include evaporation losses from stockponds and reservoirs.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

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 Irrigation	Wildlife Area	Discharge to Another Facility	Groundwater Recharge			
Alpine WWTF	Alpine SD	Alpine	570	46		X						Secondary	70	2000
Clifton WWTF	Town of Clifton	Clifton	3,010	140	X							Secondary	70	2000
Morenci WWTF	Phelps Dodge-Morenci Water & Electric Co.	Morenci	NA		Used for industrial processes							NA		
Total			3,580	186										

Notes:
NA:Data not currently available to ADWR
WWTF: Wastewater Treatment Facility
SD: Sanitation District

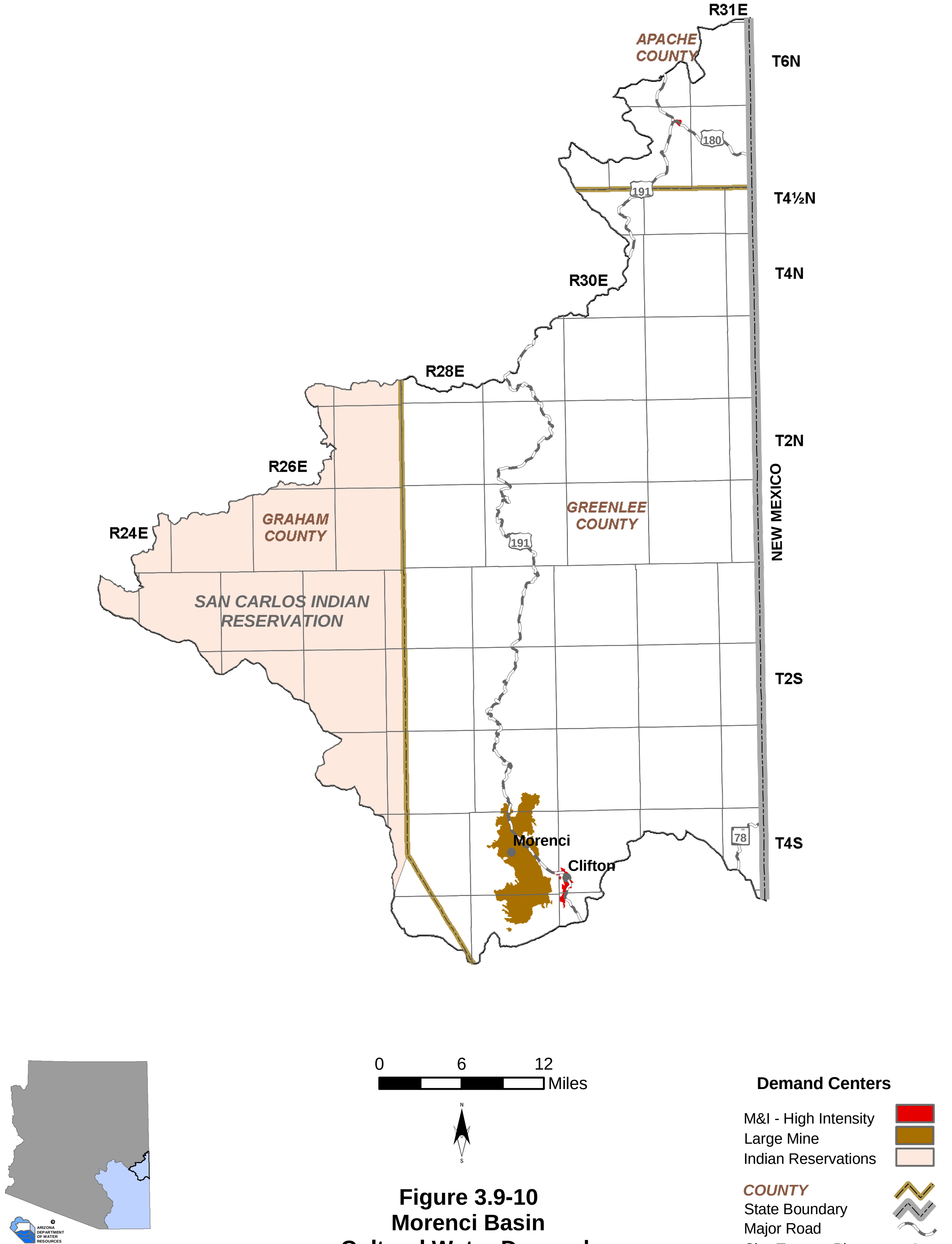


Figure 3.9-10
Morenci Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

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 3.9-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

- Nine water adequacy determinations have been made in this basin through May, 2005. All nine determinations are in the vicinity of Alpine.
- One determination of water inadequacy has been made.
- The reason for this determination of inadequacy was legal, the applicant failed to demonstrate the legal right to use the water or failed to demonstrate the provider's legal authority.
- All lots receiving an adequacy determination are in Apache County. Of the 1,759 lots, 1,725 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		Adequate		07/18/84	Alpine Country Club Homeowners Association
2	Alpine Highlands	Apache	5 North	30 East	13	47		Adequate		02/28/78	Alpine Highlands Water Company
3	Alpine Village Acres	Apache	5 North	30 East	11, 14	1505		Adequate		03/16/88	Mountain Springs Water Company
4	Alpine Village Acres 2	Apache	5 North	30 East	11, 14	66		Adequate		12/16/93	Mountain Springs Water Company
5	Alpine Village East	Apache	5 North	30 East	14	10		Adequate		07/16/85	Mountain Springs Water Company
6	Becker Estates	Apache	5 North	31 East	19	29		Adequate		03/29/82	Becker Estates Homeowners Association
7	Blue Spruce	Apache	5 North	30 East	12	24		Adequate		07/11/89	Alpine Water System
8	Jackson Spring Estates	Apache	5 North	31 East	18	34		Inadequate	B	01/07/87	Jackson Spring Estates Owners Association
9	Pine Ridge Estates	Apache	5 North	31 East	18	36		Adequate		08/03/83	Pine Ridge Estates Homeowners Association

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.

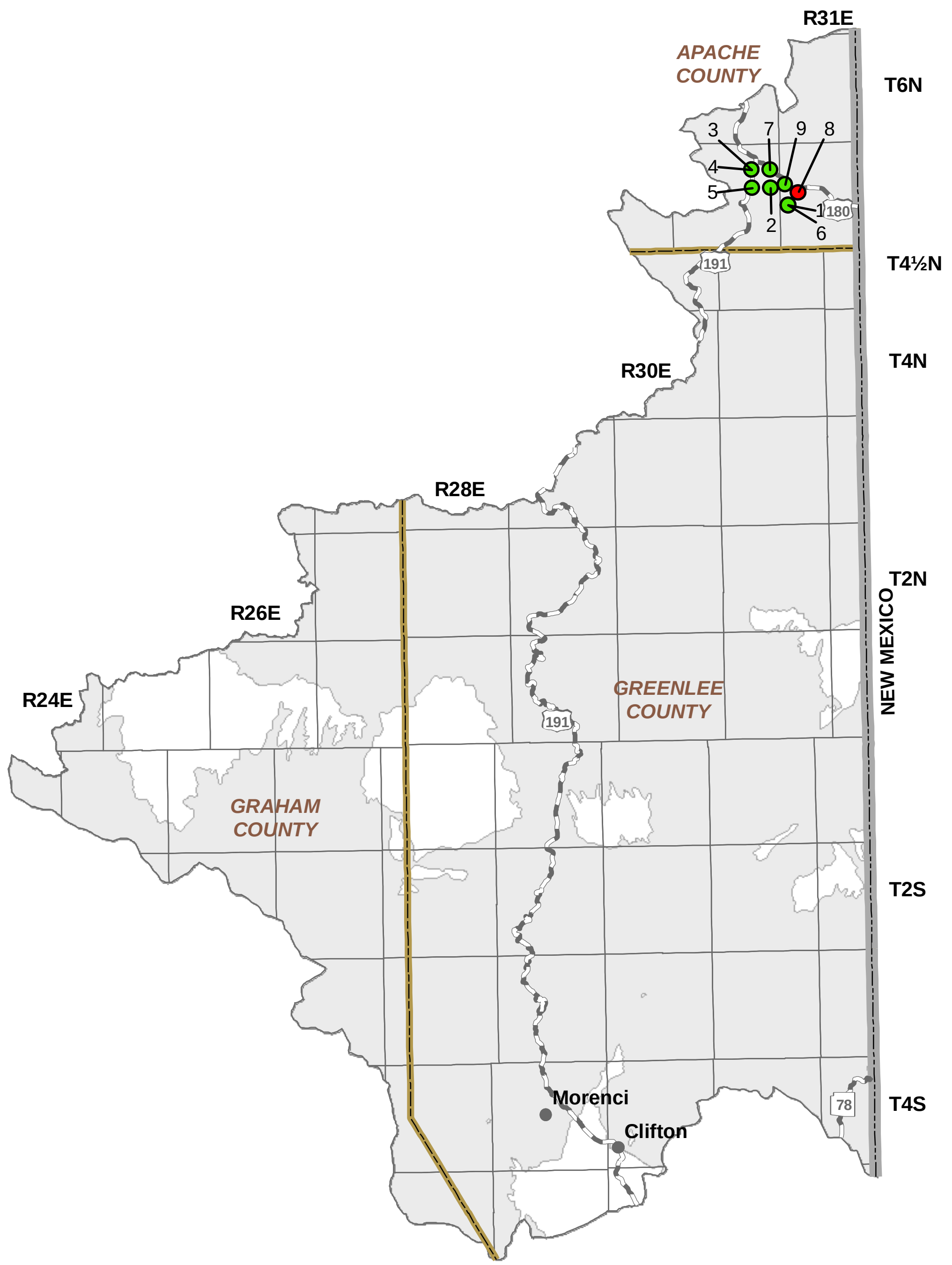
[2] Prior to February 1995, ADWR did not assign file numbers to applications for adequacy determination.

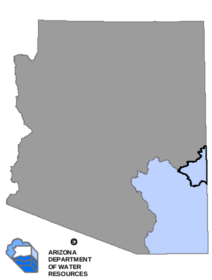
[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically unavaible;for groundwater, depth-to-water exceeds criteria)
3) Insufficient Infrastructure (distribution system is insufficient to meet demands or applicant proposed water hauling)

B. Legal (applicant failed to demonstrate a legal right to use the water or failed to demonstrate the provider's legal authority to serve the subdivision)

C. Water Quality

D. Unable to locate records





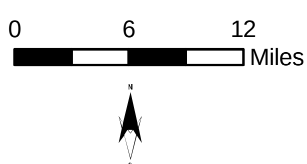


Figure 3.9-11
Morenci Basin
Adequacy Determinations

MORENCI BASIN
References and Supplemental Reading

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A

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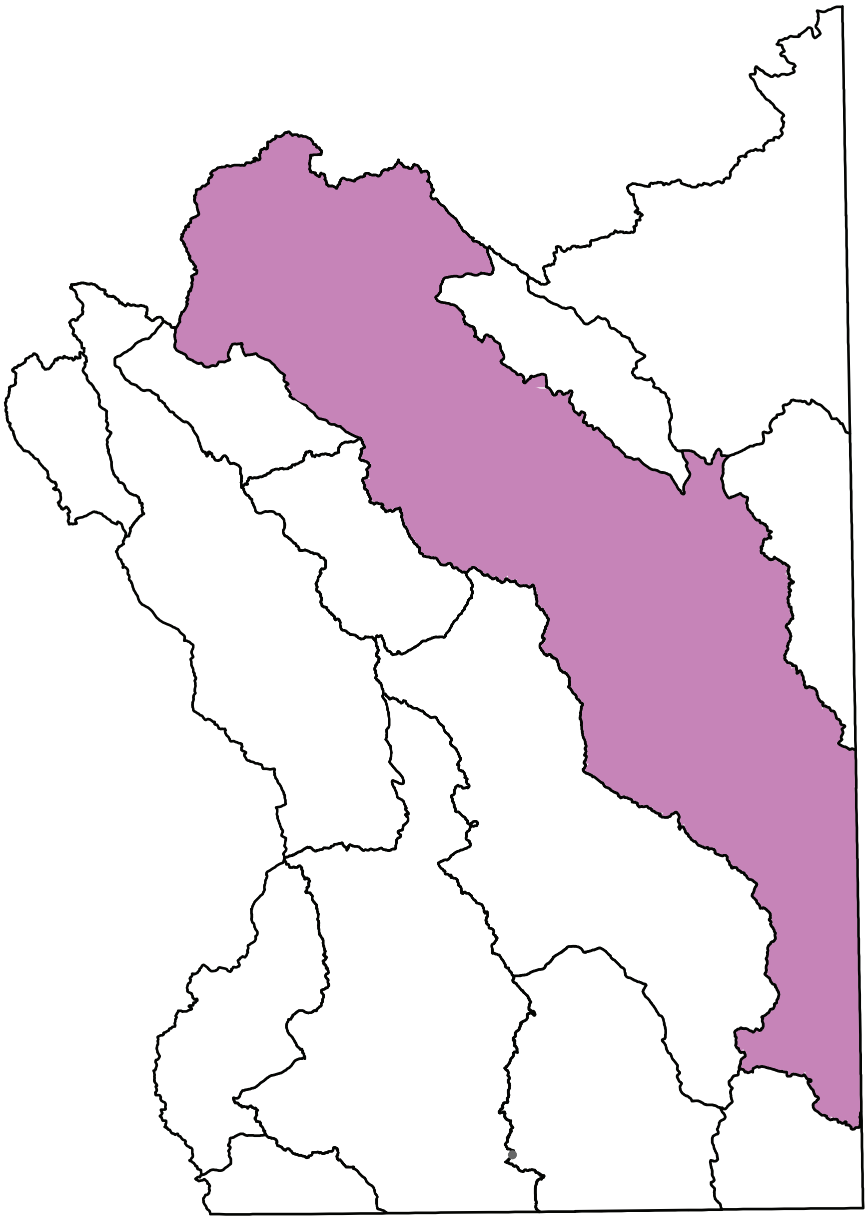
Section 3.10
Safford Basin



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 such as desert scrub, grassland, woodlands, conifer forests and chaparral.

- Principal geographic features shown on Figure 3.10-1 are:
    - Principal basin communities of San Carlos, Peridot, Pima, Thatcher, Safford and Swift Trail Junction
    - Smaller communities of San Simon and Bowie located along Interstate 10 south of the Cochise County line and Portal located in the southern portion of the basin near the New Mexico state line
    - Gila River running northwest from Greenlee County through San Carlos
    - San Simon Creek flowing through the San Simon Valley south of Safford
    - Gila Mountains northeast of Pima
    - Pinaleño Mountains west of Swift Trail Junction, which include the highest point in the basin and planning area, Mount Graham at 10,712 feet
    - Dos Cabezas Mountains on the southeastern basin boundary
    - Chiricahua Mountains along the southeastern and southern basin boundary

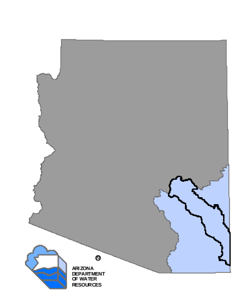


Figure 3.10-1
Safford Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest 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 U.S. Bureau of Land Management.
- 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 Area in T14S, R27E and R28E.
- Portions of the Peloncillo Wilderness Area and Gila Box National Conservation Area in T12S, R32E and T6S, R28E, respectively, 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 east of Safford, and north and south of Interstate 10.
- Primary land use is grazing.

National Forest and Wilderness

- 12.6% of land is federally owned and managed as national forest and wilderness.
- The basin includes two forest districts 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 the basin. The entire 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.
- 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 T8S, R26E.
- Primary land use is military activities.

Parks, Monuments, Historical and Recreational Sites

- 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 small portion of the Chiricahua National Monument in T16S, R30E.
- Primary land use is recreation.

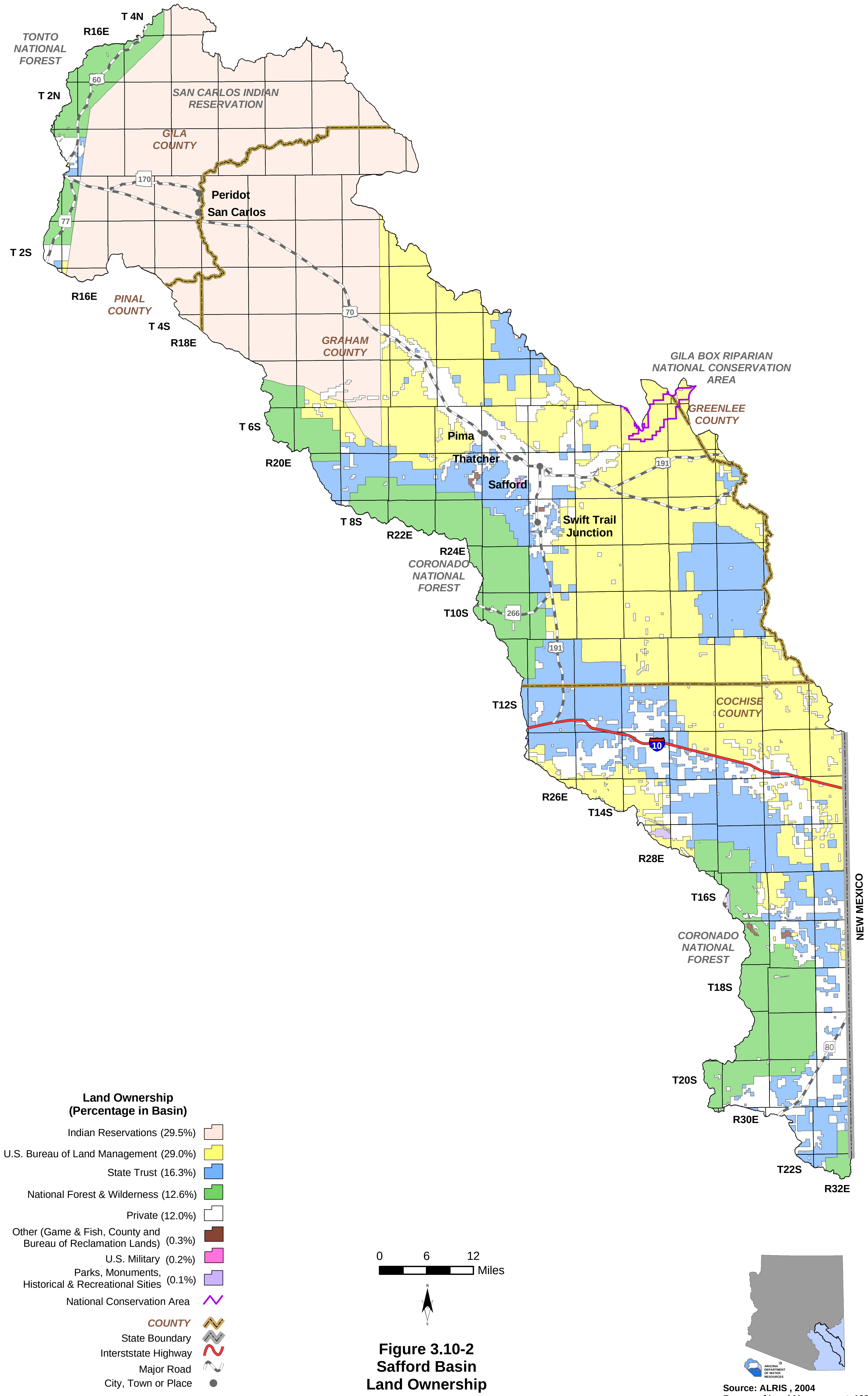


Figure 3.10-2
Safford Basin
Land Ownership

3.10.3 Climate of the Safford Basin

Climate data from NOAA/NWS Coop Network, Evaporation Pan and AZMET stations are complied in Table 3.10-1 and the locations are shown on Figure 3.10-3. The Safford Basin does not contain SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.10-1A.
- There are nine NOAA/NWS Coop Network climate stations in the basin.
- Of the nine stations, data from different periods of record may be used as shown. The variety of periods may be due to discontinued measurements, date of installation or other availability issues.
- Stations are dispersed throughout the basin.
- Station elevation ranges from 2,640 feet at San Carlos to 5,430 feet at Paradise.
- Maximum average temperatures range from 70.4°F at Portal 4 SW to 84.4°F at San Carlos.
- Minimum average temperatures range from 37.8°F at Paradise to 46.0°F at Bowie.
- Station precipitation varies considerably with an annual average precipitation range of 9.34 inches at San Carlos and 21.56 inches at Portal 4 SW.
- All stations report highest annual rainfall in the summer season (July – September).
- The driest season for all stations is spring (April – June).
- 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.
- Altitude is a factor in precipitation with the highest precipitation in the region falling in the Pinaleño and Chiricahua Mountain ranges. This basin contains the second largest range of average annual rainfall in the planning area with 36 inches separating areas of lowest and highest precipitation.

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 23.59 inches.
- Average annual evaporation at the Safford site, located at 2,956 feet, is 76.80 inches.

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, 2003.

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, 2003.

C. AZMET:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
Bowie	4,416	1987 - current	23.59 (1)
Safford	2,956	1987 - current	76.80 (6)

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

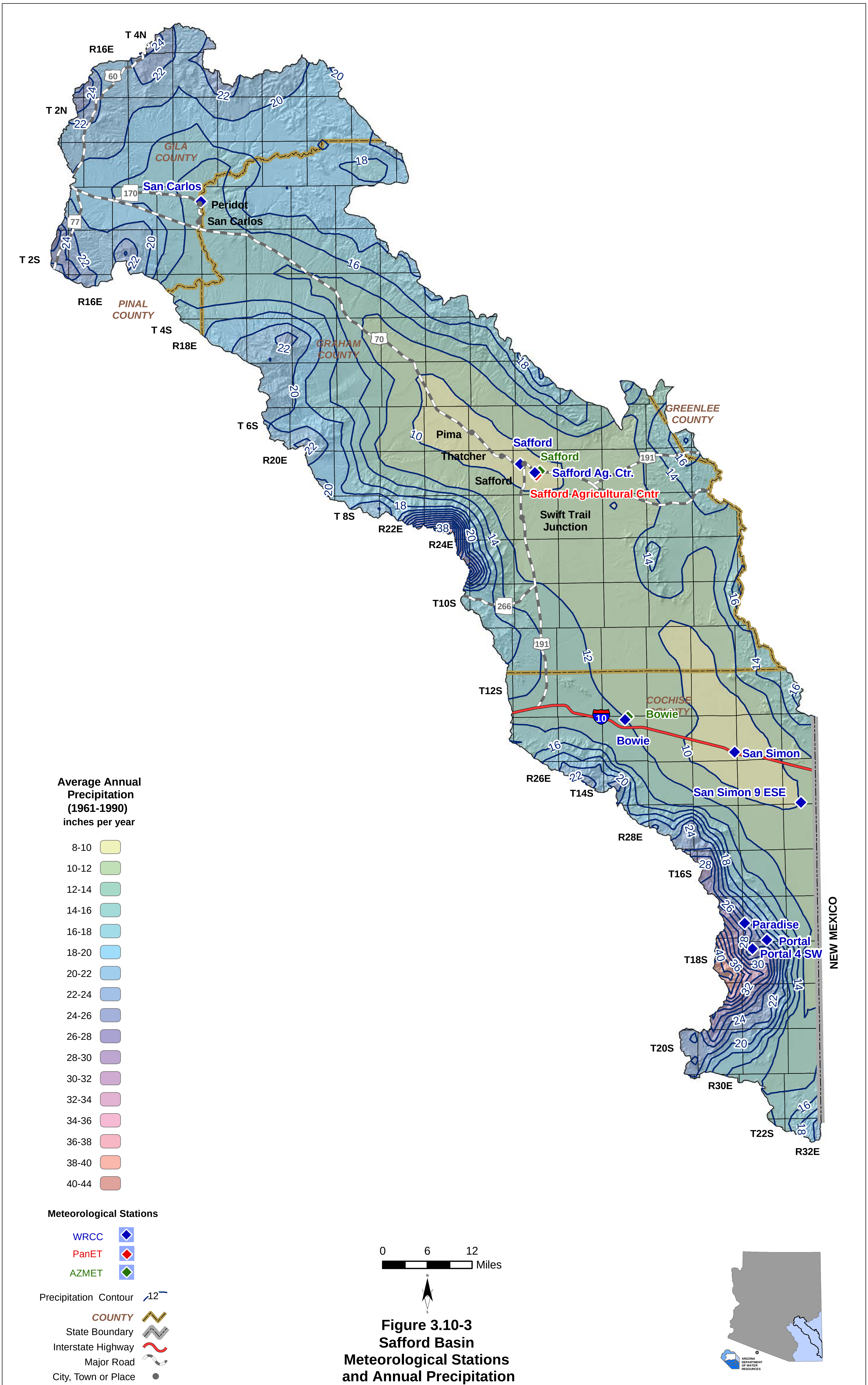


Figure 3.10-3
Safford Basin
Meteorological Stations
and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

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 as of September 2004 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, using the USGS number, is shown on Figure 3.10-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.10-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.10-2.
- Data from 18 stations, including 14 discontinued stations, are shown on the table and on Figure 3.10-4.
- These stations are located on the Gila River, Cave Creek, East Turkey Creek, San Simon River, San Carlos River, Marijilda Wash, Deadman Creek and Frye Creek.
- The average seasonal flow as a percentage of annual flow for many of the stations is highest in the Winter (January-March) and lowest in the Spring (April-June).
- Six stations show the highest average seasonal flow in the Summer (July-September) and five stations show the lowest in the Winter (January-March).
- Maximum annual flow in this basin was 1,732,915 acre-feet in 1993 on the Gila River at Calva. 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.
- Four stations are precipitation stations, three stations are precipitation/stage stations and one station is a repeater/precipitation station.

Reservoirs and Stockponds

- Refer to Table 3.10-3
- Surface water is stored or could be stored in 16 large and 57 small reservoirs in this basin.
- Of the 16 large reservoirs, 14 have a storage capacity of 500 acre-feet or more.
- 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.
- Most of the large reservoirs in this basin are used for flood control. Other uses include irrigation, water supply and recreation.
- 25 small reservoirs have a maximum storage capacity of 3,862 acre-feet. The remaining 32 small reservoirs have a total surface area of 328 acres.
- There are an estimated 1,429 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.10-4.
- Average annual runoff increases from 0.2 inches in the vicinity of Safford and Thatcher along the Gila River and in the southeastern part of the basin, to five inches in the Chiricahua Mountains along the southwestern boundary. Runoff also increases slightly north from Safford to one inch near the northern basin boundary.

Table 3.10-2 Streamflow Data for the Safford Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	6,360	10/1920-current	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	NA	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 ststistics run, less than 3 years of data								2
9457000	San Simon River near Solomon	2,192	4,720	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	7,520	11/1966-9/1993 (discontinued)	36	40	9	15	232 (1989)	800	1,124	2,730 (1991)	14
9458500	Gila River at Safford	10,459	5,830	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	8,400	10/1989-current	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	5,650	10/1929-current	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	4,480	4/1914-current	61	5	13	21	4,070 (2002)	28,677	43,480	296,181 (1993)	73

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

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
NA=Not available to ADWR

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

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	Stockton Wash Retarding	Graham County	12,400	C	State
3	Foote Wash	Graham County	5,500	C	State
4	Frye Creek Retarding #3	Town of Thatcher	3,150	C	State
5	Graveyard Wash	City of Safford	2,360	C	State
6	Billingsley	Graham Canal Co.	2,175	C	State
7	Cheslkey-Wamslee	Graham Canal Co.	2,160	C	State
8	San Jose	Private	1,734	C	Landowner
9	Central Detention	Union Canal Co.	1,190	C	State
10	Slick Rock	Private	1,000	U	Landowner
11	Freeman Wash	Graham County	960[2]	C	State
12	Tufa Stone	San Carlos Apache Tribe	850[2]	I	Tribal
13	No Name Wash	Graham County	646	C	State
14	Dry	San Carlos Apache Tribe	600	R,S	Tribal

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
15	Parks	Private	426	U	Landowner
16	Dry[4]	Private	75	P	Landowner

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 < 500acre-feet
[3]Capacity data not available to ADWR
[4]Dry Lake

Figure 3.10-4
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 3.10-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are numerous perennial stream reaches located primarily along the western boundary of the basin. Including the San Carlos River and the Blue River in the northern part of the basin.
- Numerous intermittent streams are also located primarily along the western boundary of the basin.
- The Gila River is predominantly an intermittent stream through the basin, with perennial reaches near the Greenlee and Graham County boundary and in the vicinity of Highway 70 in T4S, R22E.
- There are 24 major springs with a measured discharge of 10 gallons per minute (gpm) or greater at any time.
- Listed discharge rates may not be indicative of current conditions. 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 majority of the major springs are clustered in the vicinity of Pima. The greatest discharge rate was measured at a spring in the northeastern portion of the basin northeast of San Carlos (Warm Spring, 3,398 gpm). This is the largest discharge in the planning area.
- Three-quarters of the major springs have discharges of less than 50 gpm.
- 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.
- 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	On or before 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	On or before 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	On or before 1982

Table 3.10-5 Springs in the Safford Basin (Con't.)

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	On or before 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

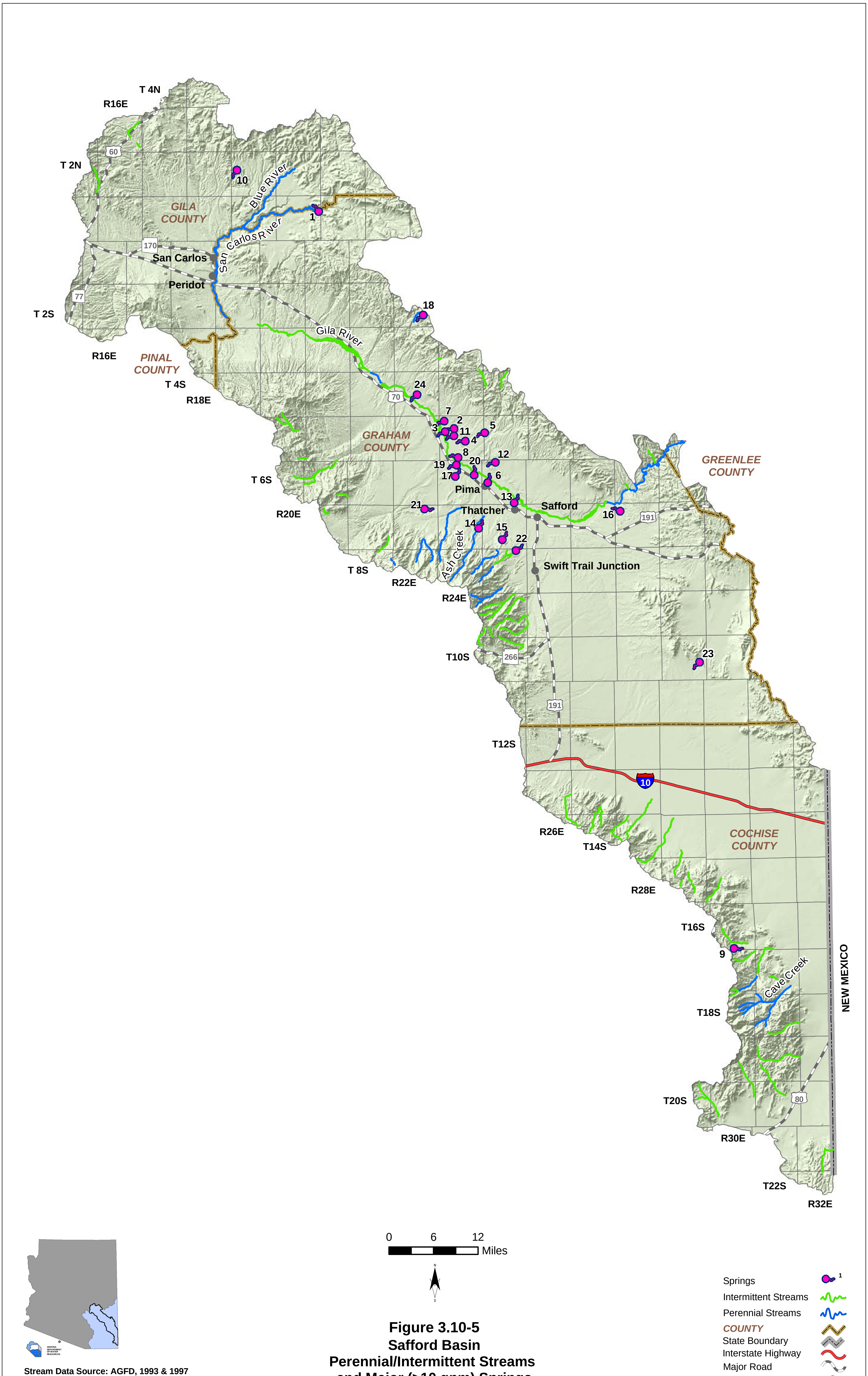
Table 3.10-5 Springs in the Safford Basin (Con't)

B.Minor Springs (con't.):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 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]Most recent measurement < 10 gpm



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

Figure 3.10-5
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 3.10-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.10-7 contains hydrographs for selected wells shown on Figure 3.10-6. Figure 3.10-8 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.10-6 and Figure 3.10-6.
- 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 3.10-8.
- As shown on Figure 3.10-8, 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 1,494 reported wells, indicates that the median well yield in this basin is 600 gpm.
- Well yield is varied throughout the basin.

Natural Recharge

- Refer to Table 3.10-6.
- The only estimate for natural recharge in this basin is 105,000 acre-feet per year from a 1986 Freethey and Anderson study.

Water in Storage

- Refer to Table 3.10-6.
- There are three storage estimates for this basin ranging from more than 27 million acre-feet to 69 million acre-feet. The most recent estimate, from a 1990 ADWR study, is 66 million acre-feet to a depth of 1,200 feet.
- The predevelopment storage estimate is 69 million acre-feet.

Water Level

- Refer to Figure 3.10-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 50 index wells in this basin.
- In 1997, the year of the last water level sweep, 559 wells were measured. A previous well sweep, in 1987, measured 1,093 wells.
- Deep water levels are found in the vicinity of Interstate 10 with water levels as deep as 517 feet. Shallow water levels are found in the Safford, Pima and Thatcher area with water levels as shallow as 21 feet.
- Change in water level ranges from decreases greater than 30 feet to increases as much as 30 feet between 1990-1991 and 2003-2004.
- Most of the measured wells in the vicinity of Pima, Thatcher and Safford show water level declines between one and 15 feet.
- Hydrographs corresponding to selected wells shown on Figure 3.10-6, but covering a longer time period, are shown in Figure 3.10-7.

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 and/or USGS
	Range 1 - 7,000 Median 600 (1,494 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 50 - 2,500	ADWR (1990 and 1994)
	Range 0 - 2,500	Anning and Duet, USGS (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)[2]	

Notes:
[1] Predevelopment Estimate
[2] 1,093 wells were meaured in a water-level sweep in 1987

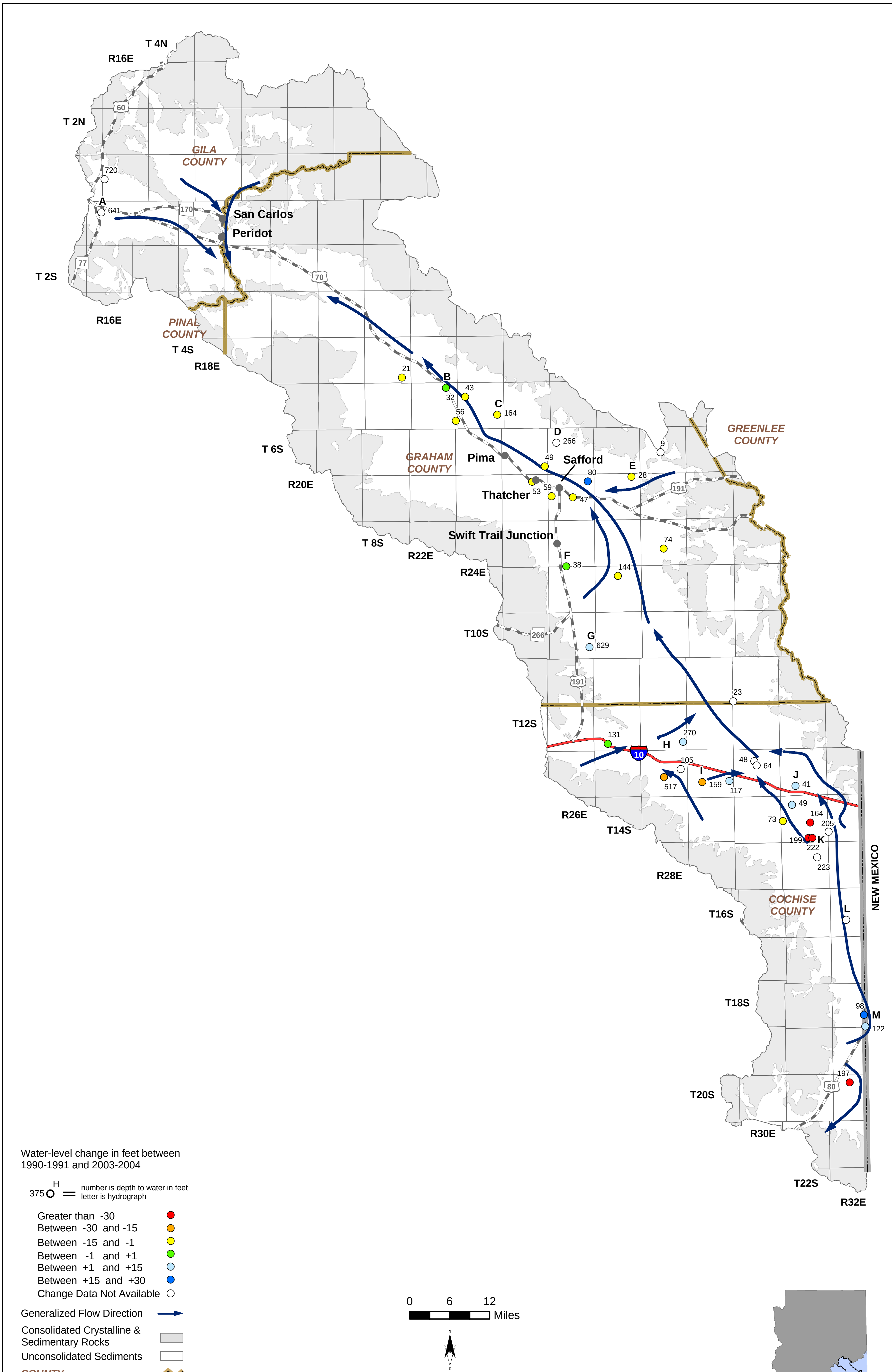
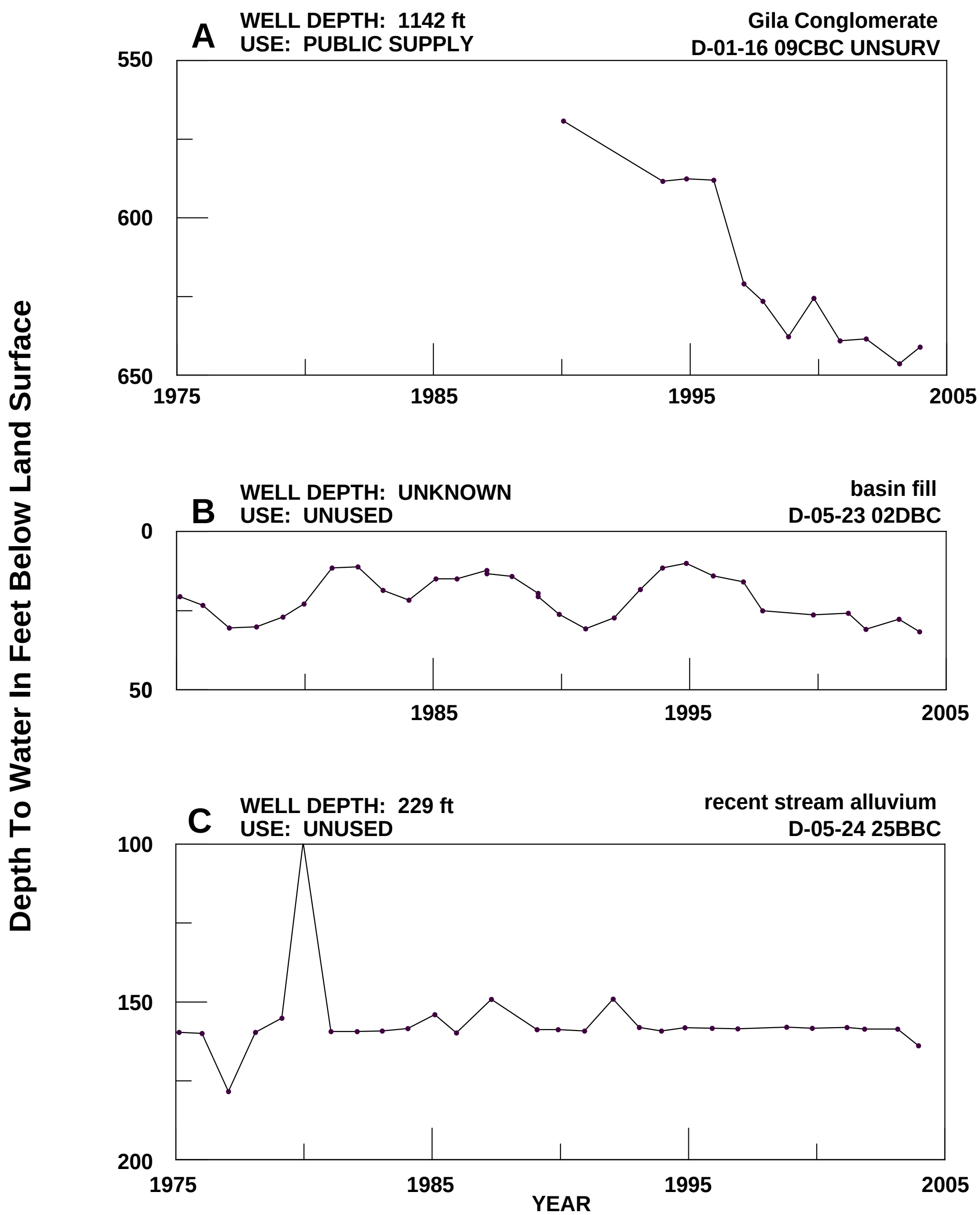


Figure 3.10-6
Safford Basin
Groundwater Conditions

Figure 3.10-7
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 3.10-7 (Con’t.)
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells

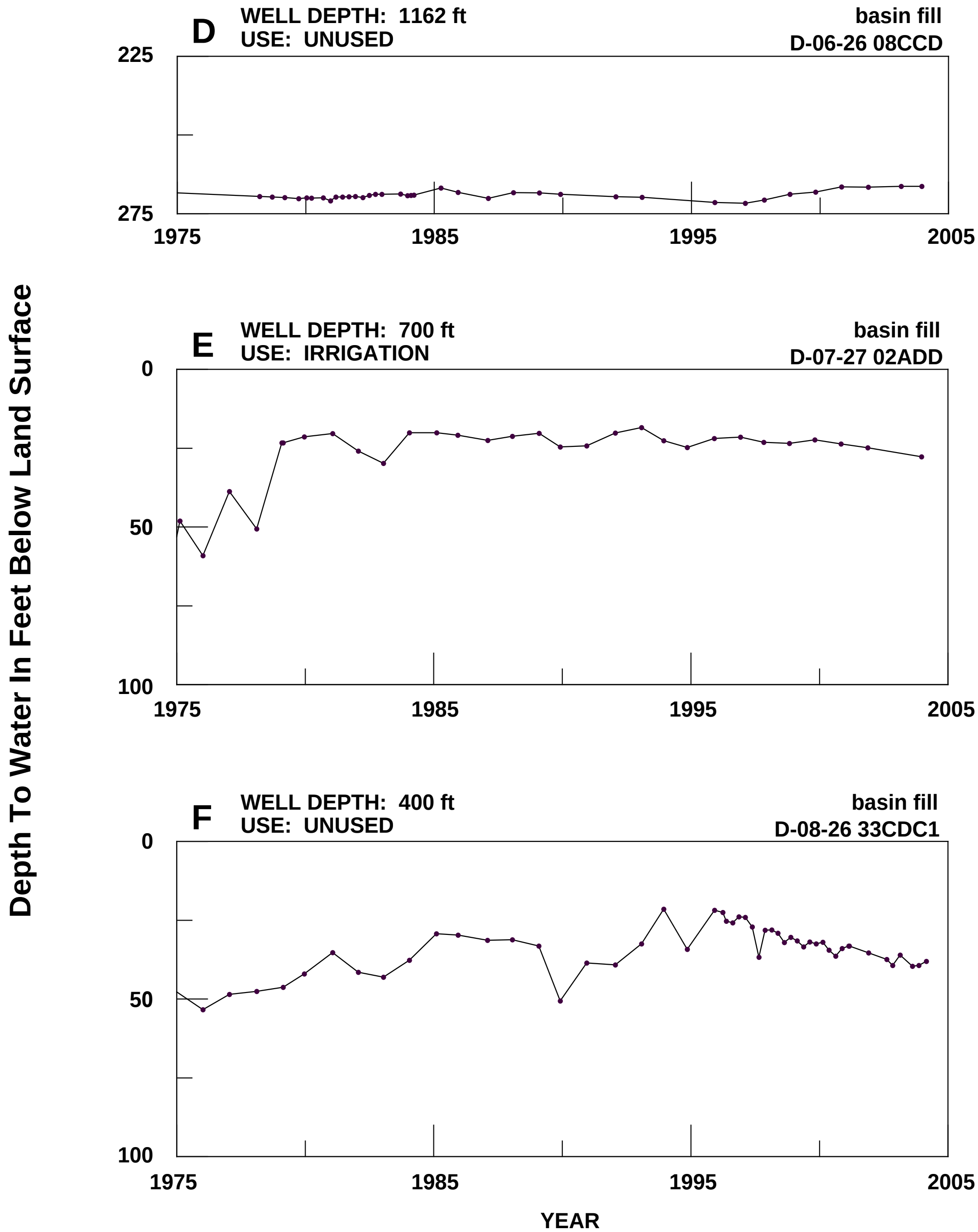


Figure 3.10-7 (Con't.)
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells

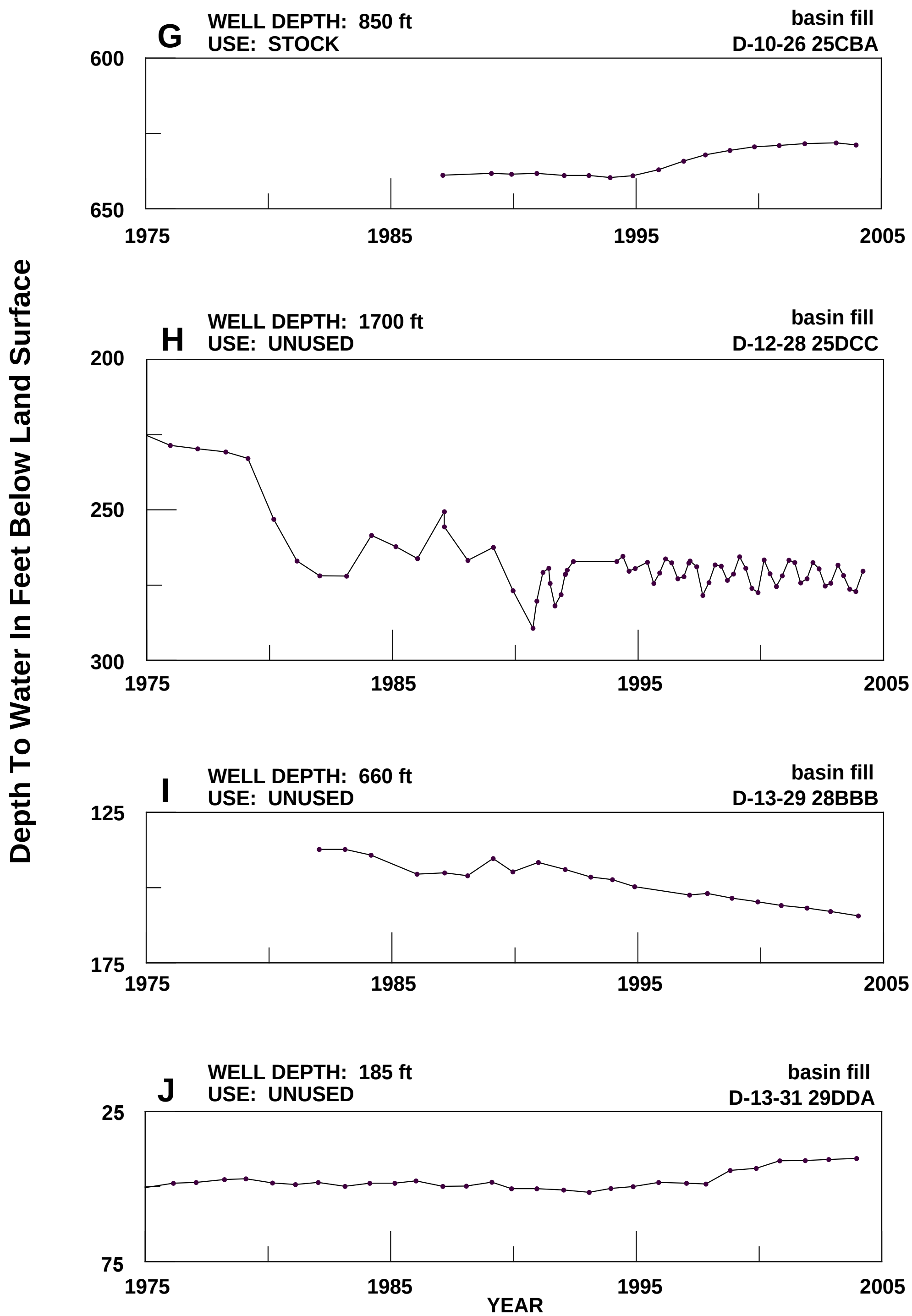
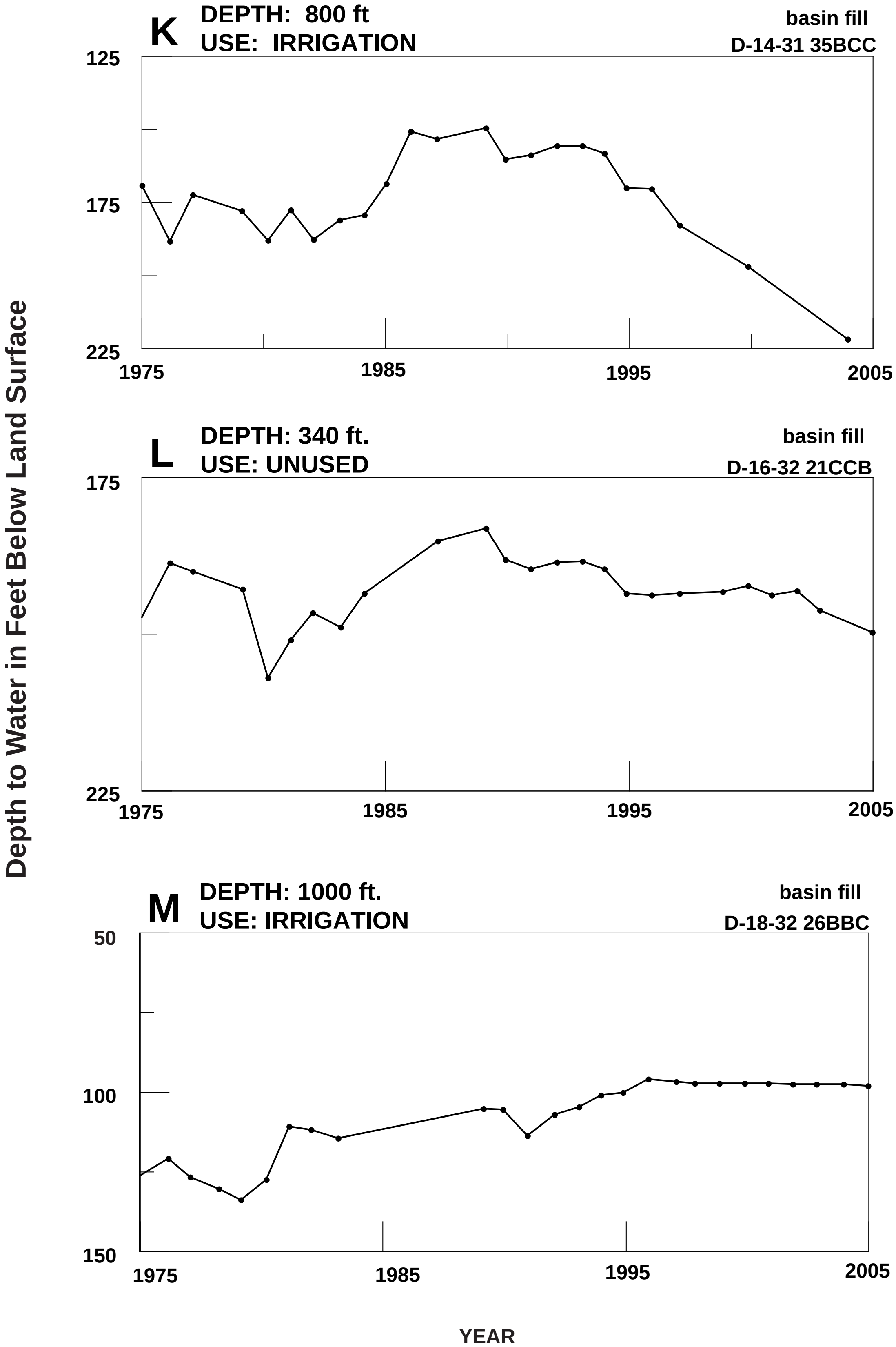


**Figure 3.10-7 (Con't.)
Safford Basin
Hydrographs Showing Depth to Water in Selected Wells**



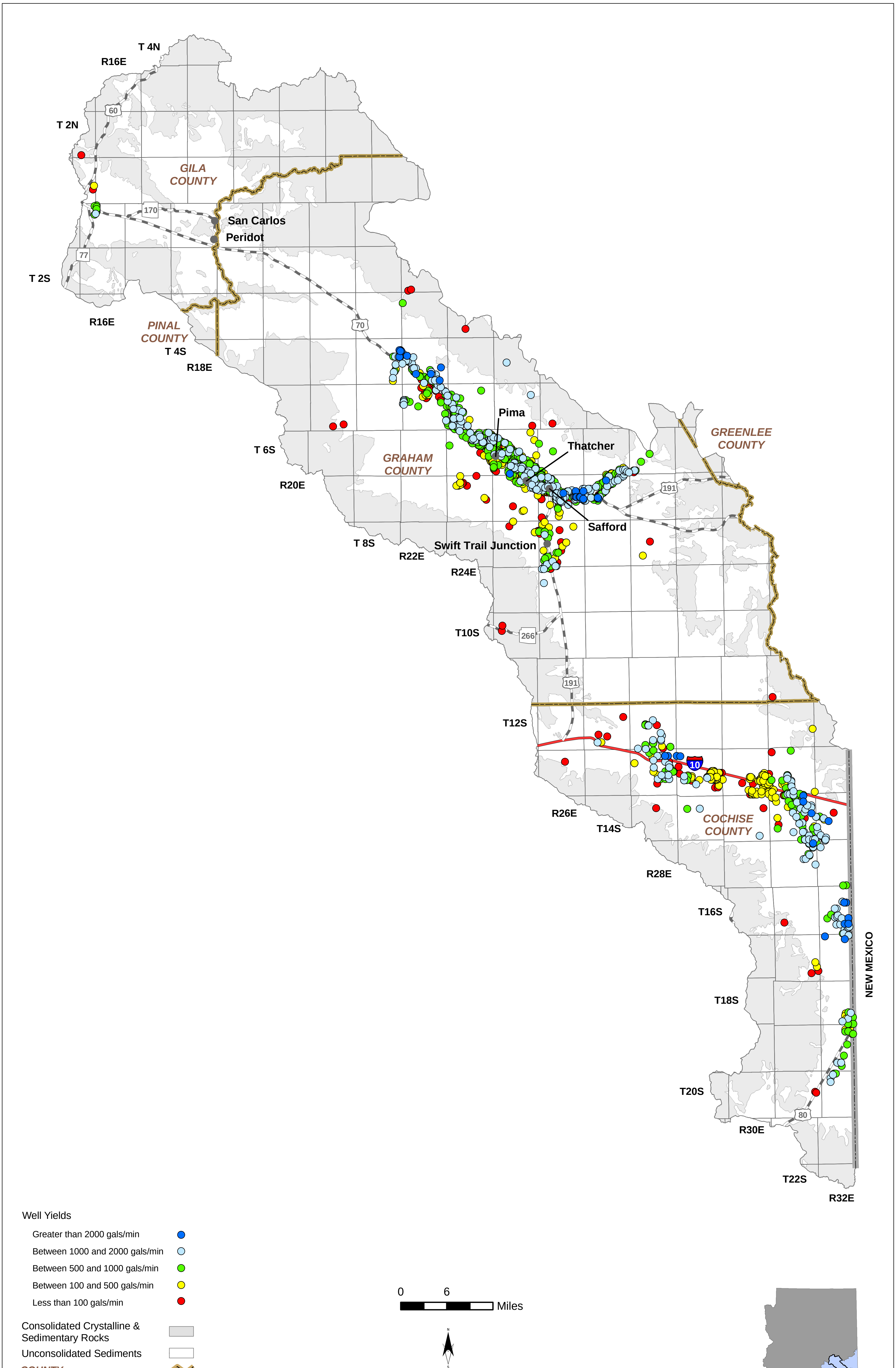


Figure 3.10-8
Safford Basin
Well Yields

3.10.7 Water Quality of the Safford Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded 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 3.10-9 shows the location of exceedences and impairment keyed to Table 3.10-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.10-7A.
- Drinking water standard exceedences in wells and springs have been reported for 173 sites in the basin.
- The most frequently exceeded parameters in the sites measured in this basin were fluoride and arsenic. These two parameters are exceeded consistently throughout the basin.
- Other parameters commonly exceeded included total dissolved solids, nitrates and lead.

Lakes and Streams

- 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 turbidity.
- There are no Total Daily Maximum Load (TMDL) reports for this basin.
- 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			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
1	Well	1 North	18 East	17	As
2	Well	1 South	18 East	12	As
3	Well	3 South	19 East	11	As
4	Well	3 South	22 East	18	TDS
5	Well	3 South	22 East	30	TDS
6	Spring	4 South	23 East	7	TDS
7	Well	4 South	23 East	18	As
8	Well	4 South	23 East	20	NO3
9	Spring	4 South	23 East	36	As, F
10	Well	5 South	21 East	36	F
11	Spring	5 South	24 East	17	F
12	Spring	5 South	24 East	17	As, Cd, F, TDS
13	Spring	5 South	24 East	17	F
14	Well	5 South	24 East	29	NO3
15	Well	5 South	24 East	29	NO3
16	Well	5 South	24 East	31	As, Pb, TDS
17	Well	6 South	23 East	3	As, F
18	Well	6 South	23 East	3	As, F
19	Well	6 South	24 East	5	Pb
20	Well	6 South	24 East	12	NO3, TDS
21	Spring	6 South	25 East	5	F
22	Well	6 South	25 East	16	F
23	Well	6 South	25 East	17	As, F, TDS
24	Well	6 South	25 East	19	As, F
25	Well	6 South	25 East	23	As, F, TDS
26	Well	6 South	25 East	26	As, F
27	Well	6 South	25 East	26	F
28	Well	6 South	25 East	26	As, F
29	Well	6 South	25 East	28	NO3
30	Well	6 South	25 East	30	As
31	Well	6 South	25 East	30	As
32	Well	6 South	25 East	33	NO3
33	Well	6 South	25 East	34	NO3
34	Well	6 South	25 East	35	NO3
35	Well	6 South	25 East	36	As, F, TDS
36	Well	6 South	26 East	35	F
37	Well	6 South	27 East	34	As
38	Well	6 South	27 East	34	As
39	Well	7 South	23 East	1	As
40	Well	7 South	23 East	1	F, Pb
41	Well	7 South	23 East	1	F
42	Well	7 South	23 East	1	F
43	Well	7 South	23 East	1	F

Table 3.10-7 Water Quality Exceedences in the Safford Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
44	Well	7 South	23 East	1	F
45	Well	7 South	23 East	1	F
46	Well	7 South	23 East	1	F
47	Well	7 South	23 East	1	F
48	Well	7 South	23 East	1	F
49	Well	7 South	23 East	1	F
50	Well	7 South	23 East	5	As
51	Well	7 South	24 East	8	As, F
52	Well	7 South	24 East	8	As
53	Well	7 South	24 East	8	As
54	Well	7 South	24 East	8	As
55	Well	7 South	24 East	14	As
56	Well	7 South	24 East	14	As
57	Well	7 South	25 East	2	As
58	Well	7 South	25 East	2	NO3
59	Well	7 South	25 East	2	NO3
60	Well	7 South	25 East	7	As, Cd, F, Pb, TDS
61	Well	7 South	25 East	11	NO3
62	Well	7 South	25 East	27	As, F, TDS
63	Well	7 South	26 East	4	As, F, TDS
64	Well	7 South	26 East	15	As, F, TDS
65	Well	7 South	26 East	21	As
66	Well	7 South	26 East	23	As
67	Well	7 South	26 East	24	As
68	Well	7 South	26 East	24	As
69	Well	7 South	26 East	24	As
70	Well	7 South	26 East	24	As
71	Well	7 South	26 East	28	TDS
72	Well	7 South	27 East	2	As, F
73	Well	7 South	27 East	2	As, F
74	Well	7 South	27 East	2	As, F
75	Well	7 South	27 East	2	F
76	Well	7 South	27 East	2	F
77	Well	7 South	27 East	2	As
78	Well	7 South	27 East	3	As, F
79	Well	7 South	27 East	8	As
80	Well	7 South	27 East	11	As, F
81	Well	7 South	27 East	16	F
82	Well	7 South	27 East	16	F
83	Well	7 South	27 East	16	As
84	Well	7 South	27 East	18	As
85	Well	7 South	27 East	20	As
86	Well	7 South	27 East	20	As, F
87	Well	8 South	26 East	6	As, F

Table 3.10-7 Water Quality Exceedences in the Safford Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
88	Well	8 South	26 East	7	As, F, TDS
89	Well	8 South	26 East	7	Pb
90	Well	8 South	26 East	7	As
91	Well	8 South	26 East	7	F
92	Well	8 South	26 East	7	F
93	Well	8 South	26 East	8	F
94	Well	8 South	26 East	8	F
95	Well	8 South	26 East	15	F
96	Well	8 South	26 East	17	F
97	Well	8 South	26 East	17	F
98	Well	8 South	26 East	18	F
99	Well	8 South	26 East	18	F
100	Well	8 South	26 East	18	F
101	Well	8 South	26 East	18	F
102	Well	8 South	26 East	20	F
103	Well	8 South	26 East	28	As, F
104	Well	8 South	26 East	32	F
105	Well	8 South	27 East	23	As, F
106	Well	8 South	28 East	22	F
107	Well	8 South	28 East	29	As, F
108	Well	8 South	29 East	22	Pb
109	Well	9 South	26 East	5	F
110	Well	9 South	26 East	6	As
111	Well	9 South	26 East	6	As, F
112	Well	9 South	28 East	31	As, F
113	Well	9 South	30 East	33	As
114	Well	10 South	27 East	28	F
115	Well	10 South	28 East	7	Se
116	Well	10 South	28 East	36	As, F
117	Well	11 South	26 East	23	F
118	Well	11 South	28 East	28	As, NO3
119	Well	11 South	28 East	31	NO3
120	Well	11 South	29 East	1	F
121	Well	11 South	29 East	1	As, F
122	Well	11 South	29 East	1	F
123	Well	11 South	29 East	10	F
124	Well	11 South	29 East	14	As, F
125	Well	11 South	29 East	36	F
126	Well	11 South	29 East	36	F
127	Well	11 South	30 East	1	F
128	Well	11 South	30 East	31	As, F
129	Well	12 South	28 East	14	NO3
130	Well	12 South	28 East	34	NO3
131	Well	12 South	29 East	1	F

Table 3.10-7 Water Quality Exceedences in the Safford Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
132	Well	12 South	29 East	16	As, F
133	Well	12 South	30 East	28	F
134	Well	13 South	26 East	10	Rad
135	Well	13 South	29 East	18	F
136	Well	13 South	29 East	21	F
137	Well	13 South	29 East	25	As
138	Well	13 South	29 East	25	NO3
139	Well	13 South	29 East	25	As
140	Well	13 South	30 East	3	F
141	Well	13 South	30 East	15	F
142	Well	13 South	30 East	15	As
143	Well	13 South	30 East	24	F
144	Well	13 South	30 East	25	F
145	Well	13 South	30 East	25	F
146	Well	13 South	31 East	6	F
147	Well	13 South	31 East	6	F
148	Well	13 South	31 East	17	F
149	Well	13 South	31 East	18	F
150	Well	13 South	31 East	20	F
151	Well	13 South	31 East	22	F
152	Well	13 South	31 East	28	F
153	Well	13 South	31 East	30	F
154	Well	13 South	31 East	31	F
155	Well	13 South	31 East	34	F
156	Well	14 South	31 East	3	NO3,TDS
157	Well	14 South	31 East	6	F
158	Well	14 South	31 East	9	Pb, NO3
159	Well	14 South	31 East	9	F, NO3, TDS
160	Well	14 South	31 East	9	NO3, TDS
161	Well	14 South	31 East	9	F
162	Well	14 South	31 East	9	F
163	Well	14 South	31 East	10	F, NO3
164	Well	14 South	31 East	10	NO3, TDS
165	Well	14 South	31 East	10	F, NO3
166	Well	14 South	31 East	16	As, F
167	Well	14 South	31 East	19	As, F
168	Well	14 South	31 East	23	Pb
169	Well	14 South	31 East	35	F
170	Well	14 South	32 East	20	NO3
171	Well	15 South	29 East	4	F
172	Well	15 South	32 East	34	Pb
173	Well	18 South	32 East	26	F
174	Well	NA	NA	NA	As, F

Table 3.10-7 Water Quality Exceedences in the Safford Basin[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	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, turbidity

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/Nitrite
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

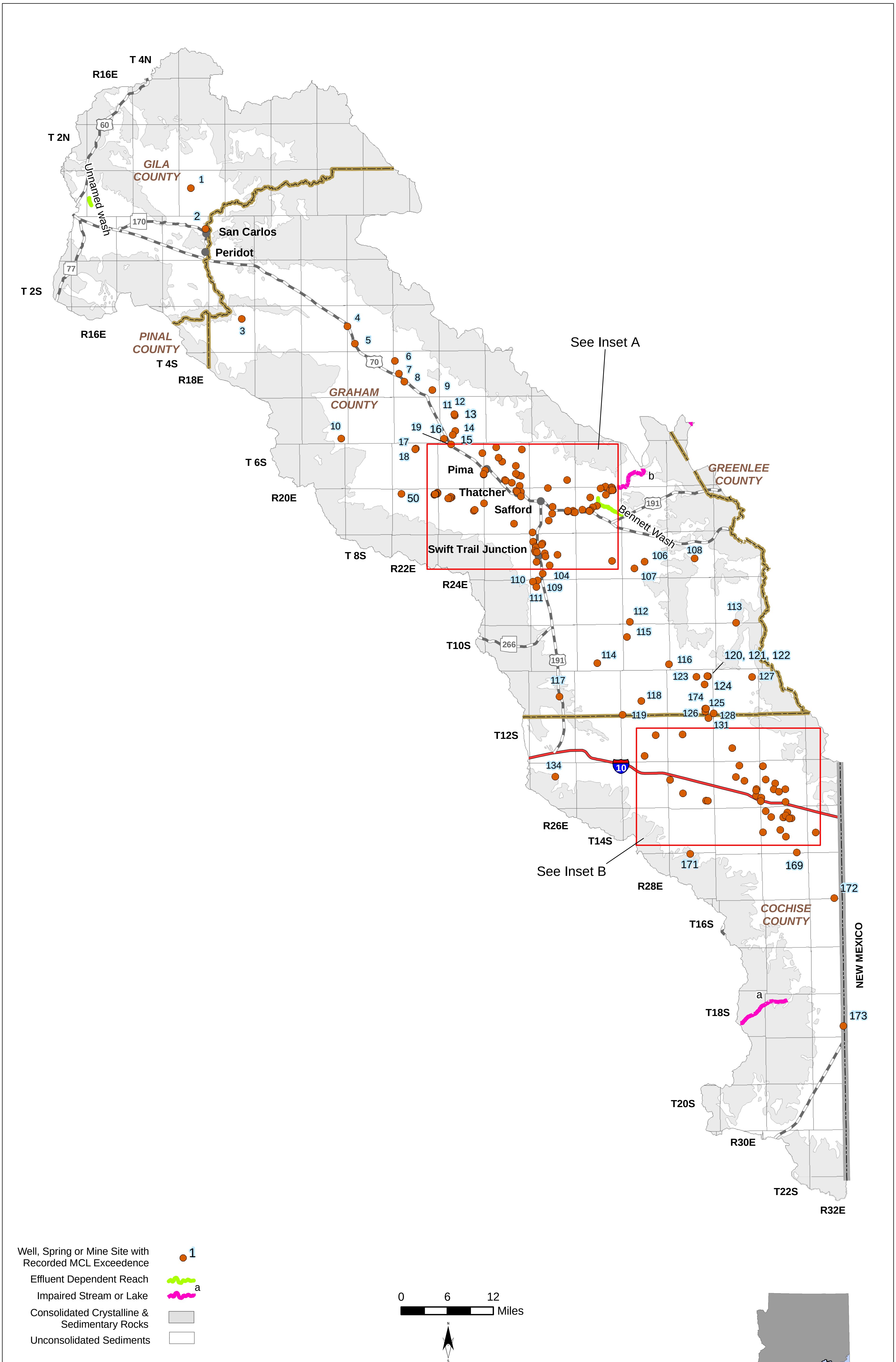


Figure 3.10-9
Safford Basin
Water Quality Conditions

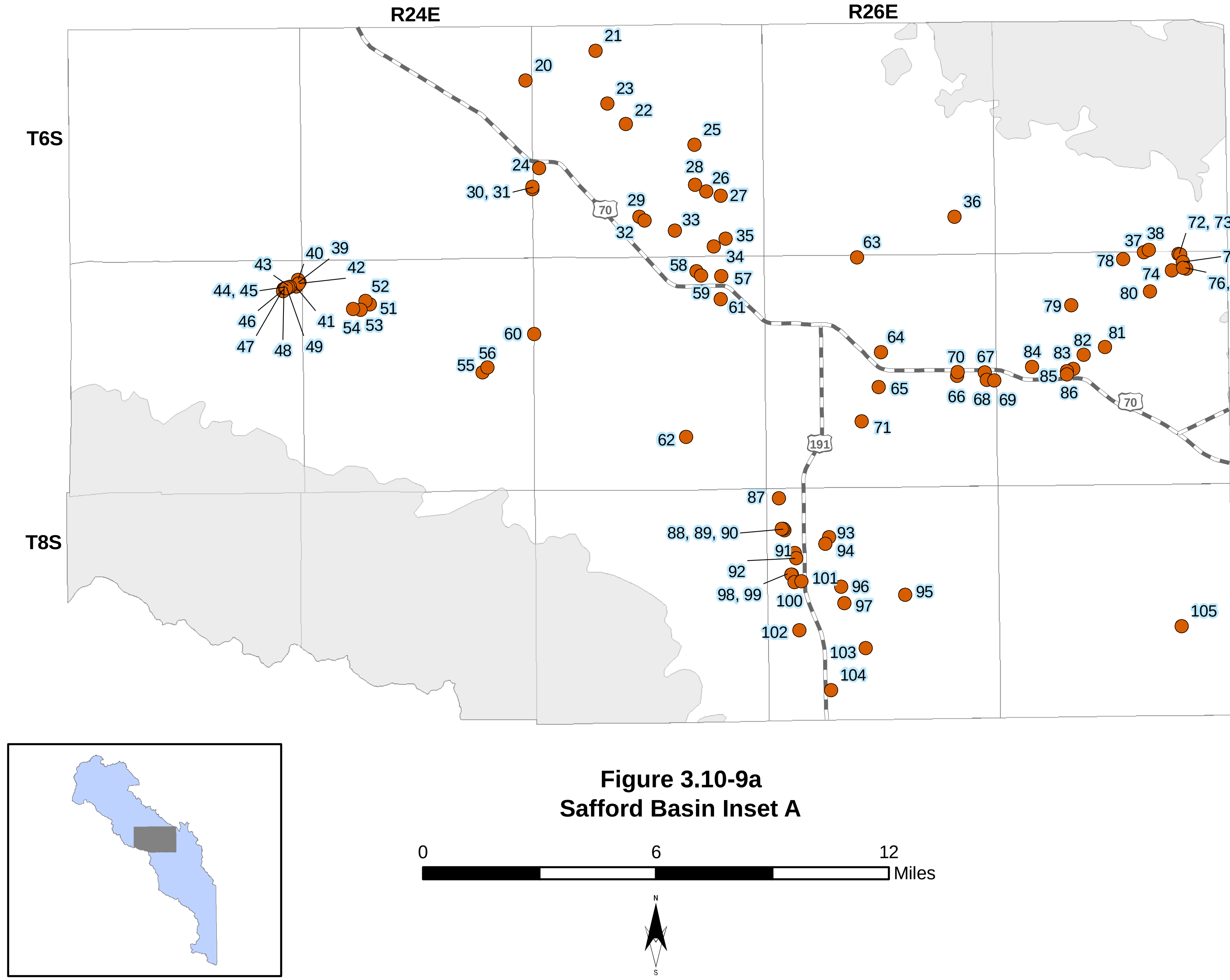


Figure 3.10-9a
Safford Basin Inset A

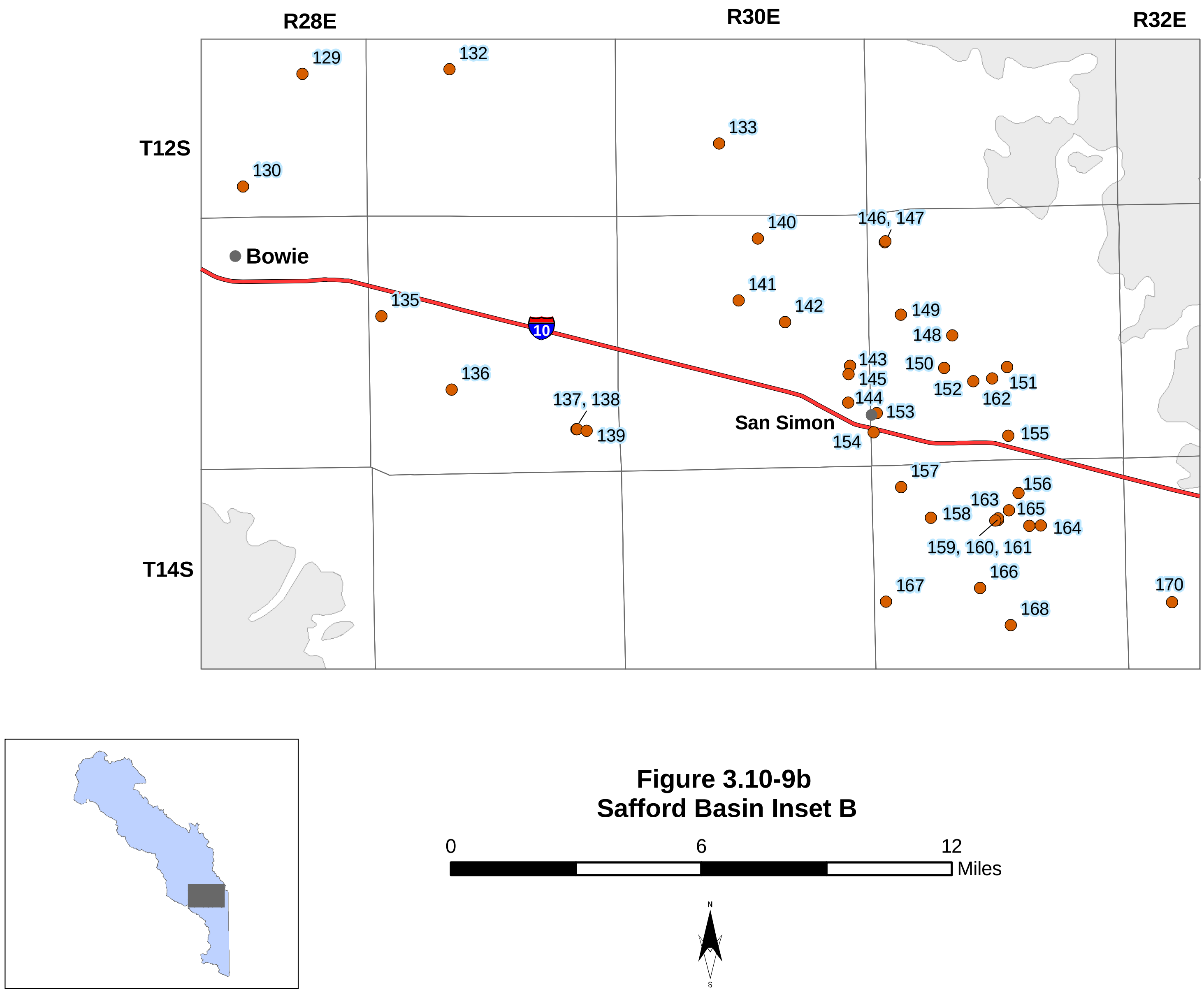


Figure 3.10-9b
Safford Basin Inset B

3.10.8 Cultural Water Demands 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 3.10-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.10-8 and Figure 3.10-10.
- Population has increased by about 600 people a year on average from 1980 to 2000. Projections suggest an increase in population of over 28,000 through 2050.
- Total groundwater use decreased from 1971 to 1990 and then increased again from 1991 to 2003. An average of 125,850 acre-feet was pumped per year in the period from 2001-2003.
- Surface water diversions increased from 1971 to 1985 and have decreased from 1986 to 2003, with 73,000 acre-feet diverted per year on average in the period from 1991 – 2003.
- All surface water diversions between 1991 and 2003 were for agriculture.
- This basin contains the largest surface water diversions, as well as largest surface water diversions for agriculture, in the planning area.
- Approximately 98% of the total water demand in this basin is for agriculture.
- Agricultural demand for groundwater versus surface water varies based on the availability of surface water.
- 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 2,800 acre-feet of municipal water demand per year and 550 acre-feet of industrial water demand per year in the period from 2000-2003.
- As of 2003 there were 3,045 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 1,690 wells with a pumping capacity of more than 35 gallons per minute.

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 2,000 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 Demands in the Safford Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971										
1972										
1973					180,000			84,000		
1974										
1975										
1976		1,945[2]	1,562[2]							
1977										
1978					184,000			86,000		
1979										
1980	27,638									
1981	27,969									ADWR (1994) Gila Water Commis - sioner (2006)
1982	28,300									
1983	28,631	241	47		113,000			125,000		
1984	28,962									
1985	29,293									
1986	29,624									
1987	29,955									
1988	30,286	201	37		71,500			117,000		
1989	30,617									
1990	30,948									
1991	31,824									
1992	32,699									
1993	33,575	191	25	3,100	650	86,000	NR	NR	117,000	
1994	34,451									
1995	35,327									
1996	36,203									USGS (2005) Gila Water Commis - sioner (2006)
1997	37,079									
1998	37,954	249	16	2,800	500	91,500	NR	NR	99,500	
1999	38,830									
2000	39,706									
2001	40,572									
2002	41,437	88	2	2,800	550	122,500	NR	NR	73,000	
2003	42,303									
2010	48,362									
2020	55,055									
2030	60,979									
2040	66,034									
2050	70,683									
ADDITIONAL WELLS:[3]		**130**	**1**							
WELL TOTALS:		**3,045**	**1,690**							

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.
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	Discharge to Another Facility	Groundwater Recharge			
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	846			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	10	NA							Secondary	NA	1996
Soda Canyon	San Carlos Apache Tribe	Soda Canyon	106	10	NA							Secondary	NA	1996
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	2,371										

Notes:
NA: Data not currently available to ADWR
WWTF: Wastewater Treatment Facility
Adv. Tr. I: Advance treatment level I

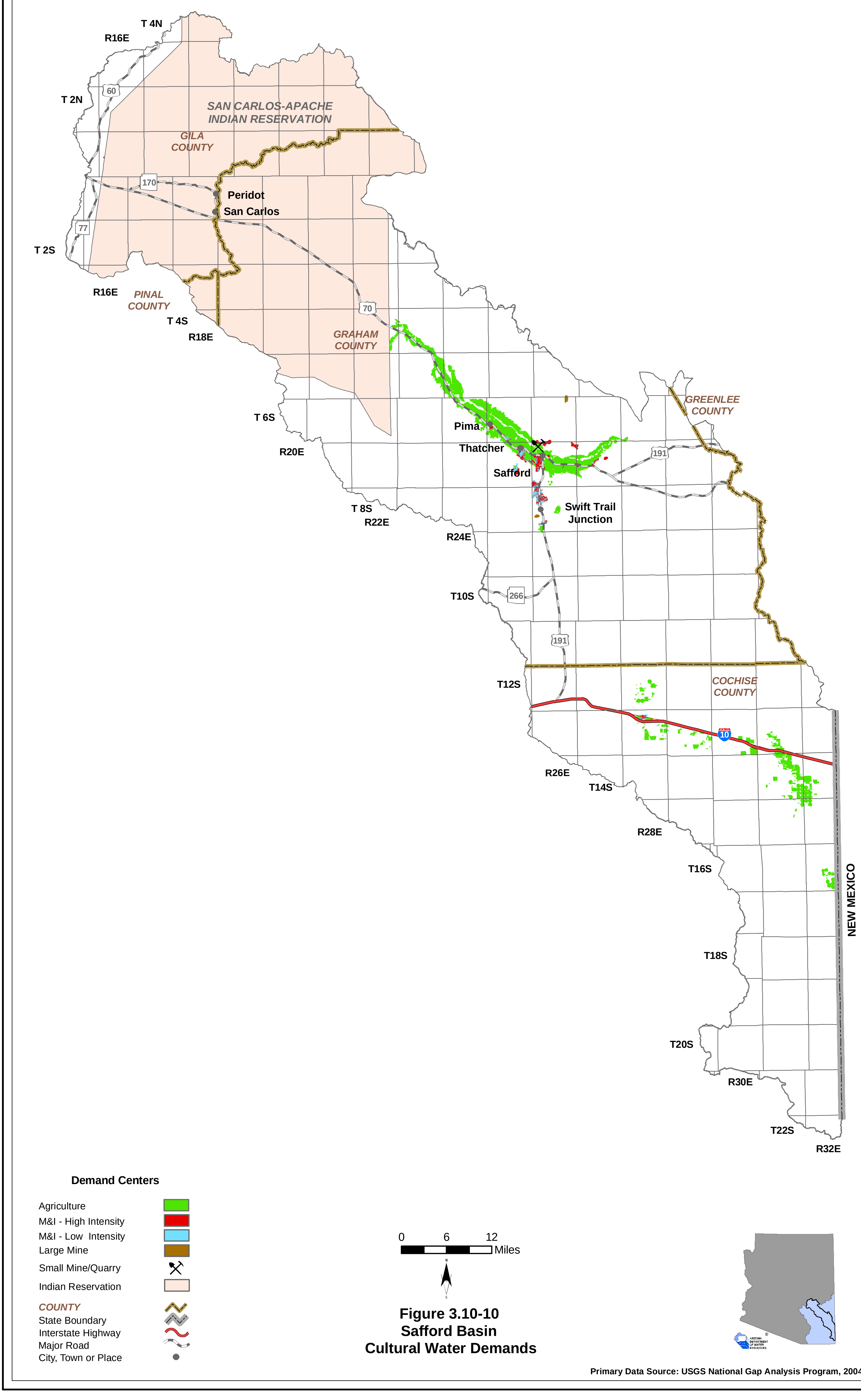


Figure 3.10-10
Safford Basin
Cultural Water Demands

Primary Data Source: USGS National Gap Analysis Program, 2004

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 3.10-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

- A total of 20 water adequacy determinations have been made in this basin through May, 2005.
- 14 determinations of inadequacy have been made, most of these determinations are in the vicinity of Swift Trail Junction, others are found in the northernmost portion of the basin and in the southern portion of the basin.
- The primary reasons for a determination 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.
- Other inadequacy determinations were for insufficient supply and for unknown reasons because the records were not available.
- 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	151	0	0
Gila	154	38	25
Graham	426	82	19
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	Apache Peaks Dev., Plat A	Gila	1 North	15.5 East	13, 14	38		Adequate		04/20/81	Apache Peaks Utilities
2	Arizona Sky Village	Cochise	17 South 17 South	32 East 31 East	19 13, 24	80	22-400785	Inadequate	A1	10/28/02	Dry Lot Subdivision
3	Buena Vista Ranches	Graham	8 South	26 East	29	25	22-300236	Adequate		12/17/96	Dry Lot Subdivision
4	Copper Canyon Ranches # 1B	Gila	1 North	15.5 East	1,12	NA		Inadequate	A1	10/16/90	Dry Lot Subdivision
5	Copper Canyon Ranches # 2	Gila	1 North	15.5 East	10, 14, 15, 22	65		Inadequate	A1, A2, C	02/02/95	Dry Lot Subdivision
6	Copper Canyon Ranches # 3	Gila	1 North	15.5 East	10	51	22-400246	Inadequate	A1	02/08/00	Dry Lot Subdivision
7	Desert Hills Ranchettes	Graham	8 South	26 East	6	49		Inadequate	C	04/06/76	Dry Lot Subdivision
8	Desert Hills Ranchettes # 3	Graham	7 South	26 East	31	66		Inadequate	A1, C	04/11/83	Dry Lot Subdivision
9	Desert Hills Ranchettes # 4	Graham	7 South 8 South	25 East 25 East	36 1	NA		Inadequate	A1, C	05/21/85	Dry Lot Subdivision
10	Galeyville Subdivision	Cochise	17 South	31 East	7, 18	71	22-400763	Inadequate	A2	08/05/02	Dry Lot Subdivision
11	High Mesa Air Park	Graham	8 South	26 East	2	NA		Inadequate	D	06/21/88	Dry Lot Subdivision
12	Los Alamos Hills # 1	Graham	7 South	24 East	4	24		Inadequate	A1	06/19/85	Dry Lot Subdivision
13	Maloy High Chaparral Estates	Graham	8 South	26 East	2	64	22-400078	Inadequate	A1, C	05/21/99	Dry Lot Subdivision
14	Mountain Air Estates	Graham	8 South	26 East	9	28		Inadequate	C	03/06/74	Dry Lot Subdivision
15	Mountain Breeze	Graham	8 South	26 East	7	4		Inadequate	C	06/16/76	Dry Lot Subdivision
16	Pima South Estates	Graham	6 South	25 East	30	27		Adequate		11/30/76	City Utilities Company
17	Pima South Estates # 1	Graham	6 South	25 East	30	6		Adequate		10/18/79	General Utilities
18	Pima South Estates # 2	Graham	6 South	25 East	30	24		Adequate		05/17/94	Graham County Utilities, Inc.
19	Siesta Hot Springs	Graham	6 South	24 East	6	90	22-300003	Inadequate	A1, C	04/21/95	Dry Lot Subdivision
20	Sundown	Graham	5 South	23 East	3	19		Adequate		07/16/79	Dry Lot Subdivision

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

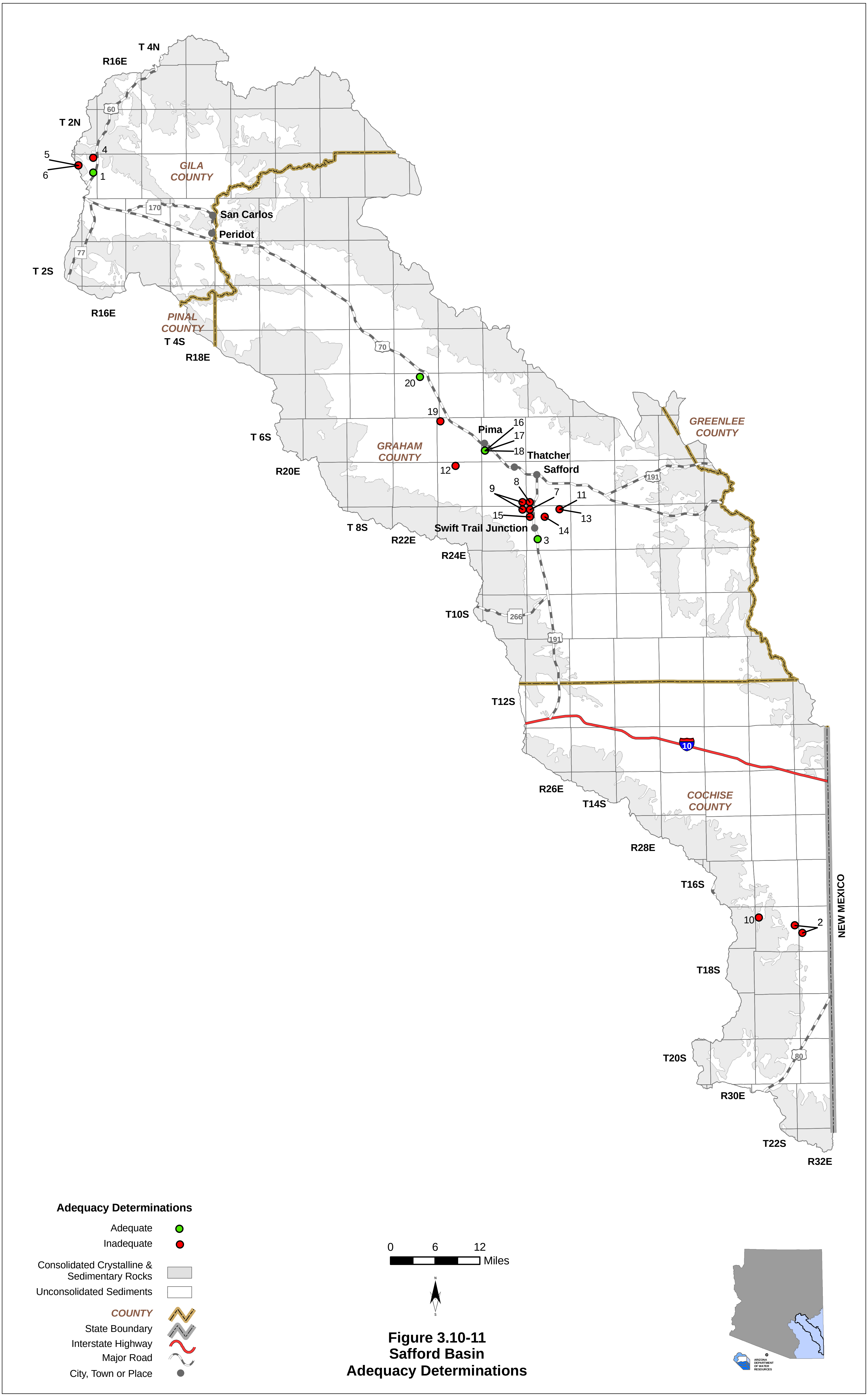


Figure 3.10-11
Safford Basin
Adequacy Determinations

SAFFORD BASIN
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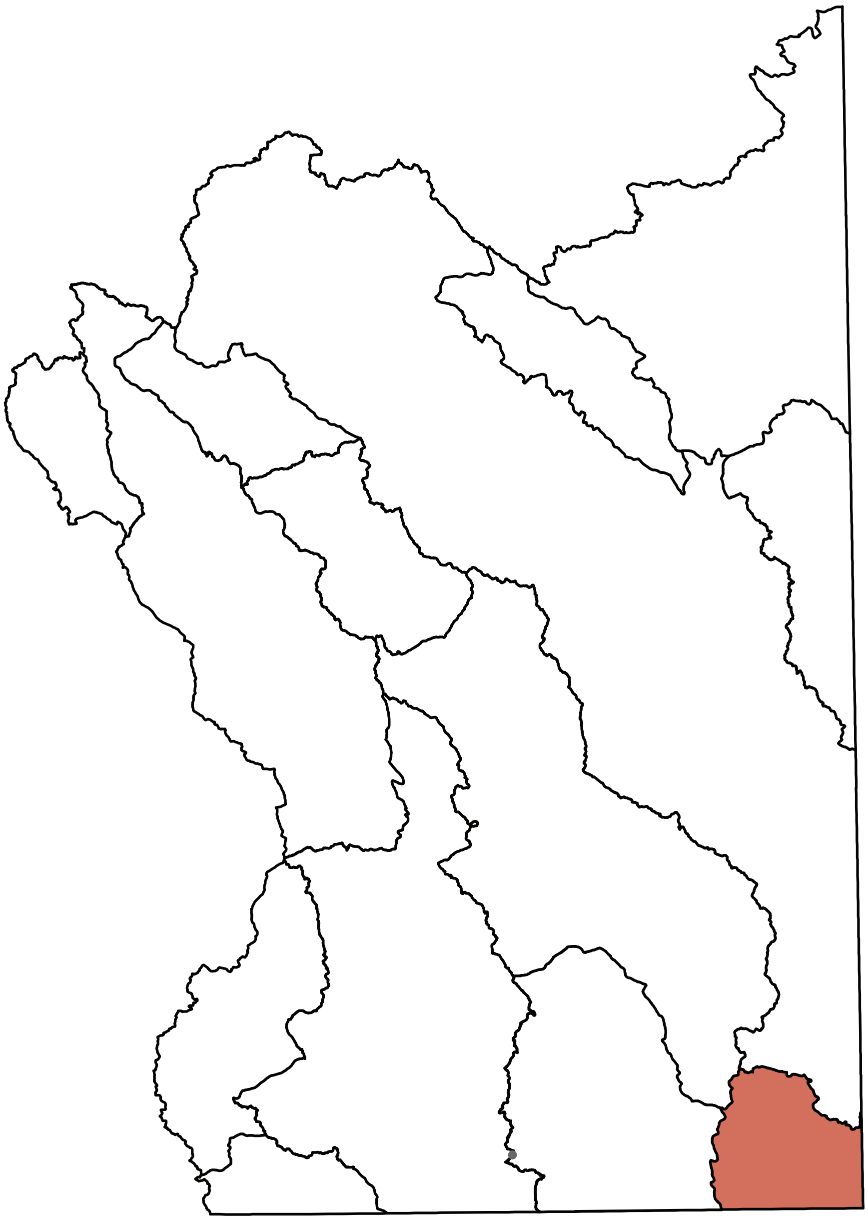
Safford Basin Index to Section 3.0

Section 3.11
San Bernardino Valley Basin

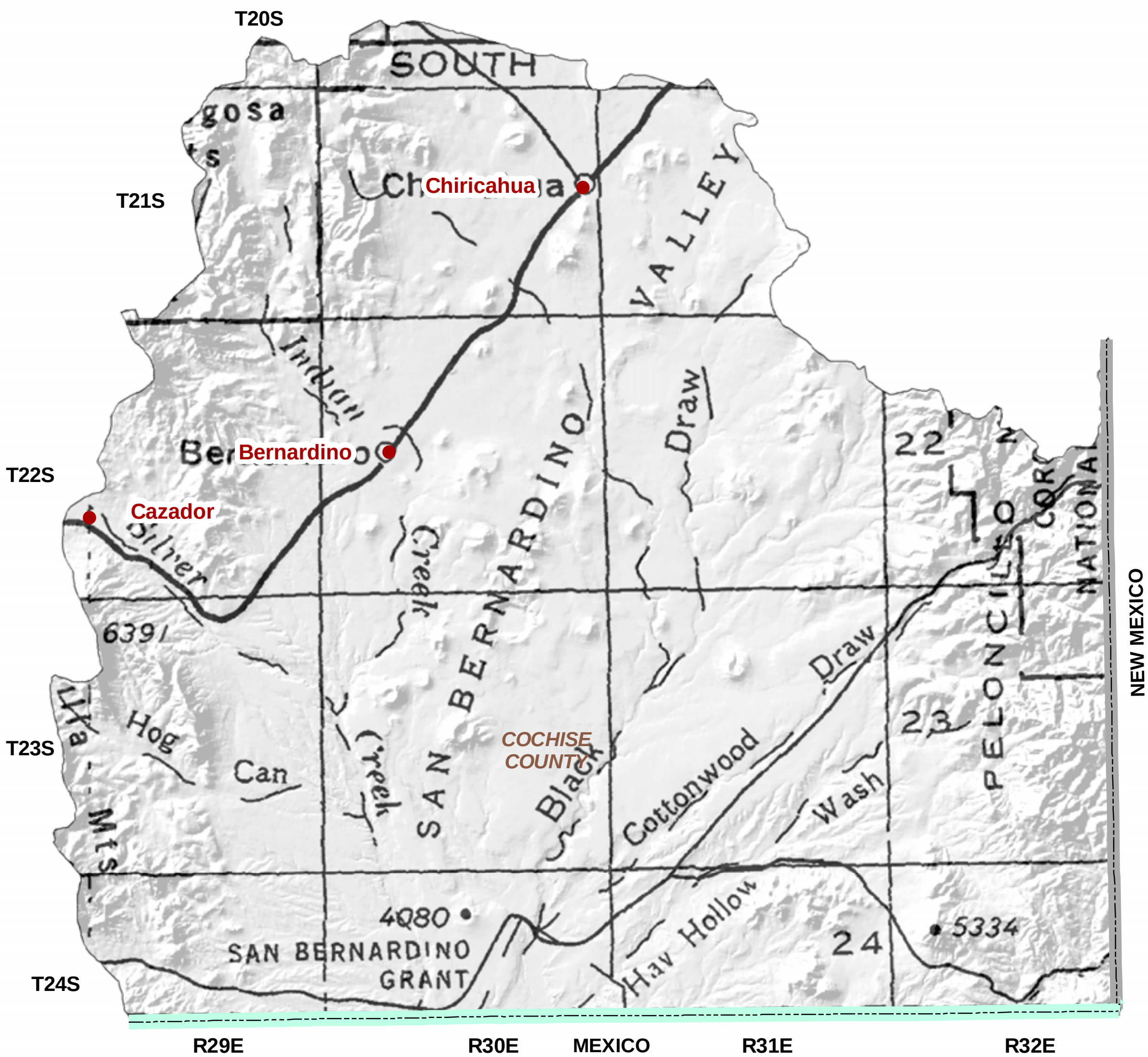


3.11.1 Geography of the San Bernardino Valley Basin

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 and desert scrub, grassland and woodland vegetation.

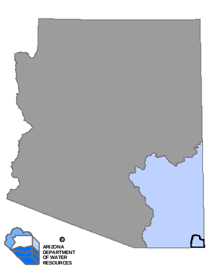
- Principal geographic features shown on Figure 3.11-1 are:
  - Principal basin communities of Chiricahua, Bernardino and Cazador
  - San Bernardino Valley east of Bernardino and Chiricahua
  - Indian Creek north of Bernardino
  - Silver Creek north of Cazador
  - Black Draw east of Bernardino running north-south to the Mexico border
  - Peloncillo Mountains to the east

- Not well shown on Figure 3.11-1 are the Perilla Mountains to the west, which include the highest point in the basin at 6,391 feet, the Pedregosa Mountains on the northwest basin boundary.



0 3 6 Miles

State Boundary
International Boundary
City, Town or Place



Base Map: USGS 1:500,000, 1981

Figure 3.11-1
San Bernardino Valley 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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

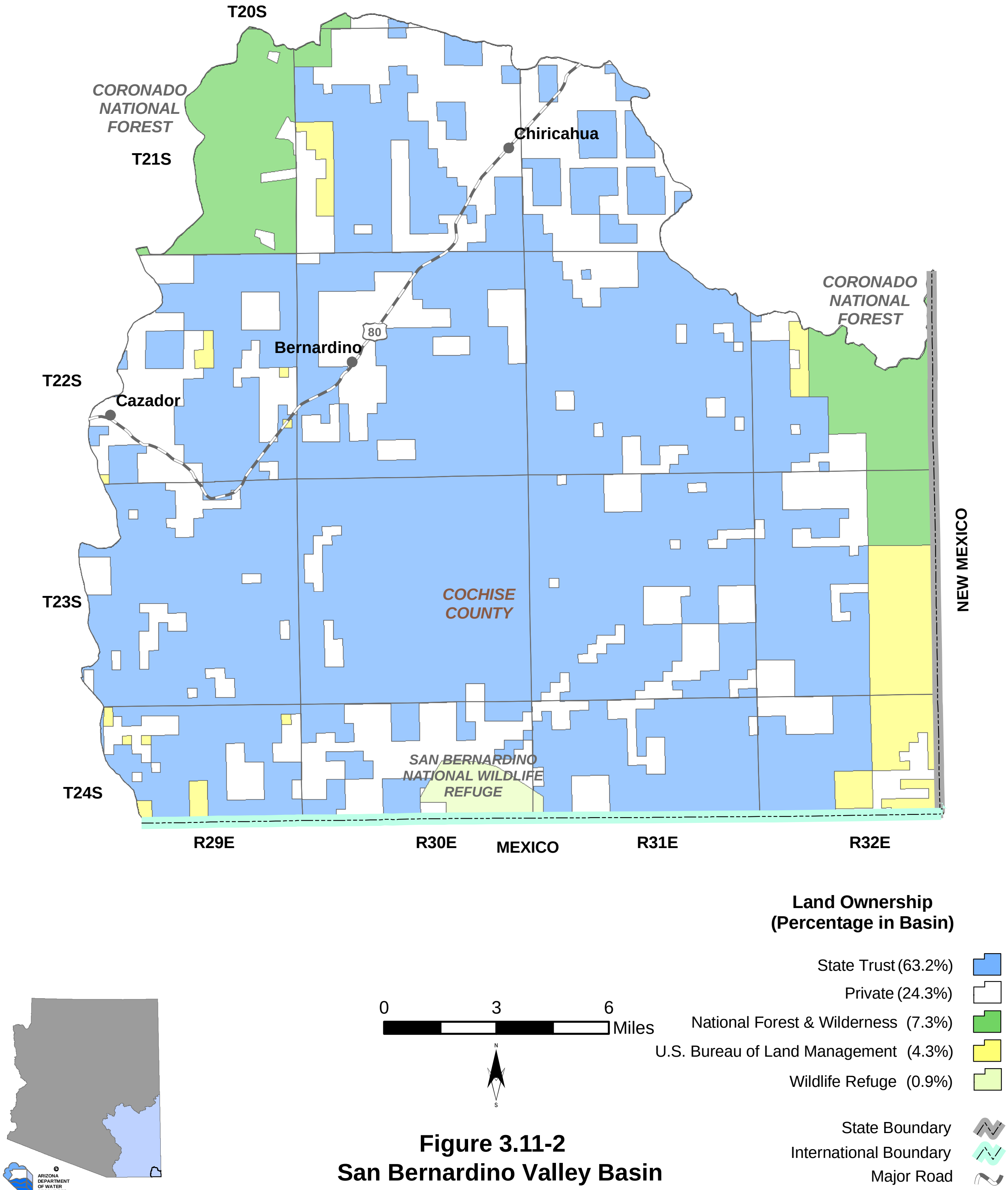
State Trust
- 63.2% of land in this basin is held in trust for public schools and nine other beneficiaries under the State Trust Land system.
- Much of the state owned land in this basin is adjacent to other state owned lands but interspersed with parcels of privately owned and Bureau of Land Management 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 and Wilderness
- 7.3% of land is federally owned and managed as national forest and wilderness.
- 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 Bureau of Land Management.
- 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 Valley Basin
Land Ownership

3.11.3 Climate of the San Bernardino Valley Basin

The San Bernardino Valley Basin does not contain any NOAA/NWS Coop Network, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. The precipitation figures shown in Figure 3.11-3 are from the Spatial Climatic Analysis Service at Oregon State University. A description of this and other climate data sources and methods is found in Volume 1, Section 1.3.3.

Average Annual Precipitation

- Average annual precipitation is as high as 22 inches at the Pedregosa Mountains in the northwest portion of the basin.
- Average annual precipitation is as low as 10 inches at the San Bernardino Valley along the border with Mexico.
- In general, rainfall increases as the elevation increases in this basin with the highest precipitation volumes in the northern portion of the basin.
- The average precipitation range of 14 inches between areas of highest and lowest rainfall is common for the planning area.

Table 3.11-1 Climate Data for the San Bernardino 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
None									

Source: WRCC, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

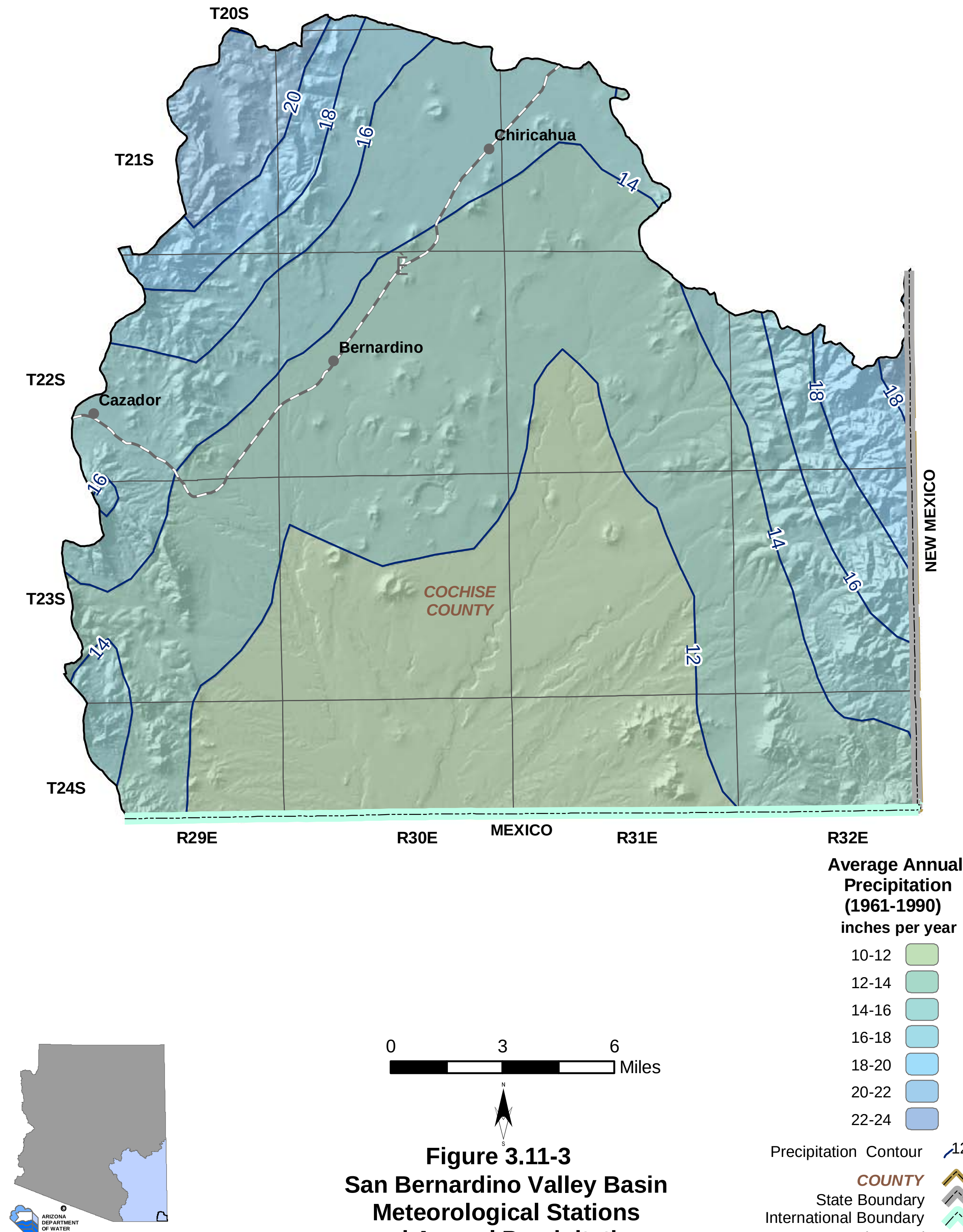
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005



Average Annual Precipitation (1961-1990)
inches per year

10-12
12-14
14-16
16-18
18-20
20-22
22-24

Precipitation Contour
COUNTY
State Boundary
International Boundary
Major Road
City, Town or Place

Figure 3.11-3
San Bernardino Valley Basin Meteorological Stations and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

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 3.11-4. The USGS annual runoff contours as well as stream channels are shown on Figure 3.11-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Reservoirs and Stockponds

- Refer to Table 3.11-4.
- 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.
- Total maximum storage for one of the small reservoirs is 45 acre-feet. Total surface area for the other four small reservoirs is 22 acres.
- There are an estimated 151 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.11-4.
- Average annual runoff varies from 0.2 inches per year in the middle half of the basin to 2 inches per year at the northern boundary.

Table 3.11-2 Streamflow Data for the San Bernardino Valley Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	
None													

Table 3.11-3 Flood ALERT Equipment in the San Bernardino Valley Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.11-4 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]	Private	401	U	Landowner

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

Total number: 1
Total maximum storage: 45 acre-feet

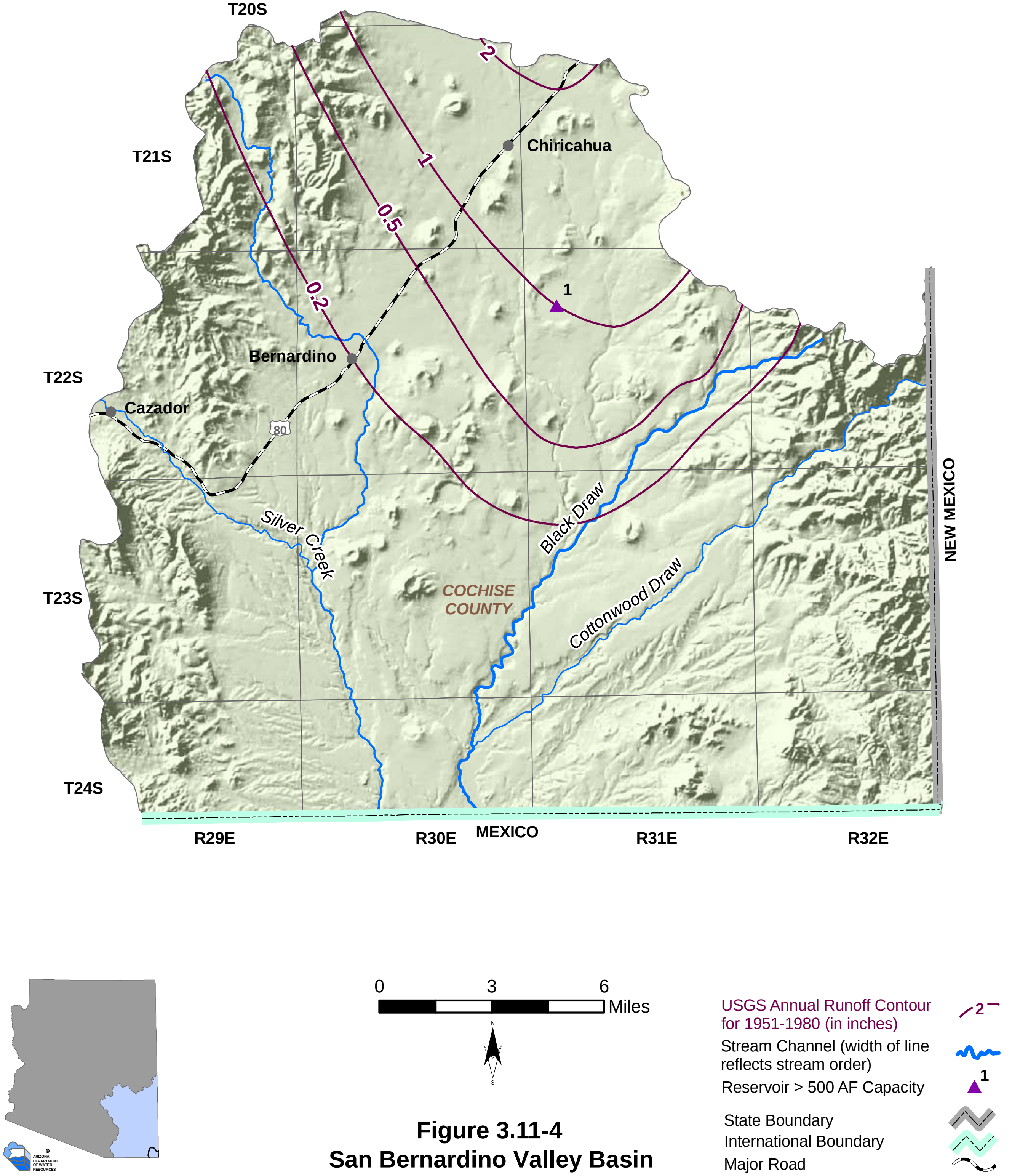
D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

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



Stream Data Source: ALRIS, 2005

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 3.11-5. There are no major springs identified in this basin. The locations of perennial and intermittent streams are shown on Figure 3.11-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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.
- Listed discharge rates may not be indicative of current conditions. The House Spring was last measured in 1985.
- The total number of springs identified by the USGS varies from 6 to 10, depending on the database reference.

Table 3.11-5 Springs in the San Bernardino Valley Basin

A. Major Springs (10 gpm or greater):

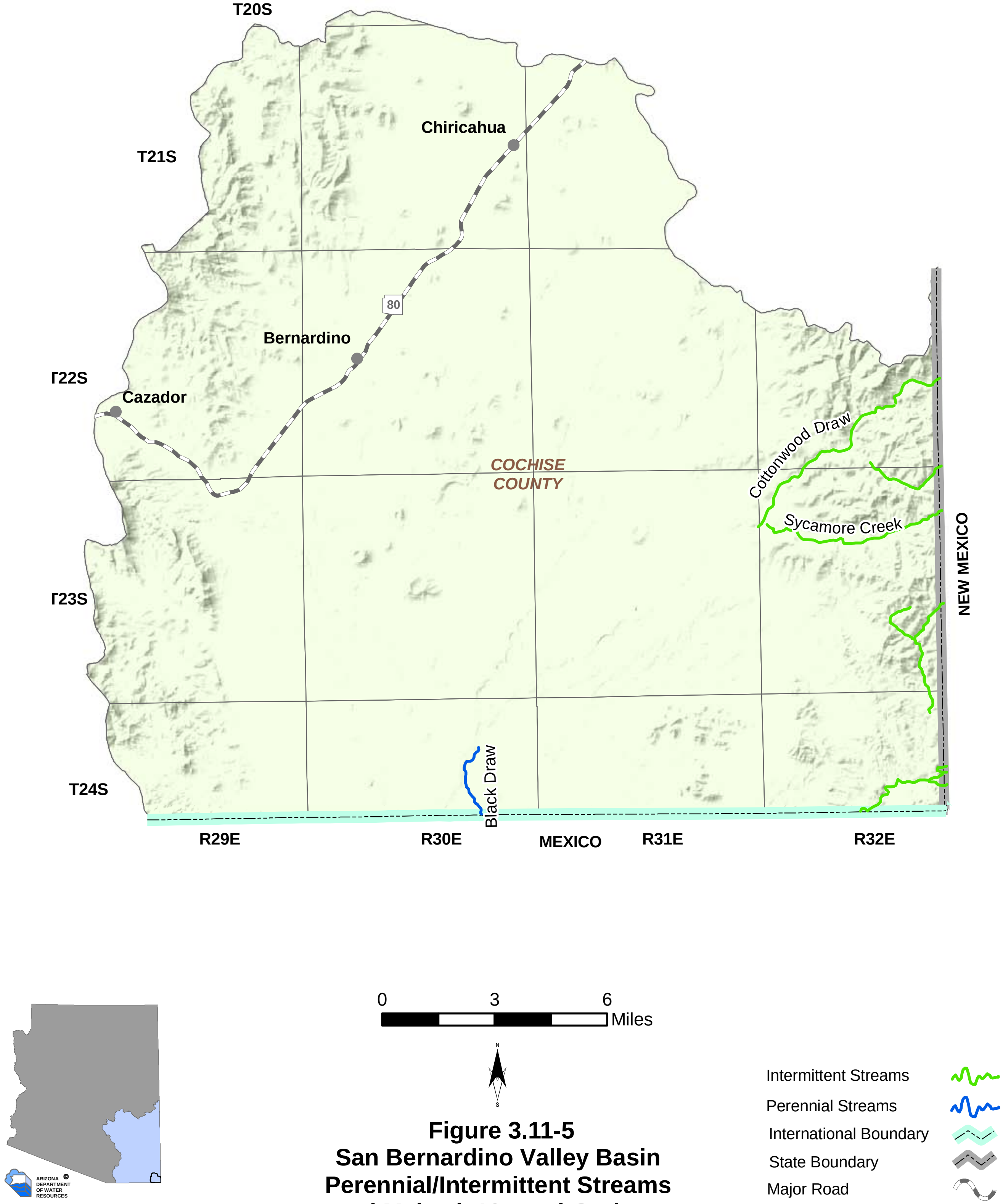
Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 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 3.11-6. 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.11-6 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 3.11-6 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, however the range is quite large, 22-600 gpm.

Natural Recharge

- Refer to Table 3.11-6.
- The only natural recharge estimate for this basin is 9,000 acre-feet per year and is from a 1986 Freethey and Anderson study.

Water in Storage

- Refer to Table 3.11-6.
- There are two storage estimates of 1.6 million acre-feet and 2 million acre-feet to a depth of 1,200 feet.
- The predevelopment storage estimate is two million acre-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.
- In 1990, the year of the last water level sweep, 50 wells were measured.
- 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.
- Two well water levels have fluctuated between a one foot decline and a one foot increase and the third well lacks change data for the period between 1990-1991 and 2003-2004.
- Hydrographs corresponding to selected wells shown on Figure 3.11-6 but covering a longer time period are shown in Figure 3.11-7.

Table 3.11-6 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:	NA	Measured by ADWR and/or USGS
	Range 22 - 600 Median 450 (3 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	NA	ADWR (1990 and 1994)
	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)
	NA	Arizona Water Commission (1975)
Current Number of Index Wells:	4	
Date of Last Water-level Sweep:	1990 (50 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate

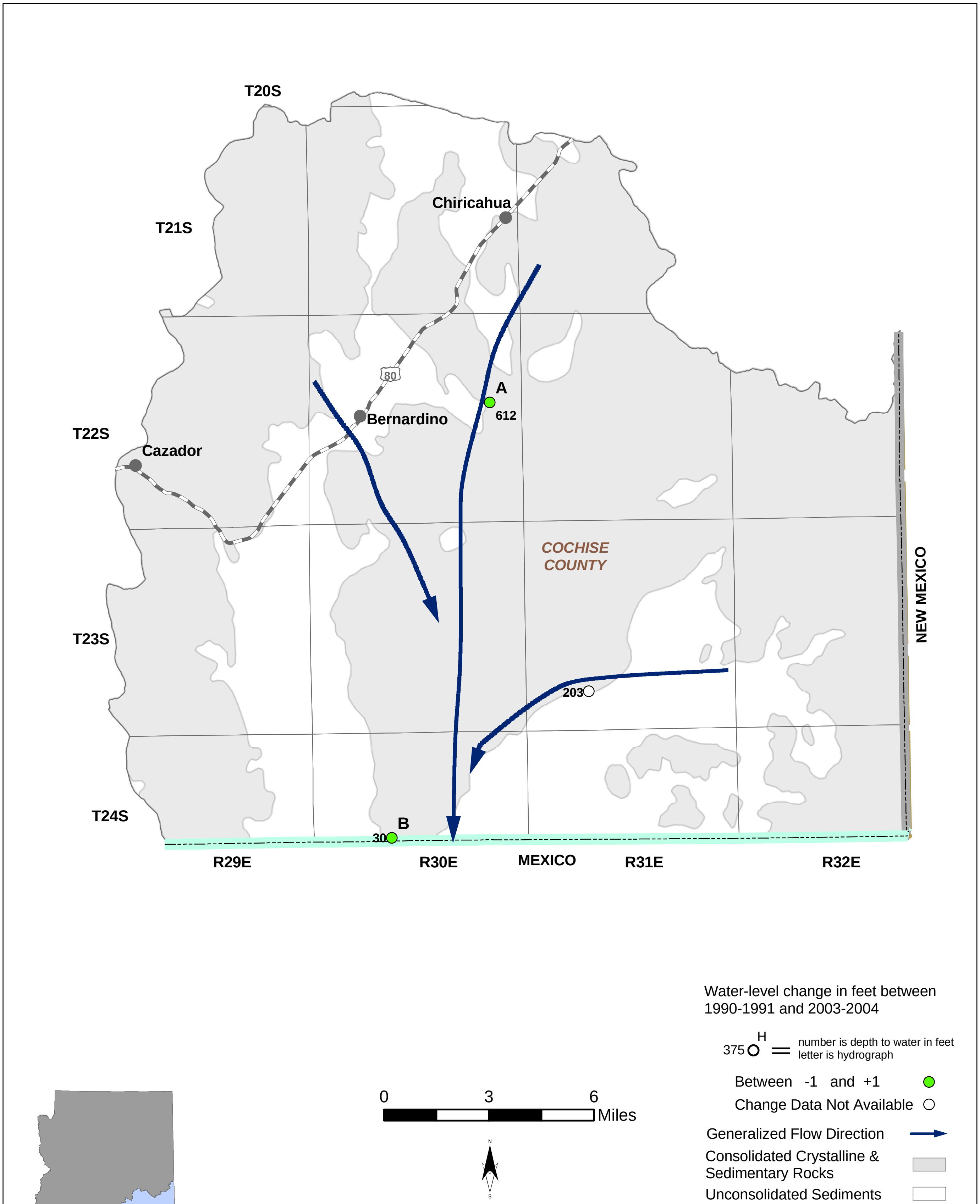
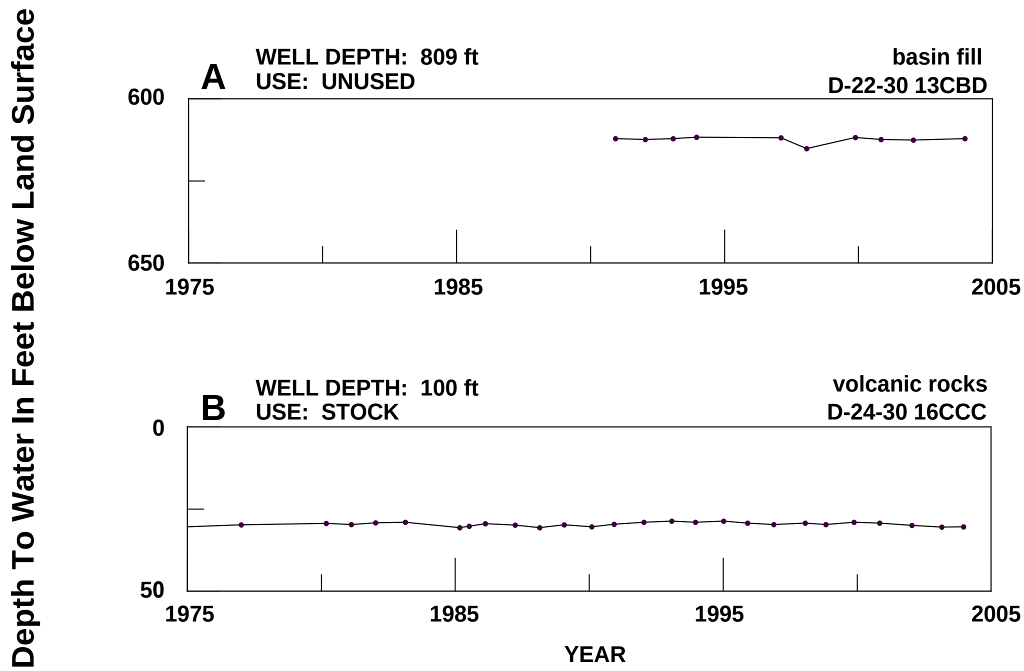


Figure 3.11-6
San Bernardino Valley Basin
Groundwater Conditions

Figure 3.11-7
San Bernardino Valley Basin
Hydrographs Showing Depth to Water in Selected Wells



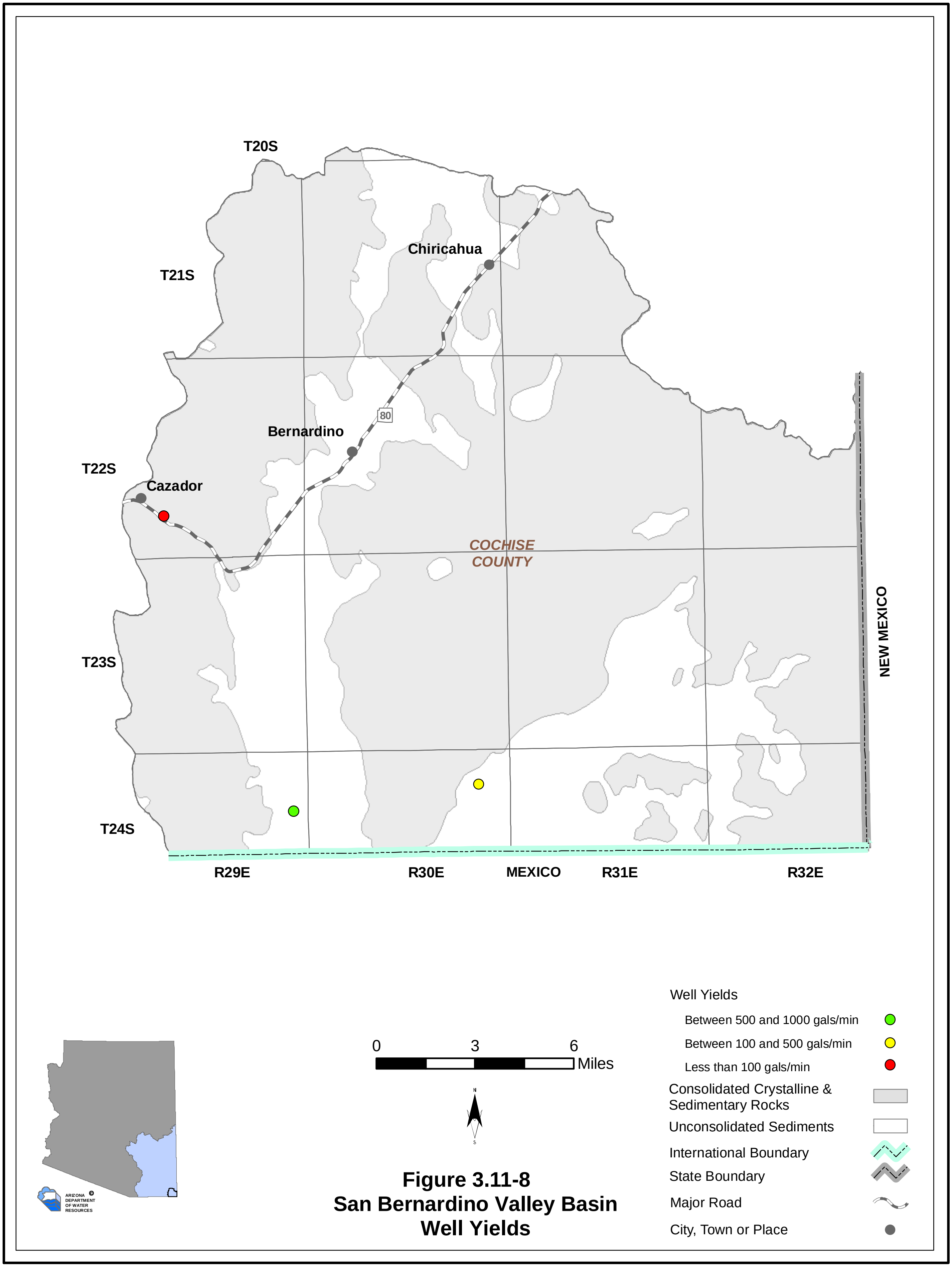


Figure 3.11-8
San Bernardino Valley Basin
Well Yields

3.11.7 Water Quality of the San Bernardino Valley Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.11-7A. There are no data on impaired lakes and streams in this basin. Figure 3.11-9 shows the location of exceedences keyed to Table 3.11-7A. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.11-7A.
- Drinking water standard exceedences have been reported for two wells in the basin.
- Both wells are in the southern portion of the basin.
- The only parameter exceeded in this basin was nitrates.

Table 3.11-7 Water Quality Exceedences in the San Bernardino Valley Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
1	Well	24 South	29 East	11	NO3
2	Well	24 South	32 East	6	NO3

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/Nitrite

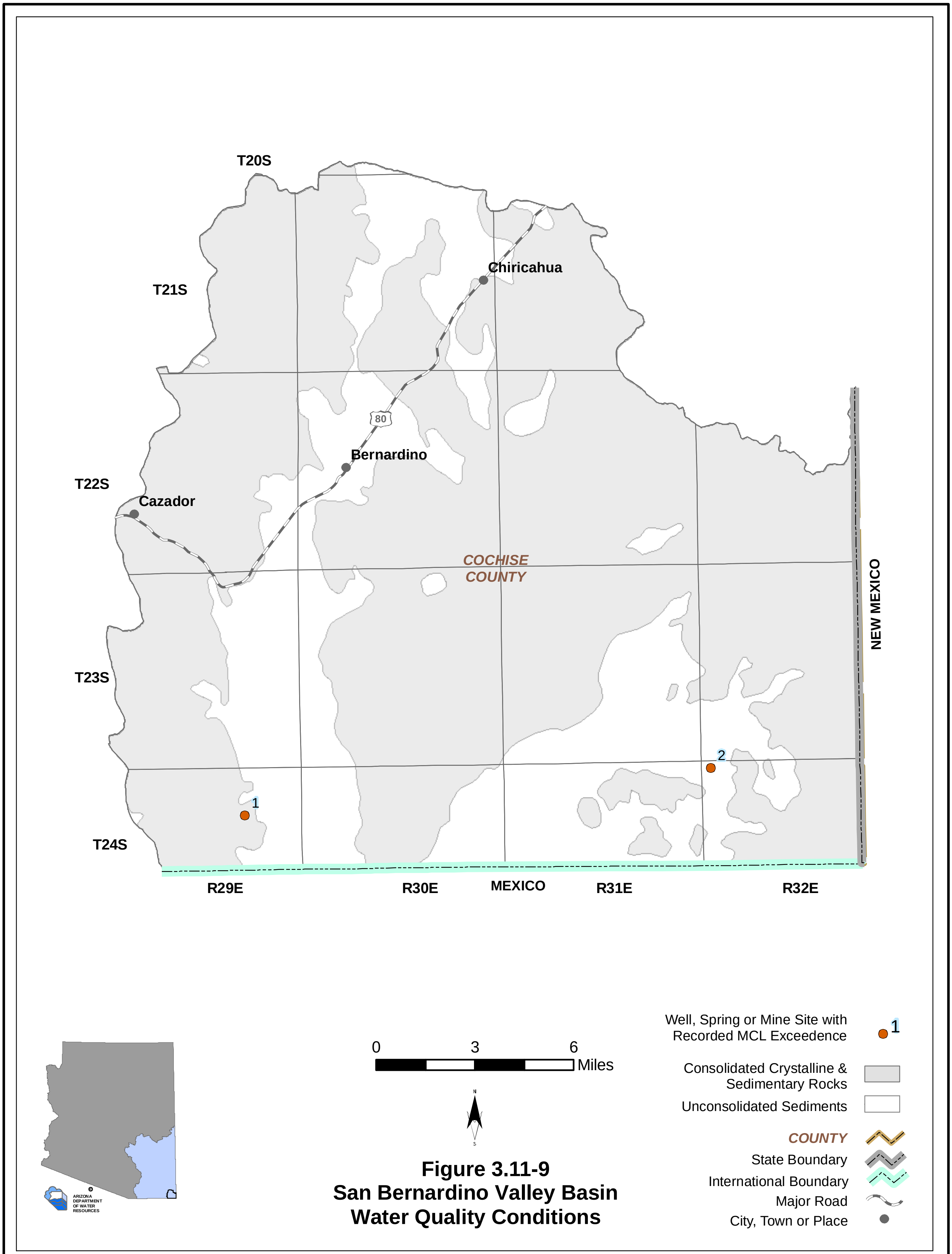


Figure 3.11-9
San Bernardino Valley Basin
Water Quality Conditions

3.11.8 Cultural Water Demands 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 3.11-8. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.11-8.
- Population increased between 1980-1990 and decreased between 1990-2000 but there was an overall increase in population. Projections suggest an increase in the rate of growth through 2050.
- Groundwater pumping has decreased from 1971- 2003 with less than 300 acre-feet pumped per year in the period from 1991 - 2003.
- 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 acre-feet per year.
- As of 2003 there were 169 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and five wells with a pumping capacity of more than 35 gallons per minute.

Table 3.11-8 Cultural Water Demands in the San Bernardino Valley Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Recent (Census) and Projected (DES) 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>Irrigation</th><th>Municipal</th><th>Industrial</th><th>Irrigation</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">117[2]</td><td rowspan="10">4[2]</td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994)</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">12</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">19</td><td rowspan="5">0</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">9</td><td rowspan="5">1</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="13">USGS (2005)</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">7</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>74</td><td rowspan="3">3</td><td rowspan="3">0</td><td rowspan="3"><300</td><td rowspan="3">NR</td><td rowspan="3">NR</td><td colspan="3" rowspan="3">NR</td></tr>
<tr><td>2002</td><td>81</td></tr>
<tr><td>2003</td><td>89</td></tr>
<tr><td>2010</td><td>142</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>270</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>512</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2040</td><td>973</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2050</td><td>1,849</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">ADDITIONAL WELLS:[3]</td><td>2</td><td></td><td colspan="7"></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>169</td><td>5</td><td colspan="7"></td></tr>
</table>

Notes:
NR = Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.11-9 Effluent Generation in the San Bernardino 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 Irrigation	Wildlife Area	Discharge to Another Facility	Groundwater Recharge			
No Wastewater Treatment Facilities Identified by ADWR in this Basin														

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 May, 2005 for the San Bernardino Valley Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 3.11-10 Adequacy Determinations in the San Bernardino Valley Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
No subdivisions on file with ADWR at this time											

SAN BERNARDINO VALLEY BASIN
References and Supplemental Reading

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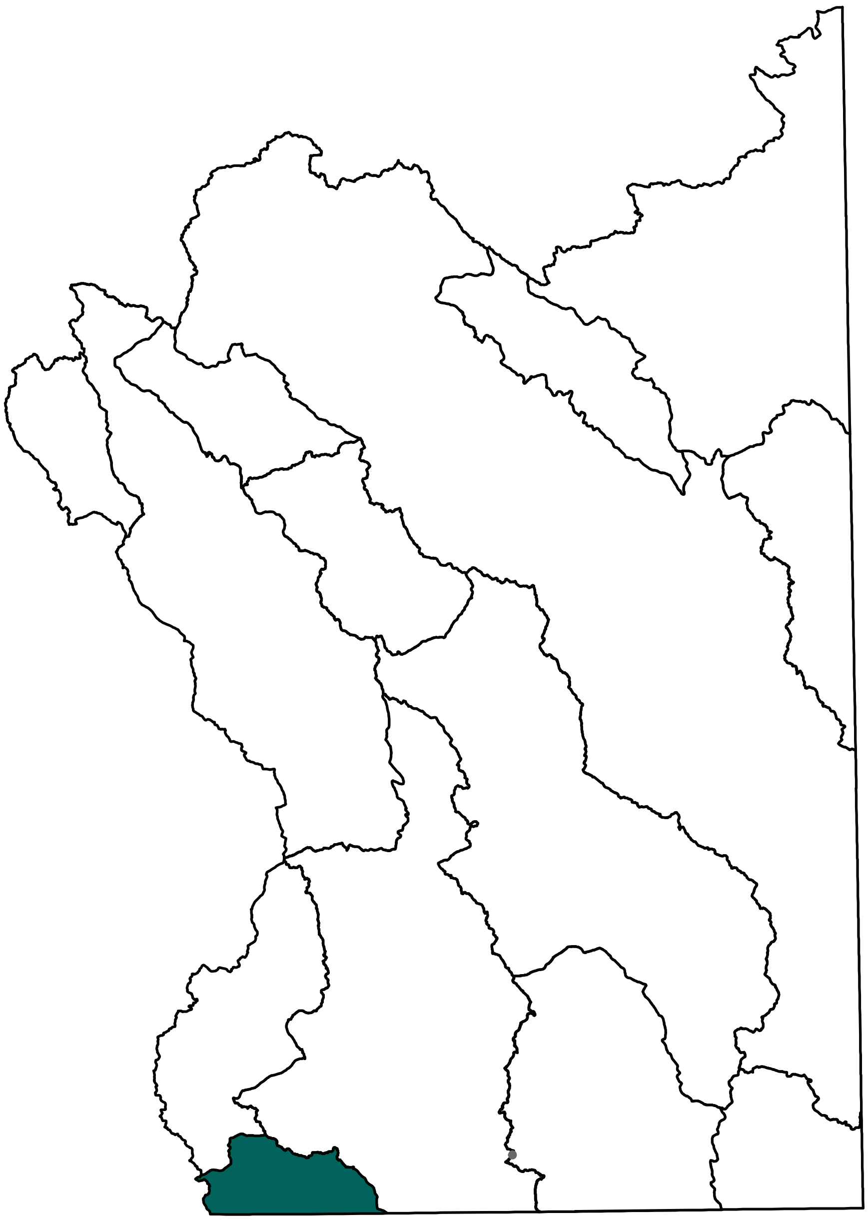
San Bernardino Valley Basin Index to Section 3.0

Section 3.12
San Rafael Basin

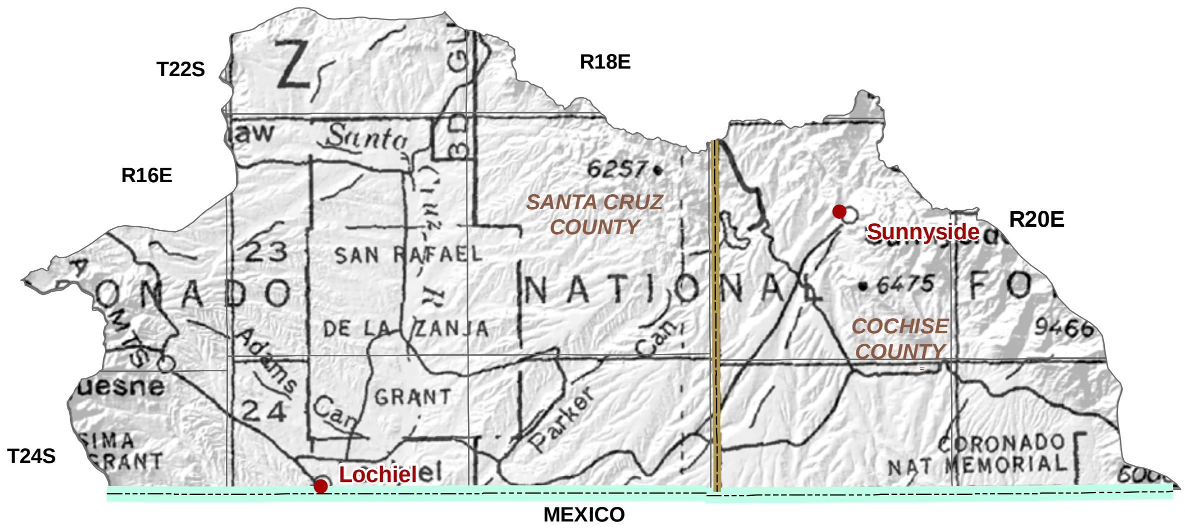


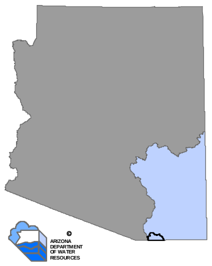
3.12.1 Geography of the San Rafael Basin

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, grasslands and woodlands.

- Principal geographic features shown on Figure 3.12-1 are:
  - Principal basin communities of Lochiel and Sunnyside, with combined populations of less than 200
  - The Santa Cruz River east of Lochiel
  - Parker Canyon west of Sunnyside
  - Adams Canyon north of Lochiel

- Not well shown on Figure 3.12-1 are:
  - The San Rafael Valley to the east of Lochiel
  - The Huachuca Mountains along the eastern basin boundary, which include the highest point in the basin at 9,466 feet





0 3 6 Miles

COUNTY
International Boundary
City, Town or Place

Base Map: USGS 1:500,000, 1981

Figure 3.12-1
San Rafael Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

National Forest and Wilderness

- 73.0% of land is federally owned and managed as national forest and wilderness.
- Forest land is in the Coronado National Forest, Sierra Vista Ranger District.
- The basin includes most of the Miller Peak Wilderness area, located in T23S, R19E and R20E.
- 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.

Parks, Monuments, Historical and Recreation Sites

- 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.

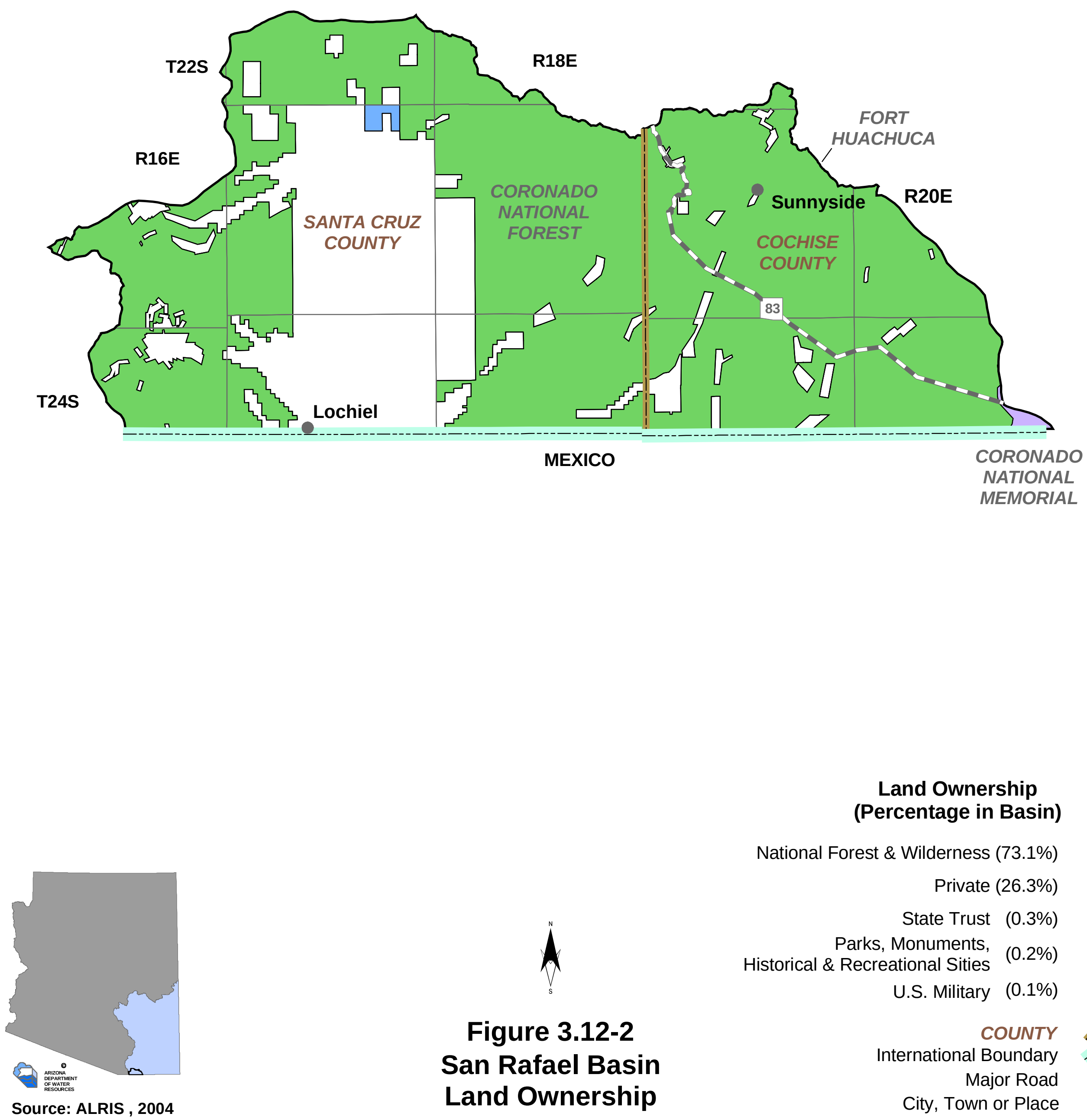


Figure 3.12-2
San Rafael Basin
Land Ownership

3.12.3 Climate of the San Rafael Basin

Climate data from a NOAA/NWS Coop Network station are complied in Table 3.12-1 and the location is shown on Figure 3.12-3. The San Rafael Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.12-1A
- There is one NOAA/NWS Coop network climate station in the basin at San Rafael Ranch, located at an elevation of 4,740 feet.
- Average maximum temperature at the station is 74.1°F and average minimum temperature is 42.6°F.
- Annual average precipitation is 17.26 inches.
- Most precipitation, 10.60 inches on average, occurs in the summer season. Summer precipitation is more than three times that of any other season.
- The driest season is in the spring (April-June) when an average of 1.16 inches is recorded.
- 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. The San Rafael Basin contains the highest low precipitation figure in the planning area.
- In general, precipitation increases as altitude increases in this basin. The range of 20 inches between areas of highest and lowest precipitation is relatively high for the planning area.

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, 2003.

B. Evaporation Pan:

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

Source: WRCC, 2003.

C. AZMET:

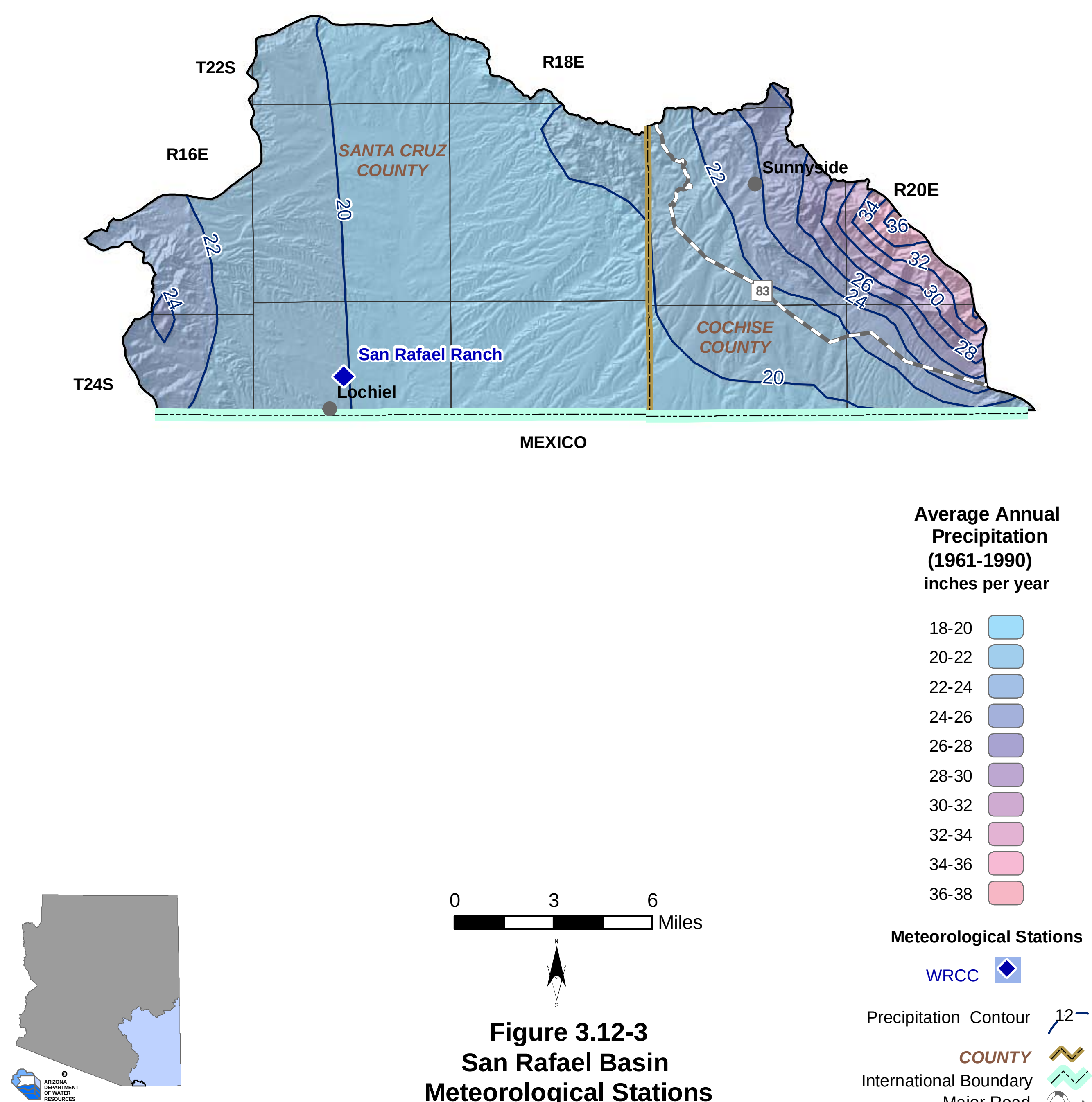
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005



Precipitation Data Source: Oregon State University, 1998

Figure 3.12-3
San Rafael Basin
Meteorological Stations
and Annual Precipitation

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 3.12-4. The location of streamflow gages, using the USGS number, is shown on Figure 3.12-4. The location of large reservoirs is also shown on Figure 3.12-4. There were no runoff contours for this basin. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.12-2.
- Data from one station located at the Santa Cruz River are shown on the table and on Figure 3.12-4.
- The average seasonal flow as a percentage of annual flow is highest in the Summer (July-September) and lowest in the Spring (April-June).
- Summer flow constitutes 84% of the annual flow.
- Maximum annual flow was 12,600 acre-feet in 1955 and minimum annual flow was 123 acre-feet in 1962. There are 21 years of annual flow record for this station.

Reservoirs and Stockponds

- Refer to Table 3.12-4.
- Surface water is stored or could be stored in one large reservoir and one small reservoir in the basin.
- Total maximum storage for the large reservoir is 4,400 acre-feet.
- The reservoir is used for recreation.
- Total surface area for the small reservoir is six acres.
- There are an estimated 258 stockponds in this basin.

Table 3.12-2 Streamflow Data for the San Rafael Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. miles)	Mean Basin 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	5,150	1/1949-current	6	2	84	9	123 (1962)	1,419	2,388	12,600 (1955)	21

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

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

Table 3.12-3 Flood ALERT Equipment in the San Rafael Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.12-4 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)[2]

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					

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

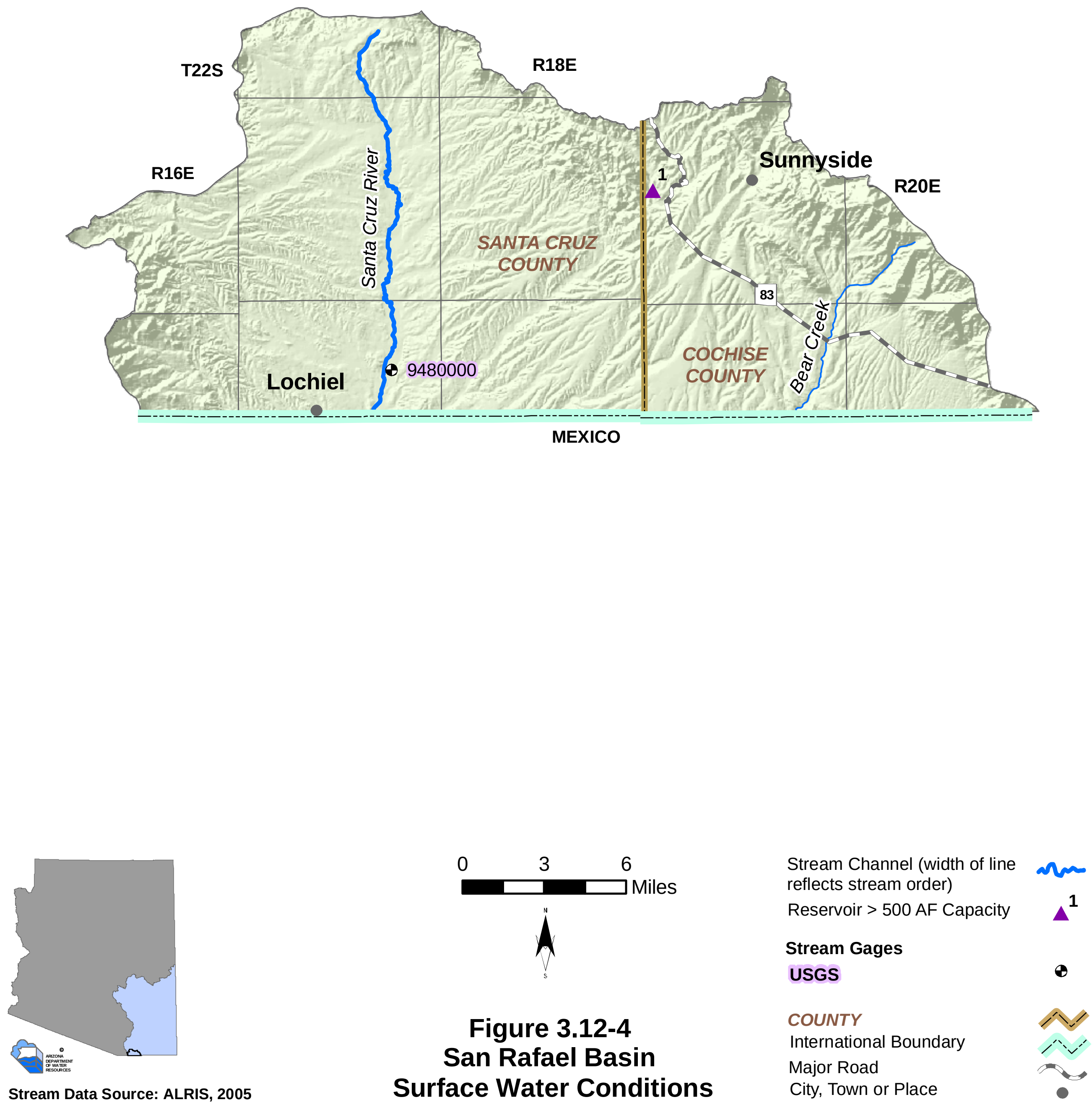


Figure 3.12-4
San Rafael Basin
Surface Water Conditions

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 3.12-5. There are no major springs identified in this basin. The locations of perennial and intermittent streams are shown on Figure 3.12-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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.
- Listed discharge rates may not be indicative of current conditions. The unnamed spring in this basin was last measured in 1981.
- The total number of springs identified by the USGS varies from 23 to 24, depending on the database reference.

Table 3.12-5 Springs in the San Rafael Basin

A. Major Springs (10 gpm or greater):

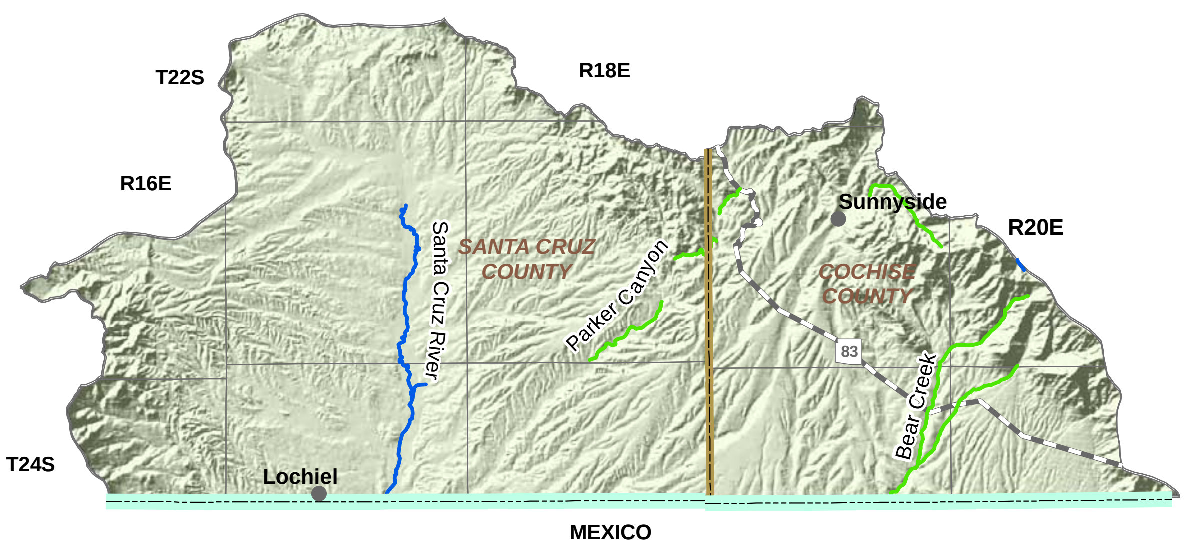
Map Key	Name	Location		Discharge (in gpm)	Date Discharge Measured
		Latitude	Longitude		
None identified by ADWR at this time					

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 23 to 24

Notes:
[1]Most recent measurement identified by ADWR



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 3.12-6. 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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.12-6 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 3.12-6 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 3.12-6.
- Principal sources of recharge in this basin are mountain-front recharge and infiltration from runoff in washes.
- The only natural recharge estimate for this basin is 5,000 acre-feet per year and is from a 1986 Freethey and Anderson study.

Water in Storage

- Refer to Table 3.12-6.
- There are two storage estimates of five million acre-feet and four million acre-feet to a depth of 1,200 feet.
- The predevelopment storage estimate for this basin is five million acre-feet.

Water Level

- Refer to Figure 3.12-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures seven index wells in this basin.
- In 2005, the year of the last water level sweep, 38 wells were measured.
- The deepest recorded water level in 2003-2004 was 205 feet northwest of Lochiel and the shallowest was six feet northeast of Lochiel.

- Most well water levels have declined between one and 15 feet between 1990-1991 and 2003-2004. The water level in one well has increased between one and 15 feet during the same time period.
- Hydrographs corresponding to selected wells shown on Figure 3.12-6 but covering a longer time period are shown in Figure 3.12-7.

Table 3.12-6 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:	NA	Measured by ADWR and/or USGS
	Range 7 - 700 Median 145 (12 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 3 - 465	ADWR (1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	5,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	NA	ADWR (1990 and 1994)
	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:	7	
Date of Last Water-level Sweep:	2005 (38 wells measured)	

Notes:
NA = Not Available
[1]Predevelopment Estimate

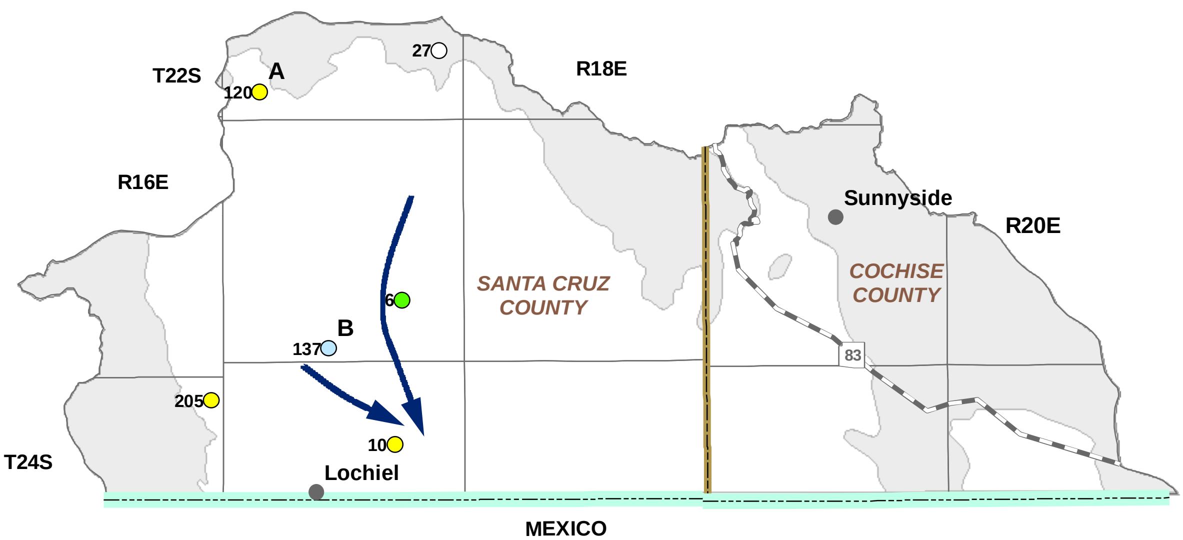
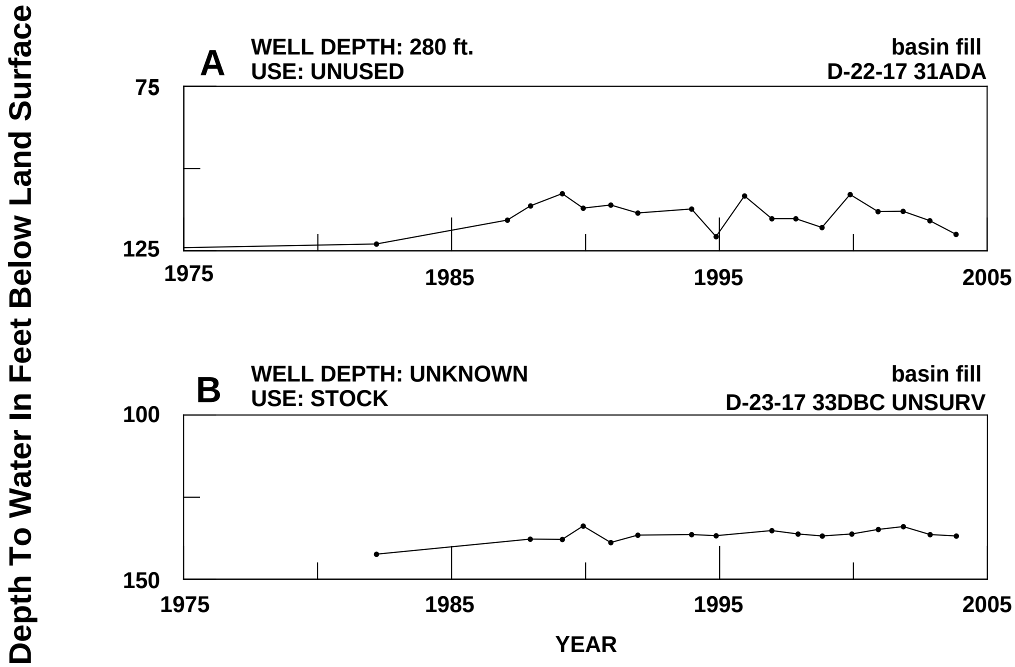


Figure 3.12-6
San Rafael Basin
Groundwater Conditions

Figure 3.12-7
San Rafael Basin
Hydrographs Showing Depth to Water in Selected Wells



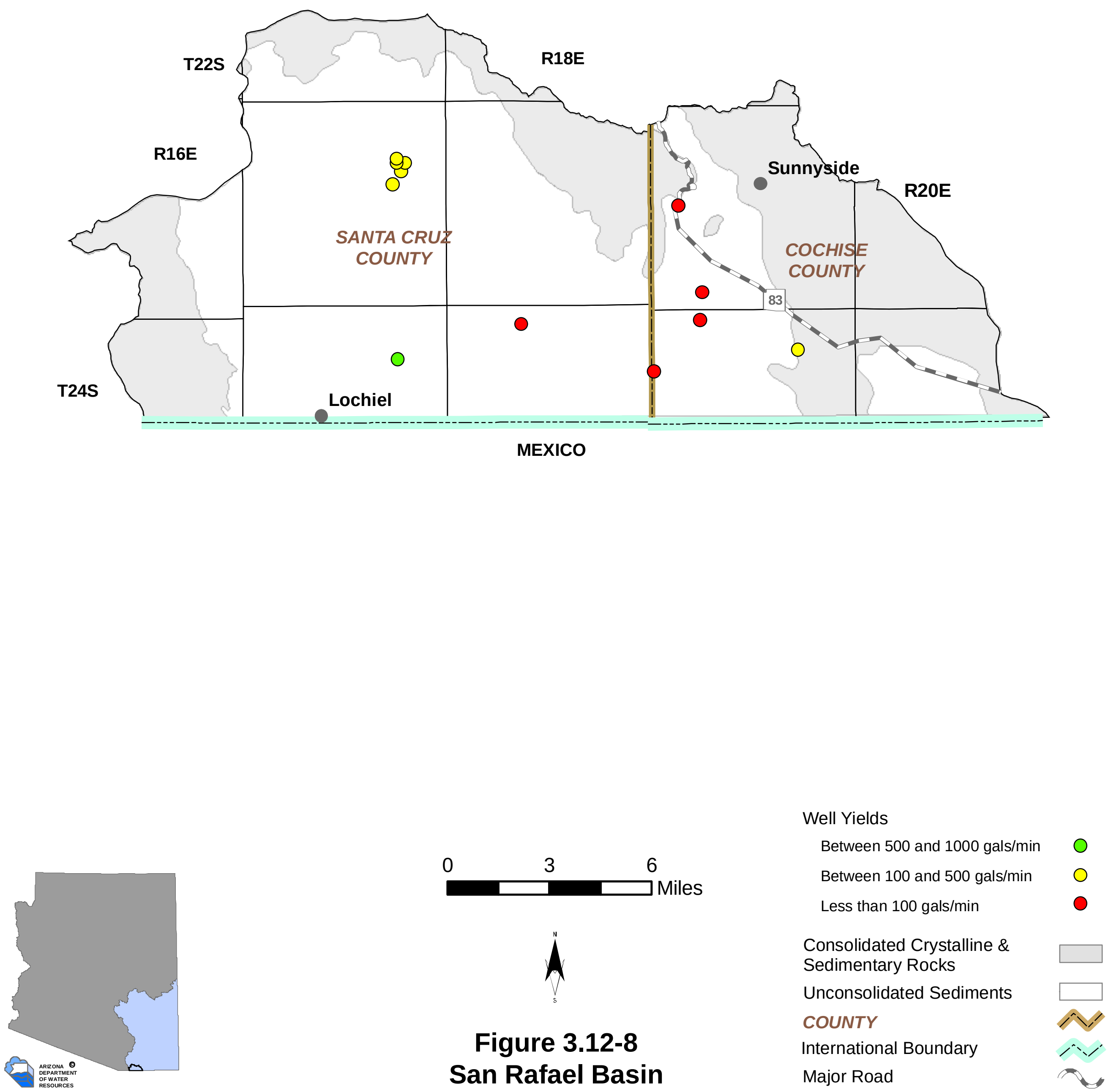


Figure 3.12-8
San Rafael Basin
Well Yields

3.12.7 Water Quality of the San Rafael Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.12-7A. 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 3.12-7B. Figure 3.12-9 shows the location of exceedences and impairment keyed to Table 3.12-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.12-7A.
- Drinking water standard exceedences in wells, springs and at mine sites have been reported for six sites in the basin.
- The most frequently exceeded parameters in the sites measured in this basin were arsenic and lead.
- Other parameters exceeded in the sites measured included radionuclides, cadmium and antimony.

Lakes and Streams

- Refer to Table 3.12-7B.
- Water quality standards were exceeded in Parker Canyon Lake.
- The parameter exceeded at Parker Canyon Lake was mercury.
- 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 3.12-7 Water Quality Exceedences in the San Rafael Basin[1]

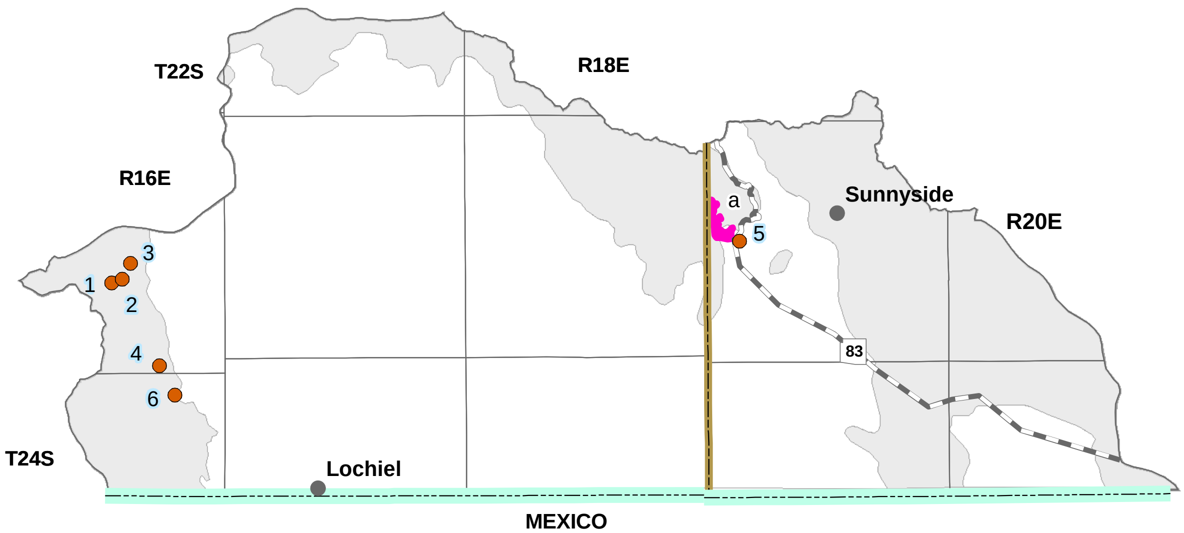
A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

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

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



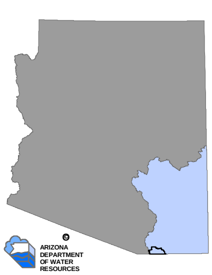


Figure 3.12-9
San Rafael Basin
Water Quality Conditions

3.12.8 Cultural Water Demands 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 3.12-8. 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.12-8.
- Population remained almost unchanged from 1980 to 2003. Projections suggest that the population will increase slightly through 2050.
- Groundwater pumping remained constant from 1971 to 2003 with less than 300 acre-feet pumped per year.
- 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 acre-feet per year. This includes domestic and stock watering use.
- As of 2003 there were 226 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 21 wells with a pumping capacity of more than 35 gallons per minute.

Table 3.12-8 Cultural Water Demands in the San Rafael Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971		189[2]	17[2]	<300			NR			ADWR (1994) USGS (2005)
1972										
1973										
1974										
1975										
1976				<300			NR			
1977										
1978										
1979										
1980	143									
1981	142	11	4	<300			NR			
1982	142									
1983	141									
1984	141									
1985	140									
1986	140	5	0	<300			NR			
1987	139									
1988	138									
1989	138									
1990	137									
1991	138	13	0	<300	NR	NR	NR			USGS (2005)
1992	139									
1993	140									
1994	141									
1995	142									
1996	143	4	0	<300	NR	NR	NR			
1997	144									
1998	145									
1999	146									
2000	147									
2001	148	3	0	<300	NR	NR	NR			
2002	149									
2003	150									
2010	158									
2020	164									
2030	171									
2040	178									
2050	186									
ADDITIONAL WELLS:[3]		**1**								
WELL TOTALS:		**226**	**21**							

Notes:
NR=Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.12-9 Effluent Generation in the San Rafael 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	Discharge to Another Facility	Groundwater Recharge			
No Wastewater Treatment Facilities Identified by ADWR in this Basin														

3.12.9 Water Adequacy Determinations in the San Rafael Basin

There are no water adequacy applications on file with the Department as of May, 2005 for the San Rafael Basin. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Section 1.3.1.

Table 3.12-10 Adequacy Determinations in the San Rafael Basin

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
No subdivisions on file with ADWR at this time											

SAN RAFAEL BASIN
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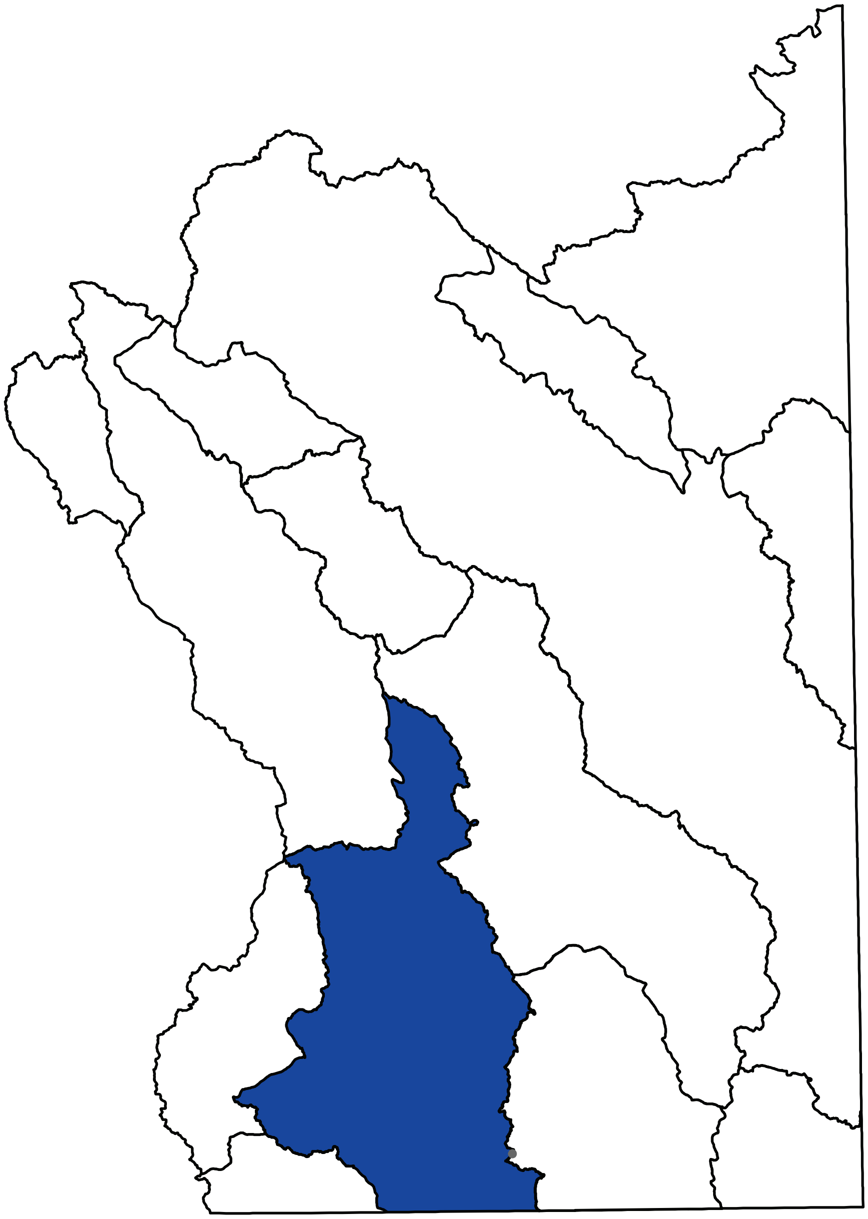
San Rafael Basin Index to Section 3.0

Section 3.13
Upper San Pedro Basin

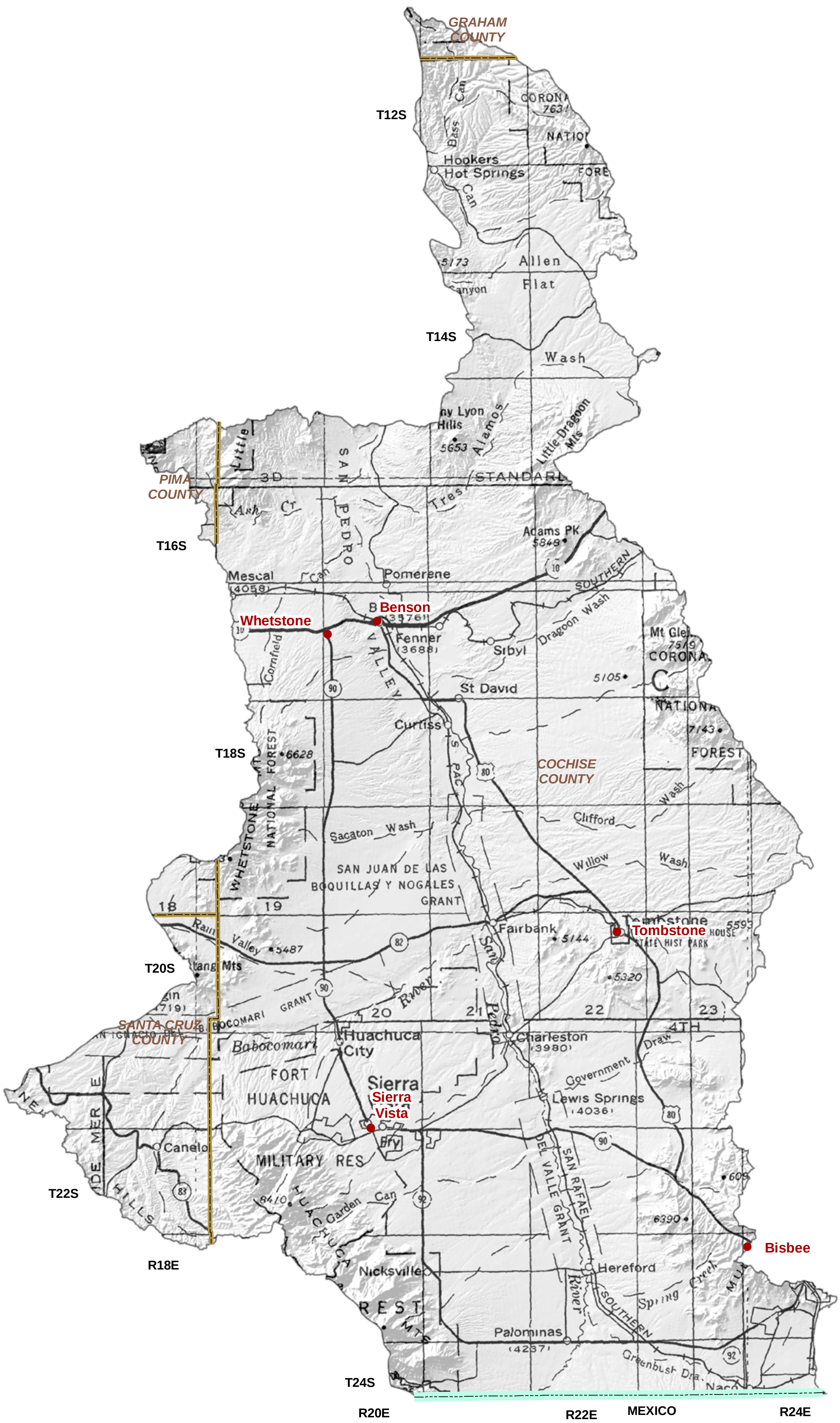


3.13.1 Geography of the Upper San Pedro Basin

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 and grassland, woodland, conifer forest and desert scrub vegetation.

- Principal geographic features shown on Figure 3.13-1 are:
  - Principal basin communities of Sierra Vista, Benson, Tombstone, Bisbee and Whetstone. Sierra Vista is the largest community in the planning area.
  - Smaller basin communities of Naco on the Mexico border, Palominas north of the Mexico border, Hereford west of Bisbee, Huachuca City north of Sierra Vista, St. David south of Benson and Pomerene north of Benson
  - San Pedro River, which flows north through the San Pedro Valley east of Sierra Vista and Benson
  - Babocomari River north of Sierra Vista
  - Allen Flat in the northern portion of the basin
  - 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

- Not well shown on Figure 3.13-1 are:
  - Canelo Hills on the southwestern boundary
  - Mule Mountains west of Bisbee
  - Dragoon Mountains along the eastern boundary of the basin east of Tombstone
  - Galiuro Mountains on the northeastern boundary of the basin
  - The highest point in the basin, 9,466 feet, at T23S, R20E in the Huachuca Mountains



0 6 12 Miles

COUNTY
International Boundary
City, Town or Place

ARIZONA DEPARTMENT OF WATER RESOURCES

Base Map: USGS 1:500,000, 1981

Figure 3.13-1
Upper San Pedro Basin
Geographic Features

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. A description of land ownership data sources and methods is found in Volume 1, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest 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 north of 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 south 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 and Wilderness

- 11.6% of land is federally owned and managed as national forest and wilderness.
- 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.
- Portions of the Miller Peak Wilderness area in T23S, R20E and the Rincon Mountain Wilderness area in T14S, R18E are in the basin.
- Primary land uses are grazing, recreation and timber production.

U.S. Bureau of Land Management (BLM)

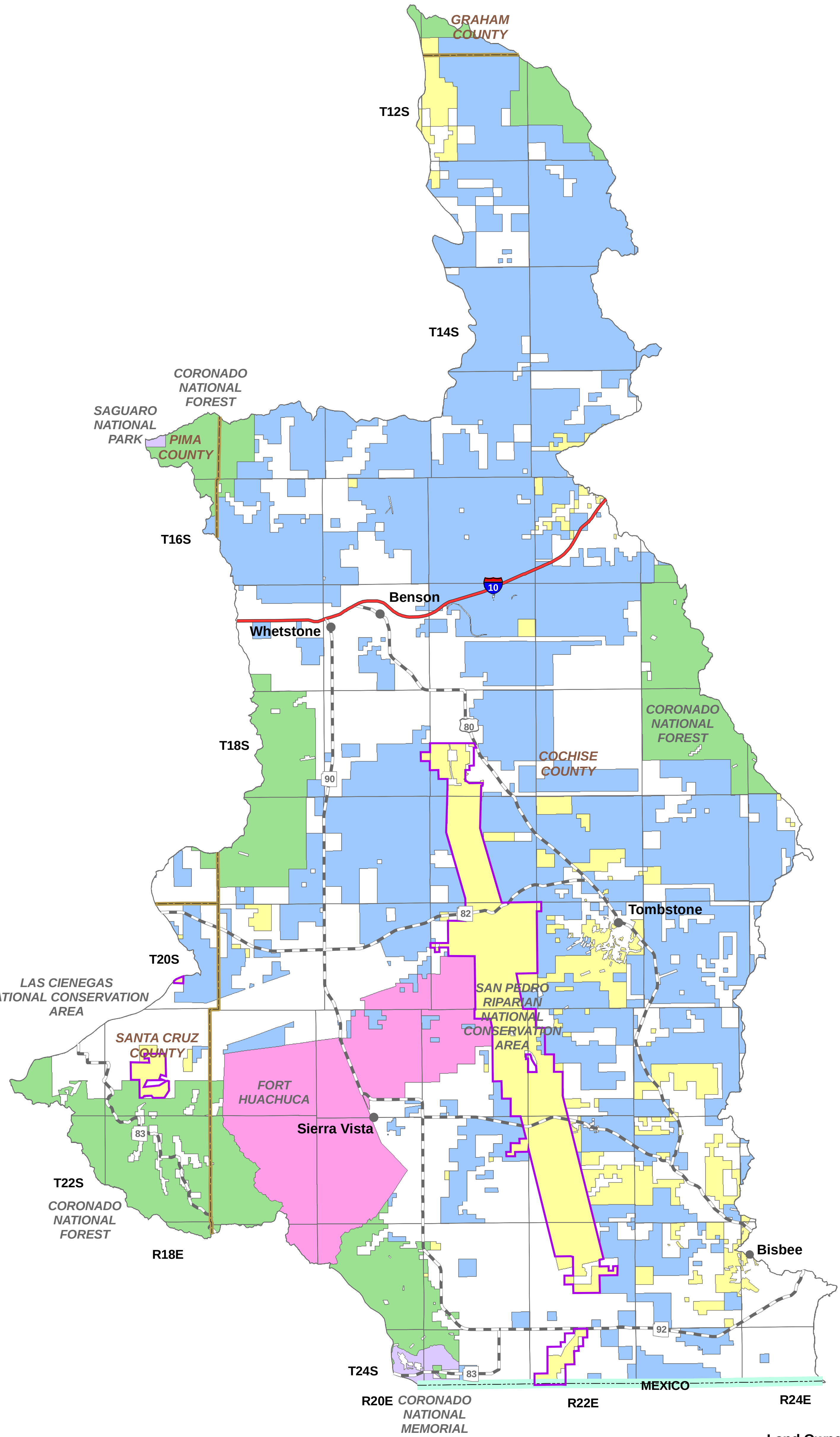
- 8.9% of land is federally owned and managed by the Safford Field Office of the Bureau of Land Management.
- The majority of the BLM land in this basin is within the San Pedro Riparian National Conservation Area.
- A portion of the Las Cienegas National Conservation Area is in T20S and T21S, R18E.
- A portion of the Redfield Canyon Wilderness is located in T12S, R21E.
- 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.
- Fort Huachuca 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.

Parks, Monuments, Historical and Recreational Sites

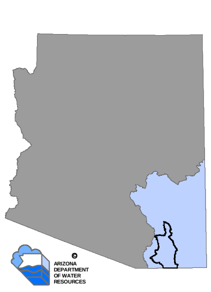
- 0.3% of land is federally owned and managed by the National Park Service.
- All park lands are within the Coronado National Memorial.
- Primary land use is recreation.



Land Ownership (Percentage in Basin)

State Trust (39.1%)
Private (33.3%)
National Forest & Wilderness (11.6%)
U.S. Bureau of Land Management (8.9%)
U.S. Military (6.8%)
Parks, Monuments, Historical & Recreational sities (0.3%)
National Conservation Area
COUNTY
International Boundary
Interstate Highway
Major Road
City, Town or Place

0 6 12 Miles



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 Coop Network stations is complied in Table 3.13-1 and the locations are shown on Figure 3.13-3. The Upper San Pedro Basin does not contain Evaporation Pan, AZMET and SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.13-1A
- There are seven NOAA/NWS Coop network climate stations in the basin.
- Of the seven stations, data from different periods of record may be used as shown. The variety of dates may be due to discontinued measurements, date of installation or other availability issues.
- The seven stations are located throughout most of the basin. There are no stations north of Interstate 10.
- Station elevations range from 3,670 feet at Benson to 5,240 feet at Coronado N.M.
- Maximum average temperatures range from 74.6°F at Canelo 1 NW to 81.0°F at Benson.
- Minimum average temperatures range from 43.3°F at Canelo 1 NW to 47.8°F at Tombstone.
- Average annual precipitation varies from 12.34 inches at Benson to 21.18 inches at Coronado N.M.
- All stations report highest average precipitation in the summer (July - September) and lowest in the spring (April – June). All stations, except Coronado N.M., receive at least half of their annual average precipitation in the summer.
- 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 vicinity of Tombstone.
- Precipitation increases as elevation increases in the basin. The range of 26 inches between areas of highest and lowest precipitation is high for the planning area.

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, 2003.

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			

Source: WRCC, 2003.

C. AZMET:

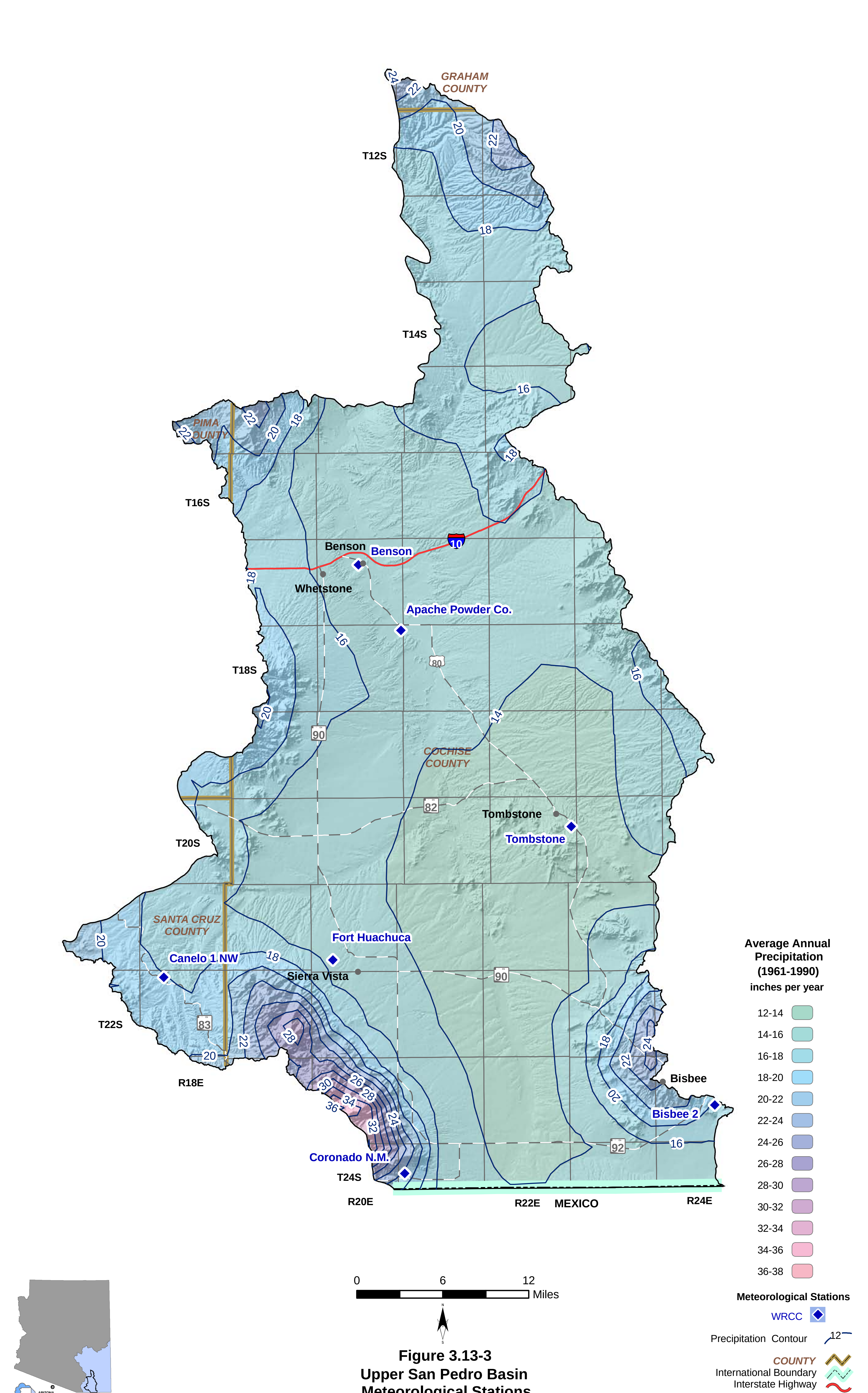
Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
None			

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005



Precipitation Data Source: Oregon State University, 1998

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 3.13-4. The location of streamflow gages, using the USGS number, is shown on Figure 3.13-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.13-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.13-2.
- Data from 13 stations, including three discontinued station, are shown on the table and on Figure 3.13-4.
- These stations are located at the San Pedro River, Greenbush Draw, Banning Creek, Ramsey Canyon, Garden Canyon, Huachuca Canyon, and the Babocomari River.
- The average seasonal flow as a percentage of annual flow for the majority of the stations is highest in 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.

Reservoirs and Stockponds

- Refer to Table 3.13-4.
- Surface water is stored or could be stored in four small reservoirs in the basin.
- Total maximum storage for two of the reservoirs is 247 acre-feet. Total surface area for the other two small reservoirs is 13 acres.
- There are an estimated 974 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.13-4.
- Average annual runoff is 0.5 inches in this basin.

Table 3.13-2 Streamflow Data for Upper San Pedro Basin

Station Number	USGS Station Name	Contributing Drainage Area (in sq. mile)	Mean Basin 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	737.0	4,950	5/1930-current	10	2	70	17	4,403 (1962)	16,659	22,873	65,464 (2000)	44
9470520	Greenbush Draw near Palominas	NA	NA	6/2000-current	0	11	35	54	0 (2001)	76	76	152 (2003)	3
9470700	Banning Creek near Bisbee	NA	NA	2/2001-current	No statistics run, less than 3 years of data								2
9470750	Ramsey Canyon near Sierra Vista	NA	NA	5/2000-current	10	8	9	73	24 (2003)	43	145	369 (2001)	3
9470800	Garden Canyon near Fort Huachuca	8.4	NA	10/1959-current	39	11	35	15	71 (1997)	1,043	990	2,086 (1995)	11
9471000	San Pedro River at Charleston	1,234.0	4,840	3/1904-current	14	5	65	16	6,778 (2002)	33,203	38,636	152,798 (1914)	84
9471300	Huachuca Canyon near Fort Huachuca	3.2	NA	10/1961-9/1964 (discontinued)	No statistics run, less than 3 years of data								2
9471310	Huachuca Canyon near Fort Huachuca	NA	NA	10/2000-current	11	7	9	73	7 (2002)	62	88	195 (2001)	3
9471380	Upper Babocomari River near Huachuca City	NA	NA	7/2000-current	16	9	28	47	1,433 (2003)	2,331	2,669	4,243 (2003)	3
9471400	Babocomari River near Tombstone	NA	NA	3/2000-current	25	8	24	43	862 (2003)	1,028	1,028	1195 (2001)	3
9471500	San Pedro River at Fairbanks	1,672.0	NA	10/1926-9/1928 (discontinued)	No statistics run, less than 3 years of data								1
9471550	San Pedro River near Tombstone	1,730.0	4,820	4/1967-current	19	4	49	28	7,314 (2002)	29,654	36,950	102,107 (1984)	24
9471800	San Pedro River near Benson	2,490.0	4,800	3/1966-9/1976 (discontinued)	5	1	87	8	8,618 (1973)	28,966	23,447	44,463 (1971)	9

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

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
NA- Not available to ADWR

Table 3.13-3 Flood ALERT Equipment in the Upper San Pedro Basin

Station Name	Station ID	Station Type	Install Date	Responsibility
None				

Table 3.13-4 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)[1]

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					

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

Total number: 2
Total maximum storage: 247 acre-feet

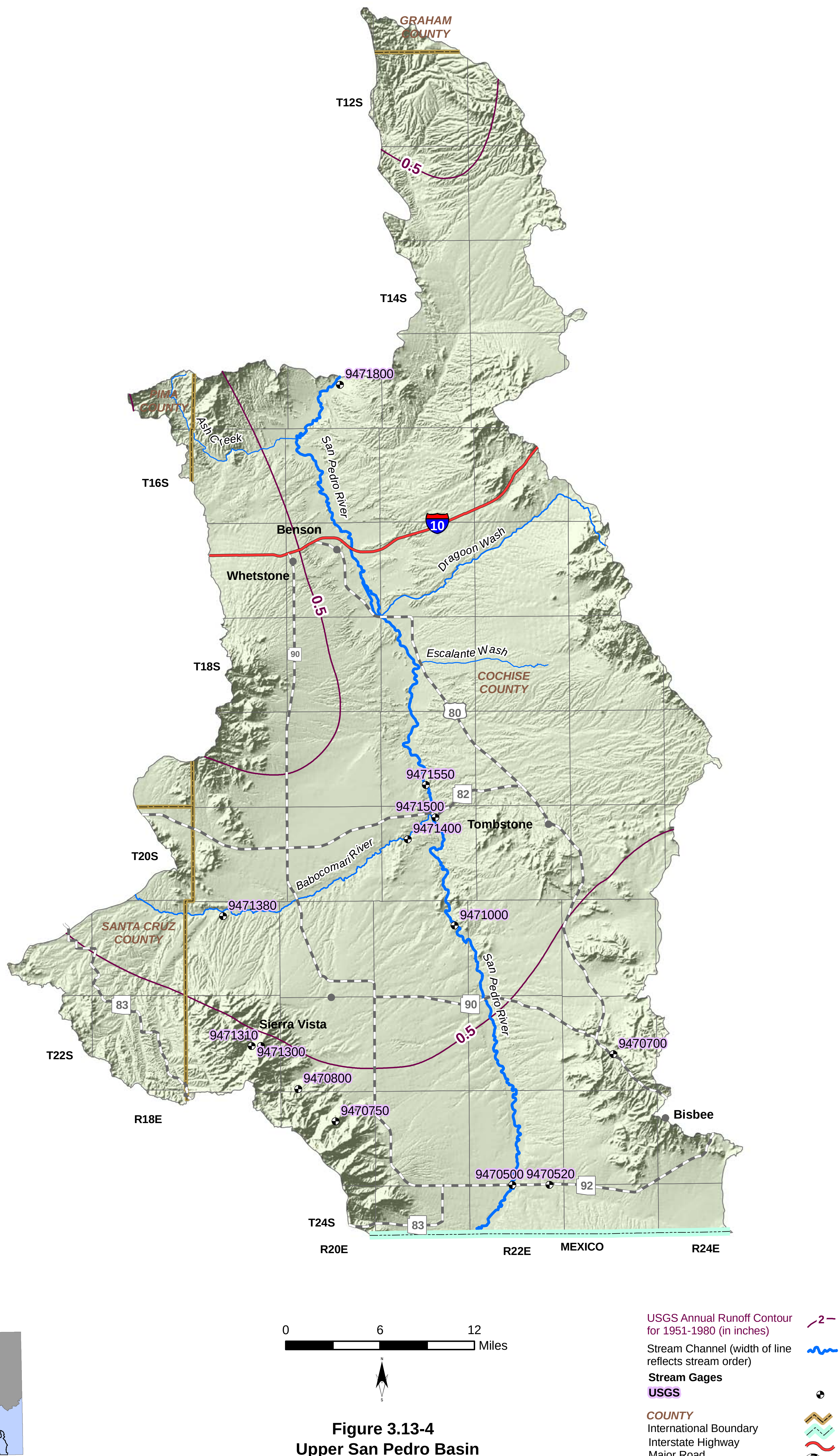
D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

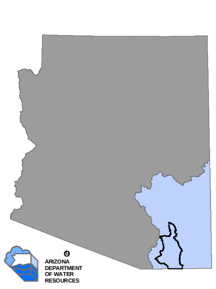
Total number: 2
Total surface area: 13 acres

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

Total number: 974 (from water right filings)

Notes:
[1]Capacity data not available to ADWR





Stream Data Source: ALRIS, 2005

Figure 3.13-4
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 3.13-5. The locations of major springs as well as perennial and intermittent streams are shown on Figure 3.13-5. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- There are numerous perennial stream reaches in this basin. Most perennial streams are in the southern portion of the basin.
- A number of intermittent stream reaches are located throughout most of the basin.
- The San Pedro River through most of this basin is intermittent 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.
- Listed discharge rates may not be indicative of current conditions. Most of the measurements were taken prior to 1982. Two major spring measurements post-date 1982.
- Most of the major springs are in the Huachuca Mountains southwest of Sierra Vista. The greatest discharge rate was measured at Garden Canyon (Garden Canyon No. 1, 164 gpm).
- Half of the major springs discharge more than 40 gpm.
- Springs with measured discharge of 1 to 10 gpm are not mapped but coordinates are given in Table 3.13-5. There are five minor springs identified in this basin.
- The total number of springs identified by the USGS varies from 79 to 91, depending on the database reference.

Table 3.13-5 Springs in the Upper San Pedro Basin

A. Major Springs (10 gpm or greater):

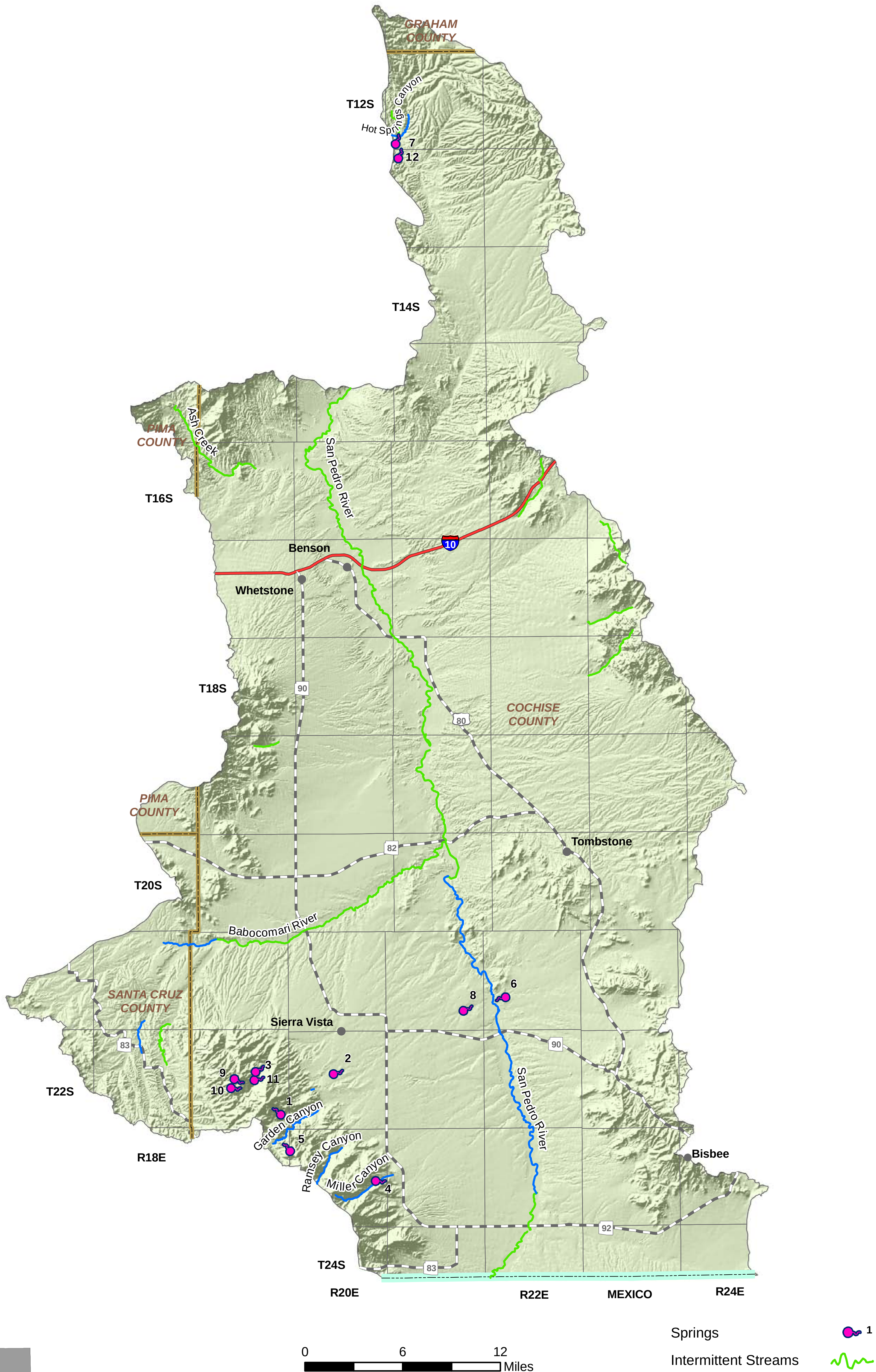
Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Garden Canyon No. 1	312807	1102132	134	2/11/1963
2	Huachuca Canyon	313103	1102318	108[3]	1958-1963
3	Unnamed[2]	313044	1102327	100	4/3/1941
4	Miller Canyon[2]	312516	1101554	97[3]	1973-1977
5	Garden Canyon No. 2	312728	1102155	76	1/8/1963
6	Lewis North	313456	1100819	45	6/30/2005
7	Hooker's Hot	322018	1101421	40	On or before 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	On or before 1982

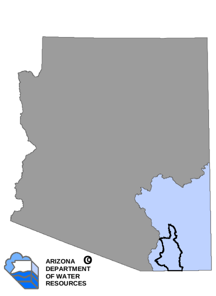
B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Unnamed[2]	330436	1095904	7	On or before 1982
Kiper	320309	1102340	5	5/17/1951
Pena Blanca	312321	1100530	4	4/17/1946
Kino	313340	1102631	4	3/30/1960
Unnamed	320316	1102233	2	10/12/1950

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and NHD, 2006): 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 3.13-5
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 3.13-6. Figure 3.13-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.13-7 contains hydrographs for selected wells shown on Figure 3.13-6. Figure 3.13-8 shows well yields in five yield categories. A description of aquifer data sources and methods is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19.

Major Aquifers

- Refer to Table 3.13-6 and Figure 3.13-6.
- 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.

Well Yields

- Refer to Table 3.13-6 and Figure 3.13-8.
- As shown on Figure 3.13-8 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 353 reported wells, indicates that the median well yield in this basin is 600 gpm.
- Well yields vary throughout the basin.

Natural Recharge

- Refer to Table 3.13-6.
- The principal sources of recharge for this basin are mountain-front recharge and streambed infiltration.
- The most recent natural recharge estimate, from a 2005 ADWR study, is 35,750 acre-feet per year.

Water in Storage

- Refer to Table 3.13-6.
- There are four storage estimates for this basin ranging from 19.8 million to 59 million acre-feet.
- The most recent storage estimate, from a 2005 ADWR study, is between 19.8 million and 26.1 million acre-feet to a depth of 1,200 feet.
- The predevelopment storage estimate for this basin is 35 million acre-feet

Water Level

- Refer to Figure 3.13-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 59 index wells in this basin.
- In 2001, the year of the last water level sweep, 736 wells were measured.

- 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.
- Change in water levels varies across the basin from a 15 foot increase to a more than 30 foot decrease.
- In general, declines of one to 15 feet were observed in the Sierra Vista and Benson areas.
- Hydrographs corresponding to selected wells shown on Figure 3.13-6 but covering a longer time period are shown in Figure 3.13-7.

Table 3.13-6 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 and/or USGS
	Range 3 - 3,800 Median 600 (353 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 100 - 2,800	ADWR (1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	35,750	ADWR (2005)
Estimated Water Currently in Storage, in acre-feet:	21,000,000 - 59,000,000 (to 1,200 ft/not given)	ADWR (1990 and 1994)
	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, Upper San Pedro report, (2005)
Current Number of Index Wells:	59	
Date of Last Water-level Sweep:	2001 (736 wells measured)	

Notes:
[1]Predevelopment Estimate

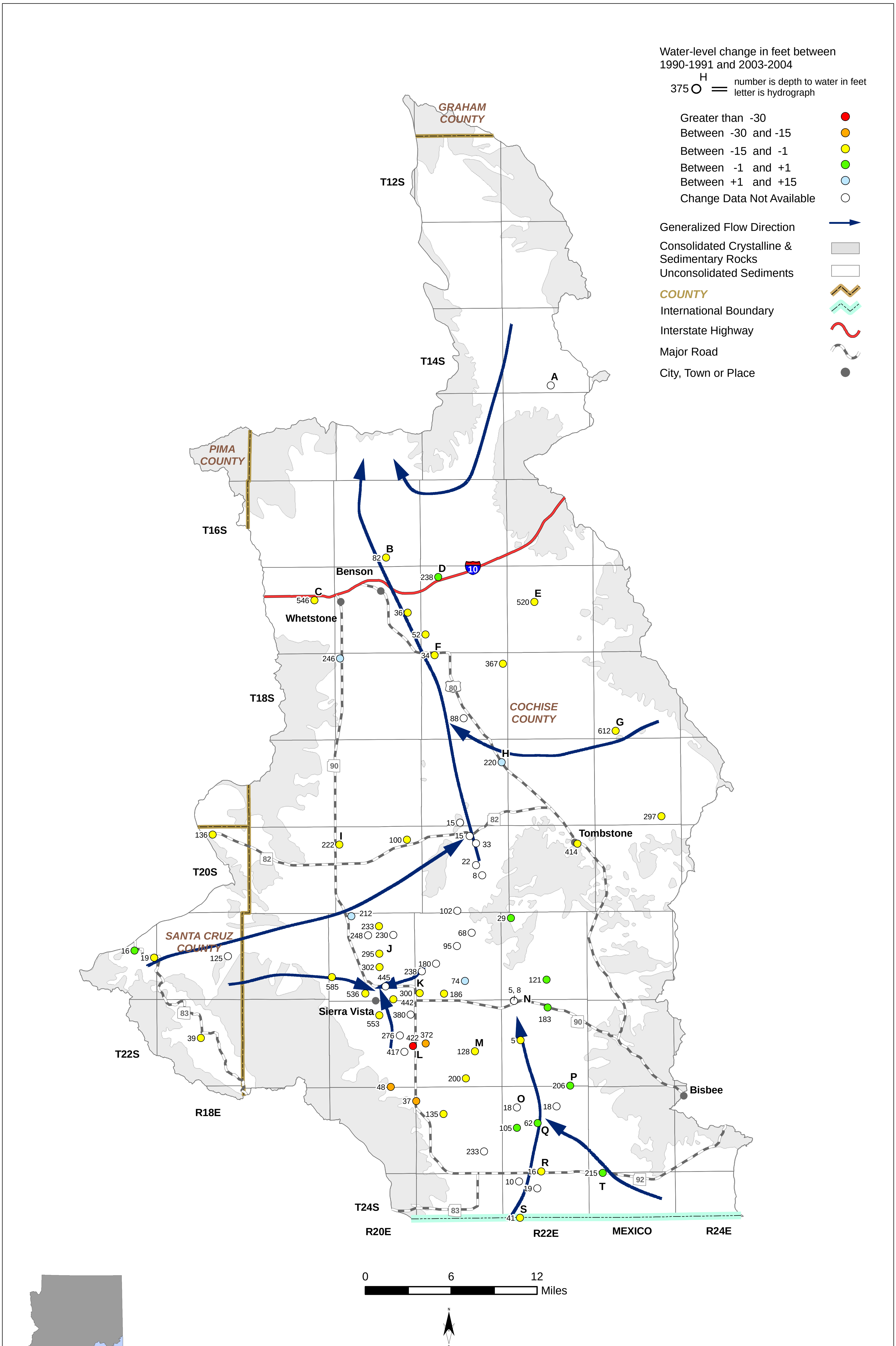


Figure 3.13-6
Upper San Pedro Basin
Groundwater Conditions

Figure 3.13-7
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

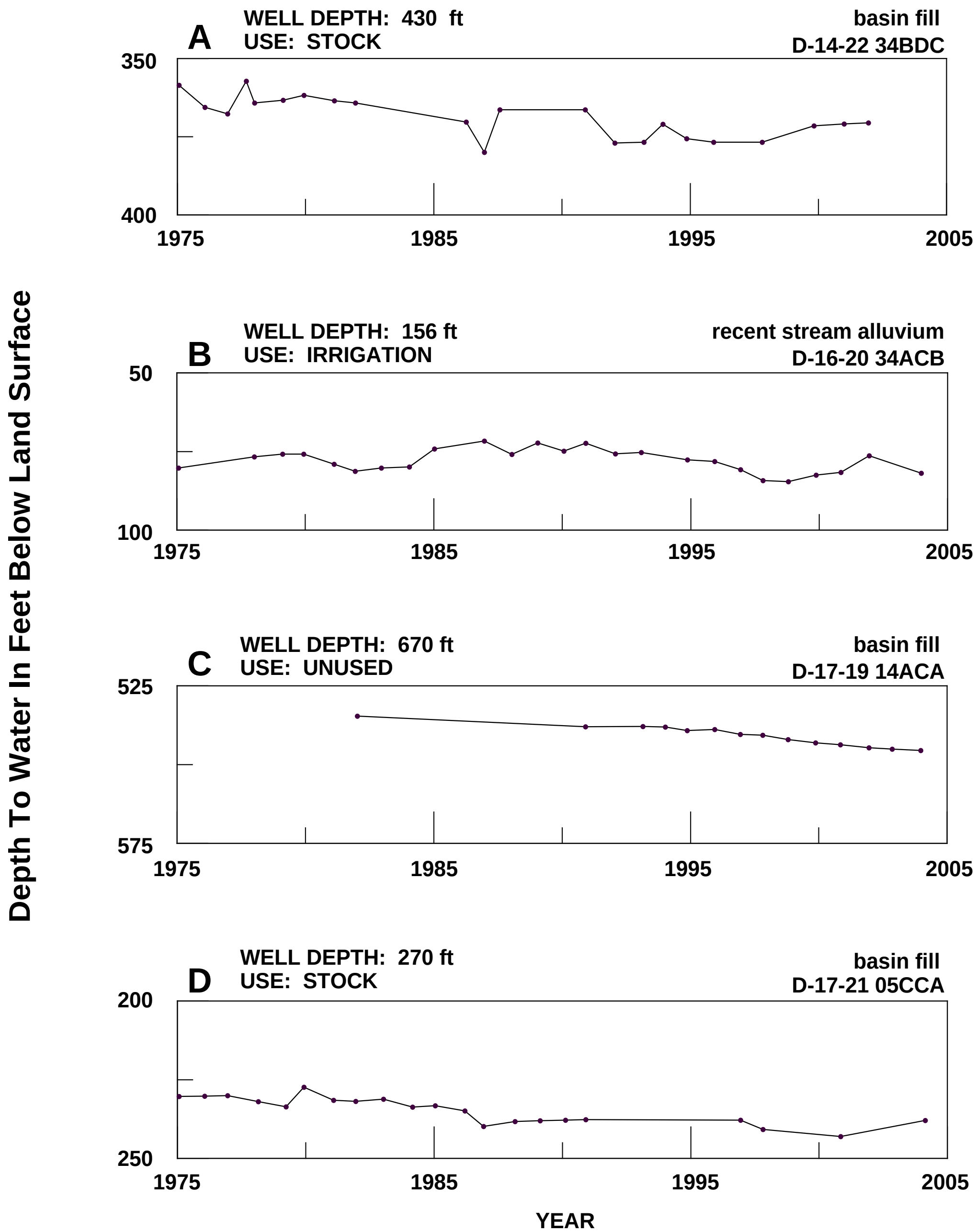


Figure 3.13-7 (Con't.)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

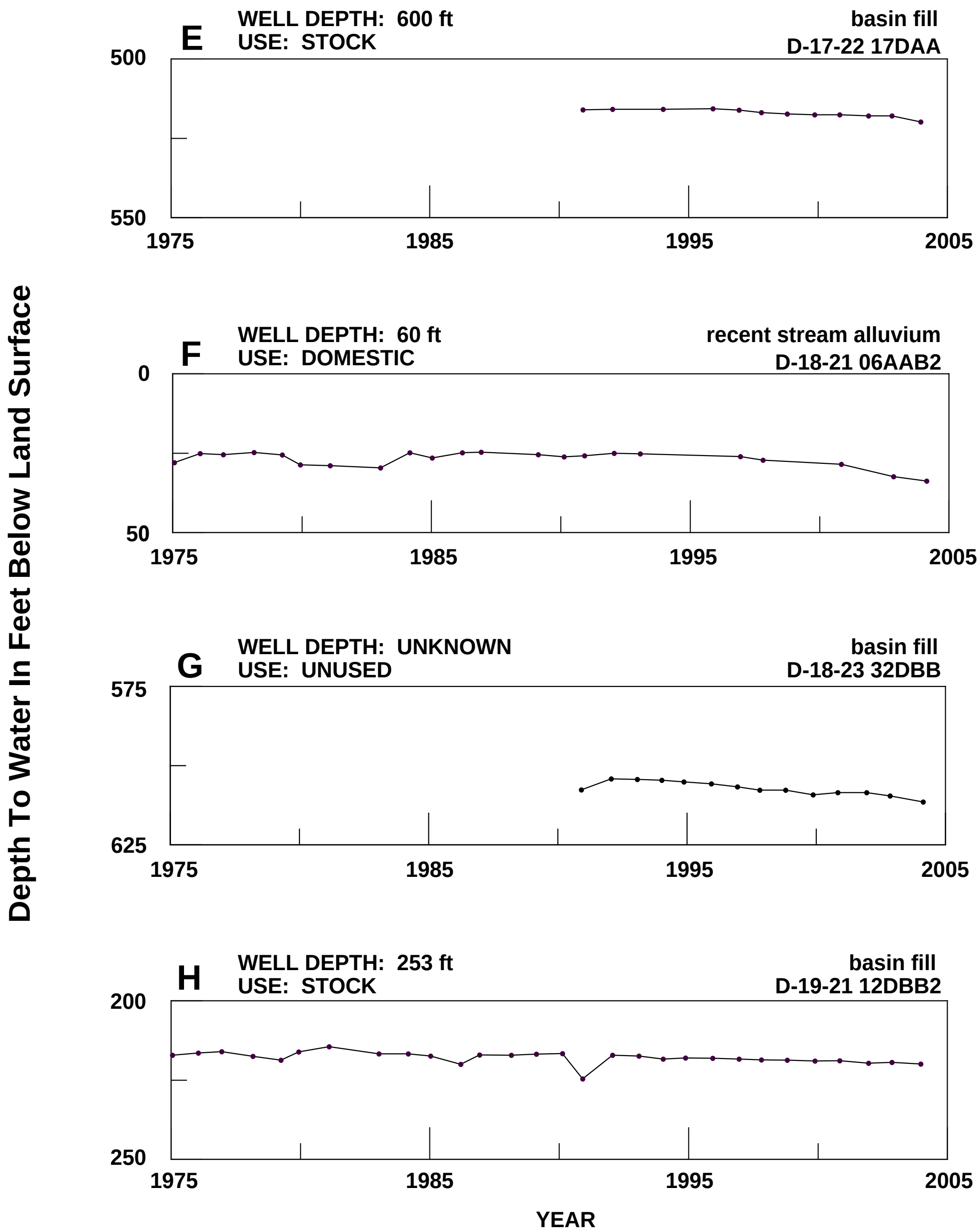


Figure 3.13-7 (Con't.)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells

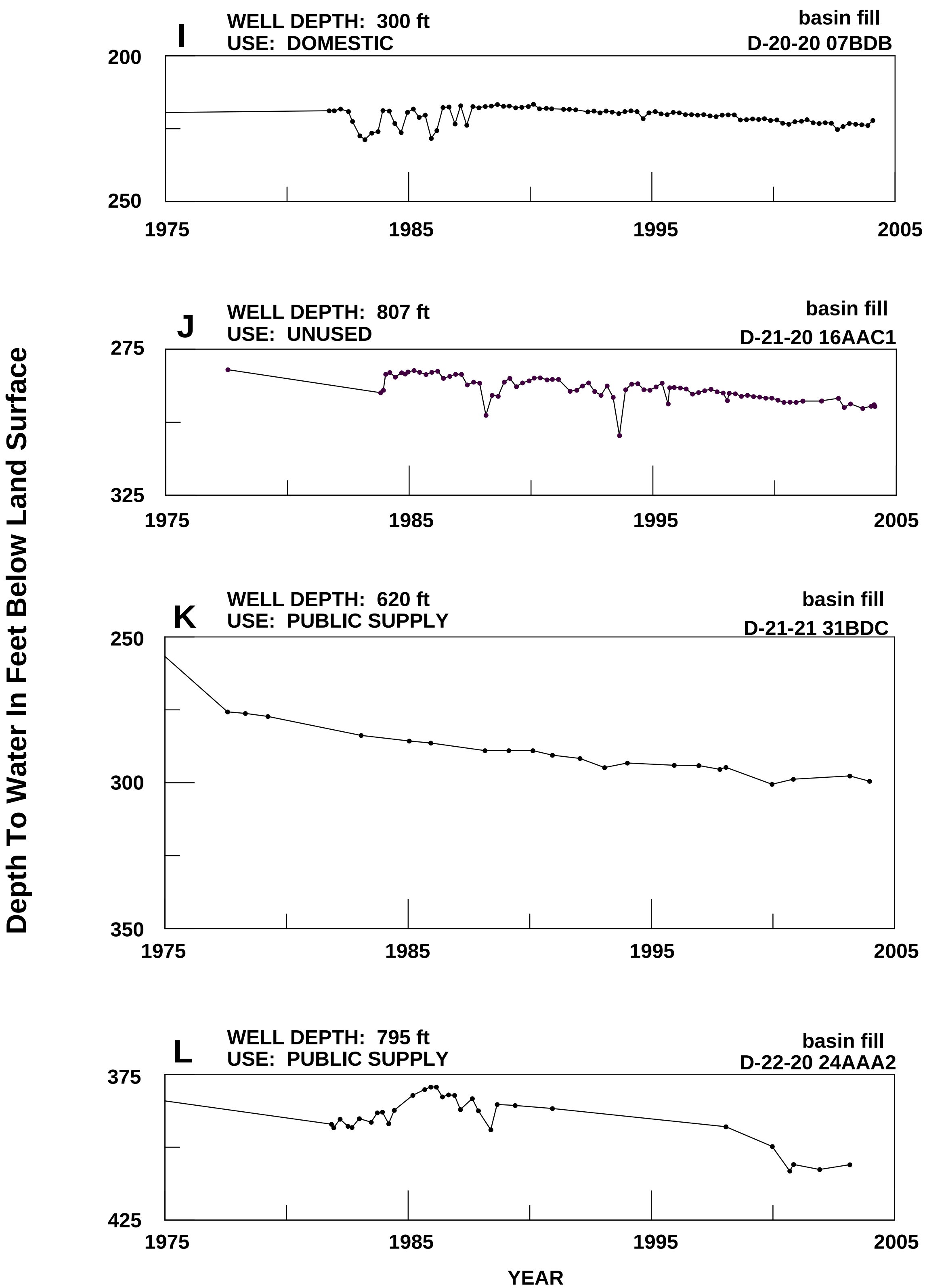
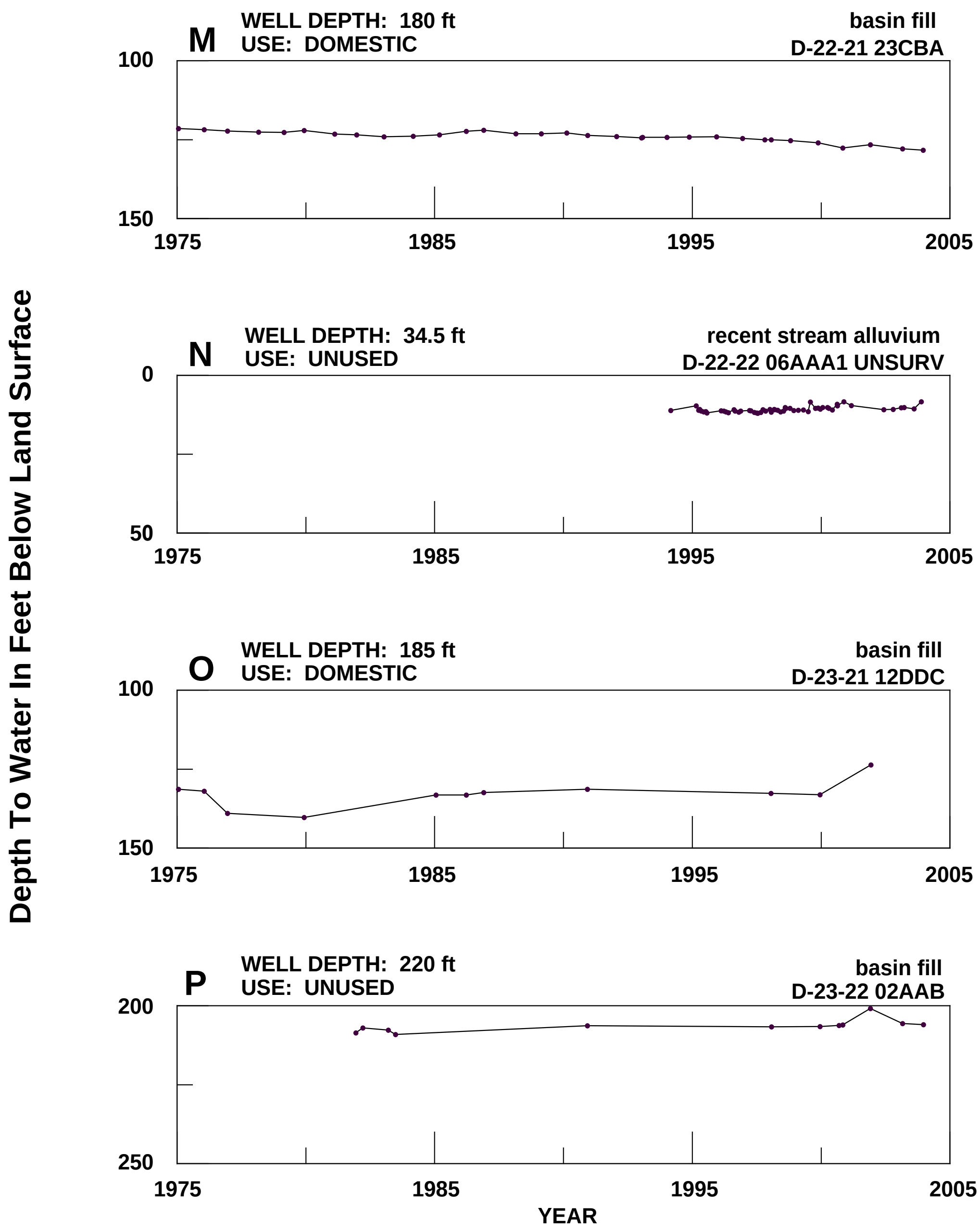
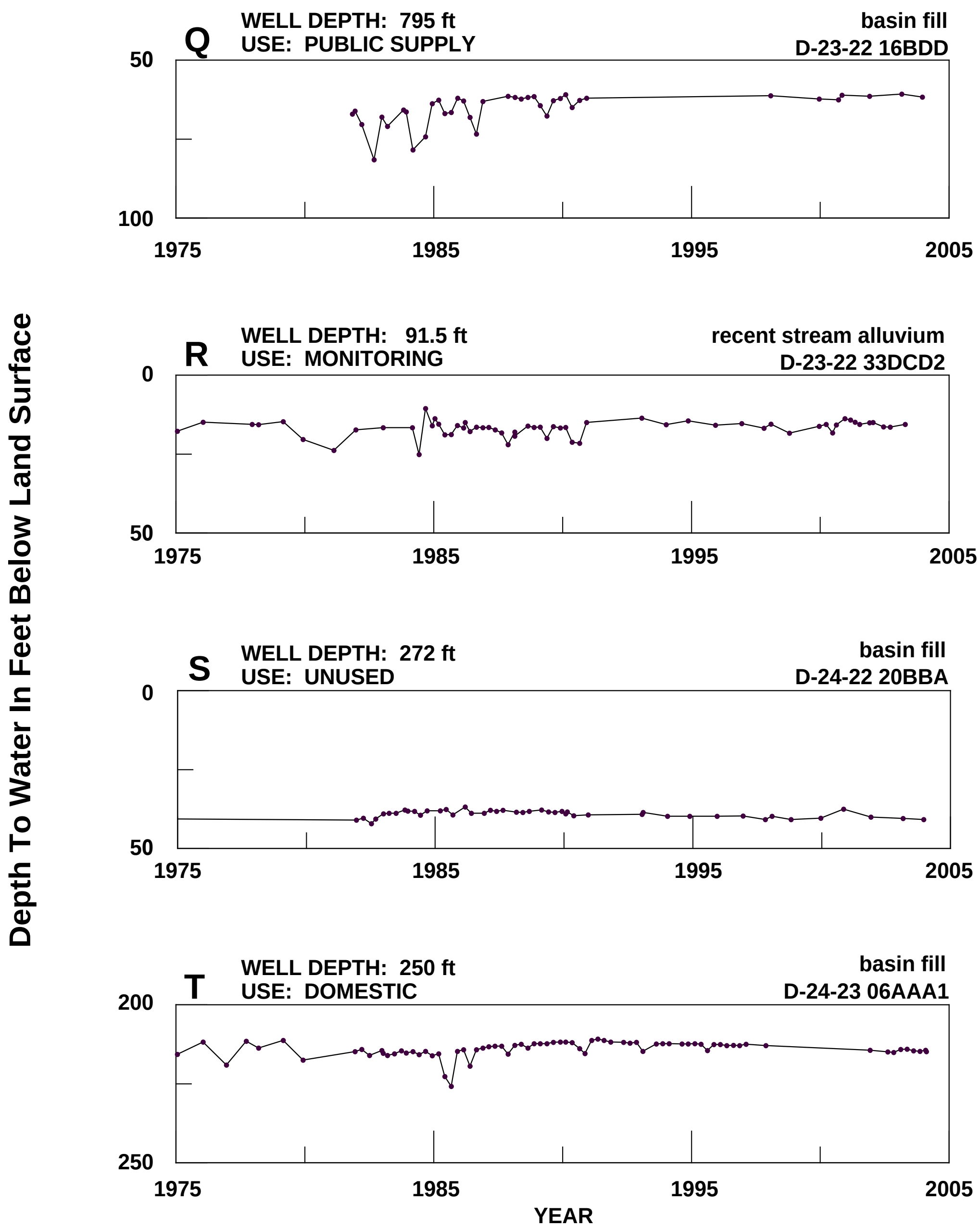


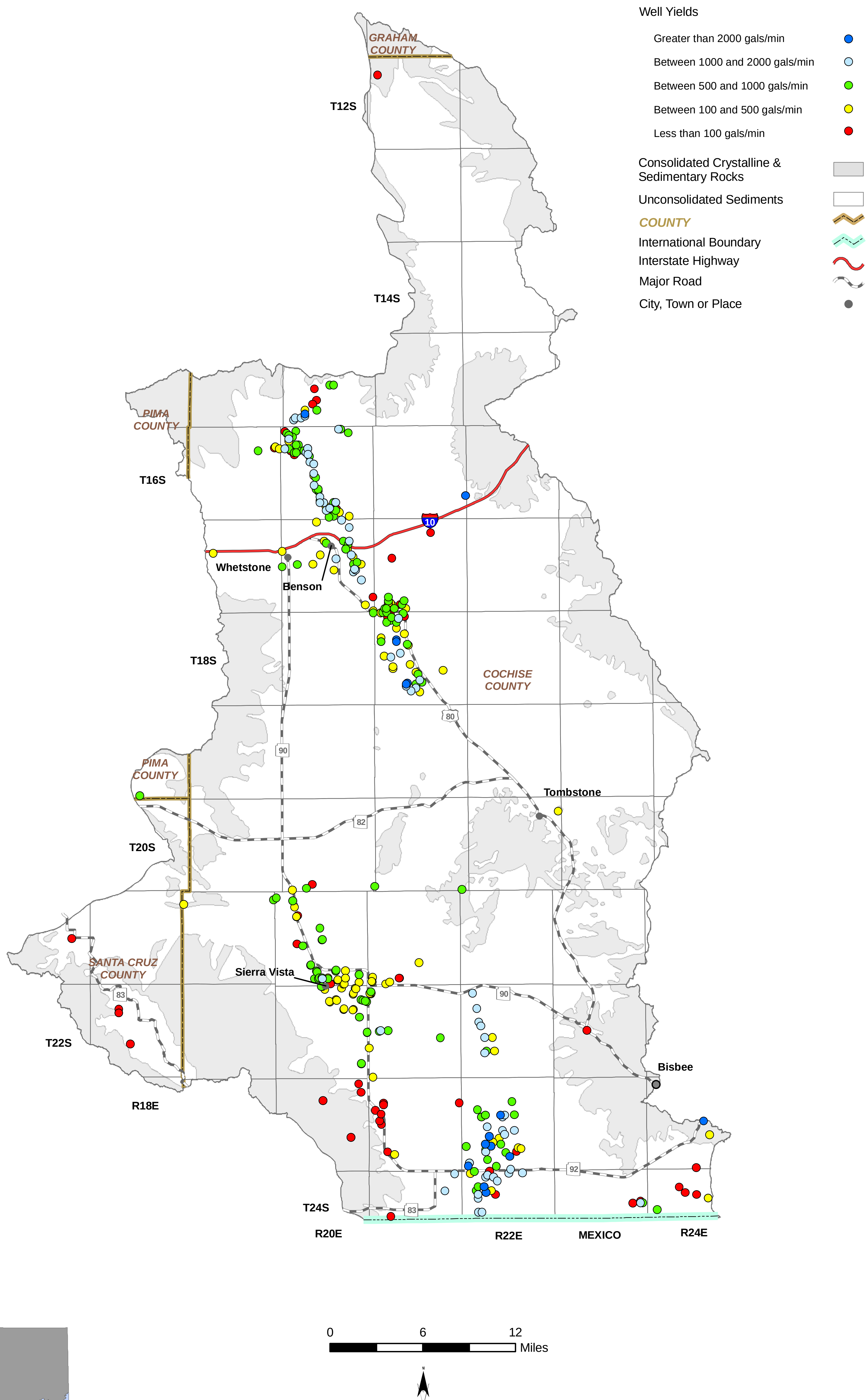
Figure 3.13-7 (Con't)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells



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 3.13-7 (Con't)
Upper San Pedro Basin
Hydrographs Showing Depth to Water in Selected Wells





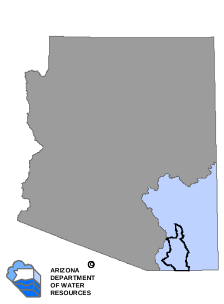


Figure 3.13-8
Upper San Pedro Basin
Well Yields

3.13.7 Water Quality of the Upper San Pedro Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded are shown in Table 3.13-7A. 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 3.13-7B. Figure 3.13-9 shows the location of exceedences and impairment keyed to Table 3.13-7. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.13-7A.
- Drinking water standard exceedences in wells, springs and at mine sites have been reported for 68 sites in the basin.
- The most frequently exceeded parameters in the sites measured in this basin were arsenic and fluoride.
- South of Sierra Vista along Highway 92, the parameter exceeded was cadmium.
- Other parameters exceeded in the sites measured in this basin included lead, nitrates, beryllium, mercury and total dissolved solids.

Lakes and Streams

- Refer to Table 3.13-7B.
- 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.
- The longest impaired reach was 28 miles.
- 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.
- There is one effluent dependent reach, Walnut Gulch, in the vicinity of Tombstone.

Table 3.13-7 Water Quality Exceedences in the Upper San Pedro Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[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

Table 3.13-7 Water Quality Exceedences in the Upper San Pedro Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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
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

Table 3.13-7 Water Quality Exceedences in the Upper San Pedro Basin[1]

A. Wells, Springs and Mines (con't.)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
59	Well	21 South	21 East	33	NO3
60	NR	22 South	18 East	35	Cd, Cu, Pb
61	Spring	22 South	19 East	14	Pb
62	Well	22 South	20 East	12	Cd
63	Well	23 South	21 East	7	Cd
64	Well	23 South	21 East	7	Cd
65	Well	23 South	21 East	18	Cd
66	Well	23 South	21 East	18	Cd
67	Well	23 South	22 East	33	Pb
68	Well	24 South	24 East	4	TDS

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in	Area of Impaired Lake (in acres)	Designated Use Standard[3]	Parameter(s) Exceeding Use
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

Table 3.13-7 Water Quality Exceedences in the Upper San Pedro Basin[1]

B. Lakes and Streams (con't.)

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]
c	Stream	San Pedro River (Mexico border to Charleston)	28	NA	A&W	Cu

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 between 1977 and 2004.
[2] As = Arsenic
Be = Beryllium
Cd = Cadmium
Cu = Copper
F= Fluoride
Pb = Lead
Hg = Mercury
NO3 = Nitrate/Nitrite
TDS = Total Dissolved Solids
[3] A&W = Aquatic and Wildlife
FBC = Full Body Contact

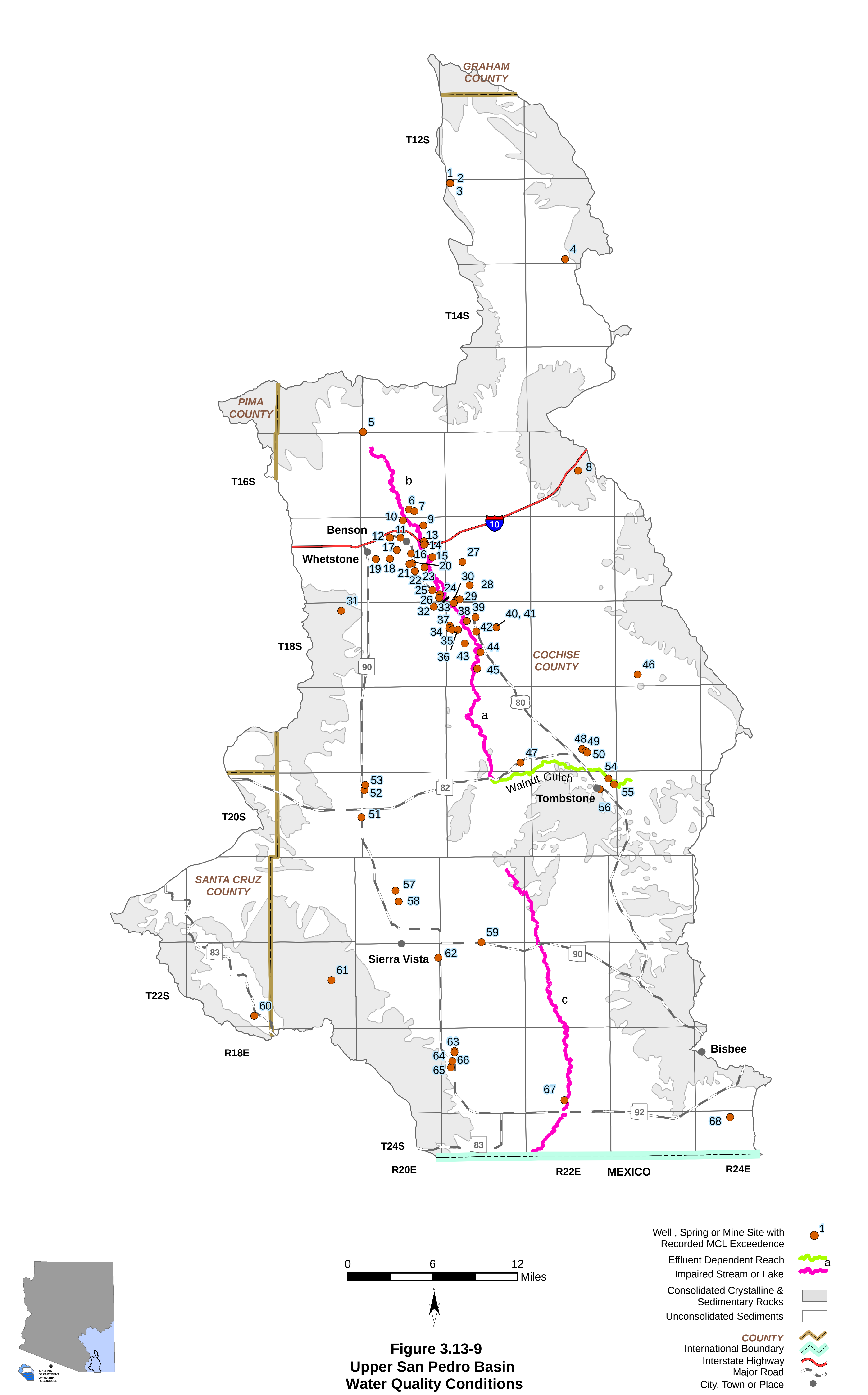


Figure 3.13-9
Upper San Pedro Basin
Water Quality Conditions

3.13.8 Cultural Water Demands 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 3.13-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown on Table 3.13-9. Figure 3.13-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.13-8 and Figure 3.13-10.
- Population has increased by about 1,200 residents a year from 1980 to 2000. Projections suggest the annual growth rate will decrease through 2050.
- 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 has remained relatively constant since 1986, with an average of 34,600 acre-feet pumped per year in the period from 2001-2003.
- Total current surface water diversions are estimated to be comparable to historic diversion volumes with approximately 4,500 acre-feet per year diverted in the period from 1991 – 2003. 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/San Jose.
- Municipal demand constitutes over half of the total groundwater use in the period from 1996-2003.
- There is one large inactive mine, the Copper Queen, in the vicinity of Bisbee, and at least two small sand and gravel pits in the vicinity of Sierra Vista. All industrial water supply is groundwater.
- As of 2003 there were 4,769 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 269 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 3.13-9.
- There are 11 wastewater treatment facilities in the basin.
- 10 of these facilities serve communities and one is used for industrial purposes.
- The three 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 55,000 people are served by these facilities.
- More than 5,000 acre-feet of effluent per year are generated in this basin.
- Three facilities discharged wastewater for irrigation in 2002 or 2003 but recent treatment facility consolidations in Bisbee will affect disposal methods.
- Two 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 3.13-8 Cultural Water Demands in the Upper San Pedro Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971										
1972										
1973				40,500			4,500			
1974										
1975		2,059[2]	496[2]							
1976										
1977										
1978				53,500			4,500			
1979										
1980	50,999									ADWR (1994) ADWR (2005)
1981	52,215									
1982	53,431									
1983	54,647	586	70	55,500			4,500			
1984	55,863									
1985	57,079									
1986	58,295									
1987	59,511									
1988	60,727	427	19	35,500			4,500			
1989	61,943									
1990	63,159									
1991	64,645									
1992	66,130									
1993	67,615	548	21	15,500	1,900	16,500	<300	NR	4,300	
1994	69,101									
1995	70,586									
1996	72,071									
1997	73,557									USGS (2005) ADWR (2005)
1998	75,042	715	13	17,500	2,000	15,000	<300	NR	4,300	
1999	76,528									
2000	78,013									
2001	79,183									
2002	80,353	239	4	18,000	2,100	14,500	<300	NR	4,300	
2003	81,524									
2010	89,715									
2020	96,354									
2030	101,634									
2040	105,699									
2050	109,896									
ADDITIONAL WELLS: [3]		**195**	**6**							
WELL TOTALS:		**4,769**	**629**							

Notes:
NR = Not reported.
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates. These wells are summed here.

Table 3.13-9 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	Discharge to Another Facility	Groundwater Recharge			
Apache Nitrogen Products	Private	Industrial Facility	NA	NA					X			NA		
Benson WWTF	Town of Benson	Benson	3,505	560		X		San Pedro				Adv.Trt.I	1,206	2003
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	80	2000
Mule Gulch WWTF	City of Bisbee	Bisbee	1,800[2]	146	Mule Gulch (Douglas Basin)							Secondary	——[3]	2002
Naco WWTF	Naco SD	Naco	846	83		X						Secondary	NA	2000
San Jose WWTF	City of Bisbee	Bisbee	1,000[2]	146		X	X					Secondary	——[3]	2002
Sierra Vista WWTP	City of Sierra Vista	Sierra Vista	36,000	2,800					X		X	Secondary	4,800	2002
Southland Sanitation	Private	Sierra Vista	NA	34		X	X					NA		2003
Tombstone WWTP	City of Tombstone	Tombstone	1,465	112	Walnut Gulch							Secondary	NA	2002
Warren WWTF	City of Bisbee	Bisbee	2,100[2]	146		X	X					Secondary	——[3]	2002
Total			55,730	5,230										

Notes:
NA: Data not currently available to ADWR
WWTF: Wastewater Treatment Facility
WWTP: Wastewater Treatment Plant
SD: Sanitation District
Adv Tr l: Advanced treatment level l
Adv. Tr. ll: Advanced treatment level ll
[1]Population varies due to temporary residents
[2]Population numbers from Upper San Pedro Active Management Area Review Report, ADWR, March 2005
[3]Bisbee's total unsewered population is 1,190

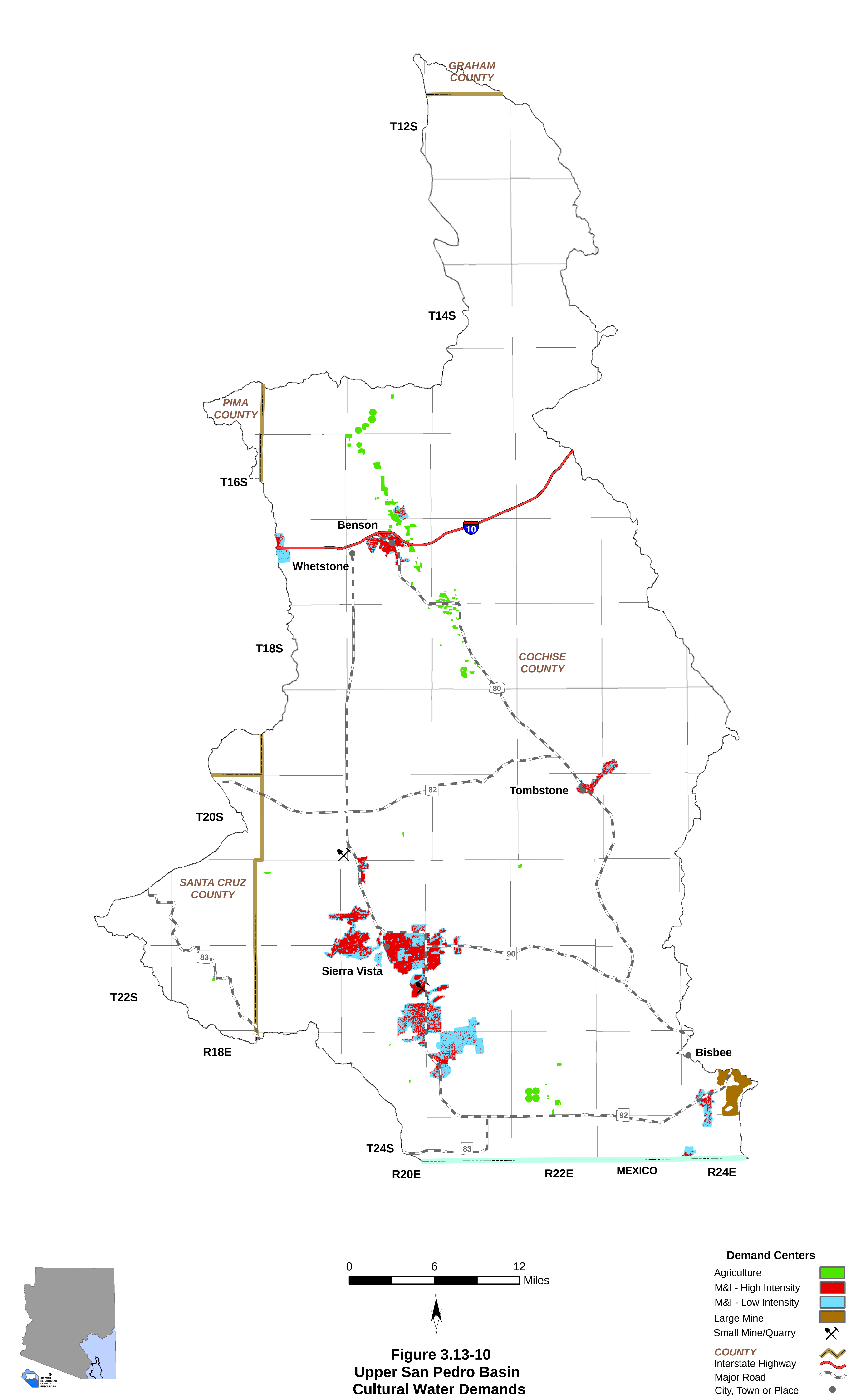


Figure 3.13-10
Upper San Pedro Basin
Cultural Water Demands

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 3.13-10. Figure 3.13-11 shows the locations of subdivisions keyed to the Table. A description of the Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

- A total of 185 water adequacy determinations have been made through May, 2005.
- 54 determinations of inadequacy have been made, most are in the vicinity of Sierra Vista and Bisbee.
- In 1984, the Department began issuing determinations of inadequate water supply in the Sierra Vista Sub-basin in the Upper San Pedro River Watershed 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.
- All lots receiving an adequacy determination are in Cochise County. Of the 22,508 lots, 14,038 or 76% were determined to be adequate.

Table 3.13-10 Adequacy Determinations in the Upper San Pedro 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	Buena Loma # 112	Cochise	22 South	21 East	7	7		Inadequate	B	02/07/85	Pueblo del Sol Water Company
2	Buena Vista Ranchettes	Cochise	17 South	19 East	5	20		Inadequate	B	07/16/87	Dry Lot Subdivision
3	Campstone	Cochise	21 South	20 East	5, 6, 7	27		Inadequate	B	08/17/87	Town of Huachuca City
4	Campus Drive Business Park	Cochise	21 South	21 East	31	18	22-400029	Adequate		03/10/99	Bella Vista Water Company, Inc.
5	Canyon de Flores Phase 1 - C	Cochise	22 South	20 East	24	69	22-400597	Adequate		09/27/01	Pueblo del Sol Water Company
6	Canyon de Flores Phase 1 - D	Cochise	22 South	20 East	24	64	22-400659	Adequate		01/16/02	Pueblo del Sol Water Company
7	Canyon de Flores Phase 1 - E	Cochise	22 South	20 East	24	52	22-400686	Adequate		05/08/02	Pueblo del Sol Water Company
8	Canyon de Flores Phase 1 - F	Cochise	22 South	20 East	24	61	22-400842	Adequate		11/04/02	Pueblo del Sol Water Company
9	Canyon de Flores Phase 2	Cochise	22 South	20 East	23, 24	355	22-400908	Adequate		06/02/03	Pueblo Del Sol Water Company
10	Carmel	Cochise	21 South	21 East	31	54		Inadequate	B	03/03/87	Bella Vista Water Company, Inc.
11	Casitas Place # 2	Cochise	22 South	21 East	6	40		Inadequate	B	06/24/85	Bella Vista Water Company, Inc.
12	Casitas Place Condominiums	Cochise	22 South	21 East	6	40		Adequate		05/26/83	Southwest Water Company
13	Chaparral Village North	Cochise	22 South	21 East	5	549	22-400847	Adequate		12/05/02	Bella Vista Water Company
14	Charleston Village	Cochise	21 South	21 East	29	185		Adequate		11/03/93	Bella Vista Water Company, Inc.
15	Cimmaron Place	Cochise	21 South	20 East	35	47	2-401496	Adequate		12/06/04	Bella Vista Water Company
16	Circle G at Ramsey Ranch	Cochise	23 South	21 East	6	437		Adequate		02/24/95	East Slope Water Company
17	Circle S Ranches	Cochise	23 South	21 East	17	36		Inadequate	B	12/12/89	Horseshoe Ranch Water Company
18	Cochise Commercial Center	Cochise	22 South	21 East	7	15		Inadequate	B	03/21/86	Pueblo del Sol Water Company
19	Cochise Terrace	Cochise	17 South	20 East	18	55	22-300410	Adequate		01/20/98	City of Benson
20	Cochise Vista	Cochise	20 South	20 East	31	45		Adequate		06/25/73	Town of Huachuca City
21	Cochise Vista Condominiums	Cochise	22 South	21 East	7	17		Adequate		08/11/83	Pueblo del Sol Water Company
22	Compass Point	Cochise	23 South	22 East	19	20	22-400685	Adequate		04/02/02	Dry Lot Subdivision
23	Copper Pointe Estates	Cochise	22 South	20 East	12	52	22-400729	Adequate		10/22/02	Arizona Water Company
24	Copper Sky Estates	Cochise	22 South	20 East	11, 12	180	22-400744	Adequate		07/15/02	Arizona Water Company - Sierra Vista
25	Corona del Sol	Cochise	22 South	21 East	7	9		Inadequate	B	12/17/84	Pueblo del Sol Water Company
26	Coronado Estates	Cochise	20 South	20 East	18, 19	7		Inadequate	B	03/20/89	Cochise Water Company
27	Cottonwoods of San Pedro	Cochise	23 South	22 East	16	90		Inadequate	A1,B	02/01/94	Dry Lot Subdivision
28	Coventry Estates	Cochise	21 South	20 East	34	20		Adequate		11/04/83	Bella Vista Water Company, Inc.

Table 3.13-10 Adequacy Determinations in the Upper San Pedro Basin (con't.)[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						
29	Covey Run	Cochise	23 South	21 East	21	26	22-401507	Adequate		11/14/05	Dry Lot Subdivision
30	Crestview	Cochise	23 South	24 East	29	54		Inadequate	A1	06/08/93	Arizona Water Company
31	Crossroads Commerce Center	Cochise	21 South	21 East	31	19	22-400501	Adequate		05/08/01	Bella Vista Water Company, Inc.
32	Deer Ridge Estates	Cochise	23 South	21 East	27	20	22-300294	Adequate		05/07/97	Dry Lot Subdivision
33	Desert Mist Commerce Center	Cochise	22 South	21 East	5	NA		Inadequate	B	03/09/89	Bella Vista Water Company, Inc.
34	Desert Shadows # 2A & 2B	Cochise	22 South	21 East	5	84		Inadequate	B	01/07/93	Bella Vista Water Company, Inc.
35	Eagle Ridge # 1	Cochise	22 South	20 East	24	59		Inadequate	B	10/14/86	Pueblo del Sol Water Company
36	Eagle Ridge # 2	Cochise	22 South	20 East	24	155		Inadequate	B	07/09/87	Pueblo del Sol Water Company
37	El Rancho Estates	Cochise	23 South	24 East	29	39		Inadequate	A1	07/10/89	Arizona Water Company
38	Executive Acres	Cochise	23 South	20 East	1	26		Inadequate	A1	05/02/85	Dry Lot Subdivision
39	Fairway Villas	Cochise	22 South	20 East	13	35		Inadequate	B	04/13/93	Pueblo del Sol Water Company
40	Foothills Ranch	Cochise	23 South	21 East	7	49		Inadequate	B	10/28/92	Nicksville Water Company
41	Foothills Ranch, # 4, 5, 6	Cochise	23 South	21 East	18	53		Adequate		01/31/95	Bella Vista Water Company
42	Gatewood	Cochise	21 South	20 East	35	75	22-401533	Adequate		11/05/04	Bella Vista Water Company
43	Golden Acres Commercial #1	Cochise	22 South	21 East	19	9		Adequate		07/22/76	Southland Utilities Company
44	Golden Acres Mobile Home Park # 2	Cochise	22 South	21 East	19	27		Adequate		07/21/81	Southland Utilities Company
45	Golden Acres Mobile Home Park # 3	Cochise	22 South	21 East	19	278		Adequate		06/17/74	Southland Utilities Company
46	Golden Meadows # 3	Cochise	22 South	21 East	30	8		Adequate		08/09/79	Southland Utilities Company
47	Golden Vistas	Cochise	22 South	21 East	30	59	22-300049	Adequate		03/29/96	Southland Utilities Company
48	Golden Vistas, Phase 2 & 3	Cochise	22 South	21 East	29	120	22-400319	Adequate		07/14/00	Southland Utilities Company
49	Grandeur Carmel	Cochise	21 South	21 East	31	54		Adequate		10/26/93	Bella Vista Water Company, Inc.
50	Greenbriar Estates, Lots 1 - 32	Cochise	22 South	20 East	13	32	22-300274	Adequate		04/11/97	Pueblo del Sol Water Company
51	Greenways, The	Cochise	22 South	20 East	13	21		Adequate		11/23/81	Pueblo del Sol Water Company
52	Heritage Park	Cochise	17 South	20 East	4	89		Inadequate	A1, B	07/31/84	Konen Water Company
53	Highland Park Estates	Cochise	22 South	20 East	11, 12, 20	110	22-400710	Adequate		05/08/02	Arizona Water Company
54	Hobby Horse Ranch	Cochise	22 South	21 East	23, 26	35	22-300035	Adequate		07/20/95	Dry Lot Subdivision
55	Hodgins Acres	Cochise	20 South	20 East	7	129		Inadequate	B	07/17/90	Whetstone Water Improvement District

Table 3.13-10 Adequacy Determinations in the Upper San Pedro Basin (con't.)[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						
56	Holiday at Pueblo Del Sol	Cochise	22 South	21 East	19	191	22-401627	Adequate		06/07/05	Pueblo Del Sol Water Company
57	Horseshoe Ranch Mobile Home Estates	Cochise	23 South	21 East	17	68		Inadequate	B	10/23/89	Horseshoe Ranch Water Company
58	Huachuca Commercial Center	Cochise	20 South	21 East	31	NA		Inadequate	D	08/17/87	Town of Huachuca City
59	Huachuca Commercial Center B	Cochise	21 South	20 East	5, 6	NA		Inadequate	D	08/17/87	Town of Huachuca City
60	Huachuca Mountain Estates	Cochise	22 South	20 East	10	370		Adequate		08/22/75	Arizona Water Company
61	Huachuca Mountain Village, A & B	Cochise	22 South	20 East	10	208		Adequate		05/25/77	Pueblo del Sol Water Company
62	Huachuca Terrace	Cochise	23 South	24 East	29	9		Inadequate	A1	06/13/87	Arizona Water Company
63	Ironhorse Village	Cochise	17 South	20 East	16	48	22-300394	Adequate		12/17/97	City of Benson
64	Kinjockity Ranch	Cochise	23 South	21 East	33	281	22-401824	Adequate		10/07/05	Bella Vista Water Company
65	La Terraza Phase B	Cochise	22 South	20 East	24	32	22-400712	Adequate		08/07/02	Pueblo Del Sol Water Company
66	La Terraza, Phase C	Cochise	22 South	20 East	23	28	22-401003	Adequate		09/17/03	Pueblo Del Sol Water Company
67	Legends at Valiente I	Cochise	21 South	20 East	35	104	22-401337	Adequate		07/07/04	Bella Vista Water Company
68	Legends at Valiente II	Cochise	21 South	20 East	35	100	22-401583	Adequate		02/04/05	Bella Vista Water Company
69	Linda Vista	Cochise	23 South	21 East	8	76		Adequate		02/27/96	Nicksville Water Company
70	Loma Catarina	Cochise	17 South	20 East	15	20		Adequate		11/04/74	City of Benson
71	London Square # 2	Cochise	21 South	20 East	34	42		Adequate		08/19/94	Bella Vista Water Company
72	Los Ranchos Subdivision	Cochise	23 South	21 East	25, 26	70	22-400238	Adequate		02/15/00	Dry Lot Subdivision
73	McCormick Place	Cochise	22 South	21 East	6	4		Adequate		09/13/83	Southwest Water Company
74	Meadows, The	Cochise	22 South	20 East	3	273		Adequate		06/12/74	Southwest Water Company
75	Mesa Mountain Northeast	Cochise	21 South	21 East	33	20		Inadequate	B	11/04/91	Arizona Water Company
76	Mesa Verde Estates	Cochise	22 South	21 East	5	66	22-401257	Adequate		01/25/05	Bella Vista Water Company
77	Mesa Verde/Mountain View	Cochise	22 South	21 East	5	127		Adequate		03/15/94	Bella Vista Water Company
78	Miracle Valley	Cochise	23 South	22 East	31	23	22-300271	Inadequate	C	04/03/97	Miracle Valley Water Company
79	Mission Coronado Estates	Cochise	22 South	21 East	19	97		Adequate		10/23/79	Southland Utilities Company
80	Mission Hills Estates	Cochise	22 South	21 East	7	129		Inadequate	B	04/13/93	Pueblo del Sol Water Company
81	Mission Shadows	Cochise	22 South	20 East	13	71		Inadequate	B	03/06/87	Pueblo del Sol Water Company
82	Montebello	Cochise	21 South	21 East	31	39		Adequate		06/23/81	Bella Vista Water Company

Table 3.13-10 Adequacy Determinations in the Upper San Pedro Basin (con't.)[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						
83	Mountain Ridge	Cochise	22 South	20 East	24	364		Inadequate	B	04/13/93	Pueblo del Sol Water Company
84	Mountain Shadows	Cochise	22 South	20 East	24, 25	244		Inadequate	B	02/12/86	Pueblo del Sol Water Company
85	Mountain Shadows - A	Cochise	22 South	20 East	25	82		Inadequate	B	07/09/87	Pueblo del Sol Water Company
86	Mountain Shadows - F (revised)	Cochise	22 South	20 East	25, 26	40	22-300253	Adequate		02/19/97	Pueblo del Sol Water Company
87	Mountain View Terrace	Cochise	22 South	20 East	13, 24	169		Inadequate	D	08/12/87	Pueblo del Sol Water Company
88	Mustang Heights	Cochise	20 South	19 East	14	33		Adequate		05/31/74	Mustang Water Company
89	Naco, Townsite	Cochise	24 South	24 East	18, 19	443		Inadequate	A1	01/28/85	Naco Water Compan
90	Northpark	Cochise	21 South	20 East	35	59		Inadequate	B	07/30/92	Bella Vista Water Company
91	Oasis Condominiums	Cochise	22 South	21 East	6	184		Inadequate	B	05/23/85	Southwest Water Company
92	Ocotillo Terrace Subdivision, 1 - 22	Cochise	21 South	20 East	35	22	22-300422	Adequate		05/27/98	Bella Vista Water Company
93	Ocotillo Villas	Cochise	21 South	20 East	35	28	22-300023	Adequate		06/28/95	Bella Vista Water Company
94	Park Place Townhouses	Cochise	23 South	24 East	29	36		Inadequate	A1	07/17/85	Arizona Water Company
95	Patton Subdivision	Cochise	21 South	20 East	8	10		Adequate		07/03/79	Town of Huachuca City
96	Pueblo del Sol	Cochise	22 South	21 East	6	127		Adequate		06/24/74	Southwest Water Company
97	Pueblo del Sol # 5, # 6	Cochise	22 South	21 East	7	48		Adequate		10/15/74	Southwest Water Company
98	Pueblo del Sol # 7	Cochise	22 South	21 East	5, 6	112		Adequate		03/12/76	Southwest Water Company
99	Pueblo del Sol # 8	Cochise	22 South	21 East	6, 7	115		Adequate		06/21/77	Southwest Water Company
100	Pueblo del Sol Co. Club Estate	Cochise	22 South	20 East	13	1165		Adequate		10/23/74	Pueblo del Sol Water Company
101	Pueblo del Sol Tract 109	Cochise	22 South	21 East	6, 7	124		Adequate		04/18/80	Southwest Water Company
102	Pueblo del Sol Tract 110	Cochise	22 South	21 East	5, 6, 7	178		Adequate		04/23/82	Southwest Water Company
103	Pueblo del Sol Tract 111	Cochise	22 South	20 East	13	278		Adequate		09/08/81	Pueblo del Sol Water Company
104	Pueblo del Sol Tract 112	Cochise	22 South	21 East	7	37		Adequate		10/15/82	Pueblo del Sol Water Company
105	Pueblo del Sol Tract 113	Cochise	22 South	21 East	7	506		Adequate		10/15/82	Pueblo del Sol Water Company
106	Pueblo del Sol Tract 115	Cochise	22 South	21 East	7	360		Inadequate	B	11/30/84	Pueblo del Sol Water Company
107	Quail Hills	Cochise	21 South	20 East	5, 8	50		Adequate		03/22/78	Town of Huachuca City
108	Quail Hollow	Cochise	21 South	20 East	35	148		Adequate		12/30/82	Bella Vista Water Company
109	Quail Hollow # 2	Cochise	21 South	20 East	35	5		Adequate		12/08/93	Bella Vista Water Company

Table 3.13-10 Adequacy Determinations in the Upper San Pedro Basin (con't.)[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						
110	Radine Ridge	Cochise	17 South	20 East	15	66		Adequate		10/01/92	City of Benson
111	Ranch, The	Cochise	21 South	21 East	30	226	22-400537	Adequate		07/20/01	Bella Vista Water Company
112	Ranchitos Los Alamos # 2	Cochise	17 South	20 East	4	64		Adequate		01/02/80	K-7 Development, Inc.
113	Rancho Arizona Subdivision	Cochise	23 South	22 East	29	48	22-401225	Adequate		12/01/04	Dry Lot Subdivision
114	Ranchos Carmella # 3, 4	Cochise	21 South	20 East	25	68		Adequate		11/03/93	Bella Vista Water Company
115	Ranchos Carmella Estates	Cochise	21 South	20 East	25	44		Adequate		10/23/79	Bella Vista Water Company
116	Reflections at Valiente	Cochise	21 South	20 East	35	146	22-401584	Adequate		02/04/05	Bella Vista Water Company
117	Remington Park West Subdivision	Cochise	22 South	20 East	11, 12	107	22-400757	Adequate		07/12/02	Arizona Water Company - Sierra Vista
118	Rincon View Subdivision, Lots 1 - 59	Cochise	17 South	19 East	5, 8	59	22-400865	Adequate		01/24/03	Mescal Lakes Water System
119	San Pedro Estates	Cochise	16 South	20 East	35	36	22-401638	Adequate		05/06/05	Pomerene Domestic Water Improvement District
120	San Pedro Terrace	Cochise	23 South	22 East	7	11	22-300117	Adequate		07/25/96	San Pedro Terrace Homeowners Assoc.
121	Sandalwood	Cochise	22 South	20 East	2	36		Inadequate	B	03/31/88	Bella Vista Water Company
122	Seminole Winds	Cochise	21 South	20 East	8	93		Adequate		04/29/94	Town of Huachuca City
123	Si Tengo	Cochise	17 South	20 East	15	6		Adequate		12/03/80	City of Benson
124	Sierra Bonita Estates	Cochise	23 South	24 East	28	48		Adequate		06/15/79	Arizona Water Company
125	Sierra Bonita Estates B	Cochise	23 South	24 East	28	50	22-400326	Inadequate	A1	05/31/00	Arizona Water Company
126	Sierra Bonita Ranches	Cochise	22 South	21 East	11	30	22-400937	Inadequate	C	11/03/03	Arizona Water Company
127	Sierra Carmichael Condos	Cochise	21 South	20 East	34	120		Inadequate	B	03/24/86	Southwest Water Company
128	Sierra Charles Condominiums	Cochise	21 South	20 East	34	120		Inadequate	B	03/24/86	Bella Vista Water Company
129	Sierra Court	Cochise	21 South	20 East	34	8		Adequate		05/09/94	Bella Vista Water Company
130	Sierra Grande	Cochise	24 South	21 East	3, 4, 10, 11	5000		Adequate		07/18/73	Unformed Company by Developer
131	Sierra Shadows	Cochise	17 South	20 East	15	6	22-300563	Adequate		12/08/98	City of Benson
132	Sierra Springs	Cochise	22 South	21 East	6	70		Adequate		01/19/95	Bella Vista Water Company
133	Sierra Tacoma Condos	Cochise	21 South	20 East	34	76		Inadequate	B	03/24/86	Bella Vista Water Company
134	Sierra Vista Estates # 2	Cochise	22 South	21 East	31	4		Inadequate	B	09/13/89	East Slope Water Company
135	Sierra Vista Industrial Park	Cochise	21 South	20 East	31	34		Adequate		06/15/79	Bella Vista Water Company
136	Somerset	Cochise	22 South	20 East	1	16		Inadequate	B	04/15/88	Arizona Water Company

Table 3.13-10 Adequacy Determinations in the Upper San Pedro Basin (con't.)[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						
137	Sonora Verde Estates	Cochise	16 South	20 East	35	NA		Inadequate	B	12/01/87	Pomerene Domestic Water Coop
138	St. David Countryside Estates, 1 - 28	Cochise	17 South	21 East	32	28		Adequate		04/02/97	Saint David Water Association
139	St. David Townsite	Cochise	18 South	21 East	16	37		Inadequate	B	02/24/89	Stratman Water Company
140	Strathan Addition	Cochise	18 South	21 East	9	21		Adequate		04/01/75	Saint David Water Association
141	Sulger City # 2	Cochise	20 South	20 East	6	21	22-300306	Adequate		06/24/97	Sulger Water Company
142	Sulger City A	Cochise	20 South	20 East	6	13		Adequate		09/26/74	Watermill Water Company
143	Sulger City B	Cochise	20 South	20 East	6	10		Adequate		01/14/76	Windmil Water Company
144	Sulger City C	Cochise	20 South	20 East	6	14		Adequate		10/14/82	Dry Lot Subdivision
145	Sulger City D	Cochise	20 South	20 East	6	19		Adequate		10/28/82	Dry Lot Subdivision
146	Sulger City E	Cochise	20 South	20 East	6	33		Adequate		08/30/93	Sulger Water Company
147	Summit, The	Cochise	22 South	20 East	11, 12	NA		Inadequate	D	11/02/84	Arizona Water Company
148	Tierra de Las Flores	Cochise	23 South	24 East	33	142		Inadequate	A1	04/21/89	Arizona Water Company
149	Tierra Del Sol Estates	Cochise	23 South	22 East	17	8	22-400207	Adequate		12/08/99	Dry Lot Subdivision
150	Tombstone Territorial Estates	Cochise	20 South	22 East	1	419		Adequate		07/26/73	City of Tombstone,
151	Tombstone Territorial Estates # 1	Cochise	20 South	22 East	1	19		Adequate		04/24/89	City of Tombstone,
152	Tombstone Villas	Cochise	20 South	22 East	2	114		Inadequate	A1	02/25/86	City of Tombstone,
153	Town & Country Estates	Cochise	22 South	20 East	11	80		Adequate		07/18/73	Arizona Water Company
154	Town & Country Estates # 3, 4	Cochise	22 South	20 East	11	90		Adequate		03/18/75	Arizona Water Company
155	Town & Country Estates # 5, 11, 12	Cochise	22 South	20 East	10, 11	183		Adequate		10/26/76	Arizona Water Company
156	Town & Country Estates # 6	Cochise	22 South	20 East	11	99		Adequate		06/21/77	Arizona Water Company
157	Town & Country Estates # 7	Cochise	22 South	20 East	11	87		Adequate		02/21/78	Arizona Water Company
158	Town & Country Estates # 8	Cochise	22 South	20 East	11	52		Adequate		08/04/76	Arizona Water Company
159	Tract 114, Lots 1 - 35	Cochise	22 South	20 East	13	35		Adequate		08/23/94	Pueblo del Sol Water Company
160	Tract 117 South, Lots 1 - 67	Cochise	22 South	20 East	13	67		Adequate		04/13/94	Pueblo del Sol Water Company
161	Trinity Terrace, Lots 1 - 17 South	Cochise	18 South	21 East	16, 17	17	22-300503	Adequate		08/05/98	Dry Lot Subdivision
162	Villa del Rio # 1	Cochise	22 South	20 East	3	20		Adequate		11/12/75	Southwest Water Company
163	Villa del Rio # 2	Cochise	22 South	20 East	3	67		Inadequate	B	05/05/86	Southwest Water Company

Table 3.13-10 Adequacy Determinations in the Upper San Pedro Basin (con't.)[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						
164	Villa La Casa	Cochise	22 South	21 East	7	4		Inadequate	B	06/21/85	Pueblo del Sol Water Company
165	Village Green	Cochise	22 South	20 East	1	141		Inadequate	B	11/13/84	Arizona Water Company
166	Village Park	Cochise	22 South	20 East	1	40		Adequate		03/12/76	Arizona Water Company
167	Village, The	Cochise	22 South	20 East	2	162		Adequate		01/26/76	Cochise Enterprises, Inc.
168	Villas de San Andreas	Cochise	21 South	20 East	35	79		Adequate		06/21/77	Bella Vista Water Company
169	Villas San Luis	Cochise	21 South	20 East	34	28		Adequate		02/09/94	Bella Vista Water Company, Inc.
170	Vista del Oro	Cochise	23 South	21 East	20	44	22-300285	Adequate		05/22/97	Bella Vista Water Company
171	Vista Village # 2	Cochise	21 South	20 East	35	67		Adequate		07/27/73	Bella Vista Water Company
172	Vista Village # 3	Cochise	21 South	20 East	35	73		Adequate		09/16/76	Bella Vista Water Company
173	Vista Village # 5	Cochise	21 South	20 East	35	122		Adequate		09/29/77	Bella Vista Water Company
174	Vista Village # 6	Cochise	21 South	20 East	35	105		Adequate		05/02/79	Bella Vista Water Company
175	Vistaview Estates	Cochise	22 South	21 East	4	356	22-400050	Adequate		04/20/99	Bella Vista Water Company
176	Whetstone Hills	Cochise	20 South	20 East	7	38	22-300377	Adequate		11/10/97	Whetstone Water Improvement District
177	Whetstone Mesa Estates # 5	Cochise	20 South	20 East	7	15	22-300040	Adequate		07/24/95	Whetstone Water Improvement District
178	White Wing	Cochise	22 South	20 East	35	114		Adequate		02/05/80	Antelope Run Water Company
179	Wild Horse	Cochise	23 South	21 East	29	77	22-300076	Adequate		01/04/96	Bella Vista Water Company
180	Wild Horse # 9	Cochise	23 South	21 East	28	79	22-300152	Adequate		06/12/96	Bella Vista Water Company
181	Windmere Subdivision	Cochise	22 South	20 East	2	65		Adequate		10/04/78	Bella Vista Water Company
182	Windsong	Cochise	22 South	20 East	1	158		Adequate		10/03/78	Arizona Water Company
183	Winterhaven Country Club Estates	Cochise	22 South	20 East	13, 14	287	22-300166	Adequate		11/04/96	Pueblo del Sol Water Company
184	Winterhaven, Phases 2E, 3, 4A and 5	Cochise	22 South	20 East	14	438	22-401002	Adequate		09/17/03	Pueblo Del Sol Water Company
185	Y-Lightning Subdivision	Cochise	23 South	21 East	4	30	22-401852	Adequate		11/14/05	Dry Lot Subdivision

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 determination.

[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically unavaible;for groundwater, depth-to-water exceeds criteria)
3) Insufficient Infrastructure (distribution system is insufficient to meet demands or applicant proposed water hauling)

B. Legal (applicant failed to demonstrate a legal right to use the water or failed to demonstrate the provider's legal authority to serve the subdivision)
C. Water Quality
D. Unable to locate records

NA= Data not currently available to ADWR

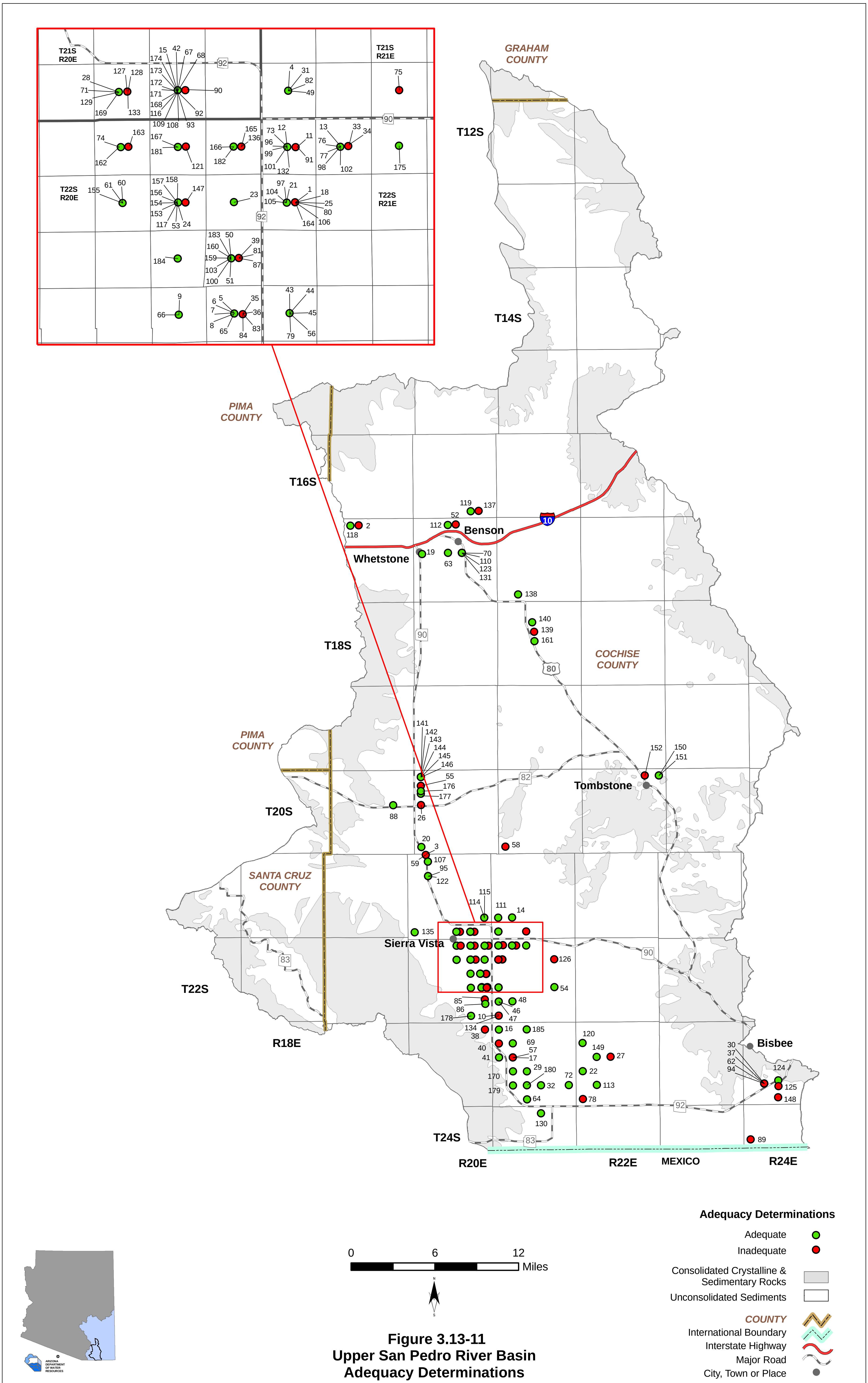


Figure 3.13-11
Upper San Pedro River Basin
Adequacy Determinations

UPPER SAN PEDRO BASIN
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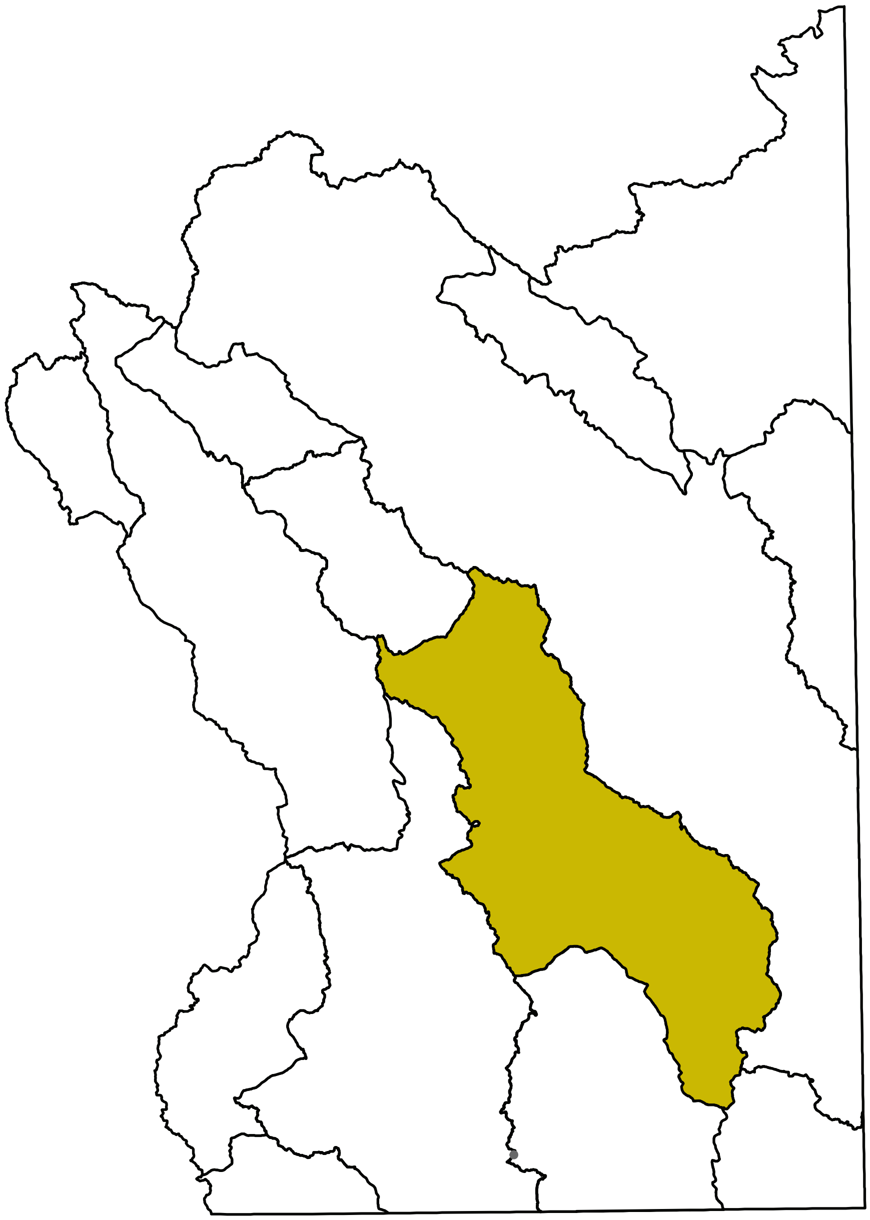
Upper San Pedro Basin Index to Section 3.0

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 and contains grassland, woodland, conifer forest and desert scrub vegetation.

- Principal geographic features include:
  - Principal basin community of Willcox
  - Smaller communities of Bonita and Fort Grant in the northern portion of the basin, Sunsites in the southwest, Sunizona on Highway 181 in the southwest and Dos Cabezas on Highway 186 southeast of Willcox
  - Ash Creek in the northern portion of the basin
  - Turkey Creek south of Sunizona
  - 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 southwest of Willcox
  - Winchester Mountains on the northwestern boundary
  - Dragoon Mountains on the central western boundary

- Not well shown on Figure 3.14-1 are:
  - Chiricahua Mountains to the southeast of Willcox, with the highest point in the basin, Buena Vista Peak at 8,823 feet
  - Swisshelm Mountains on the southwestern boundary
  - Pinaleño Mountains on the northeast boundary

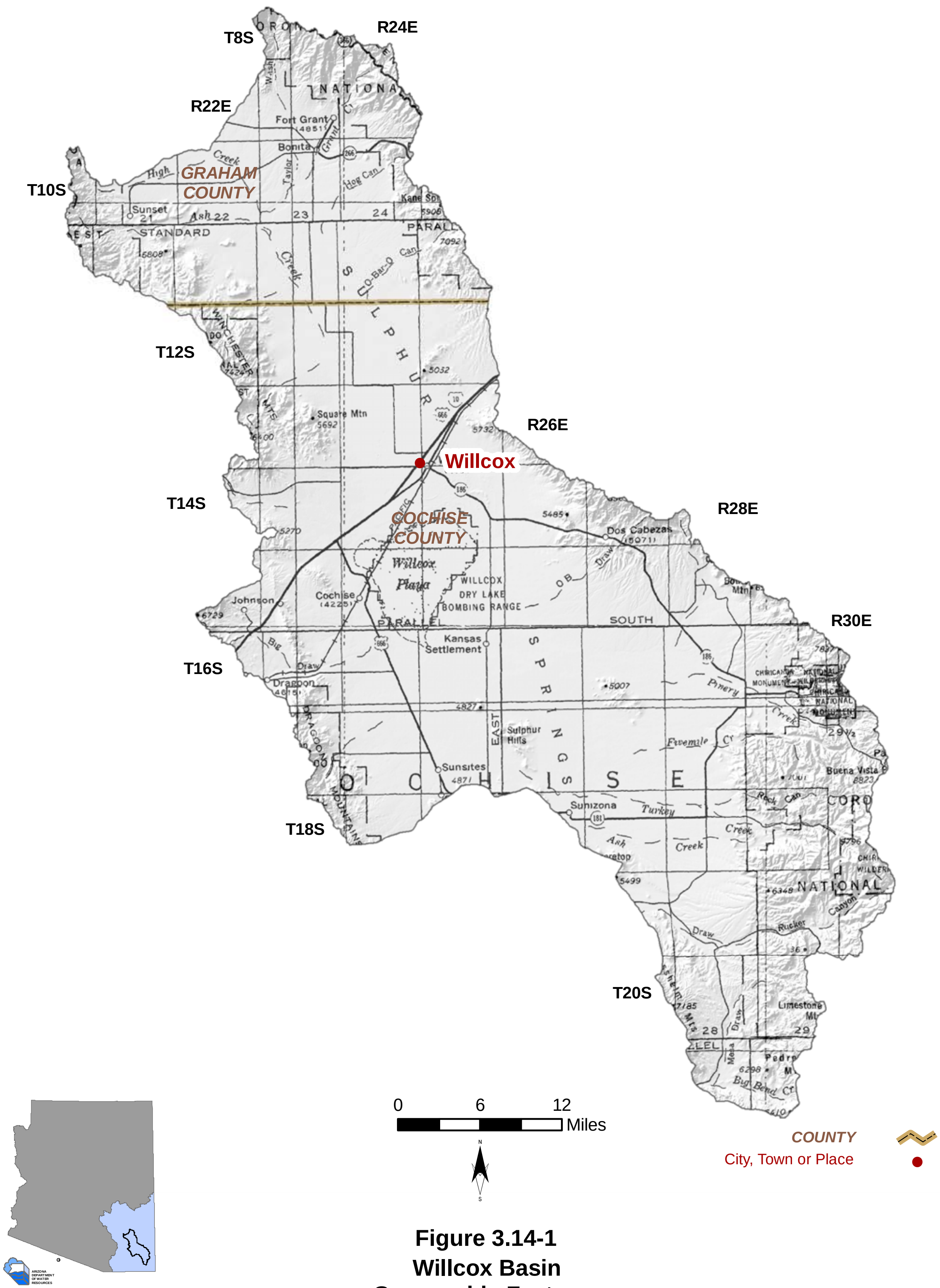


Figure 3.14-1
Willcox Basin
Geographic Features

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, Section 1.3.8. Land ownership categories are discussed below in the order of percentage from largest to smallest 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 and Wilderness
- 19.6% of land is federally owned and managed as national forest and wilderness.
- 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.
- 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 Bureau of Land Management.
- 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.

Parks, Monuments, Historical and Recreational Sites

- 0.9% of land is federally owned and managed by the National Park Service.
- 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.

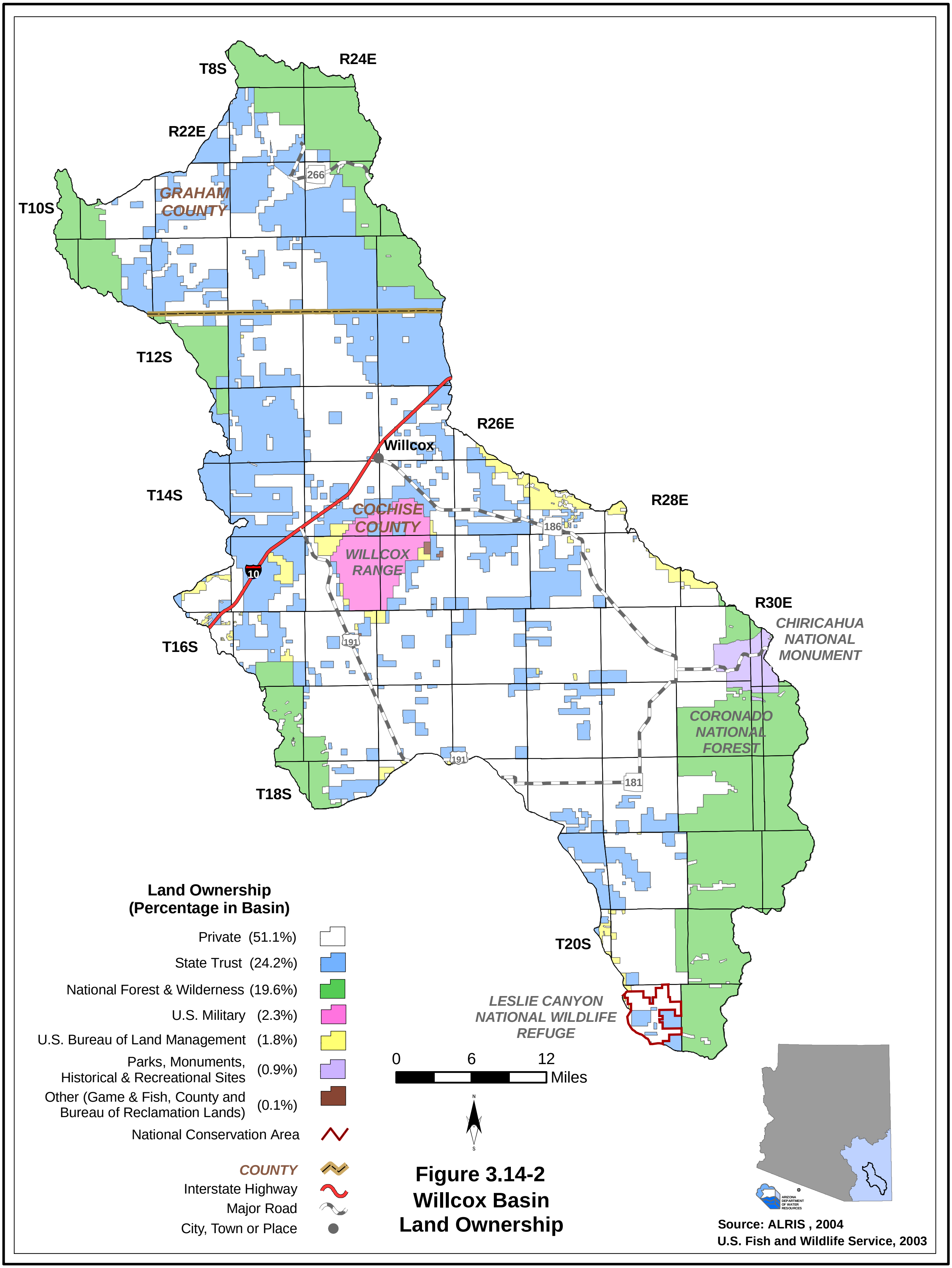


Figure 3.14-2
Willcox Basin
Land Ownership

3.14.3 Climate of Willcox Basin

Climate data from NOAA/NWS Coop Network and AZMET stations are complied in Table 3.14-1 and the locations are shown on Figure 3.14-3. The Willcox Basin does not contain Evaporation Pan and SNOTEL/Snowcourse stations. A description of the climate data sources and methods is found in Volume 1, Section 1.3.3.

NOAA/NWS Coop Network

- Refer to Table 3.14-1A
- There are six NOAA/NWS Coop network climate stations in the basin.
- Of the six stations, data from different periods of record may be used as shown. The variety of dates may be due to discontinued measurements, date of installation or other availability issues.
- The six stations are located throughout most of the basin. There are no stations in the lower quarter of the basin.
- Station elevations range from 4,180 feet at Cochise 4 SSE and Willcox to 5,300 feet at Chiricahua N.M.
- Maximum average temperatures range from 74.8°F at Chiricahua N.M. to 79.5°F at Willcox.
- Minimum average temperatures range from 42.6°F at Cochise Stronghold to 44.9°F at Fort Grant.
- Average annual precipitation varies from 10.78 inches at Cochise 4 SSE to 20.95 inches at Chiricahua N.M.
- All stations report highest average precipitation in the summer (July - September) and lowest in the spring (April – June).
- 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.
- Precipitation increases as elevation increases in the basin. 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.

AZMET

- Refer to Table 3.14-1C
- There is one AZMET station in the basin, at Bonita.
- Average annual evaporation from this site is 74.11 inches.

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, 2003.

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			

Source: WRCC, 2003.

C. AZMET:

Station Name	Elevation (feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*number of years to calculate averages*)
Bonita	4,419	1/1987 - current	74.11 (6)

Source: Arizona Meteorological Network, 2005

D. SNOTEL/Snowcourse:

Station Name	Elevation (in feet)	Period of Record Used for Averages	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								

Source: Natural Resources Conservation Service, 2005

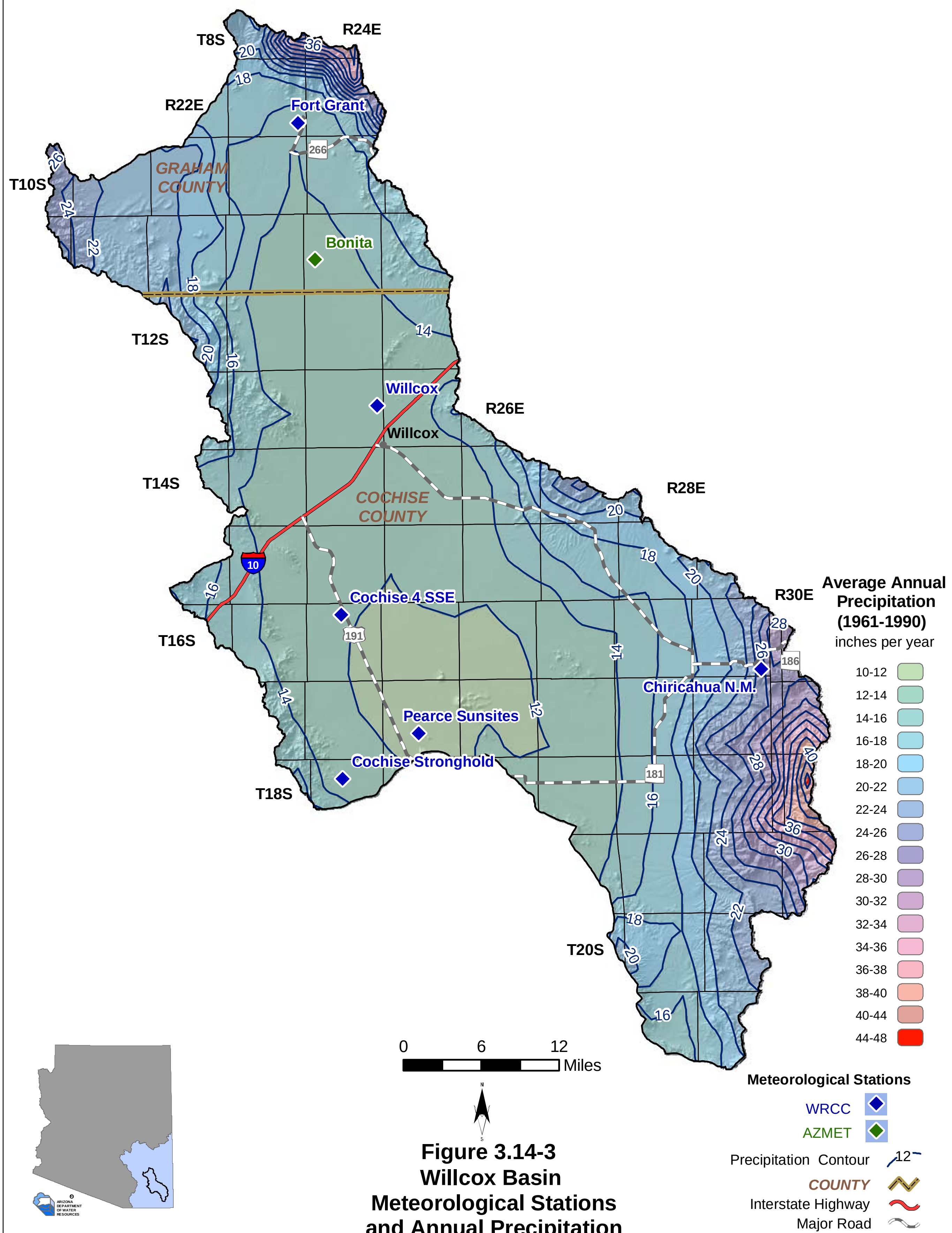


Figure 3.14-3
Willcox Basin
Meteorological Stations
and Annual Precipitation

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 as of September 2004 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, using the USGS number, is shown on Figure 3.14-4. The location of large reservoirs as well as USGS runoff contours are also shown on Figure 3.14-4. A description of stream data sources and methods is found in Volume 1, Section 1.3.16. A description of reservoir data sources and methods is found in Volume 1, Section 1.3.11. A description of stockpond data sources and methods is found in Volume 1, Section 1.3.15.

Streamflow Data

- Refer to Table 3.14-2.
- Data from four stations, including three discontinued stations, are shown on the table and on Figure 3.14-4.
- These stations are located on the Gila River, West Turkey Creek, Whitewater Draw and Leslie Creek.
- The average seasonal flow as a percentage of annual flow for all the stations is highest in the Summer (July-September) and lowest in the Spring (April-June) at three stations.
- Maximum annual flow in this basin was 97,737 acre-feet in 1930 on the Gila River. 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.
- This station is a weather station.

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.
- The largest of the reservoirs, Willcox Playa, a dry lake with a maximum surface area of 29,500 acres.
- Two of the small reservoirs have a maximum storage capacity of 185 acre-feet. The remaining seven small reservoirs have a total surface area of 182 acres.
- There are an estimated 762 stockponds in this basin.

Runoff Contour

- Refer to Figure 3.14-4.
- Average annual runoff increases from 0.2 inches in the vicinity of Willcox to five inches toward the Chiricahua Mountains in the southeast. Runoff also increases slightly north of Willcox to one inch near the northwestern basin boundary.

Table 3.14-2 Streamflow Data for the Willcox Basin

Station Number	USGS Station Name	Contributing Drainage Area (in mi^2)	Mean Basin 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	19.0	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	38.7	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	79.1	5,360	10/1969-current	16	7	55	21	22 (1976)	746	1,066	3,201 (1984)	25

Sources: USGS NWIS; Pope et al, USGS 1998; and Fisk et al., USGS 2003.

Notes:
Statistics based on Calendar Year
Annual Flow statistics based on monthly
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
NA = Data not currently available to ADWR

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

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]	NA	29,500	O	Landowner
2	Unnamed[4]	Private	309	P	Landowner

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

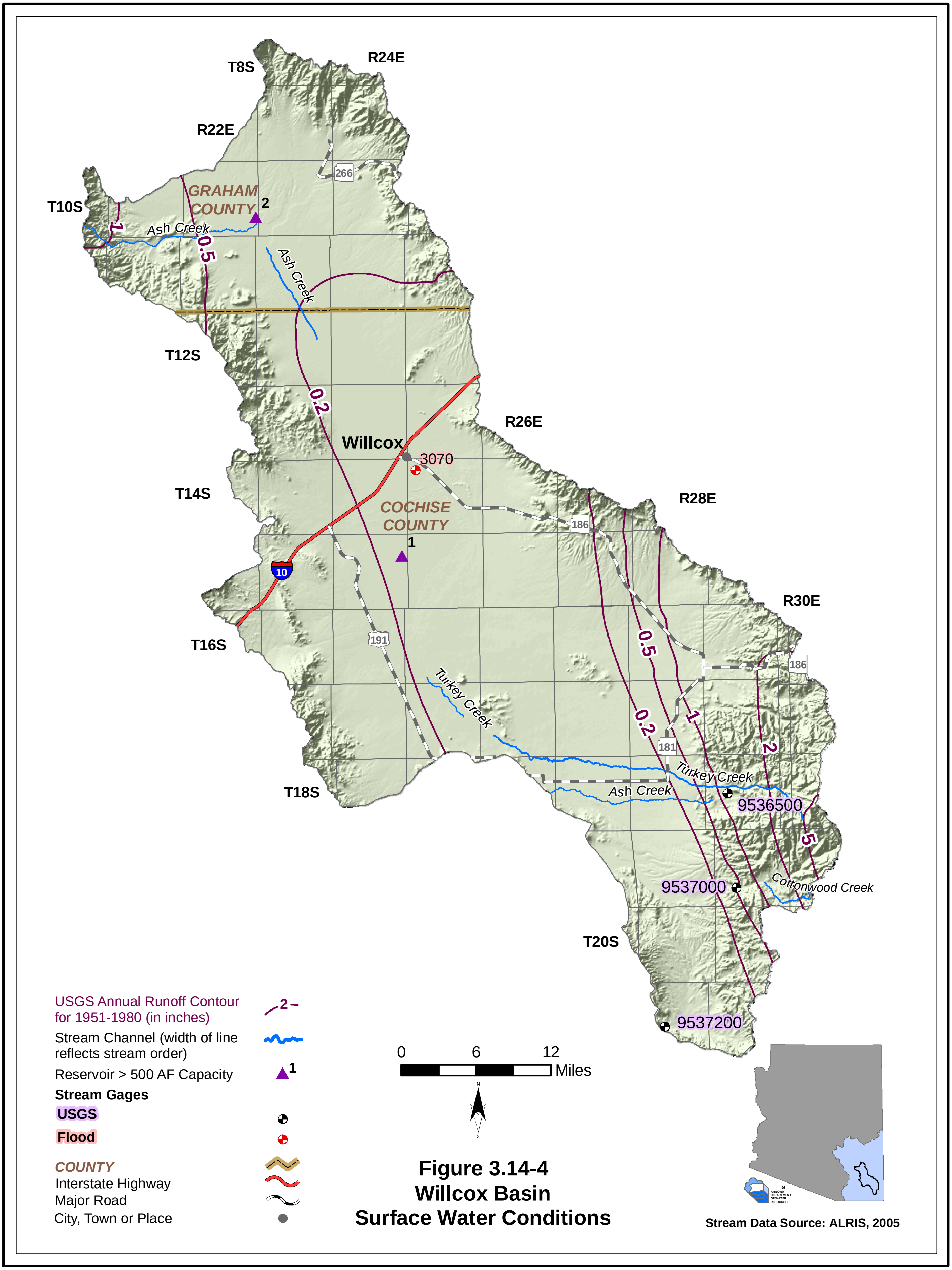


Figure 3.14-4
Willcox Basin
Surface Water Conditions

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. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, 1.3.16. A description of spring data sources and methods is found in Volume 1, Section 1.3.14.

- 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 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

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

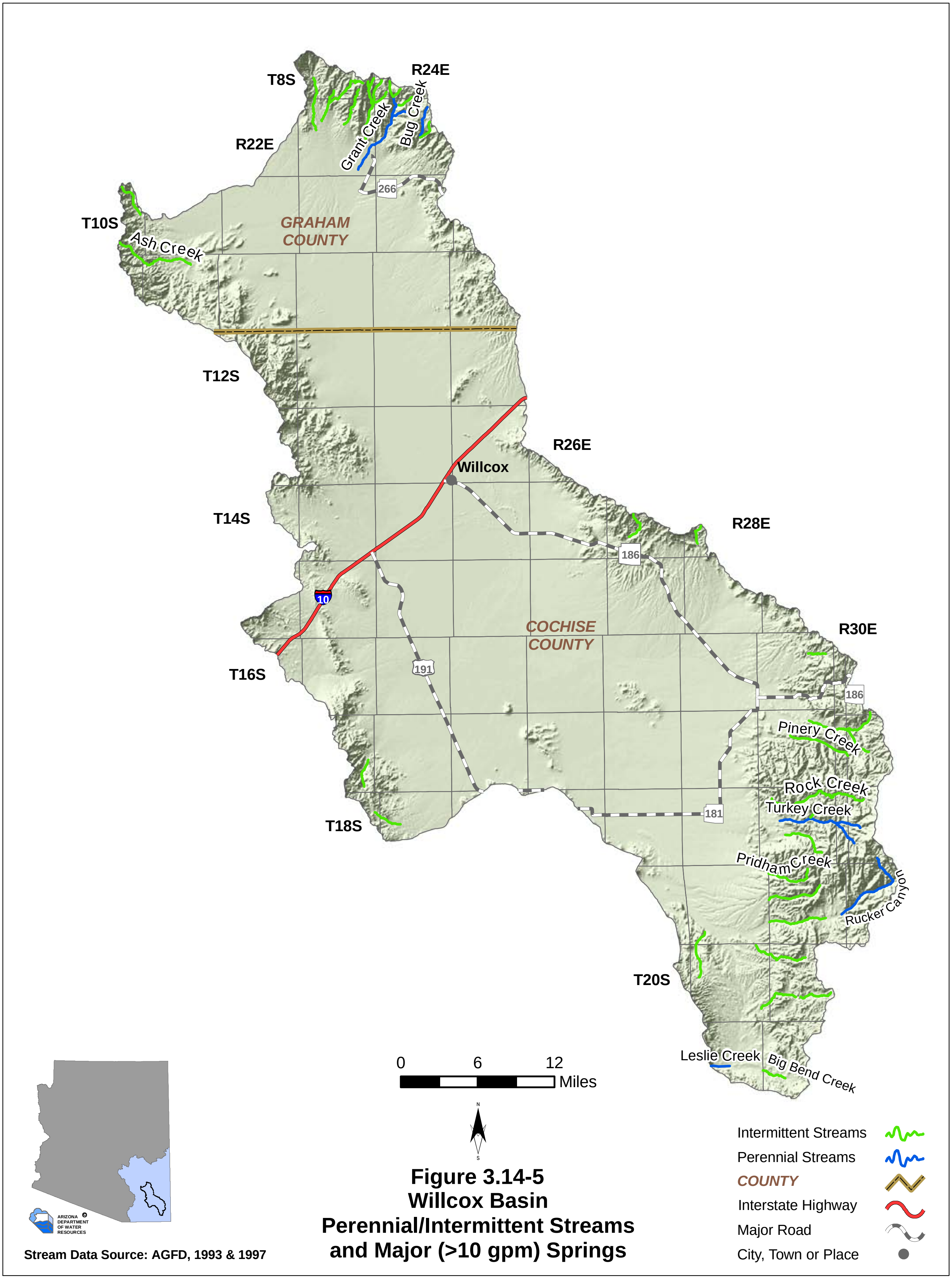


Figure 3.14-5
Willcox Basin
Perennial/Intermittent Streams
and Major (>10 gpm) Springs

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 is found in Volume 1, Section 1.3.2. A description of well data sources and methods, including water-level changes and well yields is found in Volume 1, Section 1.3.19. More detailed information on hydrogeology is found in Section 3.0.1.

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 gallons per minute (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.
- Well yields vary throughout the basin.

Natural Recharge

- Refer to Table 3.14-6.
- There are three estimates of natural recharge for this basin ranging from 15,000 acre-feet per year to 47,000 acre-feet per year. The latter, from a 1995 Anderson and Freethey study, is the most recent.

Water in Storage

- Refer to Table 3.14-6.
- There are three storage estimates in this basin ranging from 42 million acre-feet to 59 million acre-feet.
- The most recent estimate of water in storage is between 42 million and 45.3 million acre-feet to a depth of 1,200 feet and is from ADWR studies in 1990 and 1994.
- The predevelopment storage estimate for this basin is 44 million acre-feet.

Water Level

- Refer to Figure 3.14-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 46 index wells in this basin.
- In 1999, the year of the last water level sweep, 885 wells were measured.
- 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.
- All reported wells in this basin have declines of at least one foot and a number of wells show water level declines greater than 30 feet.
- Hydrographs corresponding to selected wells shown on Figure 3.14-6 but covering a longer time period are shown in Figure 3.14-7.

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 and/or USGS
	Range 2 - 3,500 Median 750 (1,007 wells reported)	Reported on registration forms for large (> 10-inch) diameter wells
	Range 50 - 2,000	ADWR (1990 and 1994)
	Range 0 - 2,500	Anning and Duet, USGS (1994)
Estimated Natural Recharge, in acre-feet/year:	47,000	Anderson and Freethey (1995)
	46,000	Freethey and Anderson (1986)
	15,000	ADWR (1994)
Estimated Water Currently in Storage, in acre-feet:	42,000,000 - 45,300,000 (to 1,200 ft)	ADWR (1990 and 1994)
	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:	46	
Date of Last Water-level Sweep:	1999 (885 wells measured)	

Notes:
[1]Predevelopment Estimate

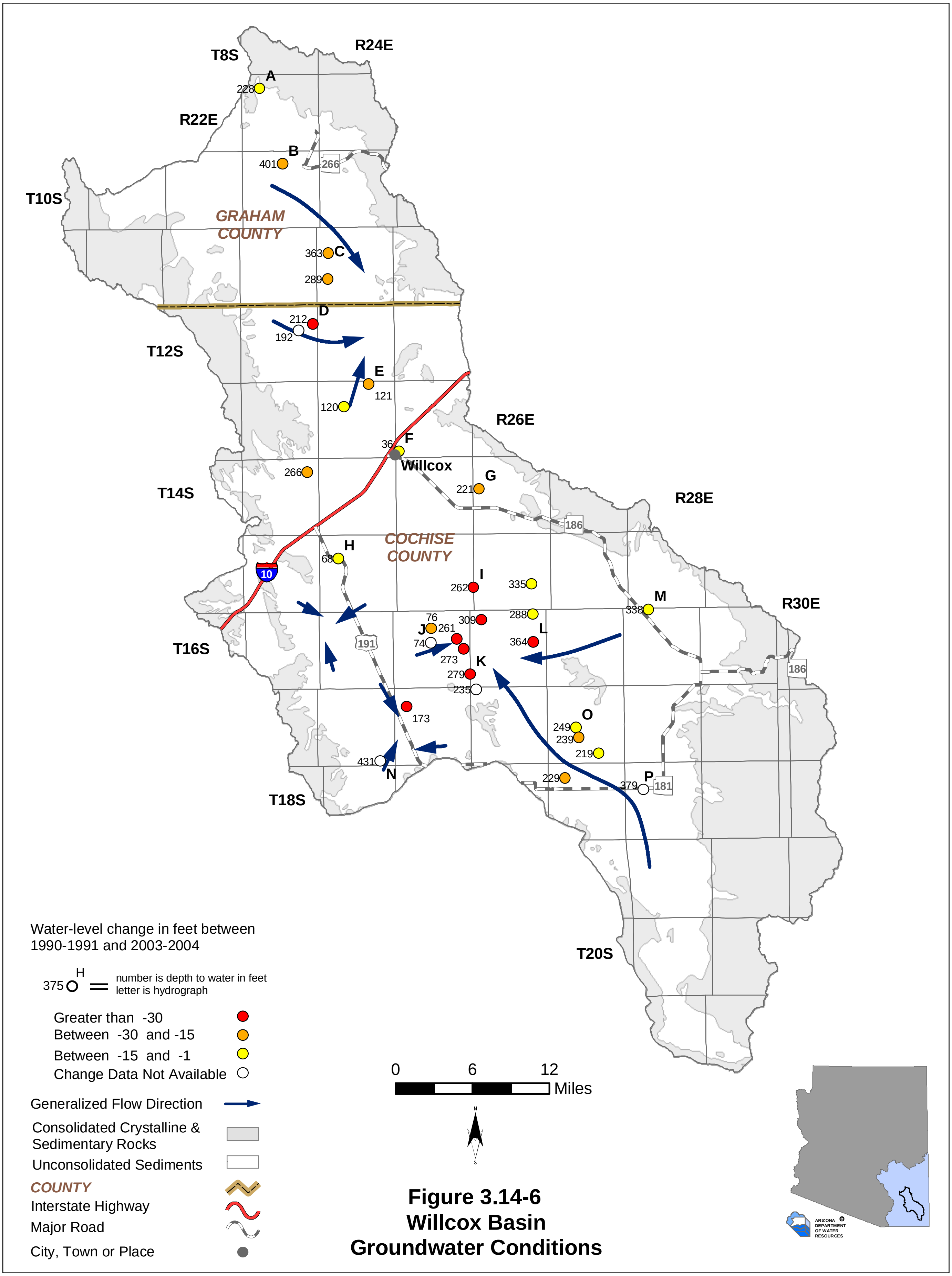


Figure 3.14-6
Willcox Basin
Groundwater Conditions

Figure 3.14-7
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

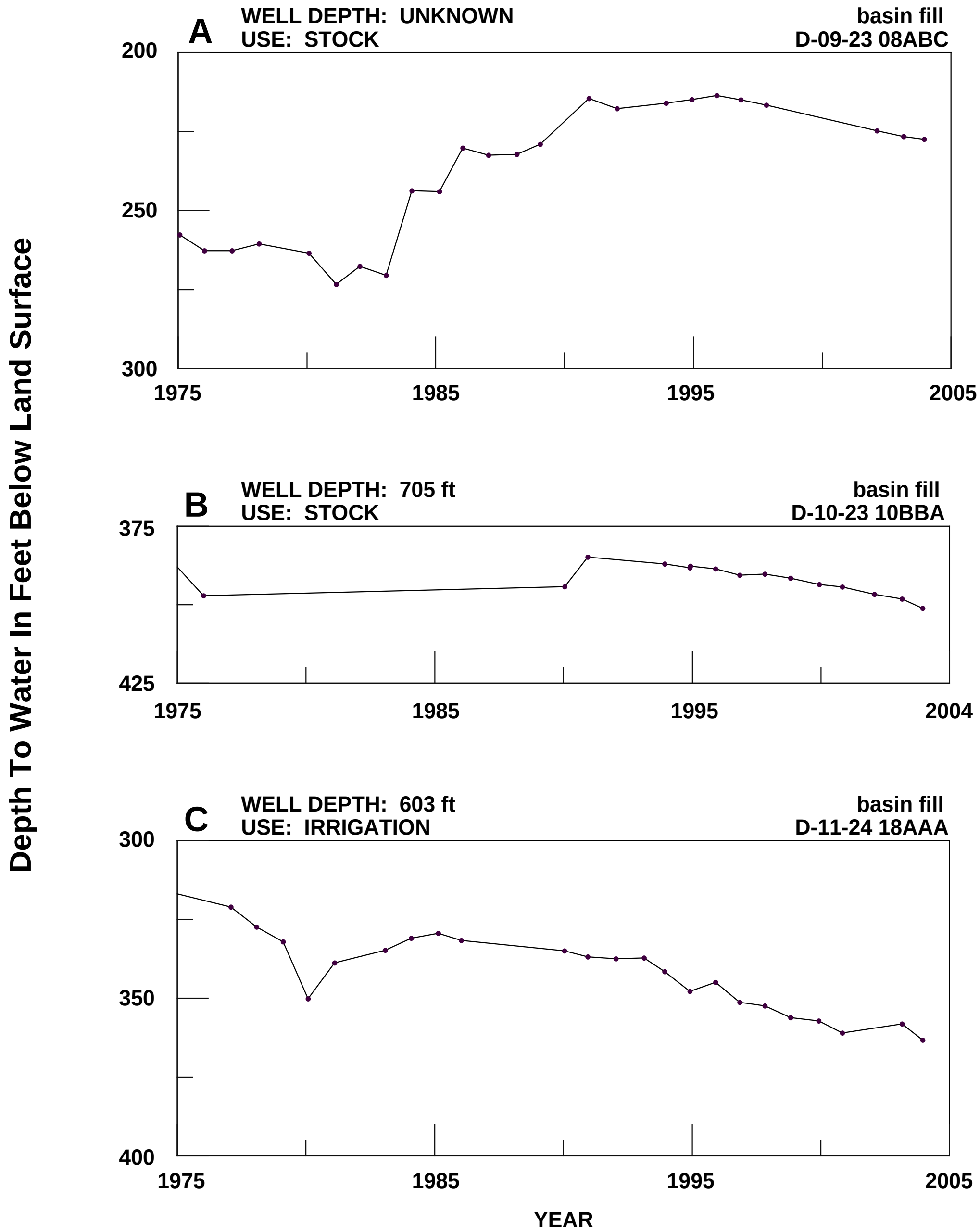


Figure 3.14-7 (Con't.)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

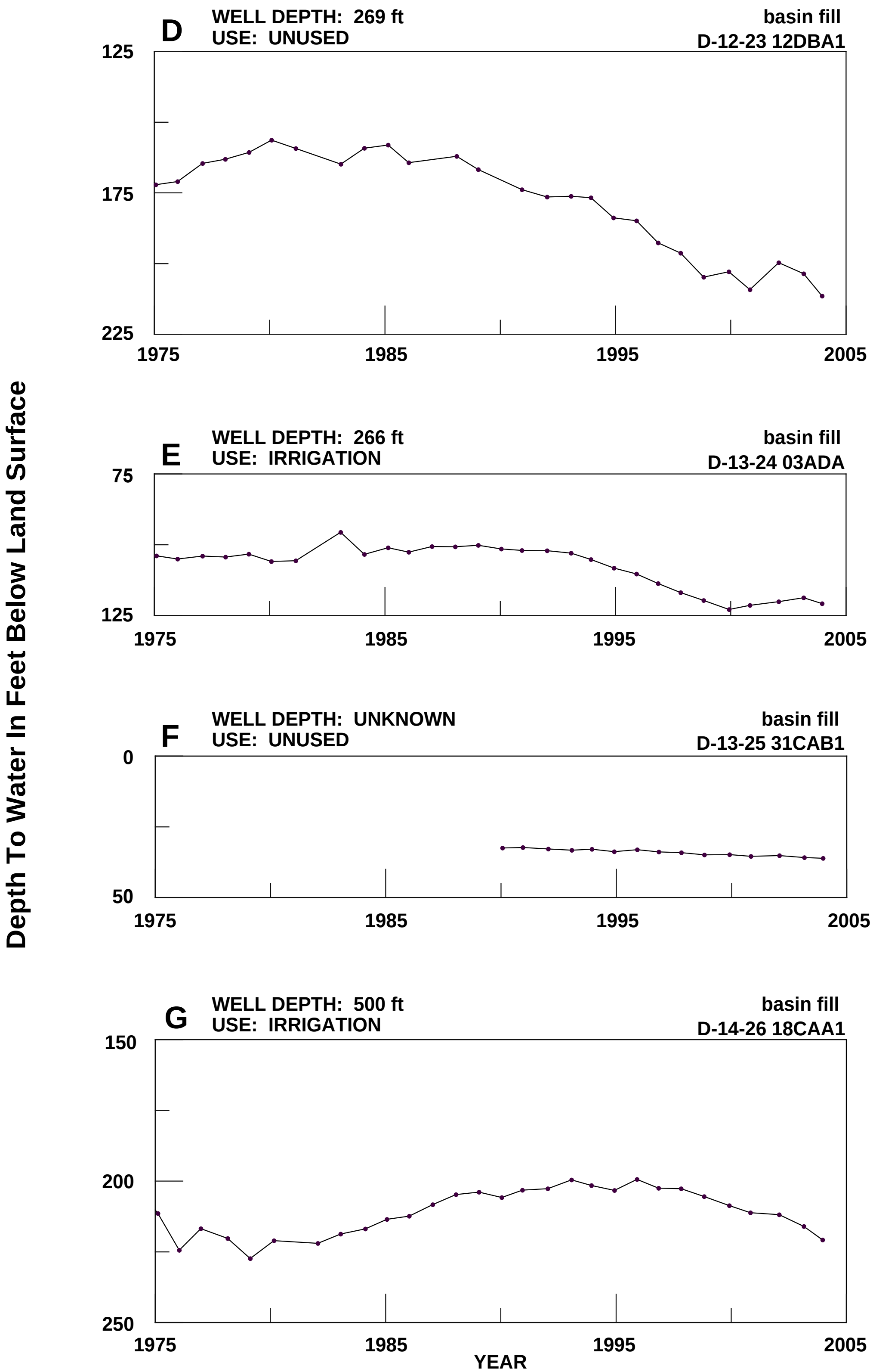


Figure 3.14-7 (Con't.)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

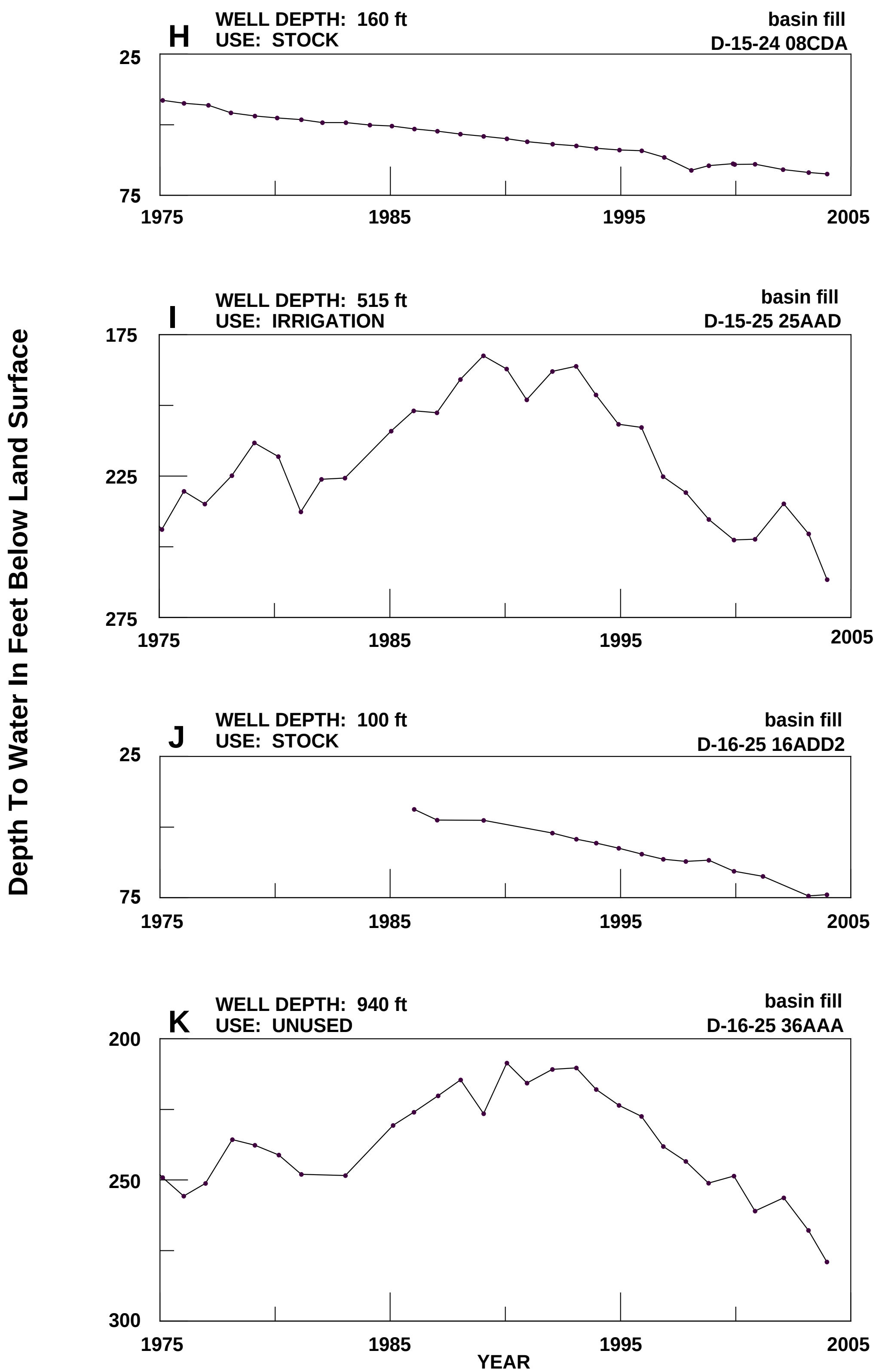


Figure 3.14-7 (Con't.)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells

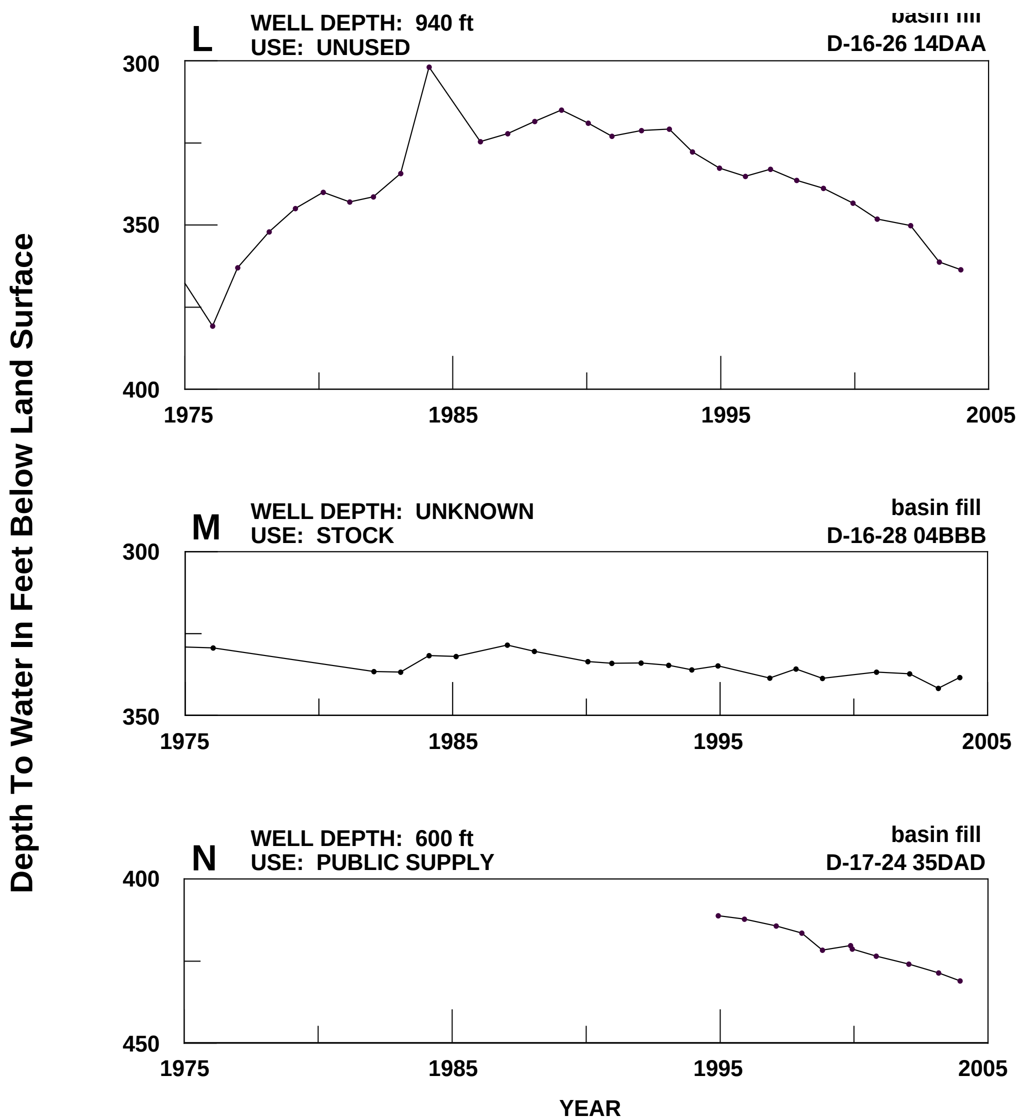
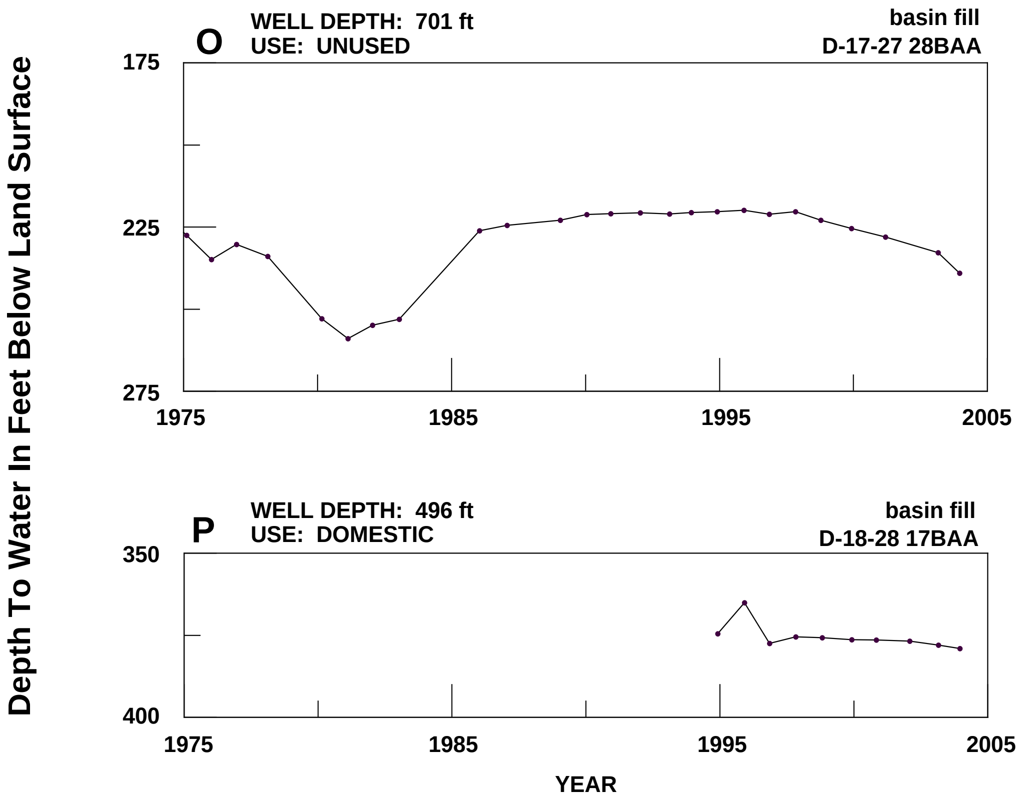


Figure 3.14-7 (Con't.)
Willcox Basin
Hydrographs Showing Depth to Water in Selected Wells



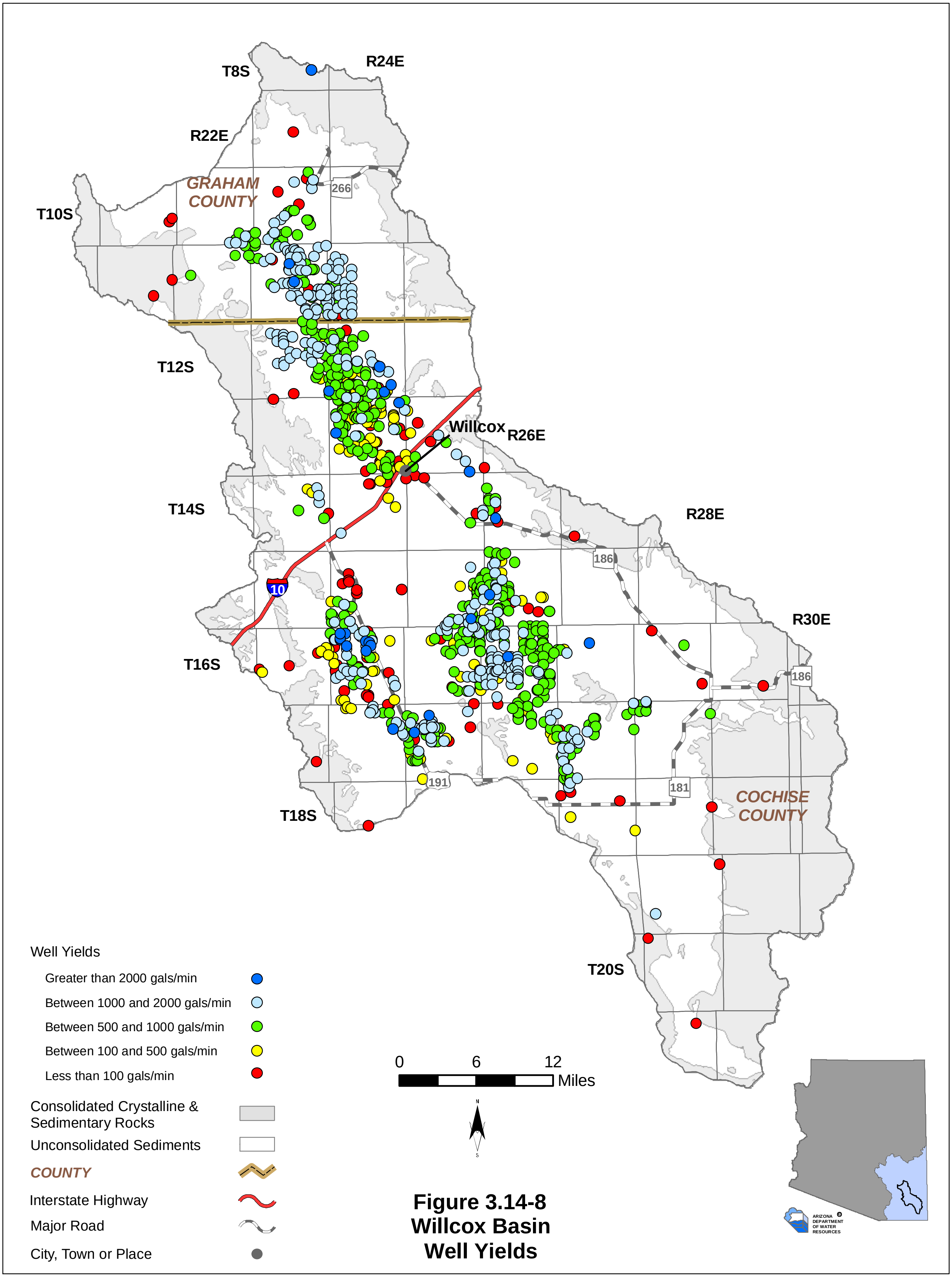


Figure 3.14-8
Willcox Basin
Well Yields

3.14.7 Water Quality of the Willcox Basin

Drinking water standard exceedences in wells, springs and mine sites including location and parameter(s) exceeded 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. A description of water quality data sources and methods is found in Volume 1, Section 1.3.18. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

Wells, Springs and Mines

- Refer to Table 3.14-7A.
- Drinking water standard exceedences in wells and springs have been reported for 73 sites in the basin.
- The most frequently exceeded parameters in the sites measured in this basin were arsenic and fluoride.
- Other parameters exceeded in the sites measured in this basin included radionuclides, nitrates, 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) Exceeding Drinking Water Standard[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

Table 3.14-7 Water Quality Exceedances in the Willcox Basin[1]

A. Wells, Springs and Mines (con't)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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
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

Table 3.14-7 Water Quality Exceedances in the Willcox Basin[1]

A. Wells, Springs and Mines (con't)

Map Key	Site Type	Site Location			Parameter(s) Exceeding Drinking Water Standard[2]
		Township	Range	Section	
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

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]
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/Nitrite
Rad = One or more of the following radionuclides - Gross Alpha, Gross Beta, Radium, and Uranium
TDS = Total Dissolved Solids

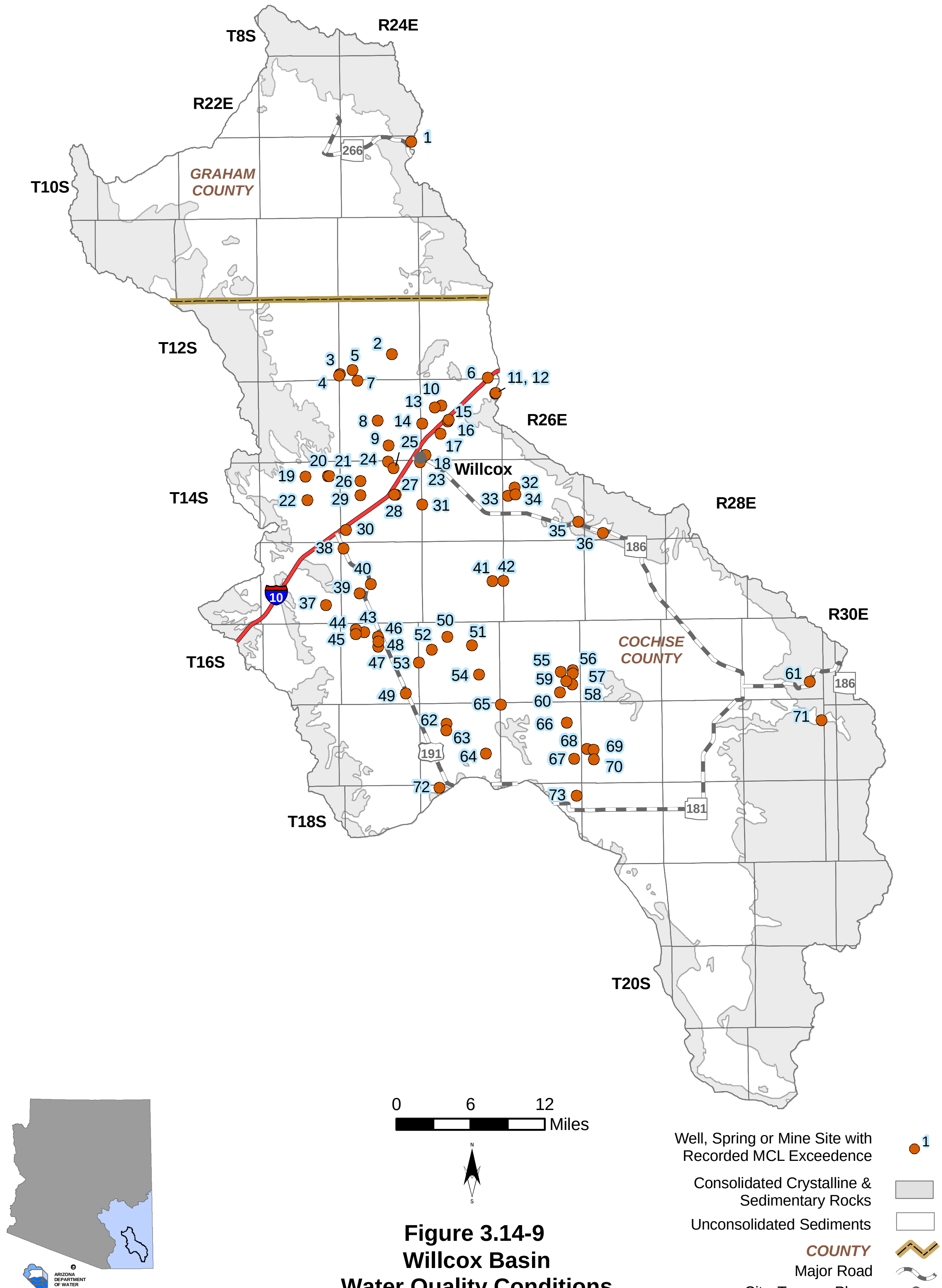


Figure 3.14-9
Willcox Basin
Water Quality Conditions

3.14.8 Cultural Water Demands 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, Section 1.3.5. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.14-8 and Figure 3.14-10.
- Population has increased by about 3,000 residents from 1980 to 2000. Projections suggest an increase in population through 2050.
- Total groundwater use decreased from 1971 to 1990 and has increased from 1991 to 2003 due to agricultural pumpage, with an average of 182,600 acre-feet pumped per year in the period from 2001-2003.
- 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 – 2003.
- Over 90% of all water use in this basin is for agriculture.
- Agricultural demand has increased from 1991 with an average of 174,000 acre-feet of water pumped per year in the period from 2001-2003.
- 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 2003 there were 3,555 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 1,088 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 3.14-9.
- There are three wastewater treatment facilities in the basin.
- Almost 4,000 people are served by these facilities.
- More than 500 acre-feet of effluent per year are generated in this basin.
- One facility, the Willcox Wastewater Treatment Plant, discharges wastewater for golf course/turf irrigation.

Table 3.14-8 Cultural Water Demands in the Willcox Basin[1]

Year	Recent (Census) and Projected (DES) 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	Irrigation	Municipal	Industrial	Irrigation	
1971										
1972										
1973					308,000			NR		
1974										
1975		2,239[2]	999[2]							
1976										
1977										
1978					214,000			NR		
1979										
1980	9,064									ADWR (1994)
1981	9,135									
1982	9,206									
1983	9,277	313	34		117,000			NR		
1984	9,347									
1985	9,418									
1986	9,489									
1987	9,560									
1988	9,631	244	23		86,000			NR		
1989	9,702									
1990	9,773									
1991	10,033									
1992	10,294									
1993	10,554	222	14	2,600	6,400	124,000	<300	NR	NR	
1994	10,814									
1995	11,075									
1996	11,335									
1997	11,596									USGS (2005)
1998	11,856	289	8	2,700	5,600	124,000	<300	NR	NR	
1999	12,117									
2000	12,377									
2001	12,504									
2002	12,632	116	5	2,700	5,900	174,000	<300	NR	NR	
2003	12,759									
2010	13,652									
2020	13,761									
2030	14,050									
2040	14,415									
2050	14,934									
ADDITIONAL WELLS: [3]		**132**	**5**							
WELL TOTALS:		**3,555**	**1,088**							

Notes:
NR - Not reported
[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through June 1980.
[3] Other water-supply wells are listed in the ADWR Well Registry for this basin, but they do not have completion dates.
These wells are summed here.

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	Discharge to Another Facility	Groundwater Recharge			
Clear Springs Utility WWTP	Clear Springs Utility Co	Clear Springs	512	47		X						NA		2003
Rip Griffin Truck/Travel Center	Private	Willcox	NA											
Willcox WWTP	Town of Willcox	Willcox	3,355	504		X		Twin Lakes				Secondary	79	2000
Total			3,867	551										

Notes:
NA: Data not currently available to ADWR
WWTP: Wastewater Treatment Plant

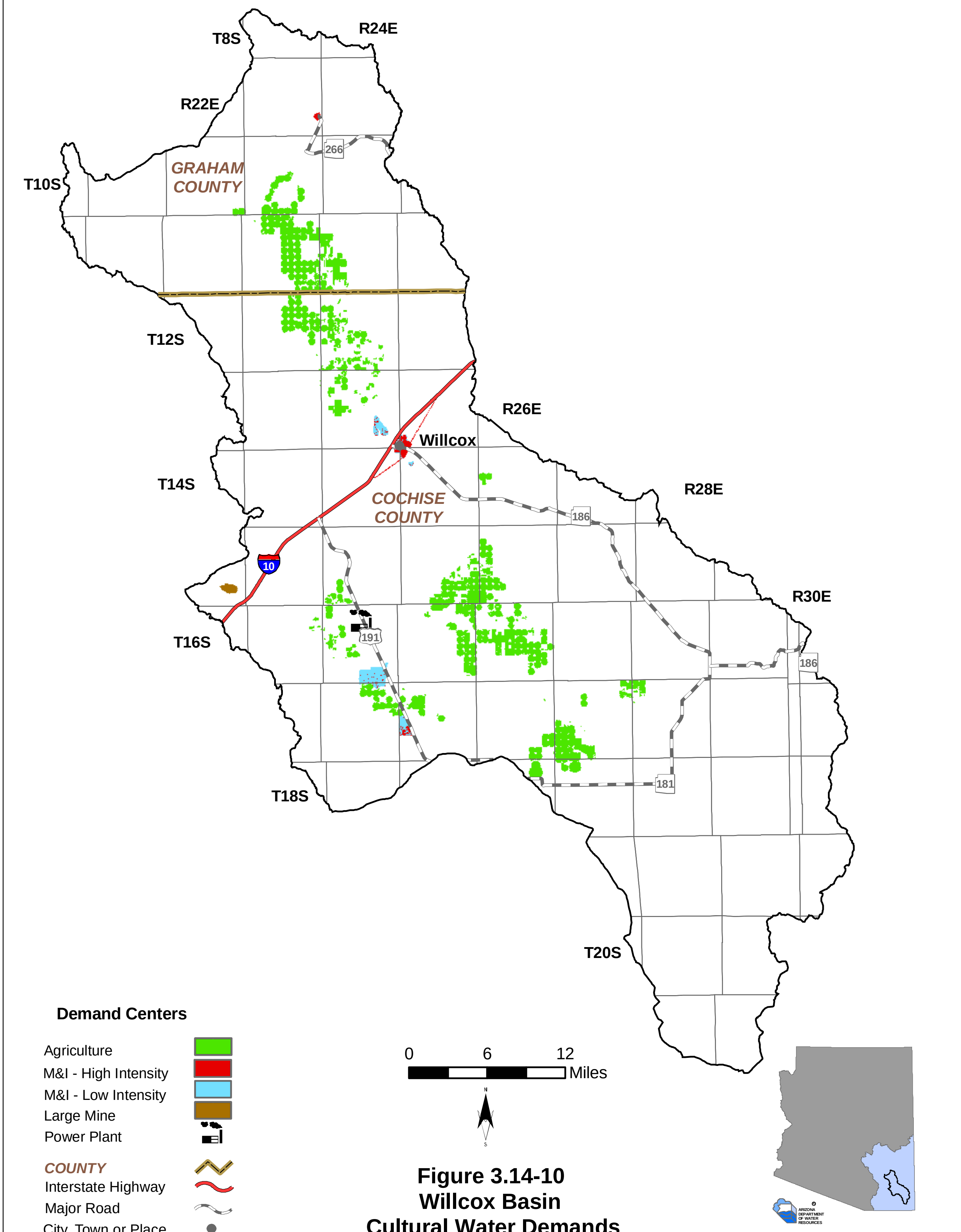


**Figure 3.14-10
Willcox Basin
Cultural Water Demands**

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 3.14-10. Figure 3.14-11 shows the locations of subdivisions keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix A. Adequacy determination data sources and methods are found in Volume 1, Sections 1.3.1.

- A total of 20 water adequacy determinations have been made in this basin through May, 2005.
- 10 determinations of inadequacy have been made, all in the vicinity of Sunsites west of Highway 191.
- 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.
- All lots receiving an adequacy determination are in Cochise County. Of the 1,577 lots, 989 or 62% were determined to be adequate.

Table 3.14-10 Adequacy Determinations in the Willcox 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	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 17 South	24 East 24 East	33 4, 9, 10, 15, 16	NA	22-300064	Inadequate	A1	03/14/96	Dry Lot Subdivision
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

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 determination.

[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically unavaible;for groundwater, depth-to-water exceeds criteria)
3) Insufficient Infrastructure (distribution system is insufficient to meet demands or applicant proposed water hauling)

B. Legal (applicant failed to demonstrate a legal right to use the water or failed to demonstrate the provider's legal authority to serve the subdivision)
C. Water Quality
D. Unable to locate records

NA= Data not currently available to ADWR

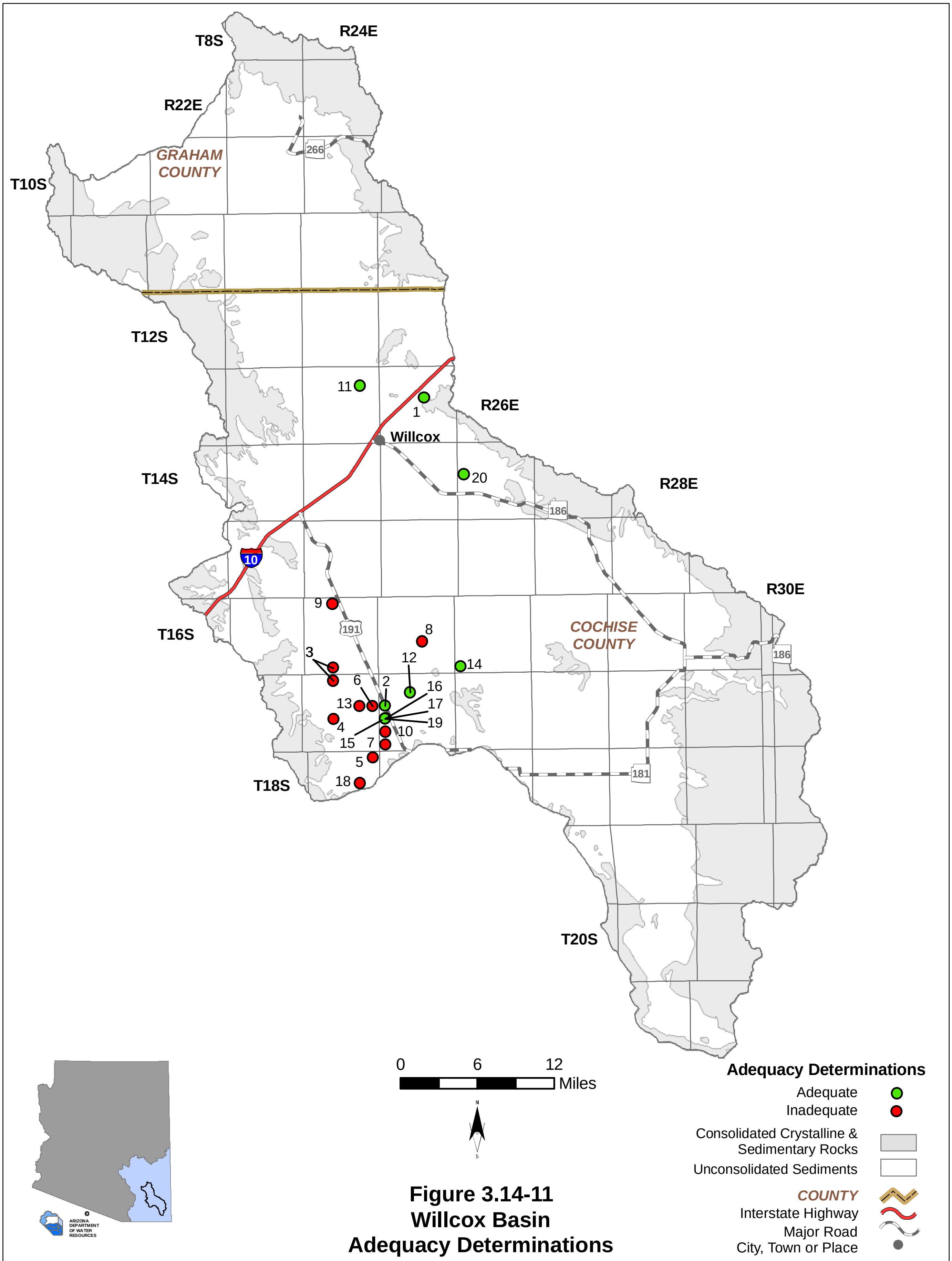


Figure 3.14-11
Willcox Basin
Adequacy Determinations

WILLCOX BASIN
References and Supplemental Reading

References

A

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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
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
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
NWS	National Weather Service

Pan ET	Pan Evapotranspiration
PDO	Pacific Decadal Oscillation
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 2005

Groundwater Basin	Project Title/Grant #	Project Category
Aravaipa Canyon	Klondyke Tailings Response Strategy Analysis (RSA)/96-0014	Research
Cienega Creek	Refinement of Geologic Model, Lower Cienega Basin, Pima County, Arizona/95-016	Research
Cienega Creek	Hydrogeologic Investigation of Groundwater Movement and Sources of Base Flow to Sonoita Creek and Implementation of Long-Term Monitoring Program/96-0006	Research
Cienega Creek	Cienega Creek Stream Restoration/96-0020	Stream Restoration & Revegetation
Cienega Creek	Oak Tree Gully Stabilization/97-034	Upland Channel Restoration
Cienega Creek	Empire/Cienega/Empirita Fencing Project/98-049	Fencing
Cienega Creek	Lower Cienega Creek Restoration Evaluation Project/99-068	Research
Cienega Creek	Redrock Riparian Improvement/99-090	Fencing & Water Developments
Douglas	Hay Mountain Watershed Rehabilitation/98-066	Watershed Restoration
Duncan Valley	Gila Box Riparian and Water Quality Improvement Project/95-014	Fencing & Upland Water Developments
Lower San Pedro	Watershed Improvement to Restore Riparian and Aquatic Habitat on the Muleshoe Ranch CMA/97-035	Fencing & Watershed Restoration
Lower San Pedro	Bingham Cienega Riparian Restoration Project/97-040	Revegetation
Lower San Pedro	San Pedro River Preserve Riparian Habitat Restoration Project/97-044	Habitat Restoration

Groundwater Basin	Project Title/Grant #	Project Category
Lower San Pedro	Riparian and Watershed Enhancements on the A7 Ranch – Lower San Pedro River/99-069	Fencing & Upland Water Developments
Lower San Pedro	Lower San Pedro Watershed Project/00-109	Feasibility Study
Lower San Pedro	Cooperative Grazing Management for Riparian Improvement on the San Pedro/00-111	Fencing & Upland Water Developments
Morenci	Blue Box Crossing/99-077	Channel Restoration
Morenci	Upper Eagle Creek Restoration on East Eagle Allotment: 4 Drag Ranch/00-102	Fencing & Upland Water Developments
Morenci	Georges Lake Riparian Restoration Project/05-129	Fencing & Habitat Protection
Safford	Eagle Creek Watershed and Riparian Stabilization/96-0012	Fencing & Upland Water Developments
Safford	San Carlos Spring Protection Project/96-0018	Fencing
Safford	Abandonment of an Artesian Geothermal Well/96-0015	Habitat Protection
Safford	Creation of a Reference Riparian Area in the Gila Valley – Discovery Park/97-028	Habitat Restoration
Safford	Stable Isotopes as Tracers of Water Quality Constituents in the Upper Gila River/97-036	Research
Safford	Tritium as a Tracer of Groundwater Sources and Movement in the Upper Gila River Drainage/98-052	Research
Safford	Fluvial Geomorphology Study and Demonstration Projects to Enhance and Restore Riparian Habitat on the Gila River from the New Mexico Border/98-054	Research
Safford	Abandonment of Gila Oil Syndicate Well #1/99-086	Habitat Protection

Groundwater Basin	Project Title/Grant #	Project Category
Safford	Gila Reference Riparian Area, Discovery Park/00-099	Revegetation
San Rafael	Santa Cruz Headwaters Project/97-045	Fencing & Upland Water Developments
San Rafael	Upper Santa Cruz Watershed Restoration/99-096	Fencing & Upland Water Developments
Upper San Pedro	Regeneration and Survivorship of Arizona Sycamore/95-009	Research
Upper San Pedro	Preservation of the San Pedro River Utilizing Effluent Recharge/95-005	Constructed Wetland
Upper San Pedro	San Pedro Riparian National Conservation Area Watershed Rehabilitation/ Restoration Project/95-015	Revegetation & Upland Channel Restoration
Upper San Pedro	Autecology and Restoration of *Sporobolus Wrightii* Riparian Grasslands in Southern Arizona/95-018	Research
Upper San Pedro	Teran Watershed Enhancement/95-020	Upland Channel Restoration
Upper San Pedro	Happy Valley Riparian Area Restoration Project/96-0013	Fencing
Upper San Pedro	San Pedro Riparian National Conservation Area Watershed Protection and Improvement Project/96-0001	Fencing
Upper San Pedro	Lyle Canyon Allotment Restoration Project/97-027	Fencing & Upland Water Developments
Upper San Pedro	Lyle Canyon Allotment Riparian Area Restoration Project --- Phase 2/99-070	Fencing & Upland Water Developments
Willcox	Cottonwood Creek Restoration/03-116	Upland Channel Restoration

Appendix B

Rural watershed partnership participants, projects, accomplishments and issues are summarized below and grouped by planning area.

SOUTHEASTERN ARIZONA PLANNING AREA

Watershed Partnership	Primary Participants	Projects & Accomplishments	Issues
Middle San Pedro Watershed Partnership (Community Watershed Alliance)	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.	• 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
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

SOUTHEASTERN ARIZONA PLANNING AREA (continued)

Watershed Partnership	Primary Participants	Projects & Accomplishments	Issues
Gila Watershed Partnership	Safford, Thatcher Pima, Graham County Greenlee County, Duncan ADWR, AZG&F ADEQ, Coop Extension BLM, USFS USBoR, NRCS/RCD	• Fluvial Geomorphology Study • Water demand study • Development of water resource management plan for the watershed area initiated • Capped several saline wells contributing to the degradation in water quality of the Gila River • Resin bush eradication project completed.	• 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 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

SOUTHEASTERN ARIZONA PLANNING AREA (continued)

Watershed Partnership	Primary Participants	Projects & Accomplishments	Issues
Upper San Pedro Partnership	Sierra Vista, Ft. Huachuca Cochise County, Huachuca City Bisbee, Tombstone TNC, Huachuca Audubon Bella Vista Water ADWR, ADEQ AACD, NRCD State Land USF&W, USFS BLM, USDA/ARS USGS, USBoR Coronado National Monument	• Comprehensive groundwater study • Numeric groundwater model • Phase I of Decision Support System model completed. • San Pedro Riparian National Conservation Area Water Demand study • Recharge study of detention basins • Engineering design to transfer effluent from Huachuca City to Ft. Huachuca for treatment and recharge • Partially funded transfer of treated effluent from new Bisbee wastewater treatment plant for use by Turquoise Valley golf course. • Second iteration of water conservation & management plan completed. • Section 321 Report to Congress submitted annually. • Funded more than $1,000,000 in conservation projects in watershed. • Conduct public outreach and educational forums • Appraisal study of five water augmentation projects initiated.	• 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 • 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

OTHER AREAS OF INTEREST:

- Douglas Basin is experiencing significant groundwater declines. Groundwater pumping is estimated at about 54,000 acre-feet per year, an increase from 43,000 in five years. ADWR has initiated a three-year groundwater study with the USGS for the Douglas Basin.

- Willcox Basin has been averaging 140,000 acre-feet of annual groundwater mining for the past 10 years causing some concern. A watershed partnership for this area is currently being organized and ADWR has initiated a three-year groundwater study of the Willcox Basin with the USGS.

- A Cienega Creek watershed group has been meeting fairly regularly to evaluate water conditions.