Arizona Department
of Water Resources
November 2009

ARIZONA WATER ATLAS

Volume 7

Lower Colorado River Planning Area




ACKNOWLEDGEMENTS

Herbert Guenther
Director, Arizona Department of Water Resources

Karen Smith
Deputy Director, Arizona Department of Water Resources

Tom Carr
Assistant Director, Statewide Water Conservation and Strategic Planning

Sandra Fabritz-Whitney
Assistant Director, Water Management

Atlas Team
Linda Stitzer, Rich Burtell – Project Managers
Phyllis Andrews
Carol Birks
Kelly Mott Lacroix
Joe Stuart

Major Contributors
John Fortune
Leslie Graser
William H. Remick
Saeid Tadayon-USGS

Other Contributors
Matt Beversdorf
Roberto Chavez
Laura Grignano (Volume 8)
Mark Preszler
Jeff Tannler (Volume 8)
Dianne Yunker
Patrick Brand
Jenna Gillis
Pam Nagel (Volume 8)
Kenneth Seasholes (Volume 8)
Larri Tearman

Climate
Gregg Garfin - CLIMAS, University of Arizona
Ben Crawford - CLIMAS, University of Arizona
Casey Thornbrugh - CLIMAS, University of Arizona
Michael Crimmins – Department of Soil, Water and Environmental Science, University of Arizona

The Atlas is wide in scope and it is not possible to mention all those who helped at some time in its production, both inside and outside the Department. Our sincere thanks to those who willingly provided data and information, editorial review, production support and other help during this multi-year project.

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

CONTENTS

FIGURES

TABLES

ARIZONA WATER ATLAS
VOLUME 7 –LOWER COLORADO RIVER PLANNING AREA

PREFACE

Volume 7, the Lower Colorado River Planning Area, is the seventh in a series of nine volumes that comprise the Arizona Water Atlas. The primary objectives in assembling the Atlas are to present an overview of water supply and demand conditions in Arizona, to provide water resource information for planning and resource development purposes and help to identify the needs of communities. The Atlas also indicates where data are lacking and further investigation may be needed.

The Atlas divides Arizona into seven planning areas (Figure 7.0-1). There is a separate Atlas volume for each planning area, an executive summary volume composed of background information, and a resource sustainability volume. "Planning areas" are an organizational concept that provide for a regional perspective on supply, demand and water resource issues. A complete discussion of Atlas organization, purpose and scope is found in Volume 1. Also included in Volume 1 is general background information for the state, a description of data sources and methods of analysis for the tables and maps presented in the Atlas, and appendices that provide information on water law, management and programs, and Indian water rights claims and settlements.

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

7.0 Overview of the Lower Colorado River Planning Area

The Lower Colorado River Planning Area is composed of eleven groundwater basins in southwestern Arizona. The planning area contains the driest and hottest portions of the State. Large expanses of federal lands consisting of military reservations, wildlife refuges and national monuments are located in the planning area. Elevations range from over 7,700 feet in the Baboquivari Mountains along the southeastern boundary of the planning area to about 70 feet at the Colorado River where it enters Mexico. All of Yuma County and most of La Paz County (91% of the county) are contained within the planning area as well as portions of Maricopa (38%), Pima (43%) and Yavapai (1%) counties. Five Indian reservations including the Cocopah, Colorado River Indian Tribes (CRIT), Gila Bend, Fort Yuma-Quechan and Tohono O'odham are located within the planning area. One of the planning area basins, Harquahala, has been designated as an irrigation non-expansion area (INA) due to insufficient groundwater to provide a reasonably safe supply for irrigation.

Although much of the planning area is relatively sparsely populated, there are several major population centers, particularly in the Yuma area. The 2000 Census planning area population was approximately 194,100 with basin populations ranging from less than 10 in the Tiger Wash Basin to almost 153,000 in the Yuma Basin. Yuma is the largest community with over 91,000 residents in 2006. Other population centers include Fortuna Foothills and San Luis located near Yuma, Parker/Parker Strip, Ajo, Gila Bend and Quartzsite.

During 2001-2005 an average of over 2,899,700 acre-feet of water was used annually in the planning area for agricultural, municipal and industrial uses (cultural water demand) – approximately 42% of the state's total demand

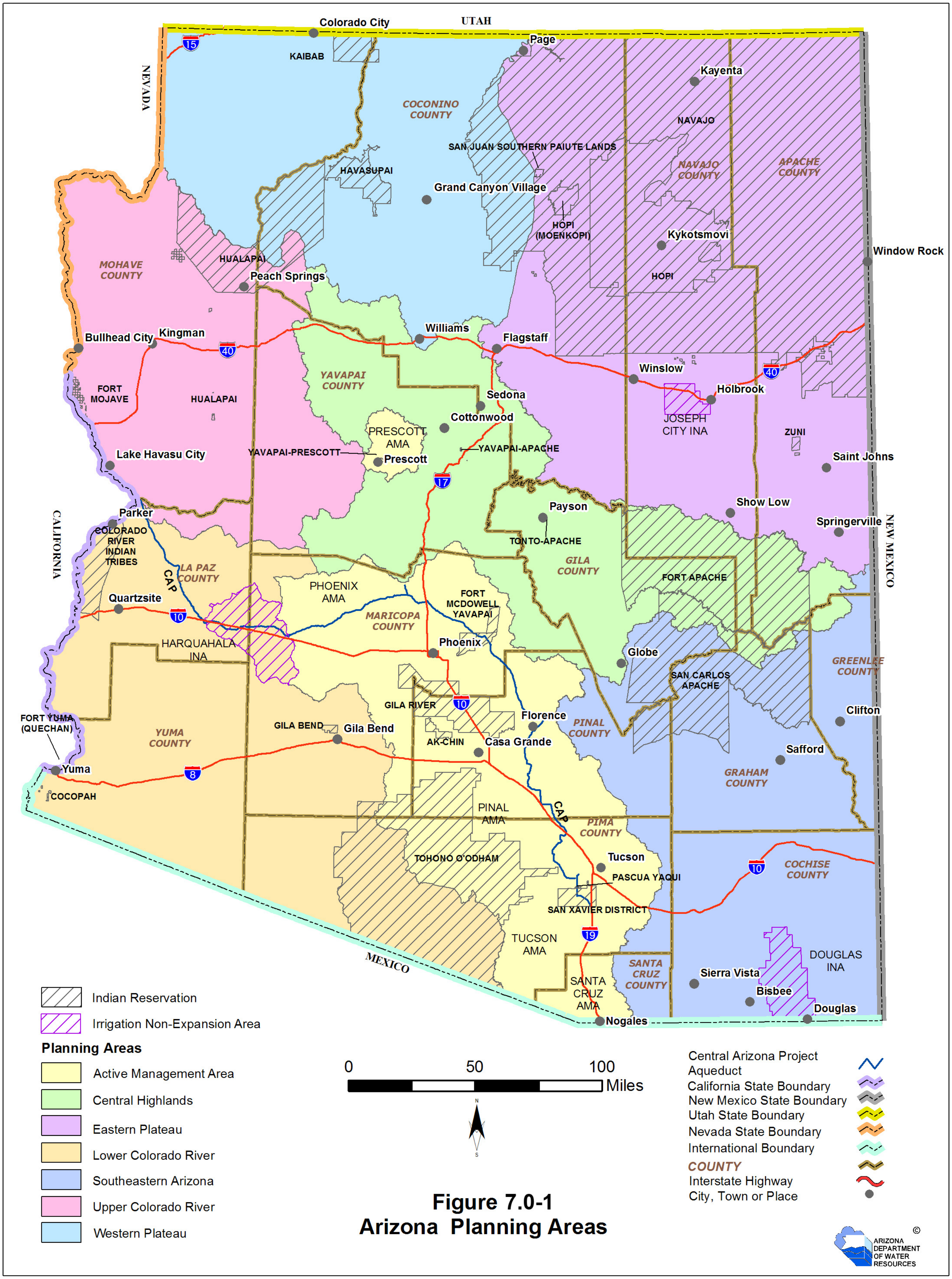


Figure 7.0-1
Arizona Planning Areas

during that period. Of the total planning area demand, approximately 964,670 acre-feet was well pumpage, 1,934,390 acre-feet was surface water diversions from the Colorado River, Gila River and the Central Arizona Project and about 680 acre-feet was effluent reuse. The agricultural demand sector was by far the largest with approximately 2,835,100 acre-feet of demand a year – 98% of the total demand. Average annual municipal sector demand was about 51,000 acre-feet a year (AFA) and industrial demand was about 13,560 AFA.

7.0.1 Geography

The Lower Colorado River Planning Area encompasses about 17,200 square miles (sq. mi.) and includes the Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley, Parker, Ranegras Plain, San Simon Wash, Tiger Wash, Western Mexican Drainage and Yuma basins. Basin boundaries, counties and prominent cities, towns and places are shown in Figure 7.0-2. The planning area is bounded on the north by the Bill Williams Basin in the

Figure 7.0-2 Lower Colorado River Planning Area

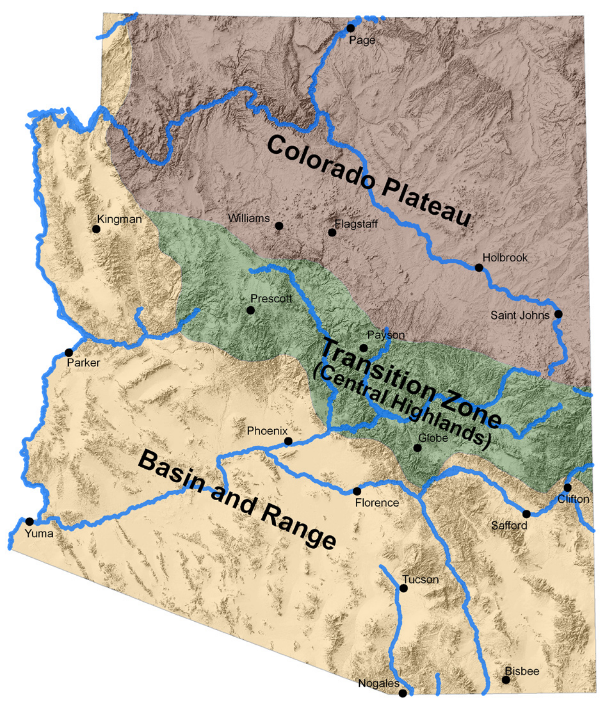
Upper Colorado River Planning Area, on the east by the Phoenix, Pinal and Tucson Active Management Areas (AMA), on the south by the international boundary with Mexico and on the west by the State of California and the international boundary.

The planning area includes all or part of four watersheds, which are discussed in Section 7.0.2. The Cocopah Indian Reservation (10 sq. mi.) and the Gila Bend Indian Reservation (16.3 sq. mi.) are entirely within the planning area. Approximately 86% (391 sq. mi.) of the CRIT, 57% (2,471 sq. mi.) of the Tohono O'odham Indian Reservation, and 4% (3 sq. mi.) of the Fort Yuma-Quechan Indian Reservation are also located within the planning area (Figure 7.0-1). The Gila Bend and Tohono O'odham reservations are two of the four land bases that make up the Tohono O'odham Nation. Comparable in size to the state of Connecticut, the Nation is the second largest Indian reservation in the United States.

The entire planning area is within the Basin and Range physiographic province characterized by northwest-southeast trending mountain ranges separated by broad alluvial valleys (Figure 7.0-3). The planning area is relatively low elevation – generally less than 3,500 feet. Higher elevation mountain ranges occur along part of the northern boundary and in the Baboquivari Mountains that form the southeastern boundary where elevations rise to over 7,700 feet. The lowest elevation is about 70 feet where the Colorado River enters Mexico at the Southerly International Boundary (SIB) in the Yuma Basin. The basin with the largest elevational range is the San Simon Wash Basin with a range of 1,650 to 7,730 feet.

A unique geographic feature of the planning area is its aridity, which has shaped its topography and surface water characteristics. In the more arid western part of the planning area, the geography consists of widely-scattered, small mountain ranges of mostly barren rock and broad, flat valleys (or plains). A number of groundwater basins in the planning area take their name from this geographic feature, e.g. Butler Valley, McMullen Valley and Ranegras Plain. Other examples of major valleys and plains are the Mohawk Valley in the Lower Gila Basin and the La Posa Plain in the Parker Basin. Relatively large areas of sand dunes occur south of Yuma and west of the Gila and Tinajas Altas Mountains in an ancient river terrace. To the southeast, the terrain contains more numerous mountain ranges and narrower valleys with higher rainfall and more plant diversity and density (ASDM, 2007a). With the exception of the Colorado River, there are no perennial streams in the planning area. The Gila River was historically perennial for most of its length but by the beginning of the 20th century the effects of farming and construction of dams both upstream and within the planning area caused cessation of perennial flows (Tellman

Figure 7.0-3 Physiographic Regions of Arizona



Data source: Fenneman and Johnson, 1946 and others, 1997). Broad sandy washes are the main surface water feature in the planning area, flowing only in response to significant precipitation events

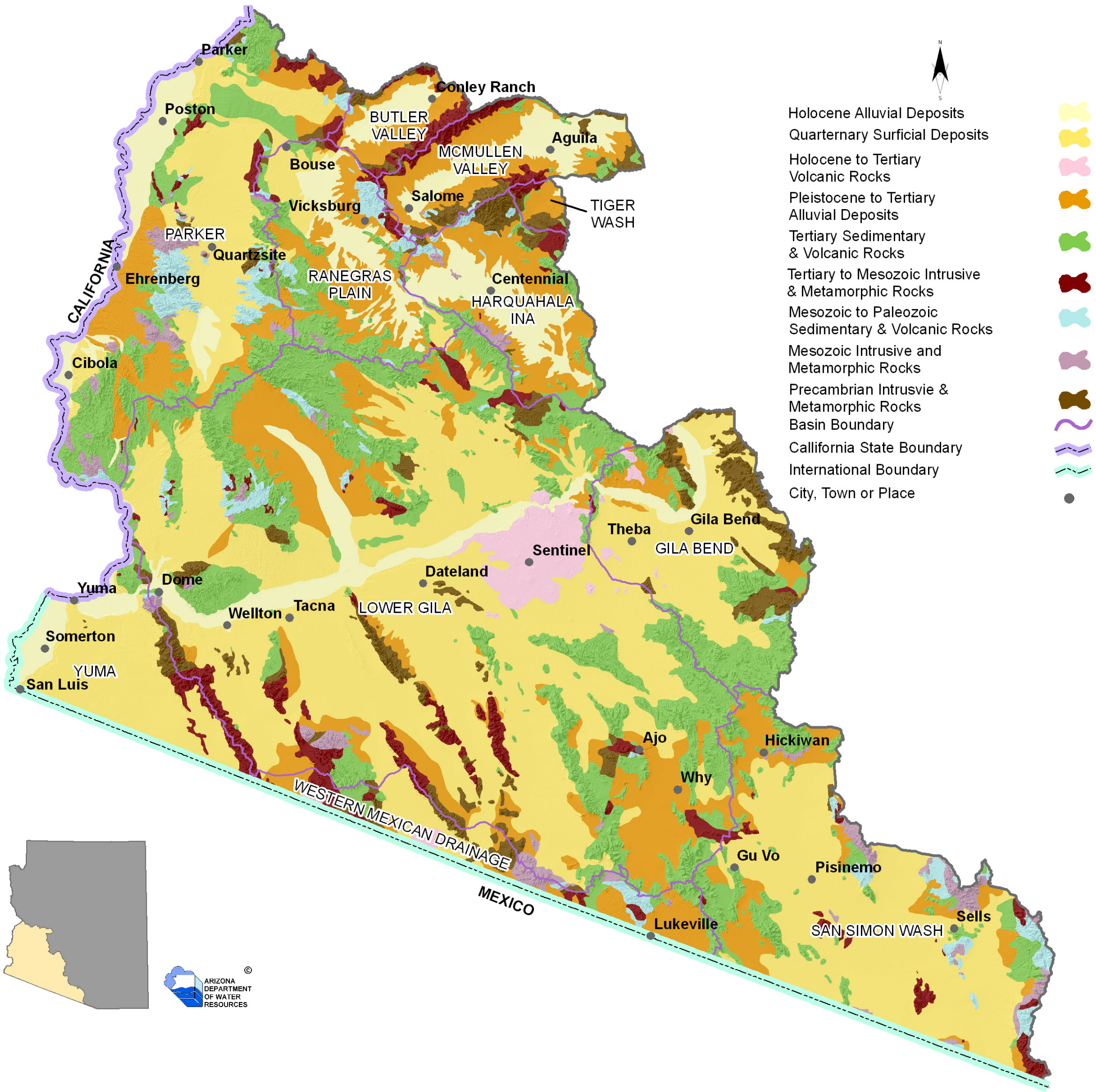
7.0.2 Hydrology[1]

Groundwater Hydrology

The groundwater basins of the Lower Colorado River Planning Area contain alluvial valleys with significant volumes of groundwater in storage. As shown in Figure 7.0-4 much of the basin is covered by Quarternary surficial deposits and Holocene to Tertiary alluvial deposits. The basin fill can have very productive water-bearing units.

Basins adjacent to the Colorado River were categorized by Anderson and others (1992) as Colorado River Basins. Colorado River infiltration was historically the main source of recharge to aquifers in these basins. Other basins in the planning area receive minimal groundwater recharge due to the aridity of the area. These other basins were categorized by

Figure 7.0-4 Surface Geology of the Lower Colorado River Planning Area
(Based on Reynolds, 1988)



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

Anderson and others (1992) as West Basins. The geology of the Colorado River Basins and West Basins are also somewhat different and each are summarized below. More detailed information on groundwater level changes, water quality, well yields, depth to water, groundwater in storage, groundwater recharge and other groundwater conditions are found in the individual basin sections.

Colorado River Basins

Colorado River Basins include the Parker and Yuma basins. In these basins the direction and occurrence of groundwater are influenced by the amount of streamflow in the Colorado River, which supplies the largest portion of groundwater recharge. Stream alluvium occurs along the Colorado River and its tributary washes and groundwater in the alluvium is hydraulically connected to the river.

In general, the aquifer consists of recent stream alluvium overlying older, partially consolidated basin-fill deposits, which in turn overlie the Bouse Formation. The Bouse Formation consists of two zones. The upper zone is composed of medium to coarse-grained sand which can yield moderate amounts of groundwater under unconfined conditions. The lower zone contains fine-grained sediments which produce limited amounts of groundwater. Groundwater is found under confined (artesian) conditions in this lower zone. A fanglomerate unit (composed primarily of cemented gravel and thin basalt flows) underlies the Bouse Formation and can yield moderate amounts of groundwater. (Anderson and others, 1992)

Parker Basin

The Parker Basin is composed of three sub-basins; La Posa Plains in the eastern portion, Cibola Valley in the southwest, and Colorado River Indian Reservation in the northwest.

Along the Colorado River groundwater occurs under confined conditions in the Bouse Formation and fanglomerate unit and under unconfined conditions in alluvial deposits. The recent stream alluvium consists of silt, sand and gravel deposits and groundwater in these

Parker Basin, Colorado River. Along the Colorado River groundwater occurs under confined conditions in the Bouse Formation and fanglomerate unit and under unconfined conditions in alluvial deposits.

deposits is hydraulically connected to the river. In the La Posa Plains sub-basin groundwater is found in relatively small amounts under unconfined conditions. In this area, groundwater flows toward the Colorado River along stream courses (Figure 7.6-6). In the Cibola Valley and CRIT sub-basins, groundwater flows parallel to the Colorado River or away from it.

Pre-development groundwater recharge is approximately 241,000 AFA. Estimates of groundwater in storage range from 14 million acre-feet (maf) to 24 maf. The median well yield reported for 75 large diameter (>10 in.) wells was 100 gallons per minute (gpm) (Table 7.6-6). Water levels declined in most wells measured between 1990-'91 and 2003-'04 (Figure 7.6-6).

Groundwater quality is generally good in the Parker Basin although arsenic, fluoride, nitrate and organic compounds have been measured at concentrations exceeding the Drinking Water Standard in some wells (Table 7.6-7). Many water quality measurements have been made in the Quartzsite area where septic tanks have caused nitrate contamination of groundwater.

Yuma Basin

Tertiary and Quaternary basin fill is the primary aquifer in the Yuma Basin. Thickness of the basin fill may exceed 16,000 feet in some areas but only the upper 2,000 to 2,500 feet is considered hydrologically important because of its excellent transmissive properties. This aquifer is subdivided into three zones. In descending order these are the upper fine-grained zone, the coarse-gravel zone and the wedge zone. The upper zone includes younger alluvium and the uppermost deposits of older alluvium. Little water is pumped from this zone although beneath irrigated areas, the water table lies within it. The middle, coarse-gravel zone is the principal water producing unit. Depths to the coarse-gravel zone begin at about 100 feet in the Colorado and Gila River valleys and at about 180 feet below land surface (bls) beneath Yuma Mesa. Throughout most of the Yuma basin the wedge zone underlies the coarse-gravel zone and overlies the Bouse Formation. The wedge zone is a major water-bearing deposit and consists of interbedded sands, gravel and cobbles. Depth to the top of this zone is about 160 feet near Laguna Dam and 300 feet in the southern Yuma Valley. (Overby, 1997) The underlying Bouse Formation is a potential source of groundwater. Units that underlie this formation (marine sedimentary rocks and volcanic rocks) are highly mineralized and deep and are not utilized.

Prior to development, nearly all groundwater recharge was from the Colorado and Gila rivers through direct channel infiltration and annual flooding. The general groundwater flow direction was from the Colorado and Gila Rivers southward under Yuma Mesa. A significant source of groundwater recharge now comes from percolation of excess water applied to crops to reduce salt accumulation in the root-zone. A groundwater mound has developed under Yuma Mesa as a result of agricultural irrigation and because groundwater flow away from the area is insufficient to drain rising water levels. This

Yuma Basin, Colorado River. Prior to development, nearly all groundwater recharge was from the Colorado and Gila Rivers through direct channel infiltration and annual flooding mound and rising groundwater levels in the Yuma area have affected groundwater flow patterns as shown on Figure 7.11-7. In the western part of the basin, groundwater flow is now generally toward the Colorado River from Imperial Dam to the Northerly International Boundary (NIB). South of the mound, groundwater flow is still generally south toward the natural drainage, but there also is a component of flow now toward the Colorado River and under the river toward the Mexicali Valley in Mexico (Dickinson and others, 2006). In the eastern part of the Yuma Basin, groundwater moves from northwest to southeast across the Yuma Desert and exits the basin into Mexico east of the Algodones Fault (Overby, 1997). The Algodones Fault trends northwest to southeast across the basin south of Yuma and is a barrier to groundwater movement, with higher water levels west of the fault (USBOR, 2009).

Groundwater levels in the basin are also influenced by water management activities. The “242 Well Field and Lateral” located east of San Luis is a 5-mile wide regulated zone consisting of 35 wells that intercept part of the groundwater flow moving south into Mexico from Yuma Mesa (see Figure 7.0-9). Irrigation drainage water is a component of this groundwater flow. Water pumped from the well field is delivered to Mexico through the 242 Lateral and other laterals to meet international treaty obligations for Colorado River water deliveries. This activity, as well as groundwater pumping in Mexico, lowers groundwater levels in private wells in the vicinity of the wellfield (USBOR, 2007a).

Pre-development groundwater recharge was approximately 213,000 AFA. Groundwater storage estimates range from 34 to 49 maf. The median well yield reported for 327 large diameter (>10 in.) wells is among the highest in the State at 2,456 gpm. Water levels in wells are generally less than 100 feet bls in most wells measured in 2003-’04 (Figure 7.11-7). As shown in hydrographs of selected wells (Figure 7.11-8), water levels in most wells are relatively stable.

Ground water quality varies across the Yuma Basin with elevated concentrations of total dissolved solids (TDS), arsenic, lead, agricultural pesticides, nitrate and volatile organic compounds in some areas (see Table 7.11-10). Groundwater was originally more similar in chemical composition to its source waters (Colorado and Gila rivers), but the quality has been altered by more than one hundred years of irrigation activity (Overby, 1997).

<u>West Basins</u>

West Basins include Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley, Ranegras Plain, San Simon Wash, Tiger Wash and Western Mexican Drainage basins. Groundwater inflows and outflows are relatively small in these basins and there are no perennial streams. Groundwater inflows consist of minor amounts of mountain front recharge and stream infiltration. The basins are contain a relatively thin, heterogeneous layer of upper basin fill underlain by lower basin fill. The lower basin fill consists of a unit of primarily fine-grained material underlain by a medium to coarse grained unit. Pre-Basin and Range sediments underlie the basin fill. Stream alluvium deposits occur along the Gila River and elsewhere and may be locally productive water-bearing sediments (Anderson and others, 1992).

Butler Valley Basin

Butler Valley Basin contains basin-fill deposits that make up the principal aquifer. These deposits range from about 500 feet in the southwest to nearly 1,500 feet thick in the central portion of the basin. The valley is bordered by mountains and some groundwater may be found along the basin margins in thin alluvium and in volcanic, granitic, metamorphic and sedimentary rocks. A 1½-mile wide area bordered by mountains where Cunningham Wash exits the basin is known as the Narrows. Groundwater is found under confined conditions northeast of the Narrows in T7N, R15W and confined conditions may occur in other areas due to the presence of clay layers. Groundwater flow is generally from northeast to southwest (Oram, 1987).

Groundwater recharge is approximately 1,000 AFA or less. Groundwater storage estimates range widely from 2.0 to 20 maf (Table 7.1-3). The median well yield reported for 17 large diameter (>10 in.) wells is 2,200 gpm. Water levels declined in most wells measured between 1990-'91 and 2003-'04, with the recent water level measurements generally ranging from 100 to 500 feet bls (Figure 7.1-5).

Groundwater quality is generally good with locally elevated fluoride and arsenic concentrations measured in wells located in the western part of the basin (Figure 7.1-8).

Gila Bend Basin

Basin-fill material is the principal aquifer in the Gila Bend Basin. Groundwater generally occurs under unconfined conditions, but there are several areas where fine-grained layers in the alluvium create either overlying perched water-table conditions as a result of percolation of irrigation water or underlying confined conditions. Confined conditions occur in the upper basin fill immediately upstream from Painted Rock Dam (Rascona, 1996).

West of Gila Bend, significant clay layers ranging from 150 to 500 feet thick are found at various depths and depth to water increases southward. North of Gila Bend, unconfined groundwater occurs primarily in the sands and gravels of the basin fill and may also occur in interbedded volcanics. The Sil Murk Formation is one of the principal water-bearing formations in the lower basin fill in this area. It is comprised of pebble to boulder-sized conglomerates with thin interbedded volcanics near the top. (Rascona, 1996)

Gillespie Dam, Gila Bend Basin. Groundwater is recharged primarily from infiltration of surface flows from the Gila River and its tributaries, and when river water is impounded behind Painted Rock Dam.

In the area north of Gila Bend, groundwater flow direction is generally from the Gila Bend Mountains east to the Gila River. In the center of the basin, groundwater flow is toward the southwest (see Figure 7.2-6).

Groundwater is recharged primarily from infiltration of surface flows from the Gila River and its tributaries, and when river water is impounded behind Painted Rock Dam. Some recharge also occurs from infiltration of irrigation water and underflow from the Hassayampa sub-basin of the Phoenix AMA (<1,000 AFA) (Rascona, 1996). Annual recharge estimates range from 10,000 to 37,000 AFA. Groundwater storage estimates range widely from 17 to 61 maf. The median well yield reported for 242 large diameter (>10 in.) wells is high with 2,700 gpm (Table 7.2-6).

Water levels in wells measured in 2003-'04 ranged from 34 feet in a well along the mountain front to almost 640 feet east of Gila Bend. Groundwater pumpage historically caused several cones of depression to form, with the largest cone north of Gila Bend and parallel to the Gila River. As shown in Figure 7.2-6 water level declines are still significant (>30 feet) in wells in this area and almost all wells measured between 1990-'91 and 2003-'04 showed some decline.

Groundwater quality is generally poor across the basin with several measurements of arsenic and fluoride concentrations meeting or exceeding drinking water standards. High concentrations of TDS and nitrate have also been detected (see Table 7.2-7).

Harquahala Basin
Groundwater in the Harquahala Basin is found primarily in basin-fill material composed of heterogeneous deposits of clay, silt, sand and gravel. The basin fill may be as much as 5,000 feet thick near Centennial. Groundwater is generally unconfined, although clay layers can cause locally semi-confined to confined conditions. Clay layers also cause perched water-table conditions in the east-central and southeastern parts of the basin from percolation of irrigation water. In the southeastern part of the basin the basin fill consists of coarse deposits of sand and gravel. North of T1S, fine-grained beds primarily composed of clay overly the coarse deposits. Wells in this area penetrate the fine-grained sequence and withdraw water from the underlying coarse-grained sequence. The fine-grained beds become thicker towards the northwest and grade into an alternating sequence of fine-grained and coarse-grained layers that overlie a conglomerate that begins at a depth of 800 to 850 feet bls. (Hedley, 1990) Reportedly, the best well yields occur from this alternating sequence in the west-central part of the basin.

Prior to the 1950s groundwater moved from northwest to southeast and exited where Centennial Wash leaves the basin. As shown in Figure 7.3-5, groundwater flow in the south central part of the basin has been impacted by agricultural pumpage that caused severe overdraft from the 1950s through the mid 1980s, resulting in large water level declines and formation of a cone of depression.

Groundwater recharge is negligible, coming primarily from infiltration of runoff in Centennial Wash. There may also be underflow from McMullen Valley Basin to the north. Seepage and infiltration of water from the Central Arizona Project (CAP) canal, which runs west to east across the southern part of the basin, may be another source of recharge. Estimated annual recharge was less than 1,200 AFA. Groundwater storage estimates range from 13 to 27 maf. The median well yield reported for 157 large diameter (>10 in.) wells is 1,620 gpm (Table 7.3-5).

Introduction of CAP water in the late 1980s replaced a significant volume of groundwater pumping, allowing groundwater levels to rise by more than 30 feet in a number of wells in the south central part of the basin. Storage of CAP water at the Vidler Recharge facility has also caused local groundwater levels to rise. Elsewhere, water levels have generally declined (see Figure 7.3-5). The Harquahala Basin was designated an INA in 1984 pursuant to A.R.S. § 45-432 to prevent new lands from being brought into agricultural production. However, under A.R.S. § 45-555 groundwater may be withdrawn and transported from the basin to an initial active management area (such as the adjacent Phoenix AMA) under specific circumstances including a provision that groundwater levels not decline by an average of more than ten feet per year.

Groundwater quality is generally suitable for irrigation purposes, but elevated TDS, fluoride, arsenic and other constituent concentrations in many wells require treatment to meet drinking water standards (see Table 7.3-6).

Lower Gila Basin
The Lower Gila Basin is composed of the Wellton-Mohawk sub-basin, the Dendora Valley sub-basin in the northeast and the Childs Valley sub-basin in the southeast (Figure 7.4-6). Groundwater occurs in both recent stream alluvium and basin fill. The stream alluvium

consists of sand, gravel and boulders in the larger washes and the floodplain of the Gila River. The thickness of the stream alluvium ranges from 10 feet in smaller washes to 110 feet in the Gila River floodplain. The basin fill consists of three units. The upper sandy unit is composed of sand and gravel with some silt and clay layers. This unit is typically 200 to 380 feet thick. The middle fine-grained unit contains primarily silts and clays with occasional thin sand and gravel beds. The middle unit ranges from 250 to 750 feet thick. The lower coarse-grained unit is composed of coarse sand and gravel and contains some well-cemented zones. The thickness of this unit is variable. Groundwater development in the eastern part of the Lower Gila Basin is in the broad alluvial plains that border the Gila River, where the main aquifer is the upper sandy unit in the basin fill. Groundwater is primarily unconfined.

Prior to development, groundwater flow was from north and southeast toward the Gila River and then downstream to the southwest. Groundwater flow has been impacted by irrigation pumpage at some locations in the basin, where cones of depression exist (see Figure 7.4-6). Historically, cones of depression occurred in irrigated areas north of Hyder, east of Dateland and in the Palomas Plain west of Hyder. Infiltration of irrigation water in the western part of the basin has created groundwater mounds in the floodplain aquifer that also affect groundwater flow.

Groundwater recharge is primarily from infiltration of runoff in washes and the Gila River floodplain. Underflow from the Painted Rock Dam on the eastern basin boundary and releases from the dam during floods also contributes to groundwater recharge. Water releases from Painted Rock Dam in 1975 resulted in an estimated 59,500 acre-feet of recharge. In the far western part of the basin, infiltration of excess irrigation water is the largest source of groundwater recharge. Estimates of natural groundwater recharge ranging from 9,000 to 88,000 AFA.

There is a significant volume of groundwater in storage with estimates ranging from 100 to 246 maf. The median well yield reported for 597 large diameter (>10 in.) wells is 1,600 gpm (Table 7.4-6). Well yields exceeding 2,000 gpm are commonly found near the Gila River, southeast of Dateland and north of Hyder.

Groundwater levels in the Gila River floodplain in the western part of the basin historically ranged from 10 to 20 feet bls and the streambed alluvium was the primary source of groundwater. As irrigation activity increased in the 1930s, groundwater levels declined and salinity increased. To provide a dependable water supply for irrigation, Colorado River water was brought to the area in 1952 and groundwater pumping for irrigation ceased. Infiltration of excess irrigation water to the stream alluvium aquifer raised water levels, necessitating the need for a system of drainage wells to maintain groundwater levels below crop root zones and canals to transport the drainage water out of the basin.

Agriculture in the Wellton-Mohawk Irrigation District. In the far western part of the basin, infiltration of excess irrigation water is the largest source of recharge.

Historic groundwater level declines were as much as 15 feet per year in irrigated areas north and west of Hyder and east of Dateland. Few water level change measurements are available for the period 1990-'91 to 2004-'05 but several measured wells in the western part of the basin show relatively stable water level conditions (see Figure 7.4-6).

Groundwater quality varies in the eastern part of the basin with elevated fluoride concentrations measured in a number of wells. In the western part of the basin, the quality of groundwater in the Gila River floodplain is unsuitable for most uses, with elevated TDS concentrations common as well as fluoride and arsenic.

McMullen Valley Basin

The principal aquifer in the McMullen Valley basin is alluvial-fan deposits in the basin fill. These deposits underlie most of the valley floor, varying in thickness from 230 feet in the Wenden-Salome area to 3,100 feet north of Aguila. Most large irrigation wells tap into this unit. Fine grained lake-bed deposits of low permeability overlie the alluvial fan deposits in the central and lower parts of the valley. These deposits range in thickness from 150 feet southwest of Wenden to about 1,100 feet northeast of Wenden. Because of their relatively low permeability, the lake-bed deposits may impede downward percolation of water, creating perched aquifers. Stream alluvium has been deposited by Centennial Wash and its tributaries and is composed of silt, sand and clay. This unit ranges from 50 feet thick in the lower end of the basin, 100 feet thick in the Wenden-Salome area, and over 450 feet thick north of Aguila. There has been some groundwater development in the stream alluvium for domestic and stock use, but irrigation pumpage has dewatered the unit in the Aguila area (Remick, 1981). The basal unit of the basin fill is a conglomerate present at a depth of about 850 to 1,600 feet bls and is largely unexplored.

Eagle Eye Peak, McMullen Valley Basin. The principal aquifer in the McMullen Valley basin is alluvial-fan deposits in the basin fill.

An estimated 1,000 acre-feet of groundwater recharge occurs annually. Groundwater storage estimates range from 14 to 15.1 maf. The median well yield reported for 167 large diameter (>10 in.) wells is 1,500 gpm (Table 7.5-5).

Water levels in measured wells are generally more than 300 feet bls. As shown in Figure 7.5-5, water levels declined in all wells measured between 1990-'91 and 2003-'04, with significant declines (>30 feet) in a well east of Aguila and in five wells in the western half of the basin.

Fluoride and arsenic concentrations exceeding drinking water standards are found at wells throughout the basin with elevated nitrate concentrations measured in a number of wells near Salome (see Table 7.5-6).

Ranegras Plain Basin

Groundwater in the Ranegras Plain Basin occurs primarily in older (Tertiary) basin-fill deposits composed of clay, volcanics, conglomerate and smaller amounts of sand and gravel. The thickness of the basin-fill deposit is not well known but is at least 1,500 feet northwest of Vicksburg. The younger (Quaternary) alluvium, which includes stream alluvium, overlies the basin fill and is composed primarily of sand

and gravel with a thickness of less than a few hundred feet. Perched groundwater occurs in the central part of T6N, R16W and in Sections 9 and 10 of T5N, R16W where water levels are 10 to 60 feet higher than the surrounding area. (Johnson, 1990)

Groundwater flow is generally to the northwest toward the community of Bouse but irrigation wells groundwater withdrawals have created a cone of depression southwest of Vicksburg (see Figure 7.7-5).

Groundwater recharge is from infiltration of runoff in Bouse Wash, Cunningham Wash and along mountain fronts. About 32 miles of the CAP canal runs through the northeastern portion of the basin and may contribute 2,000 to 3,000 acre-feet of recharge a year. (Johnson, 1990) Annual recharge estimates range from less than 1,000 acre-feet to more than 6,000 acre-feet. Groundwater storage estimates range from 9.0 to 27 maf. Although yields in some wells are relatively low due to the presence of clays, yields reported for 68 large (>10 in.) diameter wells reach 4,000 gpm with a median yield of 1,150 gpm (Table 7.7-3).

As shown in Figure 7.7-5, water levels declined in almost all wells measured between 1990-'91 and 2003-'04, with significant declines (>30 feet) east of Vicksburg Road.

New Water Mountains in the Ranegras Plain Basin. Natural groundwater recharge in this basin is from infiltration of runoff in Bouse Wash, Cunningham Wash and along mountain fronts.

Groundwater quality is generally poor with elevated TDS concentrations measured in a number of wells. Of 48 wells measured between 1984 and 1989, only five wells had TDS levels below the secondary maximum contaminant level of 500 milligrams per liter recommended by the Environmental Protection Agency (EPA). The highest TDS concentrations were measured in the north-central part of the basin (Johnson, 1990).[2] Water quality measurements taken between 1979 and 2000 also show a number of wells with elevated fluoride and arsenic concentrations (Table 7.7-4).

San Simon Wash Basin

Basin fill comprises the principal aquifer in the San Simon Wash Basin. The thickness of the basin fill ranges from near zero at the mountain fronts to over 8,000 feet near the international boundary. Four basin-fill units have been identified. Alluvial-fan deposits occur on the basin perimeter and vary in depth and well yield. Streambed alluvium consisting of sand, gravel and boulders occurs along stream channels and may yield significant volumes to wells. Deltaic deposits consisting of a sequence of clay, silt, sand and gravel are found near Papago Farms (T19S, R1E) where deposits may be 800 feet thick and well yields are relatively high. Lakebed deposits consisting of thick sequences of fine-bedded silts and clays extend to depths of more than 1,000 feet. Groundwater occurs under unconfined conditions in the basin. Groundwater flow is generally toward the southwest, then south into Mexico. (Hollett, 1985)

There is relatively little grounwater data available for the basin, which is almost entirely within the Tohono O'odham Nation. Natural recharge is estimated at 11,000 AFA and ground-

2 Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.

water storage estimates range widely from 6.7 to 45 maf. Well yield estimates range from less than 50 to 3,000 gpm (Table 7.8-5). Hollett (1985) reported that wells drilled into the lake-bed deposits in the center of the basin generally yield less than 50 gpm and well yields appear to be highest at depths of 400 to 700 feet. Depth to water averaged about 300 feet bls (Hollett, 1985).

Elevated arsenic concentrations are found across the basin and fluoride concentrations that equal or exceed drinking water standards occur in the area around Papago Farms and the international boundary (Table 7.8-6).

Tiger Wash Basin

Tiger Wash Basin is a relatively small, shallow basin composed of heterogeneous deposits of clay, silt, sand and gravel that are likely less than 1,000 feet thick. There appears to be a groundwater divide near the center of the basin from which groundwater flows to the southwest and to the northeast (Hedley, 1990) (Figure 7.9-5).

Natural recharge is estimated to be less than 1,000 AFA. Groundwater in storage estimates range from 700,000 acre-feet to 2.0 maf. Measured well yield data are not available for the basin. Anning and Duet (1994) estimated a maximum yield of 500 gpm. Two wells measured in 2003-'04 had water levels of 29 feet and 219 feet bls (Figure 7.9-6).

Two water quality exceedences have been reported in basin wells, with concentrations of arsenic and nitrate that equal or exceed the drinking water standard (Table 7.9-4).

Western Mexican Drainage Basin

The Western Mexican Drainage Basin contains broad alluvial-filled valleys containing unconsolidated gravel, sand, silt and clay deposits that make up the main water-bearing unit. Groundwater flow is toward Mexico.

Tiger Wash, Tiger Wash Basin. Tiger Wash Basin is a small, shallow, alluvial basin composed of heterogeneous deposits of clay, silt, sand and gravel that are likely less than 1,000 feet thick.

Natural recharge is estimated to be 1,000 AFA. Groundwater in storage estimates range from 3.0 to 4.1 maf. The median well yield reported for three large (>10 in.) diameter wells was 50 gpm (Table 7.10-4).

Water levels varied from 27 to 237 feet bls at wells measured in 2003-'04 and levels appear to be declining near Lukeville, likely due to development in the Sonoyta area of Sonora, Mexico (Figure 7.10-6). Water quality data collected between 1976 and 1988 along the international boundary west of Lukeville show concentrations of fluoride, arsenic and lead that equal or exceed the drinking water standard (Table 7.10-5).

Surface Water Hydrology

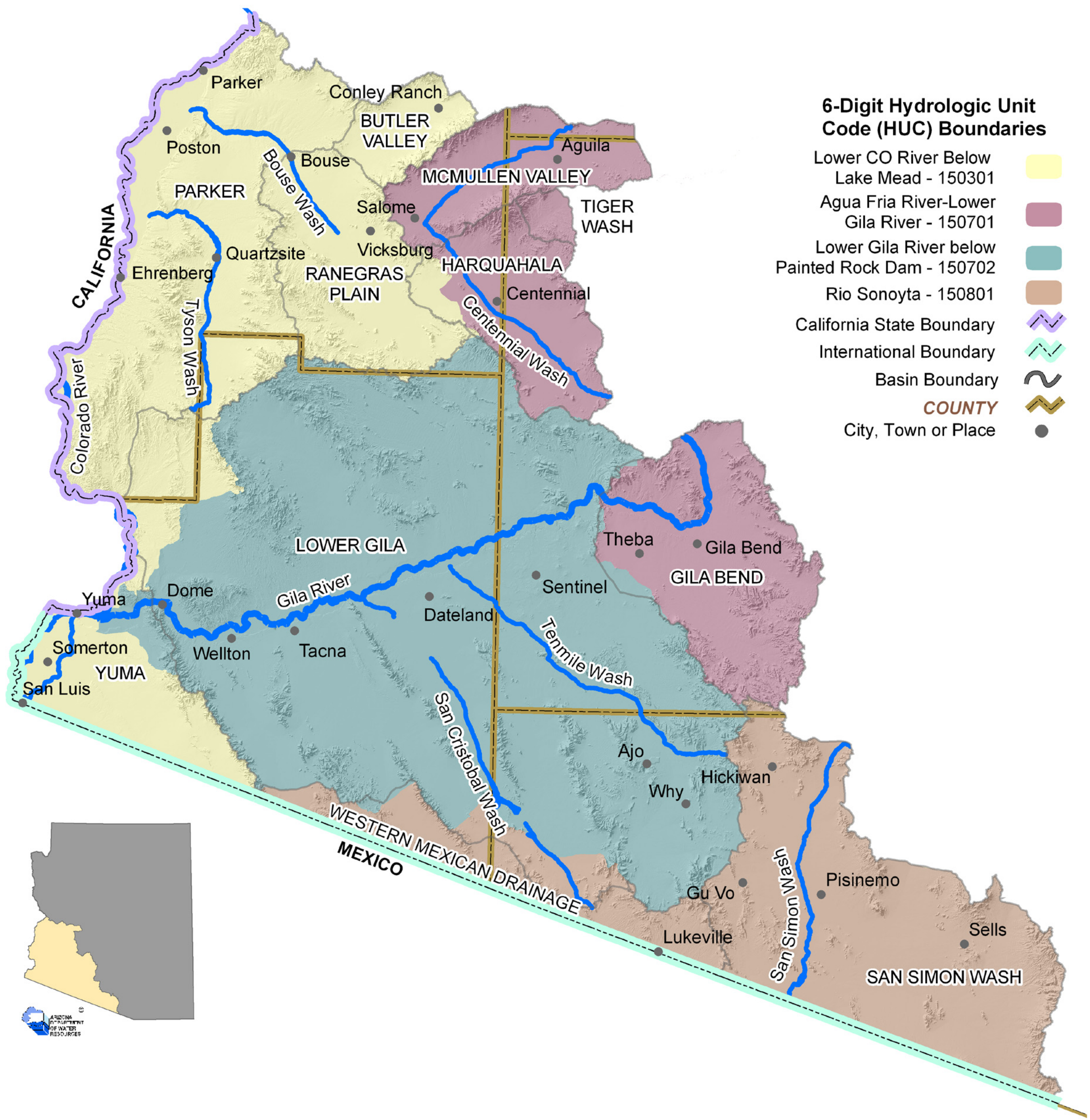
The U.S. Geological Survey (USGS) divides and subdivides the United States into successively smaller hydrologic units based on hydrologic features. These units are classified into four levels. From largest to smallest these are: regions, subregions, accounting units and cataloging units. A hydrologic unit code (HUC) consisting of two digits for each level in the system is used to identify any hydrologic area (Seaber et al., 1987). A 6-digit code corresponds to accounting units, which are used by the USGS for designing and managing the National Water

Data Network. There are all or portions of four watersheds in the planning area at the accounting unit level: Lower Colorado River below Lake Mead; Lower Gila River below Painted Rock Dam; Agua Fria River-Lower Gila River; and the Rio Sonoyta (Figure 7.0-5). More detailed information on stream flow, springs, reservoirs and general surface water characteristics are found in the individual basin sections.

Lower Colorado Below Lake Mead Watershed

This watershed extends north to Hoover Dam and includes all or parts of three basins in the Upper Colorado River Planning Area (see Volume 4, Figure 4.0-5). Within the Lower Colorado River Planning Area, all or parts of Butler Valley, Ranegras Plain, Parker, Harquahala, Lower Gila and Yuma basins are included in the watershed. The Colorado River is the only perennial surface water in the entire watershed. Within the planning area, the river flows for about 200 miles south of Parker Dam to Mexico at the Southerly International Boundary. There are many diversions and

Figure 7.0-5 Lower Colorado River USGS Watersheds
(USGS, 2005)

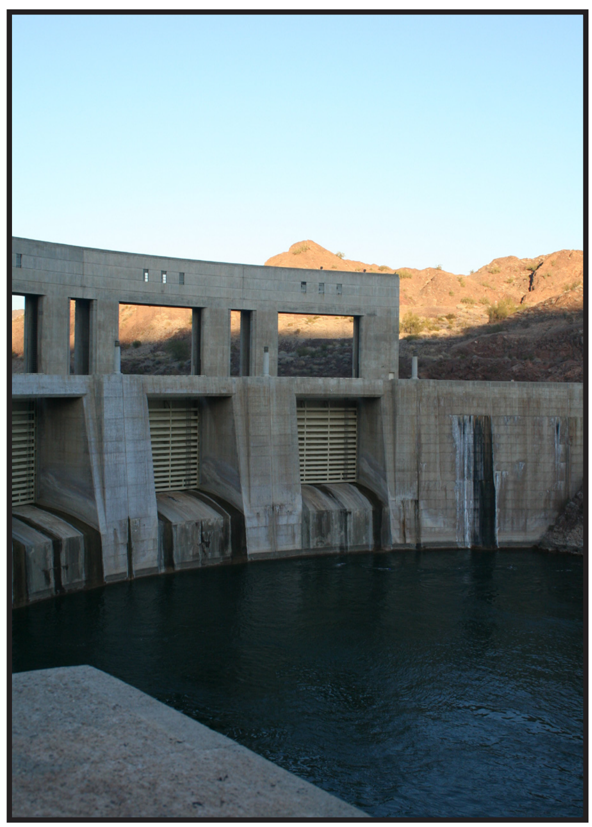


several dams along the Colorado River. Dams include Imperial, Laguna and Morelos. There are major diversions from Imperial Dam to the All-American Canal, which delivers agricultural water to California and to the Gila Gravity Canal for use in Arizona. Drainages to the Colorado River in the planning area are ephemeral and contribute little to river flow with the exception of the Gila River during flood events.

Dam construction and diversions have fundamentally altered flow in the Colorado River, including the portion in the planning area. Historically, the Colorado was a broad, meandering, unpredictable, sediment-laden watercourse, with annual flooding and frequent changes in the configuration of the channel. It sometimes overtopped its banks and flowed west to the Salton Sink, forming intermittent lakes. In the early 1900s water began to be diverted from the Colorado River via the Imperial Canal to irrigate California's Imperial Valley. When the canal filled with silt, a cut was made in the west bank of the river to temporarily allow water to flow into the valley. In 1905, massive flooding on the Colorado overtopped this diversion canal and diverted the river toward the Salton Sink (Salton Sea Authority, 2000). This flow flooded the valley, destroying farms and towns and began filling the Salton Sink, creating the modern Salton Sea. Flow continued for 18 months and for a time the Colorado ceased flowing into Mexico (Tellman and others, 1997). There were concerns that if the cutback erosion in the flow channel reached the Colorado River, it would be permanently diverted to the Salton Sink. In 1907 the Southern Pacific Railroad, which had substantial business interests in the region, repaired the gap in the diversion canal and the river resumed its natural course toward the Gulf of California.

Prior to dam construction on the Colorado River, the river flowed to the Gulf of California, forming a delta with a maze of lagoons and dense riparian habitat. Today only about 420,000 acres of the original two million acre delta survives and the river reached the sea only about half of the years between 1981 and 2002. Since 1979, an average of about 100,000 acre-feet of salty drainage water from the Wellton-Mohawk Irrigation District is delivered annually to the eastern side of the delta, creating the Cienega de Santa Clara. (Glenn and others, 2004)

There are streamflow records for eight Colorado River streamgages in the watershed. Of these, five are currently in operation and four are real-time gages. There are two active gages in the Parker Basin, one in the Lower Gila Basin and two in the Yuma Basin. The active gages in the Parker Basin portion of the watershed report similar median and mean flows (Table 7.6-2). Median flow at the gage below Parker Dam is 7.2 maf and the mean is 8.9 maf. The highest maximum annual flow (20.4 maf) in the watershed was reported at this gage in 1984. The three operating downstream gages (located below the major California diversion structures)



Parker Dam.

report mean flows substantially greater than median flows. For example, the gage on the Colorado River below Laguna Dam reports a median flow of 0.39 maf and a mean flow of 1.8 maf. The highest maximum annual flow among the three downstream gages was 15.4 maf at the Colorado River at the NIB above Morelos Dam gage (Table 7.11-2)

There are no major (>10gpm) or minor (1-10 gpm) springs in the entire watershed, and only 15 to 16 smaller springs, primarily in the Parker Basin.

A 28-mile reach of the Gila River (from Coyote Wash to Fortuna Wash) is designated as "impaired" due to elevated concentrations of boron and selenium that exceed the designated use standard for aquatic and wildlife uses (Tables 7.4-7 and 7.11-6).

Lower Gila River Below Painted Rock Dam Watershed

This watershed includes almost all of the Lower Gila Basin and part of the Yuma Basin. Major surface water drainages are the Gila River, Tenmile Wash and San Cristobal Wash (see Figure 7.0-5).

The Gila River drains the eastern and central parts of the planning area and extends 150 miles from Gillespie Dam (located where the Gila River enters the planning area in the Gila Bend Basin) to its confluence with the Colorado River in the Yuma Basin. The river originates in New Mexico and flows 600 miles from east to west across Arizona. The entire Gila River Watershed drains about 57,900 square miles and is the largest watershed in Arizona, covering over half of the state's total land area (Tellman and others, 1997).

Historically, the Gila River flowed in the planning area in the spring due to winter rain and snowmelt and in the summer following monsoon storms. Construction of dams resulted in loss of flows and water supplies downstream. Construction of Gillespie Dam in 1921 and Painted Rock Dam in 1959, impounded Gila River flow in the planning area for diversion to agricultural areas and to prevent flooding downstream. Prior to construction of the Painted Rock Dam, an average of approximately 6 AFA of groundwater was forced to the surface by the volcanic rocks of the Painted Rock Mountains and rock outcrops in the river channel at Painted Rock Narrows (Rascona, 1996). Gillespie Dam was breached during January 1993 when a 135-foot section of the dam collapsed during flooding. The same flood event filled Painted Rock Dam to full capacity of 2.5 maf, making it the largest lake in Arizona, and high volumes of spillwater caused extensive downstream damage. The reservoir is normally dry.

In the planning area, the Gila River now flows only in response to precipitation events, irrigation return flow or releases from upstream dams. Recent sources list the river as either intermittent (AZGF, 1997) or ephemeral (ADWR, 1994a). The Gila River is a flashy stream, showing wide variations in annual flow in the planning area. There are four operating streamflow gages on the Gila River. Two gages are above Painted Rock Dam in the Agua Fria River-Lower Gila River Watershed in the Gila Bend Basin, one is in the Lower Gila Basin and one is in the Yuma Basin. All four gages have years with no flow (see Tables 7.2-2, 7.4-2 and 7.11-2). By contrast, total annual flow at the

Gila River at Gillespie Dam in January 1993.

gage below Gillespie Dam and the gage below Painted Rock Dam were over 5 maf in 1993. Further downstream near the confluence with the Colorado, the gage at the Gila River near Dome recorded a maximum annual flow of over 4.7 maf in 1993, but an has recorded annual median flow of less than 4,800 acre-feet.

There are no major (>10gpm) or minor (1-10 gpm) springs in the Lower Gila River Watershed below Painted Rock Dam, and only six to eight smaller springs.

Agua Fria River-Lower Gila River Watershed

The Agua Fria River - Lower Gila River Watershed includes the drainage areas of the Agua Fria River and the Gila River from below its confluence with the Salt River to Painted Rock Dam. Within the Lower Colorado River Planning Area, Gila Bend, Harquahala, McMullen Valley and Tiger Wash basins are included in the watershed.

The Gila River is the only major watercourse. Centennial Wash is the major tributary and is an ephemeral stream with no streamgage data within the planning area. The only streamgage data for the watershed, other than those on the Gila River (mentioned above), is a discontinued gage at Sauceda Wash near Gila Bend with a maximum annual flow of about 1,100 acre-feet (see Table 7.2-2).

There are no major (>10gpm) or minor (1-10 gpm) springs in the Agua Fria River-Lower Gila River Watershed, and only five to seven smaller springs, three of which are located in the Tiger Wash Basin.

The waters of the Gila are designated as “impaired” due to elevated concentrations of organic compounds that exceed the designated use standard for fish consumption from it’s point of entry into the planning area to Painted Rock Dam. Below Painted Rock Dam the Gila

Ephemeral flow in Centennial Wash, McMullen Valley Basin.

is impaired due to dissolved oxygen, organics, selenium and boron concentrations that exceed fish consumption or aquatic and wildlife uses (see Tables 7.2-7 and 7.4-7).

Rio Sonoyta Watershed

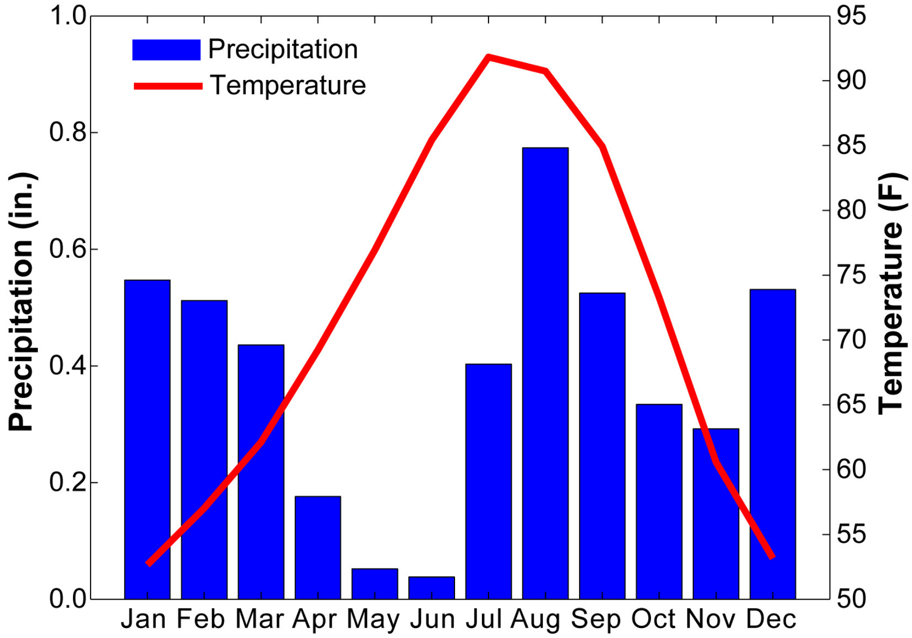
The Rio Sonoyta Watershed in Arizona includes the San Simon Wash and Western Mexican Drainage basins and the south central portion of the Lower Gila Basin. Major drainages in the San Simon Wash Basin, all ephemeral, are Hickiwan Wash, San Simon Wash and Vamori Wash (Figure 7.8-4). Vamori Wash flows northwest to San Simon Wash, which in turn flows south to the Rio Sonoyta in Mexico. There are two active streamgages in the watershed in the San Simon Wash Basin, one on Vamori Wash at Kom Vo and one on San Simon Wash near Pisinimo. These ephemeral streams flow primarily in the summer as a result of monsoon precipitation. Annual mean flow at the Vamori Wash gage is over 6,600 acre-feet and almost 2,400 acre-feet at the San Simon gage (see Table 7.8-2). The largest ephemeral tributary to the Rio Sonoyta in the Western Mexican Drainage Basin is Aguajita Wash (Figure 7.10-4).

The only major (>10gpm) and minor (1-10 gpm) springs in the entire planning area are found in this watershed in the Western Mexican Drainage Basin. Quitobaquito Springs are the only major spring with a combined discharge of 28 gpm. Located adjacent to the international boundary in Organ Pipe Cactus National Monument, the springs flow from fractured granite that forms the Quitobaquito Hills. Groundwater moves through the fractured granite and discharges in a line of springs on the southwest side of Quitobaquito Hills (Carruth, 1996). Two of the largest springs have been developed and diverted into a man-made stream channel that flows to a half-acre pond that provides habitat for the endangered Quitobaquito pupfish (Knowles, 2003). The springs are relatively warm, (a near about 74°F), and slightly brackish. The two minor springs in the planning area are located nearby. In total there are about 20 total springs in the watershed, with most located in the San Simon Wash Basin.

7.0.3 Climate[2]

The Lower Colorado River Planning Area is characterized by the highest average annual temperature in the state, 71.5°F, which is much warmer than the statewide average of 59.5°F. Average annual precipitation in the planning area is 4.6 inches, though totals are considerably higher in mountainous areas where precipitation is not recorded. Annual precipitation totals vary widely across the planning area, from 6-9 inches at Organ Pipe Cactus National Monument, Aguila, and Kofa Mine stations to less than 3 inches at Yuma Airport. On average, the Lower Colorado River exhibits the bi-modal precipitation seasonality characteristic of Arizona (Figure 7.0-6); however, the northwestern part of the planning area, near Parker, exhibits a stronger late winter peak, more typical of the Mohave Desert.

Figure 7.0-6 Average monthly precipitation and temperature from 1930-2002



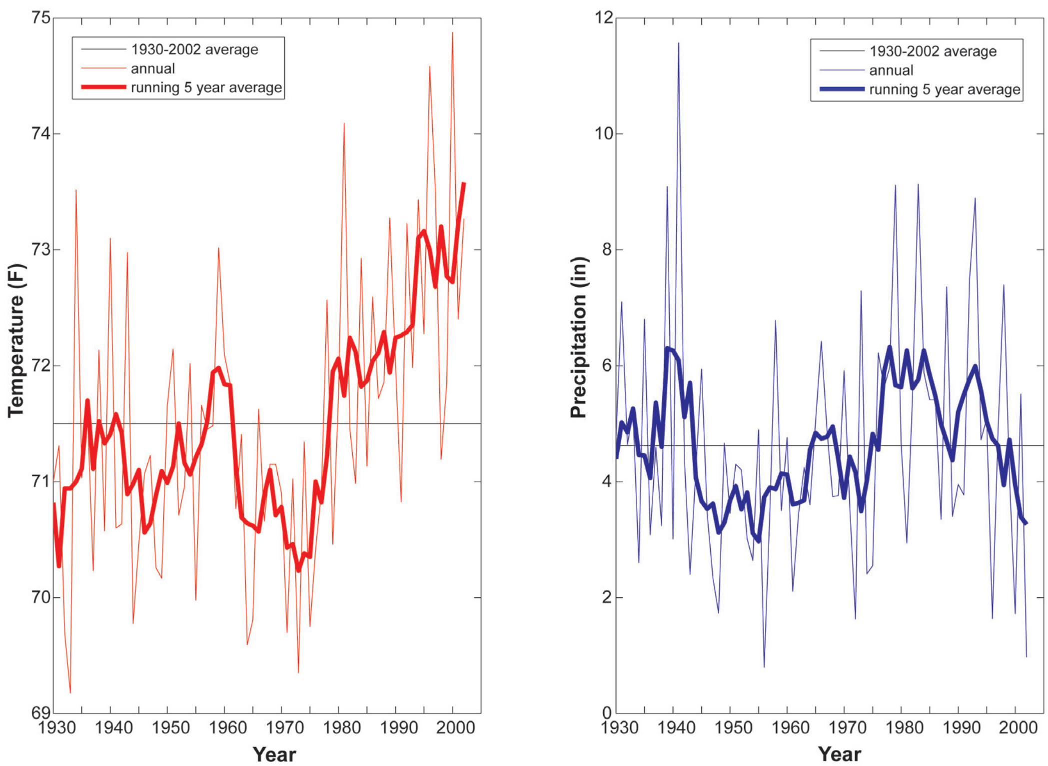
Data are from the Western Regional Climate Center. Figure author: CLIMAS.

[2] Information in this section was provided by the Institute for the Study of Planet Earth, Climate Assessment for the Southwest (CLIMAS), University of Arizona, November 2007

Frontal storm systems moving west-to-east, guided by the jet stream, deliver the area's winter and spring precipitation. Summer monsoon thunderstorms deliver abundant moisture to the eastern part of the Lower Colorado River Planning Area. The planning area shows a very strong response to El Niño conditions, with winters registering wet conditions 59% of the time and dry conditions only 24% of the time. Strong El Niño years, such as 1941, 1982, 1983, 1992 and 1993, show high precipitation (Figure 7.0-7). The precipitation response to La Niña conditions is not as pronounced with dry winters occurring only 50% of the time. Neutral El Niño-Southern Oscillation conditions yield dry planning area winters 57% of the time – a strong indication of the extreme aridity in this region. Average annual temperatures in the Lower Colorado River Planning Area have been increasing since the 1930s, and especially rapidly since the mid-1970s (Figure 7.0-7). The long-term trend is superimposed on decadal variability generated primarily by Pacific Ocean and atmosphere variations. Decadal variations are particularly obvious in the instrumental record of precipitation. Drought conditions were present for the decades of the 1940s-1960s and since the mid-1990s; the 1980s and early 1990s were relatively wet. This part of the state exhibits Arizona's highest year to-year precipitation variability, with especially high variability during the dry 1940s-1960s.

Winter precipitation records dating to 1000 A.D. estimated from tree-ring reconstructions for Arizona climate divisions show extended periods of above and below average precipitation in every century (Figure 7.0-8). A climate

Figure 7.0-7 Average annual temperature and total annual precipitation for the Lower Colorado River Planning Area from 1930-2002



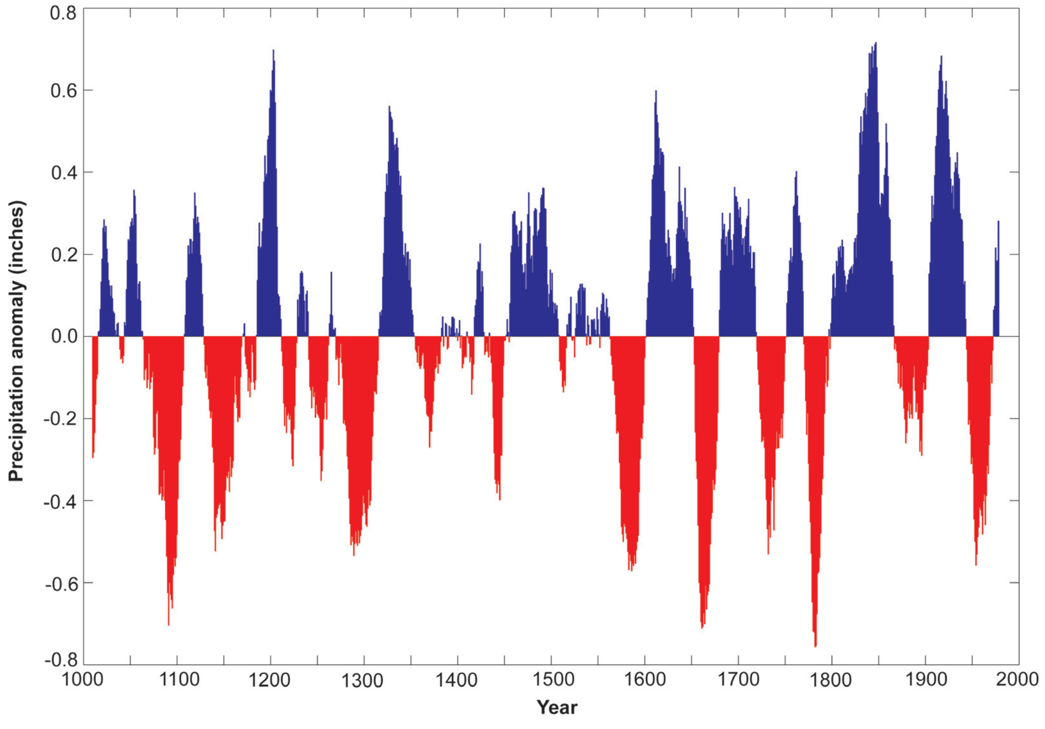
Horizontal lines are average temperature (71.5 °F) and precipitation (4.6 inches), respectively. Light lines are yearly values and highlighted lines are 5-year moving average values. Data are from the Western Regional Climate Center. Figure author: CLIMAS.

division is a region within a state that is generally climatically homogeneous. Arizona has been divided into seven climate divisions and most of the Lower Colorado River Planning Area is within Climate Division 5, which includes La Paz and Yuma counties. Markedly dry periods in Climate Division 5 include the late 1000s, mid-1100s, the late 1200s, late 1500s, and several shorter, but very intense, periods during the last 300 years. Winters were relatively wet during the late 1400s, early 1600s, much of the 1800s, and the early 1900s.

7.0.4 Environmental Conditions

Environmental conditions reflect the geography, climate and cultural activities in an area and may be a critical consideration in water resource management and development. Discussed in this section is vegetation, protection of riparian areas through the Arizona Water Protection Fund Program, threatened and endangered species, public lands protected from development as national monuments, wildlife refuges and wilderness areas, and managed waters. No instream flow claims (a non-diversionary appropriation of surface water for recreation and wildlife use) have been filed in this planning area.

Figure 7.0-8 Winter (November - April) precipitation departures from average 1000-1988 - Climate Division 5



Data are presented as a 20-year moving average to show variability on decadal time scales. Data: Fenbiao Ni, University of Arizona Laboratory of Tree-Ring Research and CLIMAS. Figure author: CLIMAS.

Vegetation

Information on ecoregions and biotic (vegetative) communities in the planning area are shown on Figure 7.0-9. With the exception of a very small area of Chihuhuan desert and Sierra Madre Occidental pine-oak forest along the southeastern boundary, the entire planning area is within the Sonoran Desert ecoregion. Biotic communities range from Lower Colorado River Valley Sonoran desertscrub to Madrean evergreen woodland. Most of the planning area is covered by Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub.

Madrean evergreen woodland occurs at the highest elevations of the San Simon Wash Basin in the Baboquivari Mountains where mean annual precipitation exceeds 16 inches. The woodland consists of evergreen oaks, alligator bark and one-seed junipers, and Mexican pinyon transitioning to semidesert grassland at lower elevation. Cacti of the semidesert grassland may extend well into the woodland. (Brown, 1982)

Interior chaparral occupies mid-elevation foothills, mountain slopes and canyons in small areas along the boundary of McMullen Valley and Butler Valley basins and along the McMullen Valley/Harquahala/Tiger Wash basin boundaries. Interior chaparral is found in areas between about 3,500 and 6,000 feet in elevation that receive 15 to 25 inches of annual precipitation (Brown, 1982). Chaparral consists of dense shrubs that grow around the same height with occasional taller shrubs or small trees. Typical shrubby species are mountain mahogany, shrub live oak, and manzanita. Chaparral plants are well adapted to drought conditions.

The western limit of the semidesert grassland community occurs in the eastern part of the planning area. A small area adjoins the Madrean evergreen woodland community in the Baboquivari Mountains and smaller areas exist in the central part of the San Simon Wash Basin along the Lower Gila/Western Mexican Drainage/San Simon Wash basin boundaries, and near Aguila in the McMullen Valley Basin. Semidesert grasslands receive between about 10 to 17 inches of annual rainfall. Grasses were originally perennial bunch grasses with intervening areas of bare ground. Where heavily grazed, grasses have shifted to annual species where summer rainfall is low, or to low growing sod grasses where rainfall is moderate to heavy. Shrubs, cacti and herbaceous plants are commonly found in the semidesert grassland community. (Brown, 1982)

Two subdivisions of the Sonoran desertscrub region exist in the planning area-the Lower Colorado River subdivision and the Arizona Upland subdivision. The Lower Colorado River subdivision is the hottest and driest of the Sonoran desertscrub subdivisions. There is intense competition for water, with plants widely spaced and more concentrated along drainage channels. In some areas the soil is covered by a single layer of tightly packed pebbles known as "desert pavement" that restricts plant types to ephemeral species. High concentrations of sodium in the soil below the pavement may also restrict plant growth. Sand dunes occur near Yuma and Parker. Characteristic plants include creosote bush, bursage, saltbush, and mixed, more diverse vegetation along washes and other

Lower Colorado River Desertscrub in the Gila Bend Basin.

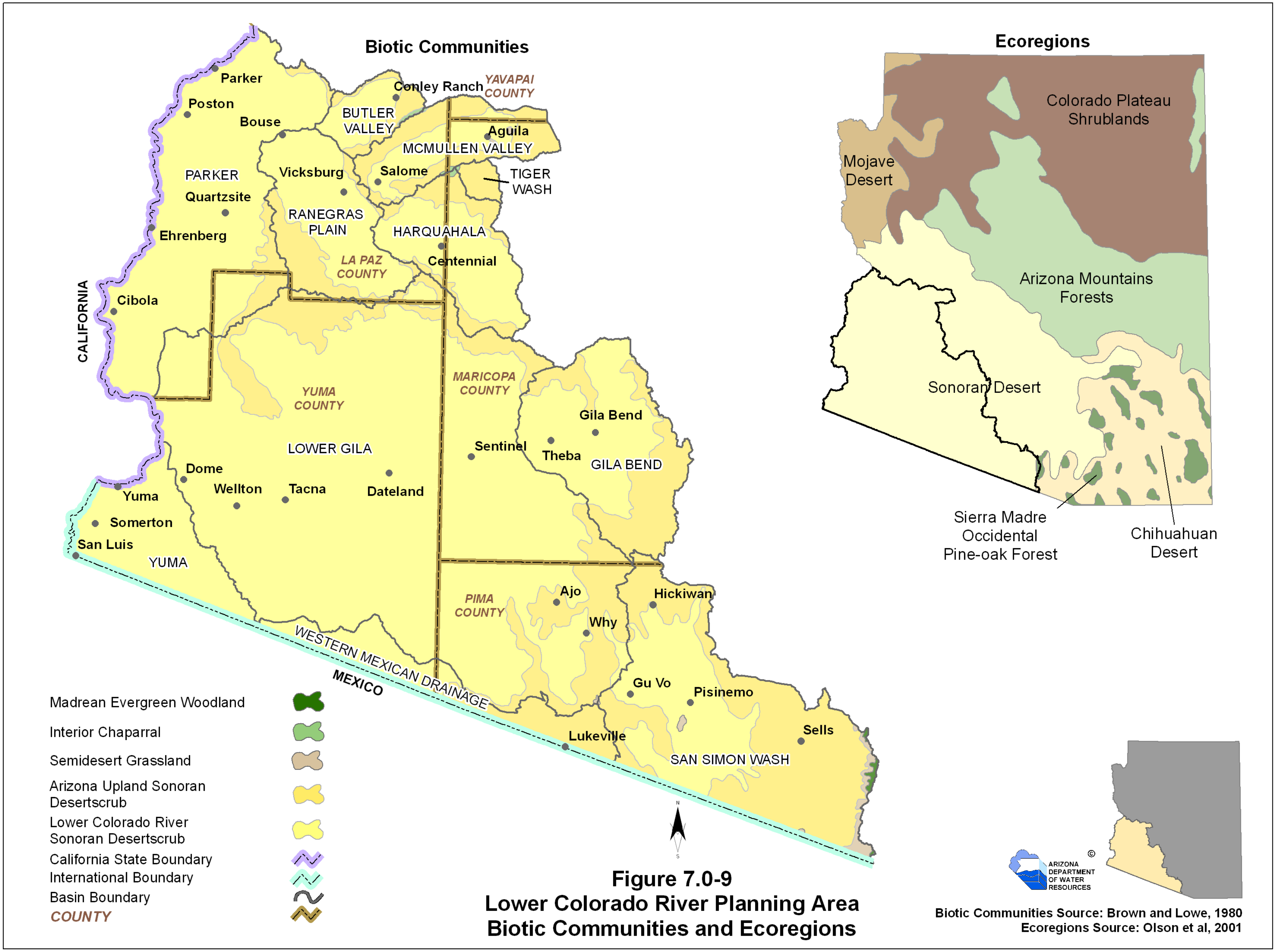


Figure 7.0-9
Lower Colorado River Planning Area
Biotic Communities and Ecoregions

areas with more water. These areas may include blue palo verde, ironwood and jojoba. Also commonly found in the subdivision are several types of cholla and other cacti. (Turner and Brown, 1982)

The Arizona Upland subdivision borders the Lower Colorado River subdivision and occurs primarily on slopes and sloping plains at elevations of 980 to over 3,000 feet where it merges with interior chaparral or semidesert grassland. This subdivision receives more precipitation than the other Sonoran desertscrub subdivisions with average annual precipitation between 8 to 16 inches. Vegetation is scrubland or low woodland in appearance with blue and foothill palo verde, ironwood, mesquite and cat-claw acacia as common tree species. Cacti are extremely important in this subdivision including saguaro, organ pipe, cholla and barrel cacti. (Turner and Brown, 1982)

Bufflegrass (Pennisetum ciliare), was introduced to the United States in the 1930s as livestock forage, and since the 1980s it has spread rapidly and can now be found on the edges of roads in most of southern Arizona. It is problematic in the Sonoran Desert because it grows densely, crowding out and competing for water with native plants and it is a fire-prone perennial that alters the natural fire regime. (ASDM, 2007b) When wildfires occur, the densely growing grass spreads fire rapidly and it thrives after fires, unlike native species (Brooks and Pyke, 2002).

Some efforts to control the spread of bufflegrass have been successful. Organ Pipe Cactus National Monument undertook a large eradication effort through yearly weeding efforts and has managed to control and largely prevent its proliferation in the area (Burns, 2007).

Riparian vegetation exists at locations along the Colorado and Gila rivers as shown on Figure 7.0-10. Along the Gila River in the vicinity of Gillespie Dam, primarily tamarisk, but also cattail, occurs. Downstream from Gillespie Dam to Painted Rock Reservoir, irrigated agriculture adjacent to the river may support native and nonnative riparian vegetation. Below Painted Rock Dam, the Gila River is mostly dry until irrigation return flows within the Wellton-Mohawk Irrigation District add some flow to the river. In the area near Dome, return flow supports riparian vegetation consisting of a narrow line of cottonwood along the channel with dense tamarisk behind (Webb and others, 2007)

Lower Gila Basin, Colorado River.

The riparian corridor of the lower Colorado River was historically a mixture of cottonwood and willow trees with backwater wetlands. These habitats were maintained by the natural flow regime consisting of spring floods that washed salts from the banks, supported germination of tree seeds, and created seasonal wetlands (University of Arizona, 2003). Although the river has been altered by dams and water delivery infrastructure, riparian ecosystems exist along most of the reach of the Colorado upstream of Imperial Dam. Floods no longer occur so the composition of woody riparian vegetation has changed with native species and tamarisk predominant.

Downstream from Parker Dam, non-native date palm, giant reed and fan palm are found with mesquite and arrowweed found further from the river. Downstream of Headgate Rock Dam (Figure 7.6-5), the river corridor widens. Riparian vegetation in this area was mapped in 1962 and covered 108,000 acres of primarily mesquite bosque with some reaches of native riparian vegetation among stands of tamarisk. The All American Canal at Imperial Dam diverts much of the flow of the Colorado River to California. Black willow, cottonwood and tamarisk are found in the abandoned river channel in this area. Through Yuma, flood control and bank protection have narrowed the river channel but has also provided more stable hydrologic conditions, resulting in an increase of riparian vegetation, primarily arrowweed. (Webb and others, 2007)

In Mexico, the Colorado River Delta was historically two million acres in size and was a maze of lagoons and thickly forested. Today, only about 420,000 acres of riparian, wetland and intertidal habitat remain. This habitat is largely maintained by the delivery of irrigation drainage water from the Wellton-Mohawk Irrigation District in Arizona. This water has flowed to the eastern side of the delta since 1979, creating the largest wetland in the Sonoran Desert, the Cienega de Santa Clara (Glenn and others, 2004).

Figure 7.0-10 Riparian Areas in the Lower Colorado River Planning Area

Riparian Data Source: AZGF 1993

Arizona Water Protection Fund Programs

The objective of the Arizona Water Protection Fund (AWPF) program is to provide grants for the protection and restoration of Arizona's rivers and streams and associated riparian habitats. Twelve restoration projects in the Lower Colorado River Planning Area had been funded by the AWPF through 2008. Ten projects were funded in the Yuma Basin for wetland, habitat and watershed restoration, exotic species control, research and revegetation. Two projects in the Parker Basin funded habitat restoration and revegetation and exotic species control. A list of projects and project types funded in the Lower Colorado River Planning Area through 2008 are found in Appendix A. A description of the program, a complete listing of all projects funded, and a reference map are found in Volume 1.

Restoration project on Colorado River in the Yuma area.

Threatened and Endangered Species[4]

A number of listed threatened and endangered species may be present in the Lower Colorado River Planning Area. Those listed by the U.S. Fish and Wildlife Service (USFWS) as of 2008 are shown in Table 7.0-1. Presence of a listed species may be a critical consideration in water resource management and development in a particular area. The USFWS should be contacted for details regarding the Endangered Species Act (ESA), designated critical habitat and current listings.

Actions related to operation of the Lower Colorado River water delivery and electrical power generation systems by both federal and non-federal entities may affect listed species and habitat or contribute to the listing of additional species in the future. The ESA directs Federal agencies to support the conservation of listed threatened and endangered species and to make sure that their actions do not jeopardize the continued existence of listed species or result in adverse modification of critical habitat. To comply with the requirements of the ESA, state and federal water, power and wildlife interests created the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The LCR MSCP is a cooperative, Habitat Conservation Program that identifies specific measures to address the needs of 26 threatened, endangered and other species that rely on habitat associated with the lower Colorado River (USDOI, 2004). Its purposes include: 1) protection of habitat while ensuring current river water and power operations; 2) addressing the needs of listed species under the ESA; and 3) reduction of the likelihood of listing additional species along the river (USBOR, 2007b). LCR MSCP reaches 4-7 are within the planning area and their general location is shown in Figure 7.0-11.

The LCR MSCP also addresses compliance with the "take" provisions of the ESA. Incidental take of a listed species, as the result of carrying out an otherwise lawful activity, is not allowed without acquiring a permit from the U.S. Fish

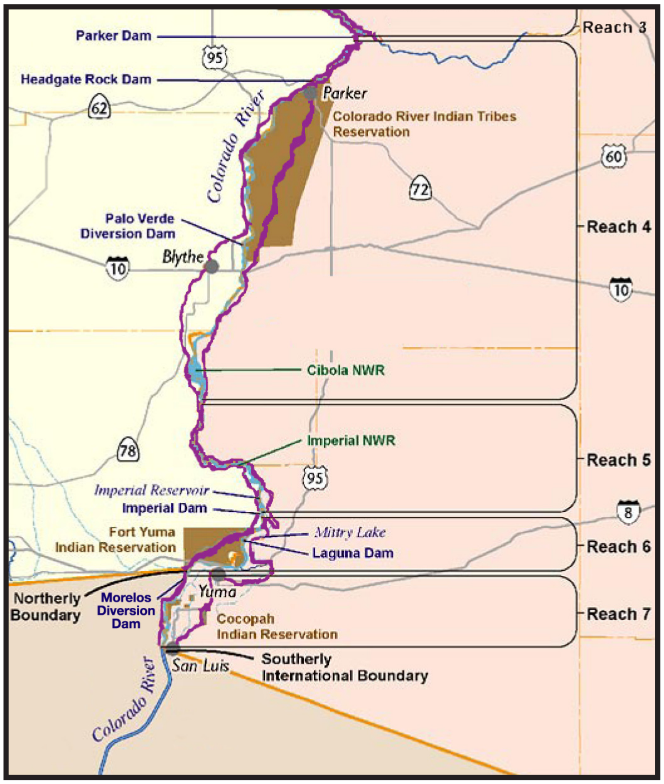
[4] An "endangered species" is defined by the USFWS as "an animal or plant species in danger of extinction throughout all or a significant portion of its range," while a "threatened species" is "an animal or plant species likely to become endangered within the foreseeable future throughout all or a significant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

Table 7.0-1 Endangered Species in the Lower Colorado River Planning Area

Common Name	Threatened	Endangered	Elevation/Habitat
Bald Eagle	X		Varies/Large trees or cliffs near water.
Bonytail Chub		X	235 - 1,960 ft./Main stream portions of mid-sized to large rivers (both strong current and pools), usually over mud or rocks.
Cactus Ferruginous Pygmy-Owl		X	1,300 - 4,000 ft./Cottonwoods, willows, mesquite bosques and dry washes.
California Brown Pelican		X	Varies/Lakes and rivers.
Kearny's Blue Star		X	3,685 - 4,500 ft./Canyon bottoms and sides in oak woodlands.
Lesser Long-Nosed Bat		X	1,190 - 7,320 ft./Desert grassland and shrubland up to oak transition.
Nichol's Turk's Head Cactus		X	2,400-4,100 ft./Sonoran desertscrub.
Quitobaquito Pupfish		X	0-4,950 ft./Small ponds and springs.
Razorback Sucker		X	<6,000 ft./Riverine and lacustrine areas, not in fast moving water.
Sonoran Pronghorn		X	400 - 1,600 ft./Broad alluvial valleys separated by block-faulted mountains.
Southwestern Willow Flycatcher		X	<8,500 ft./Cottonwood-willow and tamarisk along rivers and streams.
Yuma Clapper Rail		X	<4,500 ft./Fresh water and brackish marshes.

Source: USFWS 2008

Figure 7.0-11 MSCP Reaches in the Lower Colorado River Planning Area



Source: U.S. Department of the Interior, 2004

and Wildlife Service. The LCR MSCP documents the extent of the incidental take related to river operations and maintenance activities by both Federal and non-Federal entities and includes measures to avoid, minimize and mitigate the effect of the take (USDOI, 2004).[5]

Implementation of the LCR MSCP began in 2005. The program area extends from the full pool elevation of Lake Mead to the Southerly International Boundary with Mexico, a distance of 400 river miles and includes the historical floodplain of the Colorado River (USBOR, 2007b). The LCR MSCP is intended to serve as a coordinated and comprehensive conservation approach for a 50-year period and therefore includes measures for species not currently listed that may become listed in the future. Implementation of the program is funded by a partnership of state, Federal and other public and private stakeholders in Arizona, California and Nevada. The plan will create riparian, marsh and backwater habitat for six federally listed species and 20 other native species including conservation programs for razorback sucker and bonytail chub, both federally listed endangered species.

Historically the "Great Valley", what is now known as the Palo Verde Valley in California and Cibola Valley from the Parker area downstream to Cibola Lake, supported an extensive riparian woodland ecosystem and this area is a focal area for conservation measures under the LCR MSCP. Significant conservation measures intended to restore native riparian woodland habitats, once common along the lower Colorado River, have been implemented in Arizona at Cibola Valley Conservation Area (CVCA) in the Cibola Valley Irrigation and Drainage District, Cibola National Wildlife Refuge (CNWR), and Imperial National Wildlife Refuge (INWR). Measures include planting cottonwood, willow, mesquite, and other seedlings to create habitat for riparian woodland obligate species at CVCA, CNWR, and INWR, creation of marsh habitat for Yuma clapper rail and California black rail at INWR, and creation of isolated refugia for razorback sucker and bonytail at INWR. Investigations continue on the suitability of existing backwaters for conversion into habitat suitable for razorback sucker and bonytail. In addition, experimental habitat restoration measures have been implemented at the 'Ahakhav Tribal Preserve on the Colorado River Indian Tribes Reservation.

National Monuments, Wildlife Refuges and Wilderness Areas

The Lower Colorado River Planning Area contains 15 wilderness areas administered by the Bureau of Land Management (BLM), four National Wildlife Refuges (NWR) and two National Monuments (Figure 7.0-12). Both

[5] As defined by the ESA, take means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in other conduct." (16 U.S.C. section 1531[18])

monuments and three wildlife refuges also contain wilderness areas. In total there are 2.3 million acres of protected federal lands in the planning area, accounting for 21% of the land area.

Eight BLM wilderness areas are entirely within the planning area as well as parts of seven others. Wilderness areas are designated under the 1964 Wilderness Act to preserve and protect the designated area in its natural condition. Designated wilderness areas managed by the BLM, their size, basin location and a brief description of the area are listed in Table 7.0-2.

The largest protected area in the planning area is the Cabeza Prieta NWR, the third largest refuge in the contiguous United States with an area of over 860,000 acres. Designated in 1939, it lies within the Lower Gila and Western Mexican Drainage basins and shares a 56-mile border with the Mexican state of Sonora. Most of the

Figure 7.0-12 Wilderness Areas in the Lower Colorado River Planning Area
(Wilderness Data Source: National Atlas of the United States 2005, Land Ownership Data Source: ALRIS 2004)

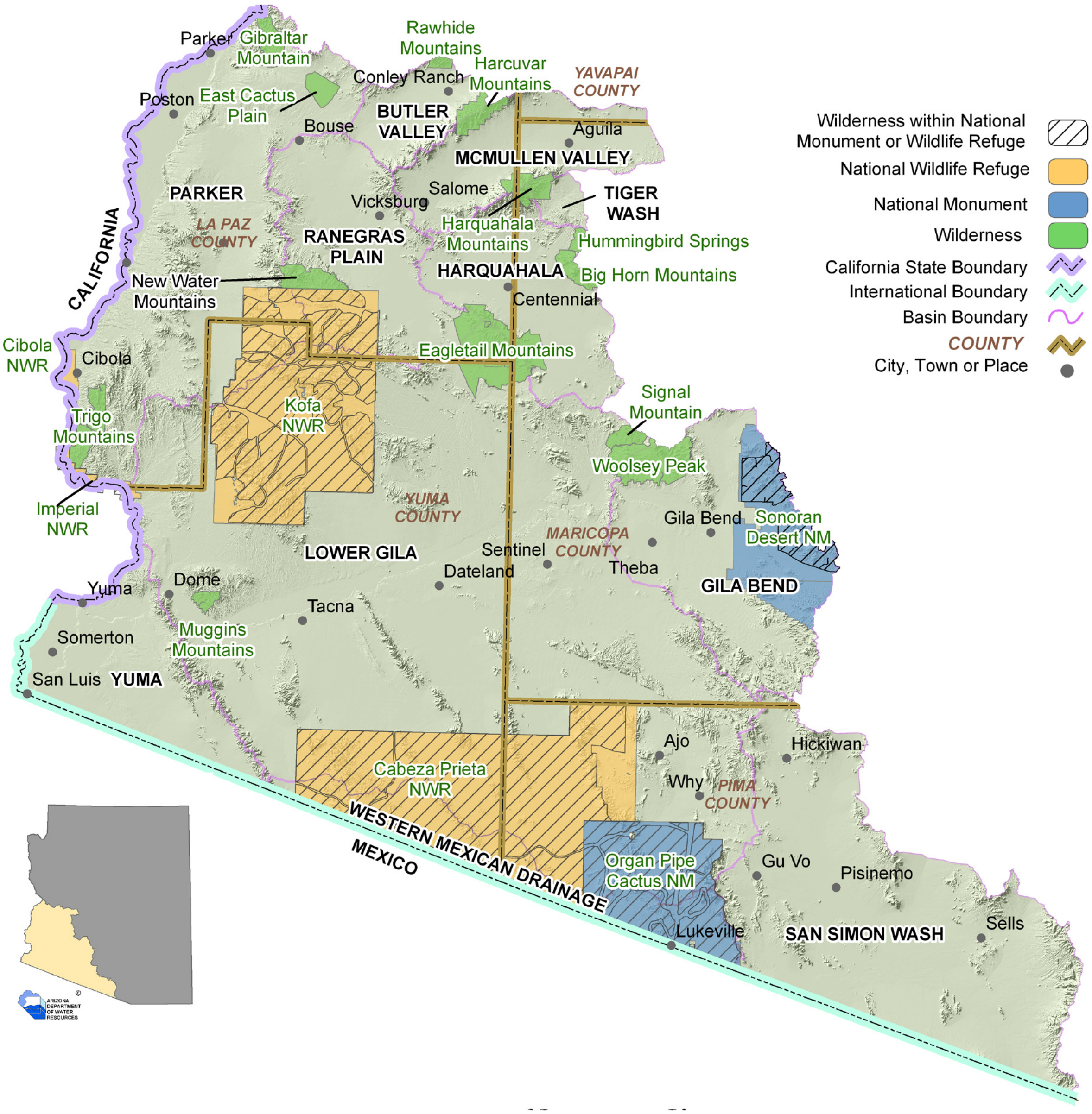


Table 7.0-2 Wilderness areas in the Lower Colorado River Planning Area

Wilderness Area	Acres in the Planning Area	Basin	Description
Big Horn Mountains	18,000 (partial)	Harquahala	Desert plain escarpments, hills, fissures, chimneys and narrow canyons.
Eagletail Mountains	100,000	Harquahala, Ranegras & Lower Gila	Large desert plain with natural arches, high spires, monoliths, jagged sawtooth ridges and numerous washes six to eight miles long.
East Cactus Plain	15,000	Parker	Intricate crescent dune topography and dense dunescrub vegetation known only in this area.
Gibraltar Mountain	19,000	Parker	Volcanic rock dissected by deep, sandy washes and rocky canyons, including many alcoves and caves.
Harcuvar Mountains	22,000 (partial)	McMullen Valley & Butler Valley	Bajadas and mountains with an isolated 3,500-acre "island" of interior chaparral habitat.
Harquahala Mountains	23,000	Tiger Wash, McMullen & Harquahala	Contains 5,691-foot- high Harquahala Peak, the highest point in southwest Arizona.
Hummingbird Springs	5,500 (partial)	Harquahala	Includes Sugarloaf Mountain which rises steeply from the Tonopah Desert plains.
Muggins Mountains	7,700	Lower Gila	Rugged peaks dissected by deeply cut drainages.
New Water Mountains	25,000	Ranegras	Craggy spires, sheer rock outcrops, natural arches, slick rock canyons and deep sandy washes.
North Maricopa Mountains*	40,000	Gila Bend	Low-elevation Sonoran Desert mountain range and extensive surrounding desert plains.
Rawhide Mountains	4,900 (partial)	Butler Valley	Low hills punctuated by numerous rugged outcrops.
Signal Mountain	12,000 (partial)	Lower Gila	Sharp volcanic peaks, steep-walled canyons, arroyos, craggy ridges and outwash plains.
South Maricopa Mountains*	40,000 (partial)	Gila Bend	Low-elevation Sonoran Desert mountain range and extensive surrounding desert plains.
Trigo Mountains	30,000	Parker	Sawtooth ridges and steep-sided canyons heavily dissected by washes.
Woolsey Peak	60,000 (partial)	Gila Bend & Lower Gila	Sloping lava flows, basalt mesas, rugged peaks and ridges.
Total Acres	400,100		

Source: BLM 2006
* Wilderness areas are within the boundaries of a National Monument.

refuge is designated as wilderness. The refuge provides habitat for desert bighorn sheep, the endangered Sonoran pronghorn and lesser long-nosed bat, as well as 420 plant species and more than 300 kinds of wildlife. (USFWS, 2007a) The U.S. pronghorn population is estimated at around 50 animals.

Cibola NWR straddles the Colorado River, with almost 13,000 acres located in the Parker Basin and the remainder in California. The refuge was established in 1964 to restore and protect historic habitat and wintering grounds for migratory birds and other wildlife. About 85% of Arizona's wintering Canadian Goose population is found on the refuge. (USFWS, 2007b)

Kofa NWR, at 665,400 acres, is located in the Lower Gila, Parker and Ranegras Plain basins. Established in 1939, it provides habitat for desert bighorn sheep, currently numbering

800-1,000 individuals, and protection for the California fan palm, the only native palm in Arizona (USFWS, 2007c). Most of the refuge is designated as wilderness.

Imperial NWR protects wildlife habitat along 30 miles of the Colorado River in Arizona and California, including the last unchannelized section of the river before it enters Mexico. The entire refuge encompasses almost 25,800 acres, of which 15,000 acres is designated wilderness. In Arizona, refuge lands are located in the Lower Gila and Parker basins. Efforts are underway to restore wetlands, control tamarisk, plant cottonwood and willow trees, protect lakes and manage marshlands and croplands to provide food and habitat for wintering migratory birds. (USFWS, 2007d)

Organ Pipe Cactus National Monument preserves approximately 106,800 acres of relatively intact Sonoran Desert ecosystem in the Lower Gila and Western Mexican Drainage basins. The Monument contains twenty-six species of cactus and provides habitat for the endangered Quitobaquito Pupfish and Sonoran Pronghorn. About 95% of the Monument is designated as wilderness. The United Nations designated the Monument as an International Biosphere Reserve in 1976. Due to the remoteness of the area, each year thousands of people illegally enter the U.S. through the monument using unofficial roads and trails. This traffic has adversely impacted habitat including deposition of trash, damage to plants, pollution of water sources, and soil erosion. (NPS, 2007)

Kofa Mountains in the Kofa National Wildlife Refuge. The Lower Colorado River Planning Area contains 2.3 million acres of protected federal lands, accounting for 21% of the land area

A portion of the 496,000-acre Sonoran Desert National Monument, established by executive proclamation in 2001, is located in the Gila Bend Basin. The monument contains extensive areas of saguaro cactus forest, and archeological and historic sites. Three wilderness areas are contained within the Monument boundaries. (BLM, 2007)

Managed Waters

Water management decisions and operations outside of the planning area affect the character of the Colorado River within the planning area. Use of Colorado River water is primarily under the jurisdiction of the federal government and was developed through a number of Congressional acts, Supreme Court Decisions, multi-state compacts and an international treaty collectively known as the “Law of the River.” More detail on management issues affecting the river are found in Section 7.0-8.

Historically, flow in the Colorado River was highly unpredictable with annual variation of 5 maf to 24 maf at its point of discharge to the Gulf of California. Sediments were carried downstream with spring floods, forming beaches and a large delta where the river met the sea. These floods often changed the course of the river. Today the river flow does not always reach the Gulf due to diversions, sediment is trapped behind dams and the river is channelized through parts of its length.

Prior to development, the Colorado River delta area was one of the richest estuaries in the world. Upstream diversions have severely impacted the delta with a small remnant remaining in the Cienega de Santa Clara. This remnant has been maintained as a result of bypassed saline return flows generated by the Wellton-Mohawk Irrigation and Drainage District. Salinity standards established by the 1944 Treaty with Mexico require that these return flows can no longer be returned to the river in Arizona. The Cienega was designated as a Biosphere Reserve in 1994 (Tellman and others, 1997). Discussions are ongoing on how to manage and utilize return flows in the Yuma area while still sustaining the Cienega.

7.0.5 Population

The 2000 Census populations for each basin and Indian reservation, from highest to lowest, are listed in Table 7.0-3. The most populous basin is the Yuma Basin with 79% of the total planning area population in 2000. Three basins have population totals less than 100 residents. The 2005 estimated population of the Yuma Basin was 181,600 and Arizona Department of Economic Security (DES) population projections forecast 305,900 residents by 2030. Historic, current and projected basin populations are shown in the basin cultural water demand tables (Sections 7.1-7.11).

The planning area is growing rapidly with a 44% population increase between 1990 and 2000. Census data for 2000 show about 194,100 residents and DES population projections forecast that the population will double by 2030, to about 388,400 residents (Table 7.0-4).

Listed in Table 7.0-4 are incorporated and unincorporated communities in the planning area with 2000 Census populations greater than 1,000 and growth rates for two time periods. Communities are listed from highest to lowest population in 2000. As shown, there are a number of rapidly growing communities in the planning area. San Luis, along the international border, had the most rapid growth rate during both time periods. Fortuna Foothills, an unincorporated community east of Yuma is also growing rapidly with a 165% growth rate between 1990 and 2000 and a 29% growth rate between 2000 and 2006. Yuma, Fortuna Foothills and Quartzsite experience a large population increase in the winter when seasonal residents arrive to enjoy the relatively warm climate. This seasonal population is not accounted for in the population estimates and projections unless these communities are listed as the primary residence.

Table 7.0-3 2000 Census population in the Lower Colorado River Planning Area

Basin/ *Reservation*	2000 Census Population
Yuma	152,928
Cocopah	*1,025*
Fort Yuma (Quechan)	*45*
Parker	16,155
Colorado River Indian Tribes (CRIT)	*3,389*
Lower Gila	11,297
San Simon Wash	5,837
Tohono O'odham	*5,833*
Gila Bend	4,256
Gila Bend	*600*
McMullen Valley	3,426
Ranegras Plain	905
Harquahala	608
Western Mexican Drainage	33
Butler Valley	15
Tiger Wash	<10

Population Growth and Water Use

Arizona has limited mechanisms to address the connections between land use, population growth and water supply. A legislative attempt to link growth and water management planning is the Growing Smarter Plus Act of 2000 (Act) which requires that counties with a population greater than 125,000 (2000 Census) include planning for water resources in their comprehensive plans. Of the five counties in the planning area, four fit the size criteria in 2000; Maricopa, Pima, Yavapai and Yuma. Only Yuma County is entirely within the planning area. The Yuma County 2010 Comprehensive Plan provides a general overview on the quality and quantity of water in the county, including information on drinking water and distribution and wastewater management (Yuma County, 2000).

The Act also requires that twenty-three communities outside AMAs include a water resources element in their general plans. In the Lower Colorado River Planning Area this requirement applies to Yuma, Quartzsite, San Luis and Somerton and all communities have complied. Plans must consider water demand and water resource availability in conjunction with growth, land use and infrastructure.

Beginning in 2007, all community water systems in the state were required to submit Annual Water Use Reports and System Water Plans. The reports and plans are intended to reduce community water systems' vulnerability to drought, and to promote water resource planning to ensure that water providers are prepared to respond to water shortage conditions. In addition, the information will allow the State to provide regional planning assistance to help communities prepare for, mitigate and respond to drought. An Annual Water Use Report must be submitted each year by the systems that includes information on water pumped, diverted and received, water delivered to customers, and

Table 7.0-4 Communities in the Lower Colorado River Planning Area with a 2000 Census population greater than 1,000

Communities	Basin	1990 Census Pop.	2000 Census Pop.	Percent Change 1990-2000	2006 Pop. Estimate	Percent Change 2000-2006	Projected 2030 Pop.
City of Yuma[1]	Yuma	54,923	77,515	41%	91,033	15%	136,305
Fortuna Foothills	Yuma	7,737	20,478	165%	28,827	29%	57,224
City of San Luis[1]	Yuma	4,212	15,322	264%	24,485	37%	55,651
City of Somerton[1]	Yuma	5,282	7,266	38%	10,258	29%	20,433
Town of Ajo	Lower Gila	2,919	3,705	27%	4,118	10%	6,266[2]
Town of Quartzsite[1]	Parker	1,876	3,354	79%	3,650	8%	4,748
Parker Strip	Parker	1,646	3,302	101%	3,802	13%	5,660
Town of Parker[1]	Parker	2,897	3,140	8%	3,308	5%	3,933
Town of Gila Bend[1]	Gila Bend	1,747	1,980	13%	1,805	-10%	5,609[2]
Town of Wellton[1]	Lower Gila	1,066	1,829	72%	1,998	8%	2,565
Town of Ehrenberg[1]	Parker	1,226	1,357	11%	1,397	3%	1,543
Total >1,000		85,531	139,248	63%	174,681	20%	299,937
Remainder of <1,000		49,096	54,814	12%	63,034	13%	88,418
Total		**134,627**	**194,062**	**44%**	**237,715**	**18%**	**388,355**

Sources: DES 2006, U.S. Census Bureau 2006
[1] Incorporated communities
[2] Derived by ADWR from MAG and PAG projections

effluent used or received. The System Water Plan must be updated and submitted every five years and consist of three components, a Water Supply Plan, a Drought Preparedness Plan and a Water Conservation Plan. By January 1, 2008, all systems were required to submit plans.

Plans have been submitted by 37 community water systems in the planning area including the City of Yuma, Town of Parker, Ajo Improvement Company/Phelps Dodge Corporation, City of Somerton, and Town of Gila Bend and were used to prepare this document. Annual water report information and a list of water plans are found in Appendix B.

The Department's Water Adequacy Program also relates water supply and demand to growth to some extent, but does not control growth. Developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents. Legislation adopted in June 2007 (SB 1575) authorizes a county board of supervisors to adopt a provision, by unanimous vote, which requires a new subdivision to have an adequate water supply in order for the subdivision to be approved by the platting authority. If adopted, cities and towns within the county may not approve a subdivision unless it has an adequate water supply. If the county does not adopt the provision, the legislation allows a city or town to adopt a local adequacy ordinance that requires a demonstration of adequacy before the final plat can be approved. To date, only Yuma County and Cochise County have adopted the provision.

Subdivision adequacy determinations (Water Adequacy Reports), including the reason(s) for inadequate determinations, are provided in basin tables and maps and are summarized for each basin in Table 7.0-5. As listed on the table, a

Table 7.0-5 Water adequacy determinations in the Lower Colorado River Planning Area as of 12/2008

Basin	Number of Subdivisions	Number of Lots[1]	Lots w/ Adequate Determ.	Lots w/ Inadequate Determ.	Approx. Percent of Lots w/ Inadequate Determ.
Butler Valley	1	76	0	76	100%
Gila Bend	6	222	43	179	81%
Harquahala	4	301	201	100	33%
Lower Gila	30	3,087	2,756	331	11%
McMullen Valley	10	2,137	2,030	233	11%
Parker	28	≥1,575	≥1,145	≥430	27%
Ranegras Plain	8	280	26	254	91%
San Simon Wash	none	none	none	none	none
Tiger Wash	none	none	none	none	none
Western Mexican Drainage	none	none	none	none	none
Yuma	262	29,264	27,523	1,741	6%
Total	**348**	**≥36,942**	**≥33,724**	**≥3,218**	**9%**

Source: ADWR 2008a
Notes:
[1] Data on number of lots are missing for some subdivisions; actual number may be larger (≥)

high percentage of lots have been determined to have an adequate water supply and only basins with relatively few subdivided lots have a high percentage of inadequacy determinations.

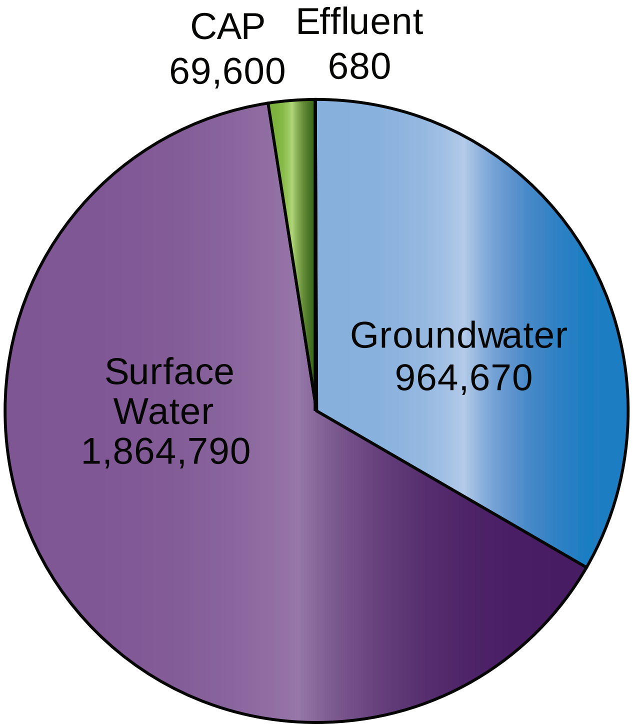
Also shown in the basin sections are approved applications for an Analysis of Adequate Water Supply (AAWS). This application is typically associated with large, master planned communities.

The service areas of two water providers in the planning area, Town of Parker and City of Yuma, have been designated as having an adequate water supply for their entire service area. If a subdivision is served by one of these designated water providers, a separate adequacy determination is not required.

7.0.6 Water Supply

Water supplies in the Lower Colorado River Planning Area include groundwater, surface water, Central Arizona Project (CAP) water and effluent. As shown on Figure 7.0-13, most water used is surface water. Colorado River water is the major supply in the Lower Gila, Parker and Yuma basins and CAP water is the largest supply in the Harquahala Basin. Gila River water combined with effluent discharge from the Phoenix AMA is an agricultural supply in the Gila Bend Basin. Elsewhere, groundwater is the primary water supply. Colorado River water is also used to meet environmental needs at the Imperial Wildlife Refuge in the Parker and Lower Gila basins. A discussion of Colorado River water entitlements and accounting is presented below. For purposes of the Atlas, water diverted from a watercourse or spring is considered surface water and if it is pumped from wells it is accounted for as groundwater. This is reflected in the cultural water demand tables in each basin section.

Figure 7.0-13 Average Annual Water Supply Utilized in the Lower Colorado River Planning Area, 2001-2005 (in acre-feet)



Colorado River Water

<u>Decree Accounting</u>

The right or authorization to beneficially use Colorado River water is defined as an entitlement. Entitlements held by Colorado River water users are created by decree of the United States Supreme Court in Arizona v. California et al. (Decree), through a contract with the Secretary of the Interior (Secretary) under Section 5 of the Boulder Canyon Project Act (BCPA) of December 21, 1928, or by Secretarial Reservation.

Table 7.0-6 shows the annual total amount of Colorado River water that was consumptively used for each category of water use within each basin in the planning area based on an accounting system established by Decree. Article V of the Decree directs the U.S. Bureau of Reclamation (Reclamation) to prepare an annual report of diversions from the mainstream, return flow of water to the mainstream that makes water

Table 7.0-6 Arizona v. California decree accounting of the consumptive use of Colorado River water in the Lower Colorado River Planning Area (in acre-feet/year)

Basin/Year [1]	1971-75	1976-80	1981-85	1986-90	1991-95	1996-00	2001-05 [2]	Entitlement [3]
Parker								
Agricultural	334,058	354,197	338,033	407,512	425,204	429,193	389,668	693,486
Industrial	0	0	0	0	0	0	0	0
Municipal	829	1,070	1,770	1,815	1,891	2,339	1,876	8,004
Environmental [4]	148	13,128	8,768	11,822	19,719	18,368	11,785	56,238
Lower Gila								
Agricultural [5]	309,367	209,015	258,612	312,237	241,267	278,826	260,818	272,980
Industrial	0	0	0	0	0	0	0	0
Municipal	2	5	6	7	19	62	80	265
Environmental [4]	40	59	22	743	1,800	1,773	665	6,262
Yuma								
Agricultural [4]	676,165	631,711	564,313	571,245	543,251	560,581	457,679	582,257
Industrial	1,046	1,021	839	610	469	2,250	674	1,772
Municipal	13,272	10,146	12,174	13,137	15,255	21,625	21,296	54,945
Environmental	0	0	0	0	0	0	0	0
TOTAL	1,334,927	1,220,352	1,184,538	1,319,126	1,248,876	1,315,019	1,144,541	1,676,209

Footnotes

1 Consumptive use for individual users may not cover an entire 5 year period, the average shown is based on the years of record.

2 In 2003, the United States Bureau of Reclamation (Reclamation) began deducting unmeasured return flows from the diversions by individual divertors. Prior to this time, Reclamation only deducted the total amount of unmeasured return flow from the total Lower Basin diversions.

3 The entitlement amounts do not include 72,000 acre-feet for the Ak-Chin (50,000 acre-feet) and Salt River-Pima Maricopa Indian (22,000 acre-feet) water rights settlements, which is delivered by the Central Arizona Project to reservations.

4 The Imperial National Wildlife Refuge spans the Parker and Lower Gila basins. Consumptive use has been prorated based on the percentage of the Refuge land area in each basin.

5 The Wellton-Mohawk Irrigation and Drainage District (IDD) spans the Lower Gila and Yuma basins. Consumptive use has been prorated based on the percentage of the Wellton-Mohawk IDD land area in each basin.

available for downstream consumptive use in the U.S. or in satisfaction of the Mexican Treaty obligation, and the consumptive use of such water. The Article V report lists diversions and return flow separately by diverter, point of diversion and state, for each of the lower basin states.

According to the Article V report, consumptive use of Colorado River water in the planning area for agricultural, municipal, industrial and environmental purposes averaged 1,144,541 acre-feet annually for the 2001-2005 time period out of a total annual entitlement of 1,676,209 acre-feet. The table shows the quantities of water diverted by surface water diversions, in-river pumps, or pumped from wells assumed to be located within the hydraulically connected aquifer of the Colorado River. When determining consumptive water use, the Article V accounting system considers measured return flow and estimates of unmeasured return flows to the mainstream.

Reclamation has made a preliminary delineation of the lateral and vertical extent of the Colorado River aquifer to provide a basis for accounting of withdrawals against river water allocations. On July 16, 2008, Reclamation proposed to develop a rule for Regulating Non-Contract Use of Colorado River Water in the Lower Basin (73 Federal Register 40916 et seq.) to prevent non-contract Colorado River water use from depleting the river and taking water from holders of Colorado River water entitlements. Reclamation's most current assessment indicates that most existing non-contract water use results from water withdrawn from wells located within the hydraulically connected aquifer of the Colorado River or from river pumps. The proposed rule would establish a methodology that Reclamation would use to determine if a well pumps Colorado River water and a process for a water user to appeal a subsequent finding (USBOR, 2008). As of October 2009, Reclamation had not adopted a rule.

Because of the complexity of the accounting system and its unique methodology that includes return flow and other considerations, the surface water and groundwater discussions in this overview section and the cultural water demand tables in sections 7.4, 7.5 and 7.11 (those basins that utilize this supply), reflect the amount of water pumped from wells and diverted from streams. This approach is comparable to that used for other planning areas. The tables do not attempt to distinguish whether the water is used pursuant to the entitlement system.

Entitlement Priority Levels

Rights to Colorado River water include the following several priority levels:

a. 1st Priority: Satisfaction of Present Perfected Rights as defined in the Arizona v. California decree;

b. 2nd Priority: Satisfaction of Secretarial Reservations and Perfected Rights established prior to September 30, 1968;

c. 3rd Priority: Satisfaction of entitlements pursuant to contracts between the United States and water users in Arizona executed on or before September 30, 1968 (2nd and 3rd priority are coequal);

d. 4th Priority: i) Contracts, Secretarial Reservations and other arrangements between the U.S. and water users in Arizona entered into after September 30, 1968, for a total quantity not to exceed 164,652 acre-feet of diversions annually and ii) contract No. 14-06-W-245, dated December 15, 1972, as amended, between the United States and the Central Arizona Project (CAP). Entitlements having a 4th priority as described in (i) and (ii) are coequal;

e. 5th Priority: Unused entitlement; and

f. 6th Priority: Surplus water.

In general, the lower priority entitlements will be the first to be impacted when the Secretary declares a shortage on the Colorado River system. Within the planning area, entitlement holders with a 1st Priority or Present Perfected Rights include the Cocopah Indian Reservation, Colorado River Indian Tribes Reservation, Fort Yuma Indian Reservation, Yuma County Water Users' Association, North Gila Valley Irrigation District, Unit "B" Irrigation and Drainage District, the City of Yuma and the Town of Parker. 2nd and 3rd priority entitlement holders (which are coequal), include the Ak-Chin Indian Community, Imperial and Cibola National Wildlife Refuges, Yuma Proving Grounds, the Marine Corps Air Station–Yuma, Wellton-Mohawk Irrigation and Drainage District and others. Information on Colorado River entitlements in the Lower Colorado River Planning Area is provided in Appendix C. Entitlements may be transferred under certain conditions. Within the planning area, the Cibola Valley Irrigation and Drainage District has assigned a portion of its entitlement to the Mohave County Water Authority (MCWA, 5th and/or 6th), to the Hopi Tribe (Priority 4t^{h}, 5th and 6th) and to Cibola Resources for municipal use at Ehrenberg. More information on entitlement transfers is in Appendix D.

Coordinated Operations and Shortage Criteria

In December 2007, Reclamation issued a Record of Decision (ROD) on interim operating criteria (2008-2026) including the coordinated operation of Lake Powell and Lake Mead and criteria for implementing shortage reductions in the Lower Basin. Historically, the reservoirs were operated independently; annual Lake Powell water releases were determined based on applicable law and relevant factors contained in the Long-Range Operating Criteria. The ROD adopted four key elements: 1) establishes rules for shortages; 2) allows coordinated operation of Lake Powell and Lake Mead to avoid Lower Basin shortages and avoid curtailment of Upper Basin water use; 3) establishes rules for surpluses; and 4) address ongoing drought by encouraging new initiatives for water conservation. If regional drought conditions continue, shortage operations could begin as early as 2011. The ROD could have implications for water supply availability in the planning area.

<u>Colorado River Water Supply Distribution System</u>

In the Lower Colorado River Planning Area, dams on the Colorado River were constructed primarily for the purpose of regulating river flow and creating storage to facilitate water diversions to Arizona, California and Mexico via canals pursuant to decrees, international treaties and other legal agreements. Figure 7.0-14 shows the location of major dams, water delivery and diversion structures, and other features along the Colorado and Gila Rivers in the planning area. The agricultural and municipal water delivery systems are discussed in the cultural water demand section (7.0.7). The Colorado River system is described briefly below, from north to south.

Parker Dam

Parker Dam, at the northern edge of the planning area in the Parker Basin, is a concrete arch structure 320 feet high and 856 feet long at its crest. It is the deepest dam in the world with 73 percent of its structural height below the original riverbed. Completed in 1938, it impounds Lake Havasu and provides a desilting basin and forebay for diversion of Colorado River water. The Metropolitan Water District of Southern California pumps water into its Colorado River Aqueduct from the forebay, conveying it 242 miles west to Lake Mathews near Riverside, California. On the Arizona side, water is pumped from the forebay into the CAP canal for use in central Arizona. (USBOR, 2007c) The dam includes a powerplant that is integrated with the Davis and Hoover powerplants, providing power to Arizona and southern California. The powerplant is remotely operated from the Hoover Control Center. (USBOR, 2006)

Parker Dam. Water is pumped to canals for use in both California and Arizona from the dam's forebay.

Headgate Rock Dam

Downstream of Parker Dam, irrigation water for the CRIT near Parker is diverted at Headgate Rock Dam. This dam was constructed in 1942 to stabilize the river channel and provide reliable irrigation supplies. (USBOR, 2007d) A levee system protects areas downstream from flooding.

Palo Verde Diversion Dam

Palo Verde Diversion Dam is located about 44 miles downstream of Headgate Rock Dam. It maintains a sufficiently high, constant water surface elevation at the Palo Verde Irrigation District canal headwork for delivery of irrigation water to the west side of the Colorado River near Blythe, California. The dam is a semipervious barrier of sand, gravel and rockfill, 46 feet high and 1,850 feet long. (USBOR, 2007e)

Senator Wash Dam

Senator Wash Dam and Reservoir is an off-stream pumping facility located on the California side of the river about two miles upstream from Imperial Dam. This structure improves water scheduling by downstream users by storing part of the riverflow upstream of Imperial Dam when it is not needed, releasing it to the river for downstream use when needed.

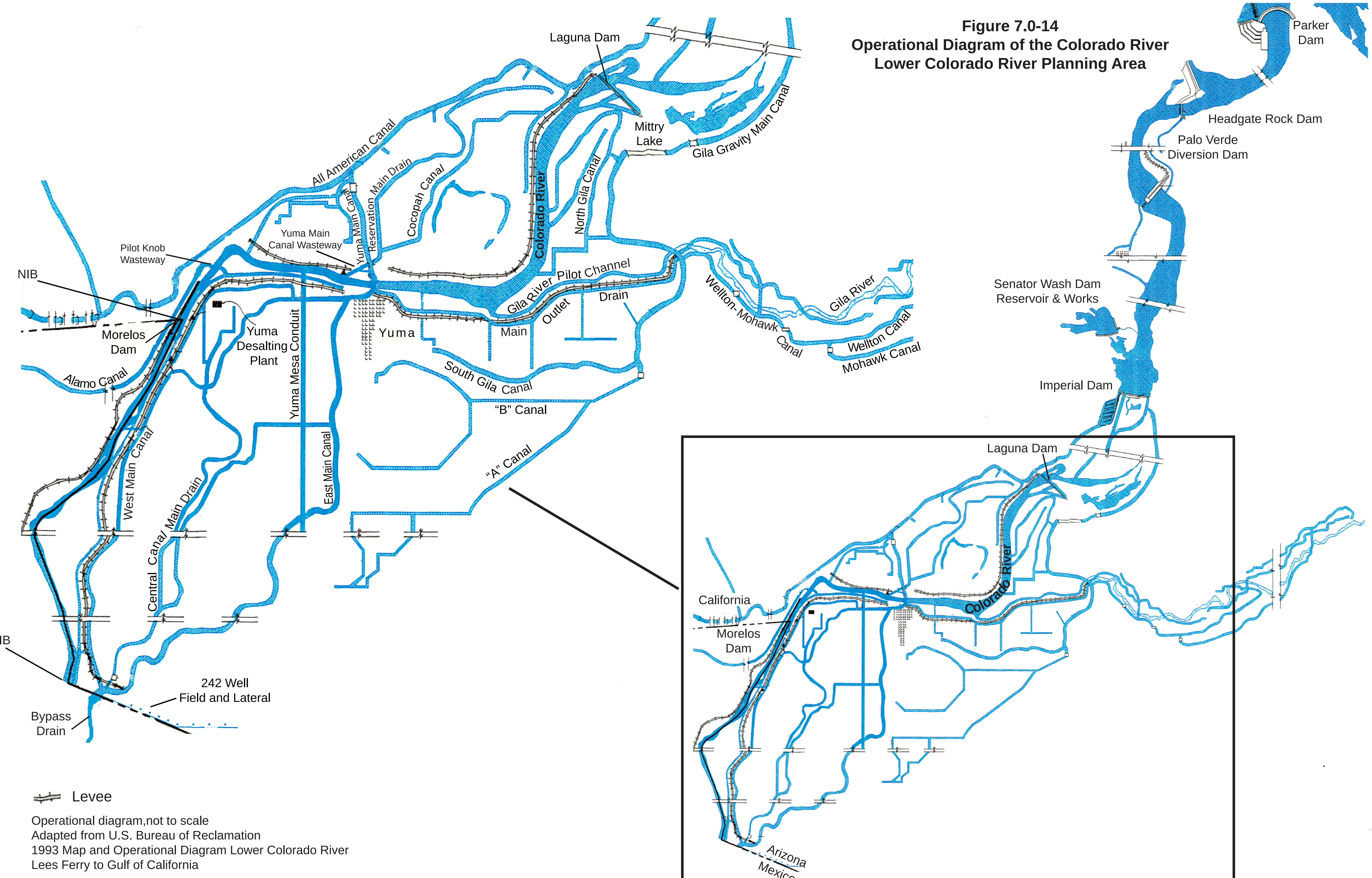


Figure 7.0-14
Operational Diagram of the Colorado River
Lower Colorado River Planning Area

Operational diagram,not to scale
Adapted from U.S. Bureau of Reclamation
1993 Map and Operational Diagram Lower Colorado River
Lees Ferry to Gulf of California

Without the dam it would take three days for water released at Parker Dam to reach Imperial Dam. The dam is an earth embankment structure 2,342 feet long with a height of about 94 feet. Other works include three dikes, a spillway and a pumping plant. (USBOR, 2007d)

Imperial Dam

Imperial Dam is a major diversion point for both Arizona and California. The dam raises the water surface about 25 feet, allowing controlled gravity flow into the All American Canal and the Gila Gravity Main Canal. The All American Canal system diverts water from the California side of the dam and serves Imperial Irrigation District, Coachella Valley Water District, the Yuma Project in Arizona and California, and the City of Yuma. The Gila Gravity Main Canal system diverts water from the Arizona side of the dam and serves the north and south Gila Valley, Yuma Mesa, and the Wellton-Mohawk Irrigation District area. Imperial Dam is also used to regulate water deliveries to Mexico required by international treaty. (USBOR, 2007b)

Laguna Dam

From Imperial Dam to the Northerly International Boundary between the U.S. and Mexico, the entire channel of the Colorado River is bounded by a system of levees. Laguna Dam, located five miles downstream of Imperial Dam serves as a regulating structure for Colorado River water. (USBOR, 2007b) Because of upstream diversions and dams, from Laguna Dam to Morelos Dam the river consists of a small active channel located within a broad, older riverbed entrenched below the historic level of the unregulated river (USBOR, 2007d).

Yuma Desalting Plant, Main Outlet Extension and Bypass Extension

Utilizing Colorado River water for domestic and agricultural purposes has steadily increased the salinity of its waters. In the 1960s crops in the Mexicali Valley were damaged by the high

Yuma Desalting Plant.

salinity of the Colorado River water used for irrigation. An amendment to the 1944 treaty with Mexico (Minute 242) guaranteed that the treaty water delivery would be no more than 115 ppm (+/- 30 ppm) more saline than the water diverted at Imperial Dam.

Nine miles downstream from Laguna Dam the Gila River enters the Colorado. Along the Gila River, extensive agricultural irrigation with Colorado River water in the Wellton-Mohawk Irrigation and Drainage District (WMIDD) has made it necessary to install drainage wells to pump excess irrigation water to keep salts from accumulating in the root zone. About 120,000 acre-feet of brackish groundwater is pumped annually. If this water was directly returned to the river it would increase salinity levels above the international treaty standard and could not be counted towards Mexico's Colorado River apportionment of 1.5 million AFA.

To desalinate the drainage water so that it could be returned to the mainstem and counted toward the apportionment, Reclamation constructed the Yuma Desalting Plant (YDP). Completed in 1992, the YDP is designed to treat up to 96,000 AFA. It operated briefly in 1993 and was then put on standby status until a 90-day demonstration run in 2007. Currently, WMIDD drainage water is discharged to the Main Outlet Drain Extension (MODE) and its bypass extension in Mexico and delivered to the Santa Clara Slough (Cienega de Santa Clara). (WMIDD, 2004)

To desalinate the drainage water so that it could be returned to the mainstem and counted toward the apportionment, Reclamation constructed the Yuma Desalination Plant (YDP). Completed in 1992, the YDP is designed to treat up to 96,000 AFA. It operated briefly in 1993 and was then put on standby status until a 90-day demonstration run was conducted in 2007. Currently, Wellton-Mohawk Irrigation and Drainage District (WMIDD) drainage water is discharged to the Main Outlet Drain Extension and its bypass extension in Mexico and delivered to the Santa Clara Slough (Cienega de Santa Clara). (WMIDD, 2004) In May 2010, a year-long pilot run of the YDP at one-third capacity is scheduled to begin. The purpose of the pilot run is to assess the suitability of the treatment process and define its long-term design. The pilot run will include a monitoring program that evaluates impacts to the wildlife and habitat associated with the Cienega.

California and Pilot Knob Wasteways

Four miles downstream from the mouth of the Gila River, the Yuma Main Canal wasteway returns water to the river to comply with the treaty obligation to Mexico. In addition, a portion of the water scheduled to be delivered to Mexico is diverted at Imperial Dam, conveyed by the All American Canal, and returned to the river through the Pilot Knob Wasteway west of Yuma. (USBOR, 2007b)

Northerly International Boundary (NIB) to Southerly International Boundary (SIB)/ Morelos Dam

The 23.7 mile long reach of the Colorado River between the NIB and the SIB is referred to as the limitrophe section. Levees have been constructed on both sides of the river. About 1.1 miles downstream of the NIB, Morelos Diversion Dam acts as a diversion control structure for the Alamo Canal, which conveys water to Mexico. Other infrastructure includes wasteways, bypass channel, levees, etc. (USBOR, 2007b) Below Morelos Dam. River flow is reduced in this section due to diversions by Mexico into the Alamo Canal and because the channel is overgrown with vegetation. In addition, sediment buildup around the spillway has caused loss of dam function. As a result, the flood capacity of the channel has been reduced, posing a threat to the safety of the Valley Division of the Yuma Project. (USBOR, 2007d)

242 Well Field and Lateral

Title I of the Colorado River Basin Salinty Control Act authorized the Protective and Regulatory Pumping Unit, consisting of the 242 well field and lateral. The unit is located east of San Luis in a 5-mile wide protected and regulated zone consisting of 35 wells, the 242 Lateral and other connecting laterals (Figure 7.0-21). The well field intercepts part of the groundwater flow, including irrigation drainage water that moves south into Mexico from the Yuma Mesa. Water pumped from the well field is delivered at the SIB to Mexico through the 242 Lateral and other laterals to meet international treaty obligations for Colorado River water deliveries. (USBOR, 2007a)

Central Arizona Project Water

Colorado River water is withdrawn at Lake Havasu at the Mark Wilmer Pumping Plant into the Central Arizona Project Aqueduct system. It crosses the Parker, Ranegras Plain and Harquahala basins via the Hayden-Rhodes Aqueduct to the CAP service area in central Arizona (Maricopa, Pima and Pinal counties).

CAP water is used both directly and stored underground in the planning area pursuant to the Department's Recharge Program. Storage facilities in the planning area are listed on Table 7.0-7. The Vidler Water Company Underground Storage Facility (USF) is located near Centennial in the Harquahala Basin where it is permitted to recharge up to 100,000 acre-

Table 7.0-7 Storage facilities in the Harquahala Basin

Permit Type/No. (Duration)	Permit Holder	Project Description	Associated Water Storage Permit No's (Permit Holder)
USF 71-576699.0004 (09/03/04 to 09/30/20)	Vidler Water Storage Company	Annual recharge up to 100,000 acre-feet of CAP water via basins and vadose zone wells.	73-576699.01 (Vidler) 73-576699.02 (AWBA)
GSF 72-593304.0000 (03/06/06 to 03/06/11)	Harquahala Valley Irrigation District	Indirect recharge up to 50,000 acre-feet per annually of uncontracted CAP water.	73-593304 (AWBA)

feet of CAP water annually. Harquahala Valley Irrigation District (HVID), located in the southern part of the Harquahala Basin holds a groundwater savings facility permit (GSF). It receives excess (uncontracted) CAP water which it uses "in-lieu" of groundwater. The Arizona Water Banking Authority (AWBA) holds water storage permits to store excess CAP water at both facilities. HVID has been using CAP water since 1986 and it has replaced groundwater as the major water supply in the basin. As a result of this storage and direct use, groundwater levels have risen in the vicinity of Vidler and HVID. A long-term storage account was established for the McMullen Valley Water Conservation & Drainage District (Vicksburg Farms) in 2000 in anticipation of the accrual of long term storage credits from storage of CAP water via two injection wells. However, a water storage permit was never issued and no water has been stored.

Surface Water

The Gila River in the Gila Bend Basin is the only major surface water supply in the planning area in addition to the Colorado River. The river is intermittent or ephemeral in the planning area and the volume available for use is a mixture of upstream releases of water from dams, storm runoff from precipitation events, irrigation return flows and effluent flows from the 23rd Avenue and 91st Avenue Wastewater Treatment Plants (WWTPs) located in the Phoenix AMA. The 91st Avenue WWTP, located near the confluence of the Salt, Gila and Agua Fria Rivers, has a current treatment capacity of 179 mgd (over 200,000 AFA). In typical years, most if not all water in this reach of the river is wastewater effluent (ADWR, 1994a). An average of 54,000 AFA of this water supply is used for irrigation in the basin.

Legal availability of a surface water supply is also an important consideration. The following discussion applies to non-Colorado River surface water. As described in detail in Appendix E, the legal framework and process under which surface water right applications and claims are administered and determined is complex. Rights to surface water are subject to the doctrine of prior appropriation which is based on the tenet "first in time, first in right". This means that the person who first put the water to a beneficial use acquires a right that is superior to all other surface water rights with a later priority date. Under the Public Water Code, beneficial use is the basis, measure and limit to the use of water. Each type of surface water right filing is assigned a unique number as explained in Appendix E and shown in Table 7.0-8. On the other hand, the act of filing a statement of claim of rights to use public waters (36) does not in itself create a water right. A Certificate of Water Right (CWR) may be issued if the terms of the permit to appropriate water (3R, 4A, or 33, and in certain cases 38), are met. CWRs retain the original permit application number.

Surface water rights may also be determined through judicial action in state or federal court in which the court process establishes or confirms the validity of the rights and claims and ranks them according to priority. Court decreed rights are considered the most certain surface water right. A court decree, Arizona v. California 373 U.S. 546 (1963), confirmed the apportionment of waters from the mainstem of the Colorado River to the Lower Basin States, set Arizona's allotment of Colorado River water at 2.8 maf and reserved irrigation water for reservations along the river including the CRIT, Cocopah and Quechan (Fort Yuma) reservations in the planning area.

Arizona has two general stream adjudications in progress to determine the nature, extent and priority of water rights across the entire river systems of the Gila River and the Little Colorado River. The adjudications will recognize existing water right settlements and decrees (see discussion below) and adjudicate all remaining water rights claims in the river systems. Pertinent to the Lower Colorado River Planning Area, the Gila River Adjudication is being conducted in the Superior Court of Arizona in Maricopa County. The Gila Adjudication was initiated by petitions filed by several parties in the 1970's, including Salt River Project, Phelps Dodge Corporation and the Buckeye Irrigation Company. The petitions were consolidated in 1981 into a single proceeding. The Gila Adjudication includes seven adjudication watersheds - Upper Salt, San Pedro, Agua Fria, Upper Gila, Lower Gila, Verde, and Upper Santa Cruz. Only the Lower Gila Adjudication Watershed is within the planning area boundaries (see Figure 7.0-15). This watershed includes all of the Gila Bend, McMullen Valley and Tiger Wash basins,

Table 7.0-8 Inventory of surface water right and adjudication filings in the Lower Colorado River Planning Area[1]

Basin	Type of Filing							Total
	BB[2]	3R[3]	4A[3]	33[3]	36[4]	38[5]	39[6]	
Butler Valley	0	0	4	0	15	8	0	**27**
Gila Bend	0	0	5	16	26	23	343	**413**
Harquahala	0	1	2	8	35	46	332	**424**
Lower Gila	0	1	11	25	104	57	845	**1,043**
McMullen Valley	0	23	11	18	78	136	484	**750**
Parker	0	0	9	6	37	5	0	**57**
Ranegras Plain	0	0	4	4	6	15	0	**29**
San Simon Wash	0	0	0	3	11	5	0	**19**
Tiger Wash	0	0	2	3	4	9	30	**48**
Western Mexican Drainage	0	0	0	1	1	0	0	**2**
Yuma	0	1	0	2	38	0	289	**330**
Total	**0**	**26**	**48**	**86**	**355**	**304**	**2,323**	**3,142**

Notes:

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

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

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

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

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

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

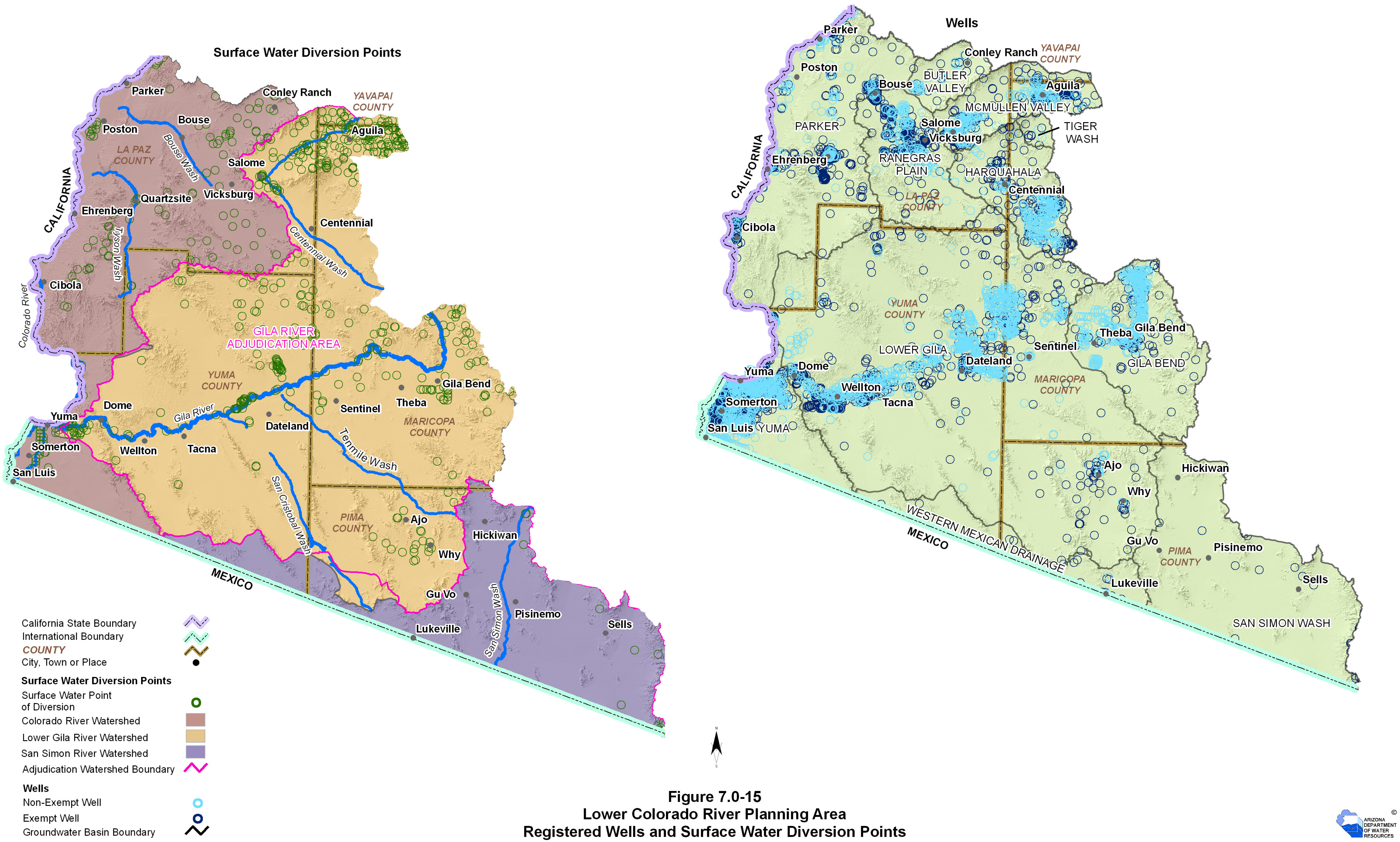


Figure 7.0-15
Lower Colorado River Planning Area
Registered Wells and Surface Water Diversion Points

most of the Lower Gila and Harquahala basins and a small part of the Yuma Basin. These watersheds do not coincide with the 6-digit HUC watersheds discussed previously and shown in Figure 7.0-5. The entire Gila Adjudication includes over 24,000 parties.

Table 7.0-8 summarizes the number of surface water right filings in the planning area. The methodology used to query the Department's surface water right and statement of claimant (SOC) registries is described in Appendix E. Of the 3,142 filings that specify surface water diversion points in the planning area, 108 CWRs have been issued to date. Most of these (46) are located in the McMullen Valley Basin. Figure 7.0-15 shows the general location of surface water diversion points listed in the Department's surface water rights registry. The numerous points reflect the large number of stockponds and reservoirs that have been constructed in the planning area as well as diversions from streams and springs. Locations of registered wells, many of which are referenced as the basis of claim in SOCs are also shown in Figure 7.0-15.

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

Groundwater

In basins without access to Colorado River or CAP water, groundwater is the primary water supply. Groundwater is an abundant and dependable water supply throughout the planning area with relatively large volumes of groundwater in storage and high well yields in many basins. Well yields typically exceed 1,000 gpm, and often exceed more than 2,000 gpm. In groundwater dependent basins, estimates of water in storage are as high as 61 maf in the Gila Bend Basin, 15 maf in the McMullen Valley Basin and 27 maf in the Ranegras Plain Basin. However, groundwater levels declined in many of these basins between 1990-'91 and 2003-'04. During this period, water levels declined by more than 30 feet in several wells in the northern part of the Gila Bend Basin, in wells near Salome-Wenden in the McMullen Valley Basin and in the central part of the Ranegras Plain Basin (see Figures 7.2-6, 7.5-5 and 7.7-5). There are widespread occurances of fluoride and arsenic levels in groundwater that equal or exceed drinking water standards and high salinity levels in many agricultural areas. As mentioned previously, importation of Colorado River water to areas in the Lower Gila and Yuma basins has locally raised groundwater levels and changed groundwater flow directions, requiring drainage wells and exportation of groundwater out of the basins.

In general, the Groundwater Transportation Act of 1991 restricts the transportation of groundwater from non-AMA groundwater basins to AMAs. However, there are three basins in the planning area from which groundwater may be withdrawn and transported outside of the basin: Butler Valley, Harquahala and McMullen Valley. General statutory provisions governing

McMullen Valley Basin. Groundwater an abundant and dependable water supply throughout the planning area with relatively large volumes of groundwater in storage and high well yields in many basins.

groundwater transportation from these basins are discussed below. Withdrawal and transportation of groundwater may cause groundwater level declines and impact the groundwater supply available for use within the basins.

Pursuant to A.R.S. § 45-553, groundwater may be withdrawn from the Butler Valley Basin and transferred to an initial AMA from State land or land owned by a political subdivision of the State (e.g. counties, cities and special districts). There are no limits on the volume of groundwater that may be transported from the basin.

Groundwater may be withdrawn from historically irrigated lands in the McMullen Valley Basin that were owned by a city or person prior to January 1, 1988 and transported to the Phoenix AMA. (A.R.S. § 45-552) Qualified groundwater importers are cities, towns, private water companies and replenishment districts for their use or use by the AWBA. The City of Phoenix owns 14,000 acres of agricultural lands in the basin. The annual volume that may be withdrawn is limited to an average of 3 acre-feet per irrigated acre with a total limit of 6 maf. If this water is used for an assured water supply demonstration in an AMA, only water withdrawn above 1,000 feet below land surface (bls) at a rate not to exceed 10 feet per year over the 100 year period will be considered.

In the Harquahala Basin, A.R.S. § 45-552 allows the transportation of groundwater pumped from historically irrigated lands owned by a political subdivision of the state and transported for its use in an AMA or use by the AWBA. The volumetric limit is 6 acre-feet per acre per year or 30 acre-feet per acre for any period of ten consecutive years. The director of ADWR may establish an alternative volume as long as it will not unreasonably increase damage to residents and other water users. Groundwater may not be withdrawn below 1,000 feet bls nor at a rate that cause declines of more than an average of ten

Agriculture and power plant in the Harquahala Basin. in general the transportation of groundwater from non-AMA groundwater basins to AMAs is restricted. However, there are three basins in the planning area from which groundwater may be withdrawn and transported outside of the basin: Butler Valley, Harquahala and McMullen Valley.

feet per year during the one hundred year evaluation period. The City of Scottsdale has applied to the Department to export 3,645.24 acre-feet of groundwater per year from 1,215.08 acres of historically irrigated lands in the Harquahala Basin. This application is currently still under review.

The Department's Groundwater Site Inventory (GWSI) database, the main repository for statewide groundwater well data, is available on the Department's website (www.azwater.gov). The GWSI database includes records for over 42,000 wells and over 210,000 ground-water level measurements statewide. GWSI contains spatial and geographical data, owner information, well construction and well log data, and historic groundwater data including water level, water quality, well lift and pumpage records. Included are hydrographs for statewide Index Wells and Automated Groundwater Monitoring Sites (Automated Wells), which can be searched and downloaded to access local information for planning, drought mitigation and other purposes. Approximately 1,700 wells have are designated as Index Wells statewide out of over 43,700 GWSI sites. (GWSI sites are primarily well sites but include other types of sites such as springs and drains). Typically, Index Wells are visited once each year by the Department's field staff to obtain a long-term record of ground water level fluctuations. Approximately 200 of the GWSI sites are designated as Automated Wells. These systems measure water levels 4 times daily and store the data electronically. Automated groundwater monitoring sites are established to better understand the water supply situation in areas of the state where data are lacking. These devices are located based on areas of growth, subsidence, type of land use, proximity to river/stream channels, proximity to water contamination sites or areas affected by drought.

Volume 1 of the Atlas shows the location of Index Wells and Automated Wells as of January 2009. At that time there were a total of 167 Index Wells and eight ADWR automatic water-level sites in the planning area located in the Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley and Ranegras Plain basins. Index wells are located in all basins except for San Simon Wash, most of which is covered by the Tohono O'odham Indian Reservation. Updated well maps may be viewed at the Department's website.

Information on major aquifers, well yields, estimated natural recharge, estimated water in storage, aquifer flow direction, and water level changes are found in groundwater data tables, groundwater conditions maps, hydrographs and well yield maps for each basin in Sections 7.1-7.11.

Automated well in the Harquahala Basin.

Effluent

Effluent, or reclaimed water, is a little used resource in the planning area with less than 700 acre-feet used annually as a partial water supply for six golf courses in the Yuma Basin and one golf course in the Parker Basin. Golf course irrigation demand is higher in the summer, but effluent production is higher in the winter when the area population increases due to winter visitors. The water supply at Foothills Executive, Foothills Par 3 and Las Barrancas Golf Courses is about 90% effluent in the winter and 90% groundwater in the summer (personal communication, T. Holyk, 11/07). Effluent discharged to the Gila River from the Phoenix AMA is an agricultural water supply in the Gila Bend Basin, but the precise volume used is not quantified.

Approximately 16,300 acre-feet of wastewater is treated in the planning area, and 79% of that (12,800 acre-feet) is generated in the Yuma Basin. Approximately 153,000 people or 79% of the total planning area population is served by a sewer system. Most of this potential water supply is discharged to evaporation ponds or to infiltration basins after treatment. A number of basins including: Butler Valley, Harquahala, McMullen Valley, Ranegras Plain, and Tiger Wash, have no record of a wastewater treatment plant. Use of septic tanks appears to be widespread throughout the entire planning area.

Contamination Sites

Sites of environmental contamination may impact the use of some water supplies. An inventory of Department of Defense (DOD), Resource Conservation and Recovery Act (RCRA), Superfund (Environmental Protection Agency designated sites), Water Quality Assurance Revolving Fund (state designated WQARF sites), Voluntary Remediation Program (VRP) and Leaking Underground Storage Tank (LUST) sites was conducted for the planning area. Of these various contamination sites, LUST, DOD, Superfund, WQARF and VRP sites are found in the planning area. Table 7.0-9 lists the contaminant and affected media and the basin location of all but the LUST sites. The location of all contamination sites in the planning area is shown on Figure 7.0-16.

Seven active VRP sites are located in the planning area and all but one is in the Yuma Basin. All are sites of organic compound contamination such as petroleum and pesticide products. The VRP is a state administered and funded voluntary cleanup program. Any site that has soil and/or groundwater contamination, provided that the site is not subject to an enforcement action by another program, is eligible to participate. To encourage participation, ADEQ provides an expedited process and a single point of contact for projects that involve more than one regulatory program (Environmental Law Institute, 2002).

Two WQARF sites and one Superfund site exist in the Yuma Basin. All sites involve Trichloroethylene (TCE) and Tetrachloroethene (PCE) contamination. The Tyson Wash WQARF Site is located between Tyson Wash and Highway 95 north of Business Route 10 in Quartzsite. Contamination was detected in 1993 and a groundwater monitoring program began in 1995 to further investigate the extent of contamination. The upper aquifer, located about 42 to 65 feet bls, has been affected. Water is being pumped and treated on site and injected back into the aquifer. (ADEQ, 2005a) The 20th Street and Factor WQARF Site is located in Yuma and also has cyanide contamination. Formerly the site of a motion picture laboratory and photo equipment manufacturer, wastewater was treated to recover silver and then discharged to a sump and disposal pond, to the ground, and used for landscape irrigation. Remedial actions at this site include soil removal and investigations to define the extent of a groundwater contamination plume. (ADEQ, 2007a) The Yuma Marine Corps Air Station (YMCAS) Superfund site, located at Yuma, involves multiple contaminants in groundwater as a result of disposal of materials related to military activities. Remedial actions include vertical recirculation of groundwater to contain and treat areas of relatively low contaminant concentrations, and air sparging/soil vapor extraction to treat the Area 1 Hot Spot (Source) Plume area (ADEQ, 2007b).

The Yuma Army Proving Ground DOD site is located northeast of Yuma and was first used as a military training facility during WWII. Later it became a site for testing of equipment under desert conditions. Groundwater contamination has occurred from the possible release of half a million gallons of fuel and from other actions. Environmental investigations and cleanup activities are underway and most of the contaminated areas are fenced. (ADEQ, 2007c)

There are 213 active LUST sites in the planning area. One hundred eight sites are located at Yuma, 22 at Gila Bend, 18 at Quartzsite, 13 each at Parker and Ehrenberg, and ten sites or less at Somerton, Vicksburg, Wellton, Salome, Lukeville, Tacna and Centennial Wash.

Table 7.0-9 Contamination sites in the Lower Colorado River Planning Area

SITE NAME	MEDIA AFFECTED AND CONTAMINANT	GROUNDWATER BASIN
Voluntary Remediation Program Sites		
Adair Memorial Park	Soil/Lead	Yuma
APS Yuma Manufactured Gas Plant (MGP)	Soil/Hydrocarbons, Polycyclic aromatic hydrocarbons (PAHs) and Volatile Organic Compounds(VOCs)	Yuma
Chevron Ajo Bulk Plant	Soil & Groundwater/Total Petroleum Hydrocarbons (TPH) and Benzene, Toluene, Ethyl benzene, and Xylene (BTEX)	Lower Gila
KMEP-Yuma Marine Corps Air Station	Soil & Groundwater/Total Petroleum Hydrocarbons (TPH); BTEX; and PAHs	Yuma
Union Pacific Railroad Former AZ Agrochemical Facility	Soil/Pesticides	Yuma
Union Pacific Railroad Yuma Yard Dieselville	Soil & Groundwater/TPH and BTEX	Yuma
Western Farm Service-Yuma Plant	Soil & Groundwater/Toxaphene dieldrin, Dichloro diphenyl trichloroethane (DDT), Dichloro diphenyl dichloroethane (DDD), Dichloro diphenyl dichloroethylene (DDE), Endrin heptachor epoxide disulphate and Nitrate	Yuma
Water Quality Assurance Revolving Fund (WQARF) Sites		
20th Street and Factor Avenue	Soil & Groundwater/Tetrachloroethene (PCE) and Cyanide	Yuma
Tyson Wash	Groundwater/ PCE and Tricholoroethene (TCE)	Yuma
National Priority List (NPL) Superfund Sites		
Yuma Marine Corps Air Station	Soil & Groundwater/TCE, Dichloroethene (DCE), PCE and Petroleum Hydrocarbons	Yuma
Department of Defense (DOD) Sites		
Yuma Army Proving Grounds	Soil & Groundwater/Hydrocarbons, Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOCs) and Metals	Lower Gila

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

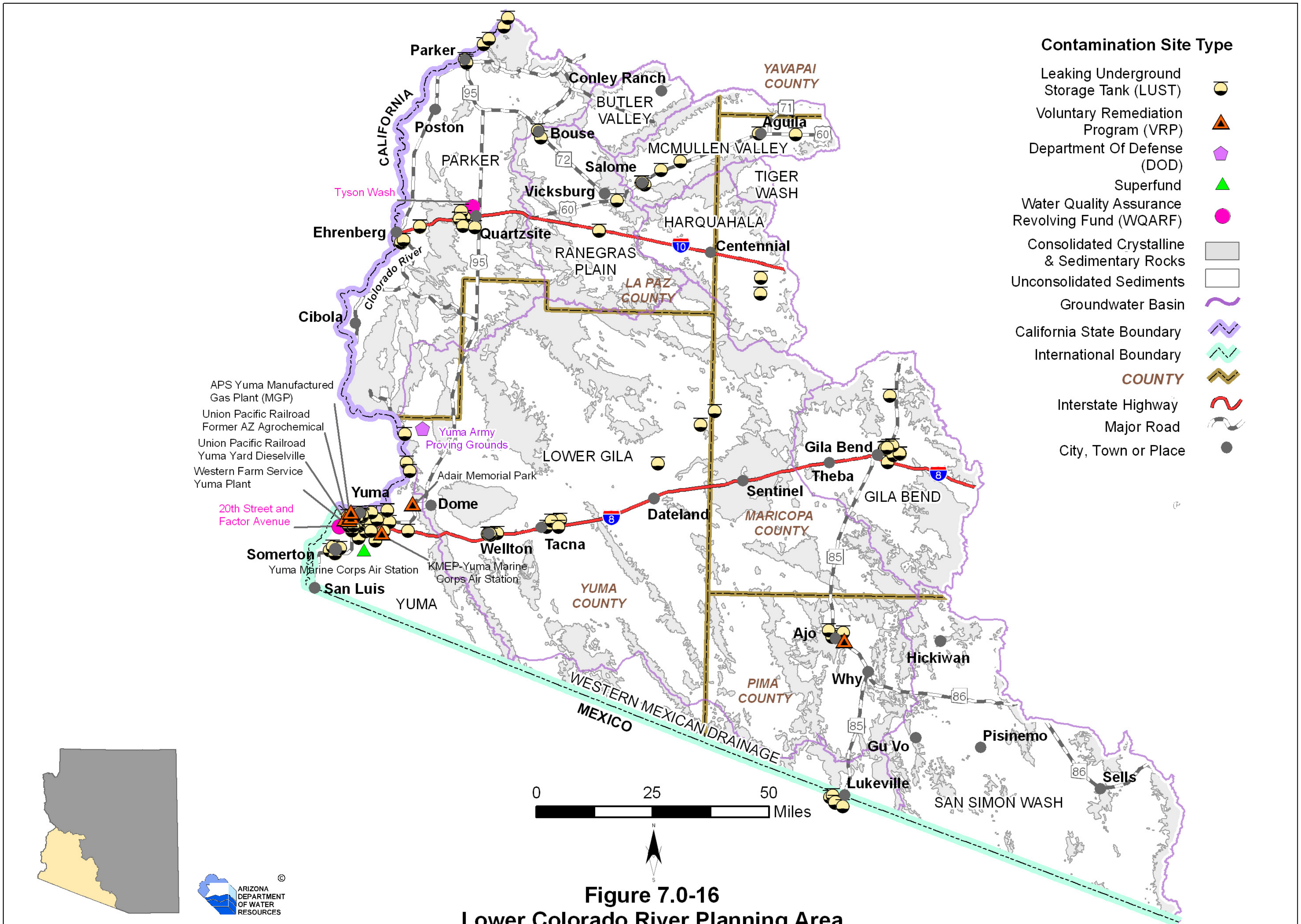


Figure 7.0-16
Lower Colorado River Planning Area
Contamination Sites

7.0.7 Cultural Water Demand

Cultural water demand in the Lower Colorado River Planning Area, organized by water source and water demand sector, is shown in Table 7.0-10. Total cultural water demand averaged approximately 2,899,700 AFA during the period from 2001-2005. Almost 98% of this demand is by the agricultural sector with approximately 2,835,100 acre-feet of annual demand. Agricultural demand occurs in all of the basins with the exception of Tiger Wash and Western Mexican Drainage basins. About 66% of the agricultural demand is met by surface water of which all but 3% is Colorado River water. Municipal demand averaged 51,000 AFA during the period 2001-2005. Municipal demand is primarily met by Colorado River water and the municipal sector is the only sector that utilizes effluent. Industrial demand, primarily related to dairies and feedlots, averaged 13,560 AFA during this period. Tribal water demand is included in these totals. As shown on Figure 7.0-17, cultural demand volumes vary substantially between planning area basins.

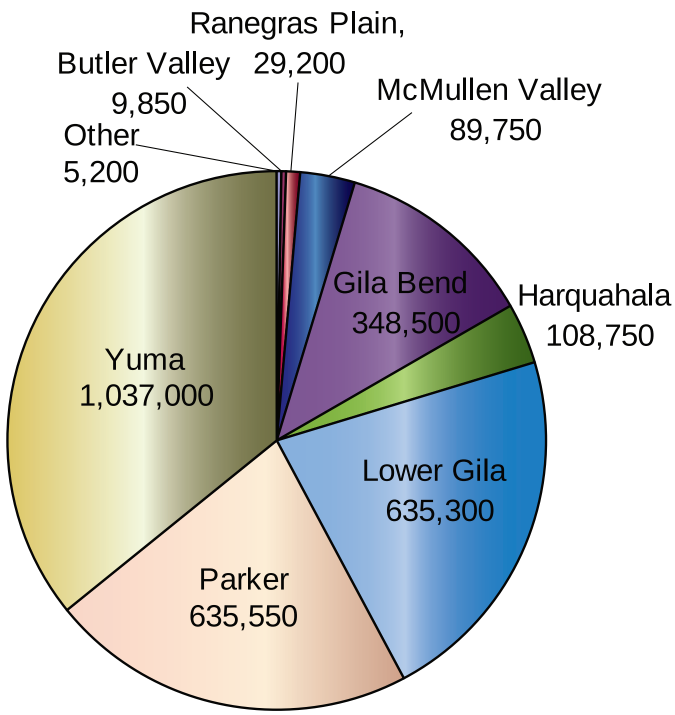
Tribal Water Demand

Tribal lands in the planning area include the Cocopah, CRIT, Fort Yuma-Quechan, Gila Bend and the Tohono O'odham reservations. The Cocopah, Fort Yuma-Quechan and CRIT hold Priority 1 Colorado River entitlements totaling 677,573 AFA. The CRIT entitlement is 662,402 acre-feet, the largest in the state and about a third of the state's non-CAP entitlement. By comparison, the total non-tribal Priority 1 entitlement in the planning area is 290,923 acre-feet. Annual tribal demand is approximately 658,000 AFA, most of which is agricultural irrigation on the CRIT Reservation in the Parker Basin. Almost the entire San Simon Wash Basin is within Tohono O'odham Reservation boundaries.

Table 7.0-10 Lower Colorado River Planning Area average cultural water demand by sector (2001-2005)

Water Source/ Demand Sector	Acre-feet	Percent
Groundwater		
Agricultural	935,700	32.27%
Municipal	17,400	0.60%
Industrial	11,570	0.40%
Surface Water		
Agricultural	1,899,400	65.50%
Municipal	33,000	1.14%
Industrial	1,990	0.07%
Effluent		
Municipal	680	0.02%

Figure 7.0-17 Average Annual Basin Water Demand, 2001-2005 (in acre-feet)



<u>Cocopah</u>

The Cocopah Reservation is entirely within the Yuma Basin. The reservation has about 1,000 tribal members and consists of three parcels (East, West and North Cocopah) located south of Yuma. The tribe has approximately 2,400 acres of land under irrigation, leased to non-tribal farmers. The tribe operates a casino and a number of community facilities. (ITCA, 2003)

There is no tribal water utility but the Cocopah Environmental Protection Office tests the quality of domestic wells and monitors agricultural water use to ensure that the tribe does not exceed its annual Colorado River allocation. This office also conducts weekly monitoring of groundwater levels and Colorado River water quality within the limitrophe region that crosses the boundaries of the West Reservation. (Cocopah Indian Tribe, 2006) The tribe's Colorado River entitlement is 8,821 AFA of Priority 1 rights and 2,026 acre-feet of Priority 4 entitlement for areas south of Morelos Dam.

Fort Yuma-Quechan

The Fort Yuma-Quechan Reservation is located primarily in California. Only 4% of the reservation land is in Arizona with about 45 residents located just east of Yuma in the Yuma Basin. Tribal offices, RV parks and two casinos are also located in Arizona. The tribe owns a 700-acre farm which is leased to a non-Indian farmer. Some of this farm is apparently located in Arizona (ITCA, 2003).

Colorado River Indian Tribes

Most of the CRIT Reservation is located in Arizona in the Parker Basin with a small portion in California. The Colorado River Indian Tribes include the Mohave, Chemehuevi, Hopi and Navajo, and consist of about 3,500 active tribal members. The primary tribal community is Parker, which contains non-tribal lands and Poston with about 400 tribal residents. The CRIT operate the CRIT Regional Water System (CRIT, 2005) and the CRIT Water Department serves the area outside the Parker Town limits. Tribal municipal demand is relatively small.

The primary economic activity on the reservation is agriculture. Pursuant to Arizona v. California, 99,375 acres of irrigated land were decreed with an associated annual Colorado River entitlement of 662,402 acre-feet. According to the 2006 Lower Colorado Accounting System, actual irrigated lands in Arizona totaled 72,610 acres, including land irrigated by lessees. The amount of irrigated acreage in Arizona reportedly averages between 72,000 to 80,000 acres. CRIT Farms manages over 15,000 acres of alfalfa, cotton, durum wheat and other crops (CRIT, 2005).

Other economic activities on the reservation include recreation, gaming, governmental services and light industry. The tribe operates two sand and gravel facilities, one at Parker and one north of Ehrenberg. These facilities supply concrete ready mix, asphalt and sand and gravel products to La Paz County and to neighboring counties in California. (CRIT, 2005)

Tohono O'odham

Water demand on the Tohono O'odham Reservation is primarily related to municipal/domestic uses in the tribal communities, particularly at Sells, and farming in the southern part of the San Simon Wash Basin at Papago Farms. The Tohono O'odham Utility Authority Water Department serves a total of about 3,200 customers and has 1,676 wastewater customers on the entire reservation which stretches into the Pinal and Tucson Active Management Areas. The Water Department is working to connect small systems into a single system that can be maintained in a central location. There are currently seven such systems in operation. (TOUA, 2007a) In the planning area there are plans to connect two community systems south of Gu Vo and connect another community with a regional system by the end of 2007. The water supply for the reservation comes from 73 wells located in and around the reservation. (TOUA, 2007b)

Gila Bend

The Gila Bend Reservation (San Lucy District) is part of the Tohono O'odham Nation but is located on 10,409 acres north of Gila Bend and divided by the Gila River. Completion of Painted

Rock Dam resulted in flood damage to district lands including destruction of a 750-acre farm and the necessary relocation of tribal members from Sil Murk Village to the 40-acre San Lucy Village just north of Gila Bend. Approximately 600 tribal members reside in the district (TON, 2007). The village includes residential dwellings, tribal offices and library. The Gila Bend Indian Reservation Lands Replacement Act (P.L. 99-503), enacted in 1986, authorizes the Tohono O'odham Nation to purchase up to 9,880 acres of private lands in Pima, Pinal or Maricopa counties to replace the reservation lands that were rendered unusable for economic development due to flooding. In 2003, the Nation acquired a 135-acre parcel in Glendale to construct a Casino in order to provide needed services to its members. (TON, 2009)

Municipal Demand

Municipal demand is summarized by groundwater basin and water supply in Table 7.0-11. Average annual demand during 2001-2005 was about 50,930 acre-feet. Sixty-five percent of this municipal demand was met by surface water from the Colorado River, primarily in the Yuma Basin. In all other basins, groundwater is the primary municipal water supply. Effluent is used to meet municipal demand in the Yuma and Parker basins.

It is estimated that about 84% of the planning area population is served by a water provider. Eight water providers in the planning area served 500 acre-feet of water or more in 2006. These providers and their demand in 1992, 2000 and 2006 are shown in Table 7.0-12. In 2006, municipal utilities served the communities of Gila Bend, Wellton, Parker, San Luis, Somerton and Yuma. Municipally-owned systems have more flexible water rate-setting ability than private water companies, which are regulated by the Arizona Corporation Commission. In addition, municipal utilities have the authority to enact water conservation ordinances. This authority may enable municipal utilities to better manage water resources within water service areas. Water provider issues are discussed in section 7.0.8.

Primary municipal demand centers are the Yuma area where the four largest communities in the planning area are located, and Parker/ Parker Strip, Ajo, Quartzsite and Gila Bend. The only basins with population centers greater

Table 7.0-11 Average annual municipal water demand in the Lower Colorado River Planning Area, 2001-2005 (in acre-feet)

Basin	Groundwater	Surface Water	Effluent	Total
Butler Valley	<300			150
Gila Bend	800			800
Harquahala	<300			0
Lower Gila	2,000	500		2,500
McMullen Valley	500			500
Parker	3,800	500	220	4,520
Ranegras Plain	400			400
San Simon Wash	1,000			1,000
Tiger Wash	<300			150
Western Mexican Drainage	<300			150
Yuma	8,300	32,000	460	40,760
Total Municipal	17,400	33,000	680	50,930

Sources: USGS 2007

Notes: Effluent figures are for golf course irrigation in 2006

Volume <300 acre-feet assumed to be 150 acre-feet for computation purposes than 1,000 are Gila Bend, Lower Gila, Parker and Yuma basins.

Yuma Area

The total municipal demand in the Yuma Basin averaged 40,760 AFA during 2001-2005. The largest providers, City of Yuma, Far West Water and Sewer, Inc., City of Somerton and City of San Luis provided about 31,850 acre-feet of Colorado River water and groundwater to customers in 2006. A number of wastewater treatment plants treat sewage in the Yuma area. The largest is the Figueroa Avenue Water Pollution Control Facility at Yuma. Somerton, San Luis and Far West Sewer also operate relatively large treatment plants. In its 2002 General Plan, the City of Yuma estimated that about 24% of existing housing units were not connected to a sewer system and that rapid growth in the Fortuna Foothills area has resulted in construction of on-site septic systems and private package treatment plants. (City of Yuma, 2002)

The City of Yuma is the largest water provider, with Priority 1 and Priority 3 Colorado River water annual consumptive use entitlements totaling 50,000 acre-feet. The City can supplement its entitlement through the use of return flow credits such as water returned to the river following wastewater treatment and conversion of irrigation rights to municipal use. Colorado River water is transported to Yuma through several facilities (see Figure 7.0-14). About 97% of the City's Colorado River water is transported through the All American Canal and Yuma County Water Users Association (YCWUA) facilities, including the Yuma Main Canal, to the Yuma Main Street Water Treatment Plant. The remaining three percent is delivered through the Gila Gravity Main Canal to the East Mesa treatment plant. (City of Yuma, 2002) In 2006, City of Yuma water demand was about 20,400 acre-feet of which 4,240 was well pumpage and 16,180 was Colorado River water. About 60% of this demand is for residential

Table 7.0-12 Water providers serving 450 acre-feet or more of water per year in 2006, excluding effluent, in the Lower Colorado River Planning Area

Basin/Water Provider	1992 (acre-feet)	2000 (acre-feet)	2006 (acre-feet)
Gila Bend			
Town of Gila Bend	537	651	557[1]
Lower Gila			
Ajo Improvement Company[2]	541	660	543
Town of Wellton	NA	158	314
Parker			
Town of Parker	887	1,049	988
Yuma			
City of Somerton	827	1,012	1,403
City of San Luis	772	1,904	3,366
Far West Water and Sewer - Fortuna Foothills	2,994	5,222	6,660
Yuma Municipal Water Department[3]	21,680	32,906	20,421

Sources: USBOR 1992, USBOR 2000, USGS 2007, Community Water System Annual Reports 2006 and 2007

NA = Not Available

[1] Demand for 2006 not available, demand from 2007 shown.

[2] The Town of Ajo is served by three water providers. Ajo Improvement Company provides water to all three systems.

[3] Yuma Municipal Water Department demand in 1992 and 2000 are reported diversions of Colorado River water from the Bureau of Reclamation Article V Decree Accounting Reports.

Fortuna Foothills in the Yuma Basin. Rapid growth in the Fortuna Foothills area has resulted in construction of on-site septic systems and private package treatment plants.

uses. Commercial demand includes deliveries to golf courses but the precise number of courses and amount delivered is not known. (City of Yuma, 2007) The Department estimated that there are at least six golf courses served by the City of Yuma with a total annual demand of over 1,800 acre-feet. It does not appear that the City of Yuma provides effluent to meet this turf irrigation demand.

Far West Water and Sewer, Inc. serves the rapidly growing Fortuna Foothills area east of Yuma in unincorporated Yuma County. In 2006, it served about 6,660 acre-feet of water. The primary water supply is surface water from the Colorado River, delivered via the Yuma Mesa Irrigation District and "A" Canal. Groundwater is used as a back-up water supply, for irrigation water at three golf courses, and for construction. Far West operates a drinking water treatment plant, seven wastewater treatment facilities and serves about 15,000 water and 6,500 wastewater connections. (Far West Water & Sewer, Inc., 2006) About 446 AFA of treated wastewater, in addition to groundwater, was delivered to Foothills Executive, Foothills Par 3, Fortuna del Rey, Las Barrancas and Mesa del Sol golf courses to meet part of their annual water demand. Total annual demand of these courses was estimated at 1,525 acre-feet.

The City of Somerton, located about ten miles southwest of Yuma, is a fast growing, primarily residential community with 10,260 residents in 2006. In 2006, approximately 1,400 acre-feet was served to customers, of which 93% were residential customers. The Somerton Municipal Water System service area is about 2.5 square miles in size and groundwater is pumped from three wells located in T9S, R24W. A fourth well is not used due to water quality problems. Depth to water is consistently about ten feet below land surface. The City is not interconnected to any other systems. It has a 2006 contract for 750 acre-feet of Priority 4 Colorado River water and is purchasing rights that are not currently being used. (City of Somerton, 2006)

Located adjacent to the international boundary, the City of San Luis is the fastest growing community in the entire planning area, growing by 37% between 2000 and 2006. In 2006, approximately 3,400 acre-feet was withdrawn from nine wells to serve almost 5,100 customer connections. Of the volume withdrawn, 1,079 acre-feet was delivered to residential customers and 948 acre-feet to non-residential customers of which 414 acre-feet was delivered to turf (City of San Luis, 2007). In 2007 the City reported only ten acre-feet delivered to turf.

<u>Parker/Parker Strip</u>

The Town of Parker and the Parker Strip had a combined population of about 6,400 in 2000. The Parker Strip is the area north of Parker along the Colorado River to the basin boundary. The area has grown rapidly, particularly the Parker Strip, which grew by 101% between 1990 and 2000. The Town of Parker Municipal System is the largest local water provider, serving about 3,200 residents with 1,250 service connections to the one square mile town, deeded inside the CRIT Reservation. The CRIT Water Department serves the area outside the town limits.

Parker Municipal System pumped almost 1,000 acre-feet in 2006 from three wells pumping Colorado River water. The town has 630 acre-feet of Priority 1 entitlement and a combined volume of 3,030 acre-feet of 4th, 5th and 6th Priority water. Water levels in system wells vary from 75 to 90 feet and well pumpage reportedly doubles in the summer months. The system is interconnected to the CRIT water system and is used for emergency purposes. (Town of Parker, 2006) In 2006 it delivered 470 acre-feet to residential customers, 285 to commercial customers and 89 acre-feet to turf.

Brooke Water LLC is the largest water provider in the Parker Strip and has an entitlement for 360 acre-feet of Priority 1 and 440 acre-feet of Priority 4 water. In 2006 Brooke Water LLC-Lakeside diverted 163 acre-feet of Colorado River water and delivered 136 acre-feet to residential customers. Emerald Canyon Golf Course, located north of Cienega Springs, uses effluent from the Buckskin/Sandpiper WWTP to meet part of its irrigation demand.

Ajo

The Town of Ajo is the largest community in the planning area not located on or near the Colorado River. Ajo was founded by the New Cornelia Copper Company in about 1915. Phelps Dodge acquired the property in 1931 and continued to operate the mine until 1985. At that time most of the company-owned non-mining properties were sold to the residents and the unincorporated community is now a tourist and retiree destination. Three water companies serve the town. (ADOC, 2007a) The largest system is the Ajo Improvement Company owned by the Phelps Dodge Corporation. It pumps water from two active wells in the Child's Well Field, seven miles north of Ajo. These wells are at depths between 1,170 to 1,350 feet. It also provides sewer services and wastewater treatment. Effluent is not reused but is discharged to evaporation ponds. Ajo Improvement Company delivers groundwater to two other water systems: Arizona Water Company-Ajo System and Ajo Domestic Water Improvement District (DWID), neither of which operate their own wells to serve customers. (Malcolm Pirnie, 2006)

In 2006, Ajo Improvement Company served 543 acre-feet of groundwater to 3,000 residents (1,390 service connections) and to the two other water systems. Its customer demand was about 300 acre-feet, of which 184 acre-feet was residential and 120 acre-feet was commercial. In that year the Ajo DWID received about 40 acre-feet of water from the Ajo Improvement Company and served about 405 residents. (Phelps Dodge Corporation, 2007) In 2006, Arizona Water Company received about 184 acre-feet of water from the Ajo Improvement Company. Arizona Water Company-Ajo System serves about 686 connections, 73% residential and 27% non-residential. (Arizona Water Company, 2007) There is a nine-hole golf course in Ajo but the source of irrigation water is not known.

Gila Bend

Located at a transportation hub, the Town of Gila Bend has a number of gas stations, mini-marts, hotels and restaurants in addition to residential housing The municipal water demand was 557 acre-feet in 2007 (2006 data were not available) served to 733 residential and 66 commercial connections. Groundwater was pumped from two wells with water levels at 300 feet bls. An emergency source of water is water trucked from Lewis Prison or Paloma Ranch (Town of Gila Bend, 2008). About 400 acre-feet of effluent is generated at the Gila Bend Wastewater Treatment Plant and all is discharged to a watercourse.

Other municipal water demands in the northern part of the Gila Bend Basin include two large prisons, the Arizona State Prison Lewis

Complex and the Eagle Point School Juvenile Corrections Facility, located on either side of Highway 85 in T2S R4W (see Figure 7.2-10). An associated Arizona Department of Corrections wastewater treatment plant generates over 400 AFA of effluent so water demand at the site is likely between 600 and 800 AFA. There is a small residential community located around a constructed water ski lake in the northern part of T4S R4W and another, Spring Mountain Ski Ranch, under construction in T3S R4W. These types of development are easier to construct outside of the state's active management areas since within an AMA, groundwater may not be used to fill a private lake larger than 12,320 square feet (about 0.28 acres) in area.

Wellton

Wellton is located in the middle of the Wellton-Mohawk Valley along Interstate 8 and serves as a business, service and recreation center for more than 5,000 people in the surrounding area. The Town of Wellton had a population of almost 2,000 in 2006 and grew by 72% between 1990 and 2000. The municipal water system receives Colorado River water from the Wellton-Mohawk Irrigation District and maintains one well for emergency backup. In 2006 the town received 314 acre-feet of surface water and served 214 acre-feet to residential customers and 97 acre-feet to commercial connections. New developments in the area, such as the master planned Coyote Wash, will increase municipal water demand. This planned community is anticipated to include 2,500 homes, a condominium complex and shopping center, and two 18-hole golf courses. By 2009, a 9-hole golf course had been completed and more than 500 lots sold. Another 18-hole course (Butterfield) is located at Wellton. (see Table 7.0-13)

Quartzsite

Although the water system for the Town of Quartzsite is not large, the community is rapidly growing with 3,650 residents in 2006. Located in the middle of the Parker Basin at the junction of Interstate 10 and U.S. 95, it is a tourist and retirement community with a population that swells in the winter with numerous gem and rock shows. There are an estimated 1.5 million annual visitors (ADOC, 2007b).

In 2007, Quartzsite withdrew 439 acre-feet of water from two wells and served 340 acre-feet to residential customers, primarily in the area

Town of Quartzsite in the Parker Basin.

north of Interstate 10. Water levels in wells were reported at 390 feet and 442 feet. Plans are underway to drill a production well on the south side of the Interstate (Town of Quartzite, 2008). Prior to 1989, private domestic wells were the only water supply and several hundred exist within the town limits (Town of Quartzsite, 2003). Quartzsite has a 4th Priority Colorado River entitlement of 1,070 acre-feet but no way to currently convey this water to the town.

In addition to the Town of Quartzsite public water system, two small private water companies, Desert Gardens RV Park and Q-Mountain MHP serve Quartzsite. The Q-Mountain system has 214 connections served by four wells that delivered about 43 acre-feet of water in 2003 (ADWR, 2004).

Municipal golf course demand is estimated to be approximately 11% of the total municipal demand in the planning area. Estimated demand and water supply for all golf courses in the planning area is shown in Table 7.0-13. There are eleven municipal golf courses in the Yuma Basin receiving a combination of groundwater, surface water and effluent, three in the Lower Gila Basin using groundwater or surface water and one each in McMullen Valley and Parker basins. Two other golf courses in the

Table 7.0-13 Golf courses in the Lower Colorado River Planning Area (c. 2008)

Facility	Basin	# of Holes	Demand (acre-feet)	Water Supply
Ajo Country Club	Lower Gila Basin	9	211	Groundwater
Butterfield Golf Course	Lower Gila Basin	18	441	Surface Water
Coyote Wash Golf Course	Lower Gila Basin	18	441	Groundwater
Sunset Links Golf Club	McMullen Valley	18	441	Groundwater
Emerald Canyon Golf Club	Parker	18	441	Surface Water/Effluent
Arroyo Dunes Golf Club	Yuma	18	175/175	Groundwater/Surface Water
Cocopah Bend RV&GC	Yuma	18	441	Surface Water/Effluent
Desert Hills Golf Course	Yuma	18	441	Surface Water
Foothills Executive Golf Course†	Yuma	9	211	Groundwater/Effluent
Foothills par 3 Golf Course†	Yuma	9	211	Groundwater/Effluent
Fortuna del Rey Golf Course†	Yuma	9	211	Groundwater/Effluent
Ironwood Golf Course	Yuma	9	211	Surface Water
Las Barrancas Golf Course†	Yuma	18	441	Groundwater/Effluent
Mesa Del Sol Golf Course†	Yuma	18	441	Groundwater/Effluent
Sierra Sands Golf Course	Yuma	18	221	Surface Water
Westwind RV & Golf Resort	Yuma	9	211	Surface Water
Total Water Use Municipal Golf Courses			*5,365*	
Dove Valley Golf Course*	Yuma	18	441	Groundwater
Yuma Golf & Country Club*	Yuma	18	441	Groundwater/Surface Water
Total Water Use Industrial Golf Courses			*882*	
Total Water Use			**6,247**	

Source: ADWR 2008b
Notes:
* Golf course served by its own well and is considered to be an industrial user
† These golf courses are served by Far West Water and Sewer. A total of 446 acre-feet of effluent is served for all courses.

Yuma Basin are believed to have facility wells that serve the course and are considered industrial golf courses and discussed below.

Agricultural Demand

The planning area contains one of the largest agricultural areas in Arizona. Yuma County, which contains most of the agricultural lands in the planning area, is considered the nation's winter vegetable capital. Crops grown here include head and leaf lettuce, romaine, broccoli, cauliflower, honeydew, cantaloupe, watermelon, cabbage, spring mix, celery, endive/escarole, and citrus including lemons, oranges, grapefruit, and tangerines. Many seed crops are also grown including broccoli, cauliflower, grasses, and onions. Annual agricultural sales are reported to total over $1.3 billion. In La Paz County, upland cotton is the largest crop, followed by Durum wheat, barley, corn for grain, and alfalfa. Other crops include onions, honeydew, cantaloupe and watermelon. Annual agricultural sales are reported to total over $92 million in this county. (AZDA, 2005)

There are 12 irrigation districts in the planning area. Their general location is shown in Figure 7.0-18 and described below.

Irrigation water supply is primarily water diverted from the Colorado River. As shown in Table 7.0-14 and Figure 7.0-19, for the period 2001-2005, an average of about 1,775,800 AFA was diverted from the Colorado River for use in the Parker, Lower Gila and Yuma Basins. An additional 69,600 acre-feet was diverted via the Central Arizona Project for use in the Harquahala Basin. Gila River water and effluent averaging 54,000 AFA was used in the Gila Bend Basin. During this period an average of 935,700 acre-feet of water withdrawn from wells was used to irrigate lands in all basins with agricultural demand.

Agricultural demand is greatest in the Yuma, Parker, Lower Gila, Gila Bend, McMullen Valley, and Harquahala basins. As shown in Figure 7.0-20, agricultural demand has steadily increased over time in most of these basins. Agricultural demand in each basin is described below. Included are findings from a USGS agricultural field survey conducted of the Butler Valley, Gila Bend, Harquahala, Lower Gila, McMullen Valley and Ranegras Plain basins in the summer of 2007, which are summarized in Table 7.0-15.

Figure 7.0-18 Irrigation districts in the Lower Colorado River Planning Area

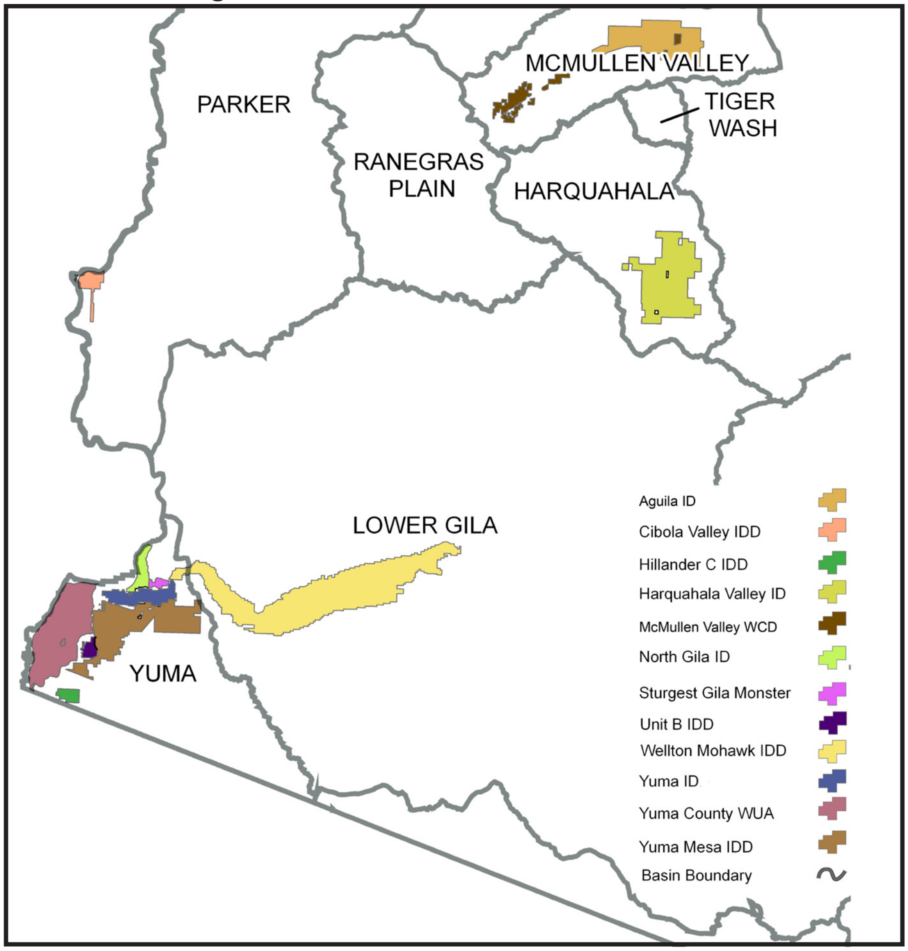


Table 7.0-14 Agricultural water demand in the Lower Colorado River Planning Area

	1991-1995 (acre-feet)	1996-2000 (acre-feet)	2001-2005 (acre-feet)
Butler Valley			
Groundwater	3,400	8,300	9,700
Total	3,400	8,300	9,700
Gila Bend			
Groundwater	237,000	244,000	289,000
Surface Water[2]	71,500	68,500	54,000
Total	308,500	312,500	343,000
Harquahala			
Groundwater	9,500	23,500	36,500
Surface Water[3]	47,500	85,000	69,600
Total	57,000	108,500	106,100
Lower Gila Basin			
Groundwater	254,000	261,100	246,000
Surface Water	365,000	391,000	383,200
Total	619,000	652,100	629,200
McMullen Valley			
Groundwater	77,000	79,500	89,100
Total	77,000	79,500	89,100
Parker			
Groundwater	1,300	<1,000	<1,000
Surface Water	662,000	667,000	630,600
Total	663,300	667,500	631,100
Ranegras Plain			
Groundwater	29,500	32,000	28,800
Total	29,500	32,000	28,800
San Simon Wash			
Groundwater	4,000	3,800	3,900
Total	4,000	3,800	3,900
Yuma			
Groundwater	206,000	218,000	232,200
Surface Water	711,000	771,000	762,000
Total	917,000	989,000	994,200
Total All Basins	2,678,700	2,853,200	2,835,100

Source: USGS 2007

Notes: Volume <1,000 acre-feet assumed to be 500 acre-feet for computational purposes
[1] Unless otherwise noted, all surface water if from the Colorado River
[2] From Gila River and effluent
[3] From Central Arizona Project water

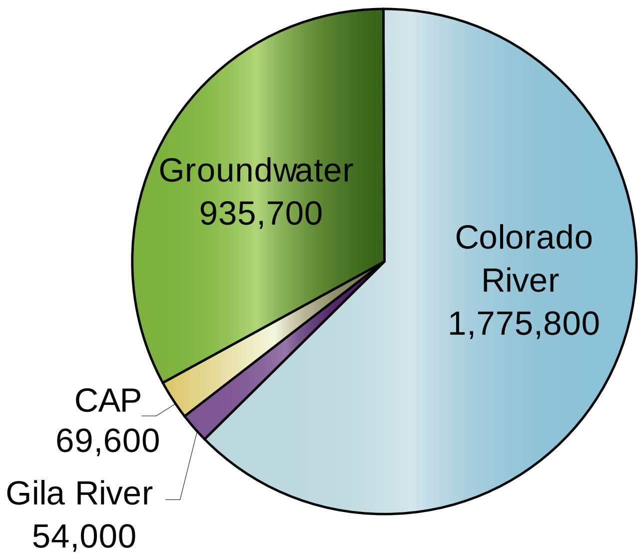
Butler Valley Basin

Agricultural demand in the Butler Valley Basin averaged 9,700 AFA during 2001-2005. Demand has more than doubled compared to the 1971-1990 time period (Table 7.1-5). Agricultural lands are located in a contiguous area in the southwest part of the basin and groundwater is the only water supply. In 2007 the USGS found 1,352 acres of irrigated alfalfa/hay, all center pivot irrigated. (USGS, 2009)

Gila Bend Basin

Irrigation in the Gila Bend Basin is located primarily along the Gila River valley and south

Figure 7.0-19 Irrigation Water Supply for the Lower Colorado River Planning Area, 2001-2005 (acre-feet)



of the Gila River in the western part of the basin. Agricultural demand averaged 343,000 AFA during 2001-2005, of which 289,000 acre-feet was groundwater and 54,000 acre-feet was a mixture of Gila River surface water, agricultural drainage and effluent discharged upstream in the Phoenix AMA. Gila Bend Basin agricultural demand was 12% of the total planning area agricultural demand. Agricultural demand has increased steadily from an annual average of 308,500 acre-feet during the 1991-1995 time period (see Table 7.2-8).

Surface water/effluent supplies are used in the northern part of the basin where they are diverted at Gillespie Dam through the Gila Bend Canal and Enterprise Canal. Prior to 1993, when Gillespie Dam was breached during a flood, more surface water was diverted. Surface water has been a less reliable supply than groundwater due to upstream dams and diversions and the unpredictability of flow even under pre-development conditions. As shown on Table 7.2-8, the proportion of groundwater used has increased since the 1990s. Investigations by the USGS found about 43,400 acres under irrigation and all acreage was flood irrigated. (Table 7.0-15) The predominant cropped acreage at that time was alfalfa/hay (76%), followed by sorghum (8%), wheat (7%) and smaller amounts of cotton, corn, jojoba, grasses and nursery plants. (USGS, 2009)

<u>Harquahala Basin</u>
The number of irrigation acres in the Harquahala Basin is limited due to the basin's designation

Figure 7.0-20 Agricultural Demand in Selected Basins in the Lower Colorado River Planning Area 1991-2005 (in acre-feet)

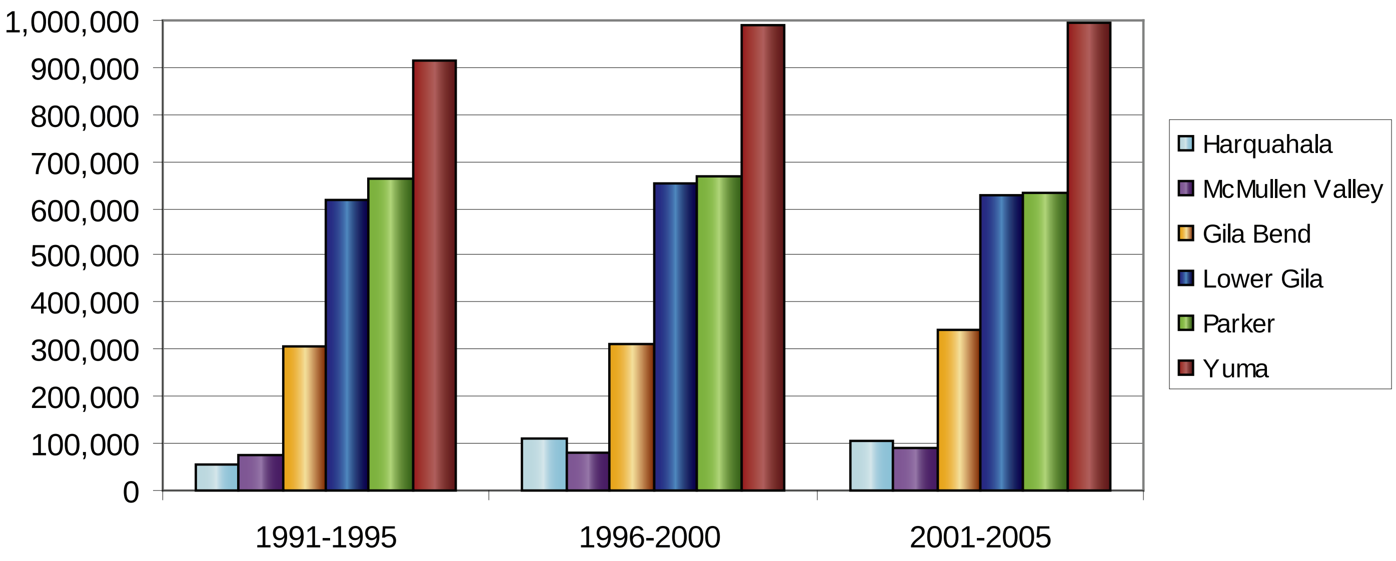


Table 7.0-15 Agricultural acreage, crop type and irrigation type in selected basins in 2007

Basin	Butler Valley	Gila Bend	Harquahala	Lower Gila		McMullen Valley	Ranegras Plain
				Wellton-Mohawk	Other		
2007 Irrigated Acreage	*1,352*	*43,434*	*25,951*	*85,876*	*17,132*	*14,668*	*6,878*
Crop Type							
Alfalfa/Hay	100%	76%	33%	29%	39%	2%	8%
Barley				<1%			17%
Corn		1%	5%	<1%	5%	<1%	26%
Cotton		4%	25%	11%	8%	19%	19%
Grasses		<1%	2%	6%	2%		
Jojoba		1%			13%		17%
Melons			13%	3%	5%	60%	
Sorghum		8%	4%	<1%	6%	8%	5%
Vegetables				32%	9%	3%	
Wheat		7%	14%	16%			
Other		2%	4%	<1%	13%	7%	8%
Irrigation Type							
Center Pivot	100%				13%		
Drip			13%		13%	20%	99%
Flood		100%	86%	NA	15%	79%	
Furrow						1%	
Sprinkler					17%		<1%
Unknown			1%		42%		

Source: USGS 2009
NA - Not Available

as an irrigation non-expansion area, or INA. In an INA farmers must report annual agricultural water pumpage to the Department. Demand averaged 106,100 AFA, during 2001-2005, representing 4% of the agricultural demand in the planning area (Table 7.3-7). Non-contract CAP water began to be used in 1984 by the Harquahala Valley Irrigation District (HVID), replacing groundwater pumpage as the primary water supply in the basin. Under the Department's Recharge Program, HVID is a permitted groundwater savings facility. (See Section 7.0.6, Central Arizona Project)

HVID lands are the most extensive in the basin, covering a large area in the southeast portion. All irrigation canals and laterals are concrete-lined (ADWR, 1998). Other irrigated areas exist near Centennial and south of the Buckeye-Salome Road in the northwest part of the basin. The USGS found 25,951 acres under irrigation in the basin in 2007. At that time, about 33% of the cropped acreage was alfalfa/hay, 25% cotton, 14% wheat,13% melons and lesser amounts of corn, sorghum, grasses, oats and nursery trees. About 86% of the lands were found to be flood irrigated and 13% were drip irrigated. (Table 7.0-15) (USGS, 2009)

Lower Gila Basin

The Lower Gila Basin contained 22% of the agricultural demand in the planning area during the 2001-2005 time period. Demand within the basin averaged between 619,000 acre-feet during 1991-1995 to a high of 652,000 acre-feet from 1996-2000. Demand declined during 2001-2005 to an average of 629,000 AFA. Colorado River water (surface water) comprises about 60% of the water supply (Table 7.4-8).

The principal farming area is the Wellton-Mohawk Irrigation and Drainage District (WMIDD), whose location generally follows the Gila River Valley west of Dateland and extends into the Yuma Basin (see Figure 7.0-18). Other irrigated areas are located north and west of Dateland, north of Hyder, near Agua Caliente (south of Hyder) and in the Dendora Valley near the eastern basin boundary.

Crop type and estimated irrigated acres in the WMIDD during 2007 are shown in Table 7.0-15. Principal crops grown were vegetables, alfalfa/hay, wheat, cotton, grasses (bermuda) and melon. A significant amount of double cropping occurs in the district (WMIDD, 2004). The irrigation method for each crop type was not available but flood irrigation is the primary irrigation method for most crops, with a few center pivots. Vegetables are irrigated with a combination of sprinkler (for seed germination) and flooding and melons are most likely irrigated with drip irrigation (personal communication, S. Tadayon, 2009).

The USGS field investigation of non-district lands in the summer of 2007 found much less land being irrigated north of Hyder than suggested by Figure 7.4-10. The USGS found 17,132 irrigated acres on non-district lands. Principal cropped acreage observed was alfalfa/hay (39%), jojoba (13%), vegetables (9%), cotton (8%) and sorghum (6%). Citrus comprised 5% of the "other category" with lesser amounts of date/palm trees and oats. Irrigation methods vary in this area with 15% of the acreage flood irrigated, 17% sprinkler, 13% drip and 13% center pivot (primarily north of Dateland). The irrigation method was unknown on 42% of the acreage. (Table 7.0-15) (USGS, 2009)

Agriculture in the Wellton-Mohawk Irrigation District.

Reclamation's Gila Project delivers Colorado River water to two divisions in the planning area - the Wellton-Mohawk Division and the Yuma Mesa Division. The WMIDD was created in 1951 to provide a legal entity that could contract with the United States to repay the cost of the Gila Project and to operate and maintain project facilities. Lands in the area have been cultivated for many centuries. During the late 19th century, diversion structures and canals were constructed to expand agricultural lands, but periodic floods and construction of upstream reservoirs led to abandonment of the surface water system and conversion to groundwater wells. However, by the early 1930s, increasing salt concentrations in groundwater and falling groundwater levels made successful farming in the area difficult and many farms were abandoned. Area farmers approached Reclamation for delivery of Colorado River water and the project was constructed during the late 1940s and early 1950s. (WMIDD, 2004)

Water for the District is diverted at Imperial Dam into the Gila Gravity Main Canal, a joint-use facility shared by five Yuma Basin irrigation districts (WMIDD, 2004). The WMIDD Colorado River entitlement is diverted into the 18.5 mile long Wellton-Mohawk Canal and to its major branches, the Wellton Canal (19.9 miles long) and the Mohawk Canal (46.8 miles long) (See Figure 7.0-14). The 13-mile long Dome Canal branches off the Wellton-Mohawk Canal west of the major branches and serves the western part of the District. There are 13 small pumping plants and 227 laterals in the WMIDD. (USBOR, 2007f) Facilities include 378 miles of main canals, laterals and return flow channels, three major pumping plants, drainage wells and groundwater level observation wells. All canals and laterals are concrete-lined except for eight miles of the main canal west of the first pumping plant. There are also hundreds of domestic turnouts along the system (WMIDD, 2004).

The WMIDD has a Colorado River Priority 3 right with a current allowable consumptive use of 278,000 AFA, but diversions are significantly higher. Diversions to the District averaged 408,258 AFA during the 2001-2005 time period. Water pumped from drainage wells and returned to the Colorado River is deemed "return flow" that is subtracted from the District's diversions to derive its consumptive use.

Long-term irrigation with Colorado River water combined with naturally elevated salt concentrations in groundwater and soil require that salts be leached from the soil by irrigating in excess of the crop consumptive use and removal of excess groundwater to prevent waterlogging. In addition, occasional flooding on the Gila River raises groundwater levels. The District operates 90 drainage wells spaced about a mile apart with an average depth of 100 feet to control rising groundwater levels, keeping water below the root zone of crops. Three-hundred observation wells monitor groundwater levels. (WMIDD, 2004)

Because the high salinity of the WMIDD return flows increase the salinity of the Colorado River, a number of actions have been taken to achieve the salinity standards for delivery to Mexico specified in Minute 242. The drainage water is pumped into a concrete-lined channel (Main Outlet Drain and Extension, MOD/MODE), which allows it to be either diverted to the main channel of the Colorado River at the NIB above Morelos Dam, or bypassed around the dam through a canal to the Cienega de Santa Clara. WMIDD has also taken steps within the District to reduce return flows including acreage reduction, improved irrigation scheduling, land-leveling and improvements to ditches and turnouts. (WMIDD, 2004)

McMullen Valley Basin

About 3% of the recent agricultural demand in the planning area is near the communities of Aguila and Wenden-Salome in the McMullen Valley Basin. There are two irrigation districts but neither the Aguila Irrigation District nor the McMullen Valley Water Conservation District has a consolidated distribution system and all district wells and ditches are privately owned. Both districts were formed in order to contract water and power from the Colorado River. (ADWR, 1998) Groundwater is currently the only water supply.

Agricultural demand in the basin has been increasing with an annual average of 89,100 acre-feet of demand during the 2001-2005 time period. (Figure 7.5-7) The USGS field investigation in 2007 found approximately 14,700 acres under irrigation with 79% flood irrigated and 20% drip irrigated. Cropped acres at the time of the investigation included melons (60%), cotton (19%) and sorghum (8%). Other crops observed were vegetables (chilis), oats, alfalfa/hay, corn, guayule, pistachio, palm and oats (Table 7.0-15). (USGS, 2009)

McMullen Valley is one of the few groundwater basins in the state designated for out of basin

Agriculture near Salome, McMullen Valley Basin. Agricultural demand in the basin has been increasing with an annual average of 89,100 acre-feet of demand during the 2001-2005 time period.

transportation of groundwater. About 14,000 acres of agricultural land have already been purchased by the City of Phoenix for transport of groundwater to the Phoenix AMA (ADWR 1994b).

Parker Basin

Irrigation in the Parker Basin represented 22% of the agricultural demand in the planning area in 2001-2005. The annual average Colorado River demand for the basin during that period was 630,600 acre-feet. A relatively small amount of groundwater, less than 1,000 acre feet, was reportedly pumped for agricultural irrigation (Table 7.6-8).

Irrigation occurs primarily on the CRIT Reservation and also within the Cibola Valley Irrigation and Drainage District (CVIDD). As mentioned in the Tribal Demand section, about 72,610 acres were irrigated on the CRIT reservation in 2006. Of this total, CRIT Farms manages over 15,000 acres of alfalfa, cotton, durum wheat and other crops (CRIT, 2005).

CVIDD was formed in 1962, and in 1964 the southern half of the district was incorporated into the Cibola National Wildlife Refuge. There is an integrated canal system and all main canals are owned by the district and concrete-lined. On average about 3,550 acres of land have been irrigated within CVIDD. Primary crops are alfalfa, bermuda and cotton, although a variety of other crops are grown including vegetables, wheat and barley. (ADWR, 1998) Colorado River water is the sole source of water. CVIDD has a Priority 4 Colorado River entitlement of 12,066 acre-feet and 5th and 6th Priority entitlements totaling 3,500 acre-feet. The USGS did not visit agricultural lands in the Parker Basin in 2007.

Ranegras Plain Basin

Agricultural demand in the Ranegras Plain Basin averaged 28,800 acre-feet during 2001-2005, all met with groundwater pumping. Agricultural demand has been relatively stable since 1991 (Table 7.7-5). In 2007, the USGS found about 6,900 irrigated acres primarily along Vicksburg road north of Interstate 10, and north of Highway 72 in the northern part of the basin. Cropped acres at that time were corn (26%), cotton (19%), barley (17%), jojoba (17%) and smaller acreages of alfalfa/hay, guayule and sorghum. Their investigations found 99% of the irrigation was by drip systems and 1% by sprinkler (Table 7.0-15). (USGS, 2009)

San Simon Wash Basin

Irrigation in the San Simon Wash Basin appears to be restricted to about 2,200 irrigable acres at the end of Reservation Road 21 near the international boundary. Average annual demand was estimated to be 3,900 acre-feet of groundwater during 2001-2005. Historic withdrawals were higher, up to 11,300 AFA during the late 1970s (Table 7.8-7). After 1980, the principal crop was alfalfa, irrigated year round (Hollett, 1985). It is not known how many acres are currently being irrigated.

Yuma Basin

The Yuma Basin is the largest agricultural demand center in the planning area with 35% of the recent demand, an annual average of 994,200 acre-feet during the 2001-2005 time period. Of this total demand, 762,000 acre-feet was water diverted from the Colorado River and 232,200 acre-feet was water pumped from wells. Annual demand has increased by over 77,000 acre-feet on average since 1991. Agricultural lands surround Yuma and extend through much of the western part of the basin from north of Fortuna Foothills to San Luis.

Bureau of Reclamation Projects

Two Reclamation projects serve irrigation water in the basin – the Gila Project and the Yuma Project (Table 7.0-16). The location of canals and associated irrigation districts is shown on

Figures 7.0-14, 7.0-18 and 7.0-21. Water for the Gila Project is diverted at Imperial Dam and delivered via the Gila Gravity Main Canal. The project is separated into the Wellton-Mohawk Division (discussed previously) and the Yuma Mesa Division. The Yuma Mesa Division includes three irrigation districts in the basin: Yuma Mesa Irrigation and Drainage District (Yuma Mesa IDD), North Gila Irrigation District (North Gila ID) and Yuma Irrigation District (Yuma ID). (USBOR 2007f)

The Yuma Project includes lands in both Arizona and California. In Arizona, the project is divided into the Valley Division and the Yuma Auxiliary Division. The Valley Division consists of the Yuma County Water Users Association (YCWUA). Water for the Valley Division is diverted at Imperial Dam into the All-American Canal to the Yuma Main Canal, then through the siphon under the Colorado River at Yuma and into the Valley Division canals. Water for the Yuma Auxiliary Division, also referred to as Unit “B”, is diverted at Imperial Dam and conveyed via the Gila Project Canals to the Unit “B” Irrigation District (Unit “B” ID) (see Figure 7.0-14).

Irrigation Districts
A total of eight irrigation districts operate in the basin (see Figure 7.0-18). The western part of the Wellton-Mohawk Irrigation and Drainage District extends into the basin and is discussed above in the Lower Gila Basin section. The general location of the water delivery and drainage infrastructure in the Yuma area including canals, conduits, drains and drainage wells is shown in Figure 7.0-14 and 7.0-21.

The three Gila Project/Yuma Mesa Division irrigation districts have a shared 3rd priority entitlement of 250,000 AFA on 37,187 acres. In addition, North Gila Valley ID has 1st and 2nd Priority entitlements, and Yuma Mesa IDD and Yuma ID have 2nd Priority consumptive use entitlements (see Appendix C).

Crops grown on Yuma Mesa IDD lands (the Mesa Unit) include citrus, alfalfa hay and seed, peanuts, cotton and grains. There are about 25,000 irrigated acres in the district. Crops grown on North Gila ID and Yuma ID lands (North and South Gila Units) include alfalfa, cotton, melons, citrus, winter vegetables and Bermuda grass seed (USBOR, 2007f). About 6,300 acres of the North Gila ID and 9,600 acres of the Yuma ID are irrigated (Yuma Area Ag Council, 2004). The South Gila Valley Unit of the Yuma Mesa Division consists of 24 drainage wells (Figure 7.0-21). Water is conveyed to

Table 7.0-16 Bureau of Reclamation project areas in the Yuma Basin

YUMA PROJECT (AZ) (Imperial Dam Diversion)		GILA PROJECT (Imperial Dam)			
Valley Division (Yuma Main Canal)	Yuma Auxilary Division (Gila Project Canals)	Wellton-Mohawk Division (Wellton-Mohawk Canal)	Yuma Mesa Division (Gila Gravity Main Canal)		
↓	↓	↓	↓	↓	↓
YCWUA	Unit “B” I.D.	Wellton-Mohawk I.D.	Mesa Unit	North Gila Valley Unit	South Gila Valley Unit
			↓	↓	↓
			Yuma Mesa ID	North Gila ID	Yuma ID

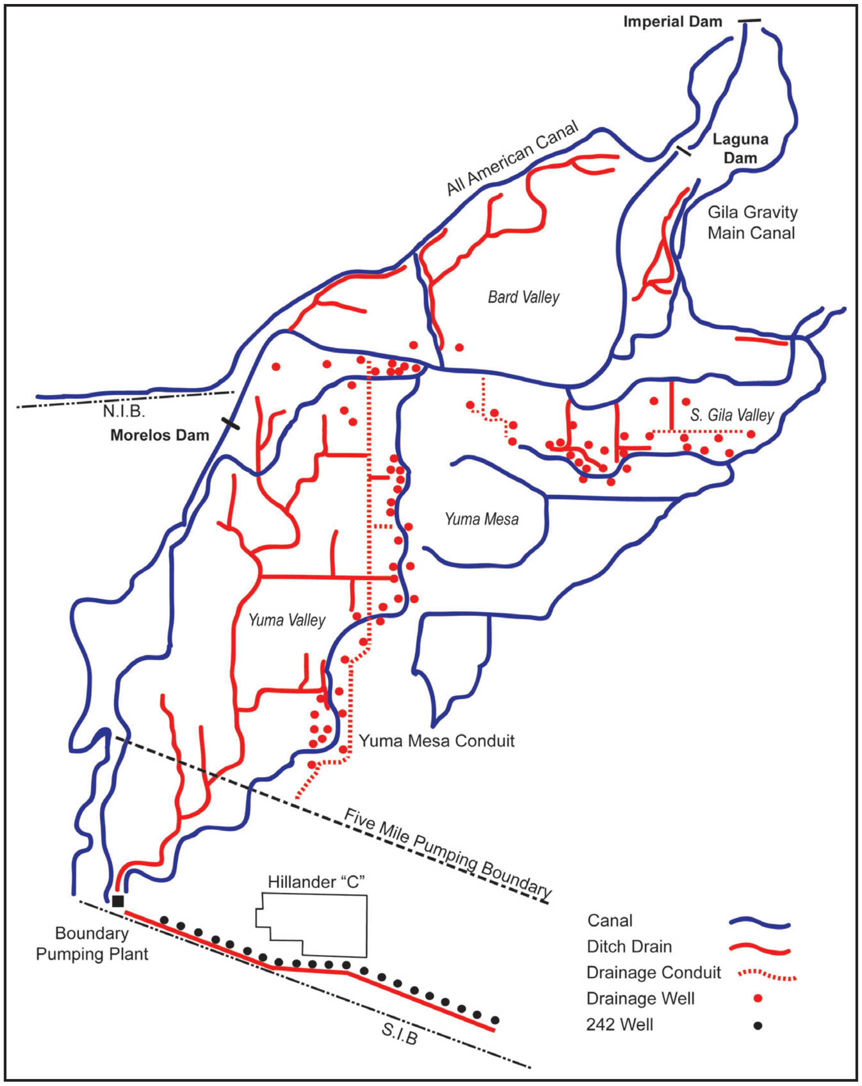
the Gila River Pilot Channel and the Colorado River to become part of the Treaty water delivered to Mexico. (USBOR, 2007g)

Unit "B" ID is a relatively small district that operates and maintains the water distribution facilities of the Yuma Auxiliary Project. It distributes water to about 3,400 acres of land on the Yuma Mesa. Crops are almost entirely citrus including grapefruit, oranges and lemons. (USBOR, 2007h) The district has a 1st Priority diversion entitlement of 6,800 acre-feet and an unquantified 2nd priority diversion entitlement.

YCWUA provides water to the Yuma Valley south of Interstate 8. It encompasses all of the Colorado River flood-plain land, approximately 53,000 acres, between the City of Yuma and the international boundary. YCWUA assumed operation and maintenance of Valley Division works of the Yuma Project in 1951 and the Siphon Drop Power Plant in 1962. There are approximately 28,800 irrigable acres in the district (Yuma Area Ag Council, 2004). YCWUA has an annual Colorado River entitlement of 254,200 acre-feet or, the consumptive use for irrigation of 43,562 acres (whichever is less) of 1st and 4th Priority water. Principal crops grown are lettuce and other produce crops in the fall and winter months and wheat, cotton, hay, and melons in the spring and summer months. In 2003, YCWUA received funding to line a number of its earthen canals to reduce seepage and conserve water. (BECC, 2003)

Excess irrigation water from the Valley Division of the Yuma Project is removed via an open drain that runs through the center of the division and terminates at the Boundary Pumping Plant at the international boundary (see Figure 7.0-21). The main drain and its branches total 56 miles in length. This drainage system is supplemented by 16 drainage wells located along the east side of the Yuma Valley that intercept groundwater flows from Yuma Mesa. YCWUA operates 11 of the wells and Reclamation operates the others. Most of this pumped water is discharged into the open drain. At the Boundary Pumping Plant, the drainage water is discharged into the bypass canal that flows into Mexico (USBOR, 2007i).

Figure 7.0-21 Yuma area drainage fields and conduit systems



Gila Monster Farms is a relatively small operation located north of the Yuma ID and west of the Wellton-Mohawk IDD. It has 1st Priority diversion rights of 780 AFA and 3rd, 4th, 5th and 6th priority rights for a total entitlement of 9,156 acre-feet (see Appendix C). Water is delivered through the Gila Gravity Main Canal. In 2006, the total irrigated area covered 2,090 acres.

Hillander "C" Irrigation and Drainage District, located north of the international boundary east of San Luis, pumps groundwater to irrigate about 2,300 acres within the 3,440 acre district. Historic use was between 15,000 and 20,000 AFA for irrigation of citrus and asparagus. Center pivot systems in the area suggest that alfalfa or other crops may be grown. The District is located adjacent to the 242 well field and has a contract to pump up to 4,000 acre-feet of water annually from the 242 Lateral (see Section 7.0.6).

Industrial Demand

Industrial demand in the Lower Colorado River planning area averaged 13,560 AFA during the 2001-2005 time period, about 0.5% of the total demand. As shown in Table 7.0-17, most demand is associated with power plants, although dairy and feedlot demand is growing, particularly in the Lower Gila Basin.

Mining activity in the Yuma Basin is associated with sand and gravel operations including the large-scale Cemex Highway 95 facility and BLT Company facility in the northern part of the basin. The New Cornelia Mine, a large open pit copper mining operation at Ajo, was placed on care and maintenance in 1983. There is a possibility that mining and ore processing may resume if copper prices increase enough. There are several small gold mines in the planning area including the Yuma King, 30 miles east of Parker. Two "industrial" golf courses are located in the Yuma Basin: Yuma Golf and Country Club and Dove Valley Golf Course. Industrial facilities are those with their own well or water supply and not served from a municipal water provider.

Table 7.0-17 shows "other" industrial uses in the Yuma area that use Colorado River water (surface water). These other uses include the

Table 7.0-17 Industrial water demand in the Lower Colorado River Planning Area

	1991-1995	1996-2000	2001-2005
Type	**Water Use (acre-feet)**		
Power Plant Total	**285**	**700**	**7,670**
Gila Bend			
Groundwater	0	0	4,600
Harquahala			
Groundwater	0	0	2,500
Yuma			
Surface Water	285	700	570
Golf Course Total	**440**	**440**	**440**
Yuma			
Groundwater	220	220	220
Surface Water	220	220	220
Dairy/Feedlot Total	**3,400**	**3,500**	**3,700**
Gila Bend			
Groundwater	0	0	100
Lower Gila			
Groundwater	3,400	3,500	3,600
Mining Total	**350**	**380**	**550**
McMullen Valley			
Groundwater	<300	<300	<300
Parker			
Groundwater	0	0	<300
Yuma			
Groundwater	200	230	250
Other Total	**2,600**	**2,900**	**1,200**
Yuma			
Surface Water	2,600	2,900	1,200
Total	**7,075**	**7,920**	**13,560**

Source: ADEQ 2005b, ADWR 2008b, USGS,2007
Notes: Volume <300 acre-feet assumed to be 150 acre-feet for computation purposes. Other category includes water use by the Yuma Desalting Plant, Union Pacific Railroad, Desert Lawn Memorial, Huerta Packing and Yuma Mesa Fruit Growers

Yuma Desalting Plant, cemetery irrigation and produce packing companies. There are other industrial demands in the planning area not reflected in the table, primarily from sand and gravel operations including at least three in the Parker Basin. Some of these operations are identified on the cultural demand maps. Water is used for aggregate washing, dust control, vehicle washing and equipment cooling at sand and gravel facilities. Relatively little water is consumed at these sites. Finally, north of Gila Bend, in the Gila Bend Basin, shrimp are pond grown at the Desert Sweet Shrimp operation. About 300,000 pounds of shrimp are produced annually and the shrimp effluent is applied to nearby agricultural fields. Water demand of this aquaculture operation is not known.

Power Plants

Panda Gila River Power Station is a 2,200 megawatt natural gas plant located in Gila Bend and completed in 2003. It was approved by the Arizona Corporation Commission (ACC) in 2001 under very strict emissions requirements. The plant has zero water discharge, with concentrated brine effluent disposed to evaporation ponds. The plant used about 4,400 acre-feet of groundwater in 2005.

The Harquahala Generating Project is a 1,000 megawatt natural gas power facility that came on line in 2003. As a condition of approval by the ACC, the owner agreed to use CAP water as the preferable supply. Groundwater use is allowed but must meet the same siting and permitting requirements of facilities in AMAs. The facility is designed to be zero water discharge and treats and recycles water more than 130 times to minimize consumption. (PG&E Corporation, 2000) The facility used about 750 acre-feet of groundwater and CAP water in 2005.

Arizona Public Service (APS) operates the natural gas Yucca Power Plant near Yuma. There are four combustion turbine units that produce nearly 150 megawatts of power to APS customers. The plant's other combustion turbine unit and one steam unit are owned by the Imperial Irrigation District in California. The plant provides power on an as needed basis, particularly during the summer months. (APS, 2007) The plant, which has a 1,500 acre-feet of 5th priority entitlement, used about 350 acre-feet of Colorado River water in 2005.

Panda Gila River Power Station, Gila Bend Basin.

Dairy/Feedlot

There are a number of dairy and feedlot operations in the planning area and these facilities are a growing demand sector due to development pressures and land costs in more urban parts of the state. Dairies and feedlots are located adjacent to irrigated land where feed is grown and where disposal of wastes can occur.

In 2003, Citrus Valley Dairy was the only dairy operating in the Gila Bend Basin with a groundwater demand of about 100 acre-feet. Painted Rock Dairy began operation the next year and the combined demand in 2005 was approximately 170 acre-feet for an estimated 1,600 animals.

There are two dairies in the Lower Gila Basin, G.H. Dome Valley and Hine Hettinga, with a 2005 demand of 152 acre-feet and 94 acre-feet respectively. These dairies house a combined total of 1,900 animals. There are also two

Painted Rock Dairy, Lower Gila Basin.

feedlots in the basin. The Kammann Cattle Company used about 27 acre-feet of water for about 800 animals while McElhaney Cattle used about 3,394 acre-feet for an estimated 101,000 animals in 2005.

A biorefinery was planned to open in 2008 near Vicksburg in the Ranegras Plain Basin. Plans included a 7,500-cow dairy, a corn fractionation mill, a biodiesel plant and a waste-to-energy conversion plant. While the facility has been substantially constructed, the project has been delayed with a focus on development of algae biomass as an alternative to corn and grains for biofuels. (AZFB, 2008) As of October 2009, the facility had not commenced operation.

7.0.8 Water Resource Issues in the Lower Colorado River Planning Area

Water resource issues in the Lower Colorado River Planning Area have been identified in regional studies primary involving Colorado River water supplies, through the distribution of surveys and from other sources. There are no ADWR Rural Watershed Initiative Groups in the planning area. Colorado River and groundwater transportation issues, planning and conservation activities and results from water provider surveys are discussed in this section. Environmental protection and restoration, and local management of water resources to meet the needs of growing communities while maintaining the agricultural economy are important considerations in the planning area.

Colorado River Issues

Issues involving the Colorado River system have implications for resource management and supply availability in the planning area. Issues include consequences related to compliance with the International Treaty with Mexico, agreement on management of the Colorado River system under shortage conditions in a manner that is equitable for all users, salinity control and water quality, entitlement transfers, and the development of accounting surface rules. Information on the "Law of the River" and more detailed discussion of some of the issues described below are found in Appendix D.

Mexican Treaty

Compliance with conditions of the delivery of 1.5 maf of water to Mexico under the 1944 Treaty and Minute 242 have required significant investments and actions within the U.S. and in the planning area. In the 1960s, salinity associated with irrigation return flows from the Wellton-Mohawk Irrigation and Drainage District (WMIDD) to the Colorado River coupled with reduced flows in the river system developed into a major international issue. To address this issue, Minute 242 to the Treaty was negotiated. This Minute requires that the Treaty water delivered to Mexico will be of nearly the same quality as that which is diverted at Imperial Dam and delivered to U.S. water users. To comply with this requirement, the U.S. implemented a number of measures including re-routing drain water from the WMIDD to the Cienega de Santa Clara in Mexico. The U.S. also built a $250 million dollar desalination plant in Yuma to treat WMIDD drain water, so that it could be returned to the mainstream for delivery to Mexico. The facility was completed in 1992, operated briefly in 1993 and then placed in standby status.

Imperial Dam and Colorado River, Lower Gila Basin.

A consequence of continuing to annually bypass the approximately 100,000 acre-feet of saline irrigation return flow to the Cienega de Santa Clara was the reestablishment of a rich, ecologically important wetland in the Mexican Delta. Currently, there is significant interest on both sides of the border to continue to maintain the area in its present condition. However, bypassing this water to Mexico each year without crediting it against the U.S. Treaty obligation requires the U.S. to release an equal amount of water from storage in Lake Mead. As a result, the risk of shortage is increased, particularly to the Central Arizona Project and other equal priority water users in Arizona. After more than a decade of drought, the potential for shortage has been further amplified.

Reactivation of the Yuma Desalination Plant to treat and discharge this water to the Colorado River to meet U.S. Treaty obligations with Mexico, would impact the Cienega. In recognition of this concern, the Yuma Desalination Plant/Cienega de Santa Clara Workgroup was formed in 2004 to identify and discuss potential solutions that would preserve the Cienega and make the treated bypass flows available for use under the Treaty. Workgroup recommendations were released in April, 2005.

In 2007, Reclamation conducted a pilot run of the Yuma Desalting Plant by operating it at about ten percent capacity for three months. The purposes of the run were to test new equipment, acquire current operational data, and identify design deficiencies to better determine whether the facility could reliably and efficiently be operated on a long-term basis. Results from this study were favorable. However, it was determined that to obtain more conclusive information, the plant needed to be operated at a scale and for a duration which covers seasonal variations associated with chemical use and power consumption. As a result, Reclamation will conduct a second pilot run of the facility. During this pilot run, which is scheduled to be initiated in May 2010, the plant will operate at up to one-third capacity for 365 operating days during a 12- to 18-month period. Components of the project will include a commitment to offset the reduced bypass flows with up to 30,000 acre-feet of Colorado River water and an extensive monitoring program for the Cienega.

Shortage Sharing

As mentioned in Section 7.0.6, Reclamation issued a Record of Decision (ROD) in December, 2007 on interim operating criteria (2008-2026). The elements of the ROD, which include rules for shortages and surpluses, coordinated operation of Lake Powell and Lake Mead, and water conservation have implications for water supply availability in the planning area.

The shortage recommendation implements water supply reductions when Lake Mead water storage is depleted to key surface water level elevations. In Arizona, hydrologic modeling indicates that shortage reductions will impact 4th, 5th and 6th priority water users, including on-river municipal, industrial and agricultural contractors and to the Central Arizona Project excess pool. During a shortage, the available water supply is sufficient to meet all higher priority water users.

Currently, Arizona and the other Colorado River Basin States, Reclamation and federal and state water organizations in Mexico have been engaging in discussions regarding the development of cooperative, innovative and holistic measures that will ensure that the Colorado River will continue to be able to meet environmental, agricultural and urban water demands in both countries. To further this effort, the U.S., Mexico and the Basin States are working to develop a policy framework.

Salinity and Other Water Quality Issues

Increased salinity levels in the Colorado River affect agricultural, municipal and industrial uses. Damages in the U.S. are estimated at $330 million per year, and while economic damage in Mexico is not quantified, it also poses a significant concern. The EPA approved salinity standards proposed by the Colorado River Basin Salinity Control Forum for three locations in Arizona, including two in the planning area. The water quality standards establish a flow-weighted average annual salinity standard that must be maintained on the lower Colorado River at the following locations in the planning area: Below Parker Dam (to Imperial Dam) - 747 mg/L and at Imperial Dam - 879 mg/L.

In 2005, the Governor of Arizona appointed The Clean Colorado River Alliance (Alliance) stakeholder group to address water quality issues for the Colorado River. In addition to salinity, the Alliance identified several other water quality concerns including nutrients, metals, endocrine disrupting compounds, perchlorate, bacteria and pathogens, and sediment. In 2006, the Alliance issued a report titled Clean Colorado River Alliance Recommendations to Address Colorado River Water Quality. The report includes a number of recommendations to monitor and mitigate the impacts of these pollutants.

Groundwater Transportation

In general, groundwater cannot be transported between groundwater basins or from a groundwater basin outside an AMA into an AMA (A.R.S. §§ 45-544 and 45-551 through 45-555). These restrictions were designed to protect hydrologically distinct groundwater supplies and rural economies by ensuring that groundwater is not depleted in one groundwater basin to benefit another. Three basins in the planning area, Butler Valley, Harquahala and McMullen Valley, are designated as basins from which groundwater may be withdrawn and transported under certain conditions. Information about the statutory provisions is found in Section 7.0.6.

As of December 2007, only the City of Phoenix has purchased agricultural land in the McMullen Valley Basin for the purpose of potentially transferring groundwater to the Phoenix AMA. In addition, the Department has received an application from the City of Scottsdale to transport groundwater from the Harquahala Basin. As competition for water supplies in AMAs increases, it is likely that additional applications will be filed. Under the transportation statutes the rate of groundwater decline and pumping depth are regulated in the McMullen Valley and Harquahala basins, but there are no specified limits for the Butler Valley Basin. Withdrawal and transportation of groundwater may cause groundwater level declines and impact the groundwater supply available for use within the basins.

Planning and Conservation

As mentioned in section 7.0-5, all community water systems in Arizona are required to submit a water system plan as part of the State's Drought Preparedness Plan. The system water plan includes a water supply plan, water conservation plan, and drought preparedness

Big Horn Mountains, Harquahala Basin.

plan. Water providers are required to develop the plan to ensure they reduce their vulnerability to drought and prepare to respond to potential water shortage conditions.

Local Drought Impact Groups (LDIGs) are county-level voluntary groups created to coordinate drought public awareness, provide impact assessment information to local and state leaders, and implement and initiate local drought mitigation and response actions. These groups are coordinated by local representatives of Arizona Cooperative Extension and County Emergency Management and supported by ADWR's Statewide Drought Program. To date, LDIG groups have not been formed in La Paz or Yuma counties. Information on LDIGs may be found at http://www.azwater.gov/dwr/drought/LDIG.html.

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 to incorporate into the Arizona Drought Preparedness Plan, adopted in 2004. Questionnaires were sent to almost 600 water providers, jurisdictions, counties and tribes, and a report of the findings from the survey was subsequently completed (ADWR, 2004).

There were 15 water provider and 2 jurisdiction respondents in the Lower Colorado River Planning Area and all numerically ranked a list of 18 issues. Issues that ranked consistently high by the most respondents are shown in Table 7.0-18. As shown, most respondents were concerned about the need for infrastructure replacement and the ability to fund improvements, and had water quality concerns. Few respondents were concerned about inadequate storage or pumping capacity to meet future demand or the need for additional water supplies.

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, 31 water providers in the Lower Colorado River Planning Area, with a total of approximately 40,200 service connections, participated and provided information on water supply, demand, and infrastructure and almost all ranked a list of seven issues. Respondents were from the Gila Bend, Harquahala, Lower Gila, McMullen Valley, Parker and Yuma basins.

Water providers were asked in the 2004 survey to rank seven issues from 0 to 3 with 0 = no concern, 1 = minor concern, 2 = moderate concern and 3 = major concern. There were 30 respondents that ranked issues. As shown in Table 7.0-18, infrastructure concerns ranked as important concerns, similar to the 2003 survey. This was especially of concern to providers in the Lower Gila Basin. Water quality issues were not included in the issues list but a separate question asked the respondent to indicate contaminant concerns. Of the 31 respondents, 6 indicated concerns about arsenic and one indicated a concern about proximity to a source of contamination. Unlike results from the 2003 survey, this group of respondents was

Table 7.0-17 Water resource issues ranked by survey respondents in the Lower Colorado River Planning Area

Issue	Percent of 2003 respondents that ranked issue as one of the top 5 (of 18)	Percent of 2004 respondents reporting issue was a moderate or major concern
Inadequate storage capacity to meet peak demand	NR	26%
Inadequate well capacity to meet peak demand	NR	10
Inadequate water supplies to meet current demand	NR	6
Inadequate water supplies to meet future demand	NR	23
Infrastructure in need of replacement	65%	45
Inadequate capital to pay for infrastructure improvements	35	58
Drought related water supply problems	NR	6
Ability to meet arsenic standard	35	NA
Concern about proximity of wells to sources of contamination	29	NA

Source: ADWR, 2004; ADWR, 2005

Note: 2003 respondents consisted of 15 water providers and 2 jurisdictions. 2004 respondents included 30 water providers
NR=not reported as a top 5 issue
NA= respondents were not asked to rank the issue

comprised of more large water providers and expressed concern about storage capacity and supplies to meet future demand.

7.0.9 Groundwater Basin Water Resource Characteristics

Sections 7.1 through 7.11 present data and maps on water resource characteristics of the groundwater basins in the Western Plateau 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 7.1 through 7.11.

<u>Geographic Features</u>
Geographic features maps are included to present a general orientation to principal land features, roads, counties and cities, towns and places in the groundwater basin.

<u>Land Ownership</u>
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 federal lands are typically maintained for a purpose with little associated water use. State owned land may be sold or traded, and is often leased for grazing and farming. The extent of state owned lands is due to a number of legislative actions. The State Enabling Act of 1910 and the Act that

established the Territory of Arizona in 1863 set aside sections 2, 16, 32 and 36 in each township to be held in trust by the state for educational purposes. Other legislation authorized additional state trust lands for specified purposes, which are identified for each basin (ASLD, 2006).

Climate

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

Surface Water Conditions

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

Surface water maps display runoff contours and the location of reservoirs and gages. Also shown are 1st and 2nd order streams, and 3rd order streams with gages. The stream order used is the Cartographic order, similar to 'stream level' used by the USGS to categorize streams in its National Hydrography Dataset (NHD). This method assigns Level 1 to the principal stream in a drainage area, major tributaries are assigned Level 2, minor tributaries are assigned Level 3, etc.

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

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

Perennial and Intermittent Streams and Major Springs

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

Groundwater Conditions

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

Natural recharge is typically the least well known component of a water budget. Many of the estimates in the Atlas are derived from studies of larger geographic areas and all deserve further study. Similarly, estimates of storage are based on rough estimates and considerably more studies are needed in most basins. Components of storage include aquifer depth and specific yield.

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

The flow directions that are shown generally reflect long-term, regional aquifer flow in the basin and are not meant to depict temporary or local-scale conditions. However, flow directions in some basins indicate how localized pumping has altered regional flow patterns.

Water Quality

Water quality conditions impact the availability of water supplies. Water quality data was compiled from a variety of sources as described in Volume 1 Section 1.3. The data indicate areas where water quality exceedences have previously occurred, however additional areas of concern may currently exist where water quality samples have not been collected or sample results were not reviewed by the Department (e.g. samples collected in conjunction with the ADEQ Aquifer Protection Permit programs). It is important to note also that the exceedences presented may or may not reflect current aquifer or surface water conditions.

Cultural Water Demand

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

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

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

Water Adequacy Determinations

Information on water adequacy and inadequacy determinations for subdivisions, with the reason for the inadequacy determination provides information on the number and status of subdivision lots. Listing the reason for the inadequacy identifies which subdivisions have a demonstrated physical or legal lack of water or may have elected not to provide the necessary information to the Department.

Briefly, developers of subdivisions outside of AMAs are required to obtain a determination of whether there is sufficient water of adequate quality available for 100 years. If the supply is determined to be inadequate, lots may still be sold, but the condition of the water supply must be disclosed in promotional materials and in sales documents.

In addition to these subdivision determinations for which a water adequacy report is issued, water providers may apply for adequacy designations for their entire service area. If a subdivision is to be served water from one of these water providers, then a separate adequacy determination is not required (See Section 7.0-5).

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

REFERENCES

Anderson, T.W., G.W. Freethy and P. Tucci, 1992, Geohydology and Water Resources of Alluvial Basins in South-Central Arizona and Parts of Adjacent States-Regional Aquifer-System Analysis: USGS Professional Paper 1406.B.

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Agriculture (AZDA), 2005, Yuma County: Accessed December, 2007 at http://www.azda.gov/Main/yuma.htm

Arizona Department of Commerce (ADOC), 2007a, Ajo Community Profile: Accessed December, 2007 at www.azcommerce.com

______, 2007b, Quartzite Community Profile: Accessed December, 2007 at www.azcommerce.com

Arizona Department of Economic Security (DES), 2006, Workforce Informer: Accessed August 2005 at www.workforce.az.gov

Arizona Department of Environmental Quality (ADEQ), 2007a, 20th Street and Factor Avenue Water Quality Assurance Revolving Fund (WQARF) Site: Accessed December 2007 at www.azdeq.gov/environ/waste/sps/

_____, 2007b, Yuma Marine Corp Air Station National Priorities List (NPL) Site: Accessed December 2007 at www.azdeq.gov/environ/waste/sps/

_____, 2007c, U.S. Army Yuma Proving Ground Department of Defense (DoD) Site: Accessed December 2007 at www.azdeq.gov/environ/waste/sps/

_____, 2006a, Active DOD, Superfund, WQARF, and LUST contamination sites in Arizona: GIS cover, received February 2006.

_____, 2006b, Brownfield Tracking System: Accessed June 2006 at www.azdeq.gov/ databases/brownsearch.html.

_____, 2005a, Tyson Wash Water Quality Assurance Revolving Fund (WQARF) Site, Publication Number FS 05-13: Accessed December 2007 at www.azdeq.gov/environ/waste/sps/

_____, 2005b, Active dairy farms & feedlots: Data file, received October 2005.

_____, 2002, The Status of Water Quality In Arizona – 2002: Volume 1. Arizona's Integrated 305(b) Assessment and 303(b) Listing Report

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Water Management Division

_____, 2008b, Water use by golf courses in rural Arizona: Unpublished analysis by ADWR Office of Regional Strategic Planning.

_____, 2005, Data from 2004 rural water provider questionnaire: ADWR Office of Resource Assessment Planning.

_____, 2004, Rural Water Resources Study-Rural Water Resources 2003 Questionnaire Report.

_____, 1998, Water Service Organizations in Arizona.

_____, 1994a, Arizona Water Resources Assessment, Vol. II Hydrologic Summary.

_____, 1994b, Arizona Water Resources Assessment, Vol. I Inventory and Analysis.

Arizona Farm Bureau (AZFB), 2008, XL Renewables Hits a Few Bumps in the Road but Renewables is Still the Focus: Accessed October, 2009 at http://www.azfb.org/news/index.cfm?fuseaction=article&rowid=224

Arizona Game and Fish (AZGF), 1997, Remote Sensing Mapping of Arizona Intermittent Stream Riparian Areas.

_____, 1993, Arizona Riparian Inventory and Mapping Project: GIS cover.

Arizona Land Resource Information System (ALRIS), 2004: Land Ownership, GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html

Arizona Public Service, 2007, Power Plants: Accessed December 2007 at http://www.aps.com/general_info/AboutAPS_18.html

Arizona-Sonora Desert Museum (ASDM), 2007a, Center for Sonoran Desert Studies-Lower Colorado River Valley and Arizona Uplands: Accessed November, 2007 at http://www.desertmuseum.org/desert/sonora.php).

_______, 2007b, Invaders of the Sonoran Desert Region: Bufflegrass: Accessed October 2007 at: www.desertmuseum.org/invaders.htm

Arizona State Land Department (ASLD), 2006, Historical overview-Land Grant and Designation of Beneficiaries: Accessed February 2006 at http://www.land.state.az.us/history.htm.

Arizona Water Company, 2007, Community Water System Report-Ajo: Submitted to ADWR May, 2007

Border Environment Cooperation Commission (BECC), 2003, Yuma County Water Users Association Water Conservation Improvement Projects.: Accessed November 2007 at http://www.cocef.org/aproyectos/ExcomYuma2003_09ing.htm

Brooks, M.L. and D.A. Pyke, 2002, Invasive Plants and Fire in the Deserts of North America, Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: the First National Congress on Fire Ecology, Prevention and Management.

Brown, D., ed., 1982, Biotic Communities of the Southwest-United States and Mexico, Special Issue of Desert Plants, Volume 4. Numbers 1-4, Published by the University of Arizona for the Boyce Thompson Southwestern Arboretum

Burns, S., 2007, "Stopping the Spread: The fight against bufflegrass rages on in Southern Arizona." In Tucson Weekly, April 26, 2007.

Carruth, R.L., 1996, Hydrogeology of the Quitobaquito Springs and La Abra Plain Area, Organ Pipe Cactus National Monument, Arizona, and Sonora, Mexico, USGS Water-Resources Investigations Report 95-4295

Central Arizona Project (CAP), 2009, Report on Pilot Run of Yuma Desalting Plant & Related Agreements: Accessed October 2009 at http://www.cap-az.com/includes/docs/meetings/

City of San Luis, 2007, 2006 Community Water System Annual Report: Submitted to ADWR, June, 2007.

City of Somerton, 2006, Somerton Water Supply Plan: Submitted to ADWR, December 2006.

City of Yuma, 2007, 2006 Community Water System Annual Report: Submitted to ADWR, June, 2007

_____, 2002, City of Yuma 2002 General Plan, Public Services Element.

Cocopah Indian Tribe, 2006, Environmental Protection: Accessed December, 2007 at http://www.cocopah.com/docs/environ.html

Colorado River Indian Tribes (CRIT), 2005, About the Tribes and Business Opportunities: Accessed December, 2007 at http://critonline.com/index.shtml

Dickinson, J.E., M. Land, C.C. Faunt, S.A. Leake, E.G. Reichard, J.B. Fleming and R.E. Pool, 2006, Hydrogeologic Framework Refinement, Ground-Water Flow and Storage, Water-Chemistry Analyses, and Water-Budget Components of the Yuma Area, Southwestern Arizona and Southeastern California, USGS Scientific Investigations Report 2006-5135

Environmental Law Institute, 2002, An Analysis of State Superfund Programs: 50 State Study, 2001 Update.

Far West Water & Sewer, Inc., 2006, Water Supply & Drought Preparedness Plan: Submitted to ADWR, December, 2006.

Fenneman, N.H. and D.W. Johnson, 1946, Physiographic divisions of the conterminous U.S.: GIS cover.

Glenn, E.P., P. Nagler, R. Romo and O. Hinojosa-Huerta, 2004, Regeneration of Native Trees and Wetlands in the Delta; In Southwest Hydrology, January/February 2004.

Hedley, J.D., 1990, Maps Showing Groundwater Conditions in the Harquahala Irrigation Non-Expansion Area and Tiger Wash Basin, Maricopa and La Paz Counties, Arizona-\ 1989. Department of Water Resources Hydrologic Map Series Report Number 17.

Hollett, K.J., 1985, Geohydrology and Water Resources of the Papago Farms-Great Plain Area, Papago Indian Reservation, Arizona and the Upper Rio Sonoyta Area, Sonora, Mexico USGS Water-Supply Paper 2258.

Intertribal Council of Arizona (ITCA), 2003, Cocopah Tribe and Fort Yuma-Quechan Tribe: Accessed October, 2007 at www.itcaonline.com

Johnson, B.J., 1990, Maps Showing Groundwater Conditions in the Ranegras Plain Basin, La Paz and Yuma Counties, Arizona-1988. Department of Water Resources Hydrologic Map Series Report Number 18.

Knowles, G., 2003, Aquatic Life in the Sonoran Desert, In Endangered Species Bulletin May/ June 2003 Volume XXVIII No. 3.

Malcolm Pirnie, 2006, System Water Plan Ajo Improvement Company Phelps Dodge Corporation: Submitted to ADWR, November 2006.

National Atlas of the United States, 2005, National Wilderness Preservation System of the United States: GIS Cover, Accessed December 2007 at http://www.nationalatlas.gov/atlasftp.html#wildrnp

National Park Service (NPS) 2007, Organ Pipe Cactus National Monument: Accessed October 2007 at http://www.nps.gov/orpi/index.htm

Olson, D. M, E. Dinerstein, E.D. Wikramanayake, N.D. Burgess, G.V.N. Powell, E.C. Underwood, J.A. D'amico, I. Itoua, H.E. Strand, J.C. Morrison, C.J. Loucks, T.F. Allnutt, T.H. Ricketts, Y. Kura, J.F. Lamoreux, W.W. Wettengel, P. Hedao & K.R. Kassem, 2001, Terrestrial Ecoregions of the World: A New Map of Life on Earth. BioScience 51:933-938

Oram, P, 1987, Map Showing Groundwater Conditions in the Butler Valley Basin, La Paz County, Arizona-1986. Department of Water Resources Hydrologic Map Series Report Number 13.

Overby, A., 1997, Maps Showing Groundwater Conditions in the Yuma Basin, Yuma County, Arizona-1992. Department of Water Resources Hydrologic Map Series Report Number 30.

Pacific Gas and Electric Corporation (PG&E), 2000, PG&E Corporations's Harquahala Plant Receives Unanimous Approval of Environmental Capatibility Certificate: Press Release, June 8, 2000.

Phelps Dodge Corporation, 2007, Community Water System Report-Ajo Improvement Company: Submitted to ADWR May, 2007.

Rascona, S.J., 1996, Maps Showing Groundwater Conditions in the Gila Bend Basin Maricopa County, Arizona – 1993. Department of Water Resources Hydrologic Map Series Report Number 29.

Remick, W.H., 1981, Maps Showing Ground-Water Conditions in the McMullen Valley Area, Maricopa, Yavapai, and Yuma Counties, Arizona-1981. Department of Water Resources Hydrologic Map Series Report Number 6.

Reynolds, S.J., 1988, Geologic Map of Arizona: Arizona Geologic Survey Map 26.

Salton Sea Authority, 2000, Historical Chronology: Accessed November, 2007 at http://www.saltonsea.ca.gov/histchron.htm

Seaber, P.R., Kapinos, E.P. and G.L. Knapp, 1987, Hydrologic Unit Maps; U.S. Geological Survey Water-Supply Paper 2294, 63 pp.

Tellman, B., R. Yarde and M. Wallace, 1997, Arizona's changing rivers: How people have affected rivers: Water Resources Research Center, University of Arizona, Tucson, Arizona.

Tohono O'odham Nation (TON), 2009; Issue Brief: The United States' Obligation to Replace Damaged Reservation Land; Accessed October 2009 at http://www.tonation-nsn.gov/pdf/Land_Replacement_Issue_Brief.pdf

______, 2007, Community-Districts; Accessed October 2009 at www.tonation-nsn.gov

Tohono O'odham Utility Authority (TOUA), 2007a, Water: Accessed December 2007 at http://www.toua.net/water.html

______, 2007b, TOUA 2006 Annual Water Quality Report.

Town of Gila Bend, 2008, Gila Bend Water System Water Supply Plan: submitted to ADWR March, 2008.

Town of Parker, 2006, Town of Parker Water Supply Plan: Submitted to ADWR, December 2006.

Town of Quartzsite, 2008, Town of Quartzite Water Supply Plan: Submitted to ADWR, March, 2008.

_______, 2003, Town of Quartzite 2003 General Plan-Conservation, the Environment and Water Resources Element.

Turner, R.M. and D.E. Brown, 1982, Sonoran Desertscrub; In Biotic Communities of the Southwest-United States and Mexico, Special Issue of Desert Plants, Volume 4. Numbers 1-4, Published by the University of Arizona for the Boyce Thompson Southwestern Arboretum.

U.S. Bureau of Land Management (BLM), 2007, Sonoran Desert National Monument: Accessed October 2007 at http://www.blm.gov/az/

______, 2006, Arizona Wilderness Areas: Accessed December 2006 at www.blm.gov/az/wildarea.htm

U.S. Bureau of Reclamation (USBOR), 2009, Seepage and Groundwater Investigations, Yuma Area Groundwater Elevations map: accessed October, 2009 at http://www.usbr.gov/lc/yuma/programs/YAWMS/Groundwater/YA122008-72dpi.pdf

______, 2008, Regulating the Use of Lower Colorado River Water Without an Entitlement; Notice of Proposed Rulemaking: Federal Register / Vol. 73, No. 137 / Wednesday, July 16, 2008; 43 CFR Part 415

______, 2007a, CRB - Salinity Control Project - Protective and Regulatory Pumping Unit: Accessed December, 2007 at www.usbr.gov/dataweb/html/crbscpprpu.html

______, 2007b, Draft Environmental Impact Statement, Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lakes Powell and Mead.

______, 2007c, Parker-Davis Project: Accessed December, 2007 at http://www.usbr.gov/dataweb/html/parkerdavis.html

______, 2007d, Colorado River Front Work and Levee System: Accessed December, 2007 at http://www.usbr.gov/dataweb/html/fwls.html

______, 2007e, Colorado River Basin Salinity Control Program Palo Verde Irrigation District, California: Accessed December, 2007 at http://www.usbr.gov/dataweb/dams/az10314.htm

______, 2007f, Gila Project Arizona: Accessed December, 2007 at http://www.usbr.gov/dataweb/html/gila.html

______, 2007g, Yuma Project Arizona and California: Accessed December, 2007 at http://www.usbr.gov/dataweb/html/yuma.html

______, 2007h, Yuma Auxiliary Project Arizona: Accessed December, 2007 at http://www.usbr.gov/dataweb/html/yumaap.html

______, 2007i, Groundwater Recovery and River Regulation Program-Yuma Area Well Fields: Accessed December, 2007 at http://www.usbr.gov/lc/yuma/facilities/yao_wellfields_map.html

_____, 2006, Parker PowerPlant: Accessed December, 2007 at http://www.usbr.gov/power/data/sites/parker/parker.html

_____, 2000, Accounting for Colorado River Water Use within the States of Arizona, California, and Nevada Calendar Year 2000: Accessed December 2007 at http://www.usbr.gov/lc/region/g4000/wtracct.html

_____, 1992, Accounting for Colorado River Water Use within the States of Arizona, California, and Nevada Calendar Year 1992: Accessed December 2007 at http://www.usbr.gov/lc/region/g4000/wtracct.html

U.S. Census Bureau, 2006, on-line data files: Accessed January 2006 at www.census.gov

U.S. Department of Interior (USDOI), 2004, Final Programmatic EIS/EIR Lower Colorado River Multi-Species Conservation Program, Volume 1.

U.S. Fish and Wildlife Service (USFWS), 2008, Endangered Species List by County: Accessed July 2008 at www.fws.gov/arizonaes/documents/countylists and www.fws.gov/ifw2es/endangeredspecies/lists/default.cfm.

_____, 2007a, Cabeza Prieta National Wildlife Refuge: Accessed October 2007 at http://www.fws.gov/refuges/

_____, 2007b, Cibola National Wildlife Refuge: Accessed October 2007 at http://www.fws.gov/refuges/

_____, 2007c, Kofa National Wildlife Refuge: Accessed October 2007 at http://www.fws.gov/refuges/

_____, 2007d, Imperial National Wildlife Refuge: Accessed October 2007 at http://www.fws.gov/refuges/

U.S. Geological Survey (USGS), 2009, Preliminary Data from 2007 Agricultural Ground Truthing in Select Basins in the Lower Colorado River Planning Area; GIS cover received October, 2009.

_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 2000-2005: Data file, received December 2007.

______, 2005, 1:2,000,000-Scale Hydrologic Unit Boundaries: GIS Cover, accessed in 2007 at http://nationalatlas.gov/atlasftp.html?openChapters=chpwater#chpwater

University of Arizona, 2003, A brief history of the Colorado River Delta: Accessed November, 2007 at http://www.ag.arizona.edu/colorado_river_delta/delta/intro.html

Webb, R.H., S.A. Leake, R.M. Turner, 2007, The Ribbon of Green; Change in Riparian Vegetation in the Southwestern United States, University of Arizona Press, 462 pp.

Wellton-Mohawk Irrigation and Drainage District (WMIDD), 2004, History/ Irrigation/ Agriculture/Drainage/ Challenges: Accessed December 2007 at http://www.welltonmohawk.org/html

Yuma Area Ag Council, 2004, Yuma Area Irrigation Districts: Accessed December, 2007 at http://www.yaac.net/irrigation.html

Yuma County, 2000, Yuma County 2010 Comprehensive Plan.

Section 7.1
Butler Valley Basin

7.1.1 Geography of the Butler Valley Basin

The Butler Valley Basin, located in the northern part of the planning area, is 288 square miles in area. Geographic features and principal places are shown on Figure 7.1-1. The basin is characterized by a valley bordered by two mountain ranges. Vegetation types include Lower Colorado River and Arizona uplands Sonoran desertscrub and a small amount of interior chaparral on the eastern basin boundary. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.1-1 are:
  - Cunningham Wash running northeast to southwest in the northern portion of the basin
  - Butler Valley bordered by the Harcuvar Mountains on the eastern basin boundary and the Buckskin Mountains on the northwestern basin boundary
  - Harcuvar Peak at 4,618 feet, the highest point in the basin
  - The lowest point in the basin at 1,345 feet at "The Narrows" where Cunningham Wash exits the basin.

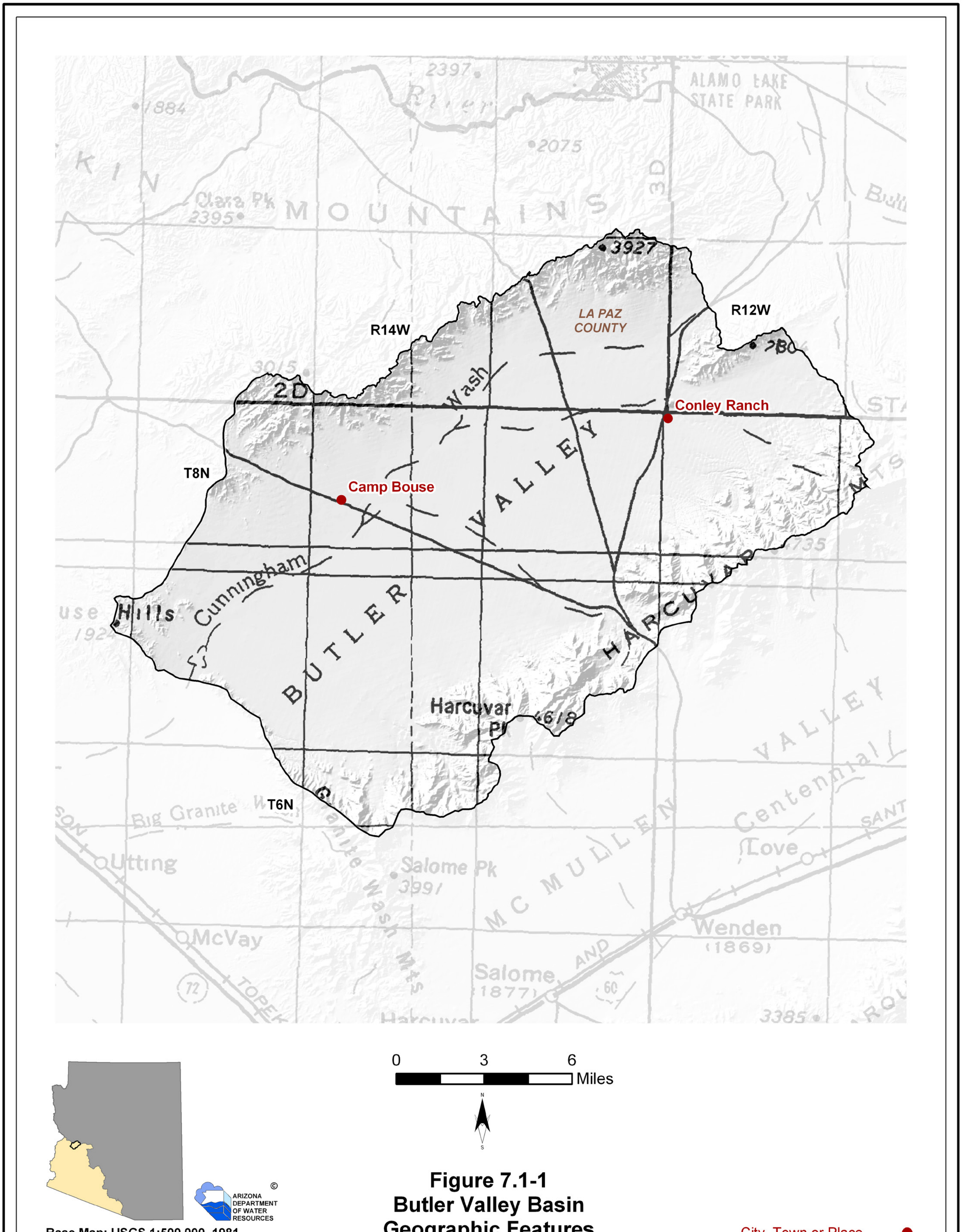


Figure 7.1-1
Butler Valley Basin
Geographic Features

7.1.2 Land Ownership in the Butler Valley Basin

Land ownership, including the percentage of ownership by category, for the Butler Valley Basin is shown in Figure 7.1-2. Principal features of land ownership in this basin are the large blocks of U.S. Bureau of Land Management and State Trust lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 55.5% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- BLM land in this basin includes 4,900 acres of the 38,000 acre Rawhide Mountains Wilderness and 11,000 acres of the 25,000 acre Harcuvar Mountains Wilderness. (see Figure 7.0-12)
- Land uses include grazing, resource conservation and recreation.

State Trust Land

- 43.9% of the land is held in trust for the public schools, the Pioneer Home and both the Dept of Corrections and Juvenile Corrections and county bonds under the State Trust Land system.
- Primary land use is grazing.

Private

- 0.6% of the land is private.
- Small parcels of private land are found surrounded by BLM land in the northern and southern portions of the basin.
- Land uses include domestic and ranching.

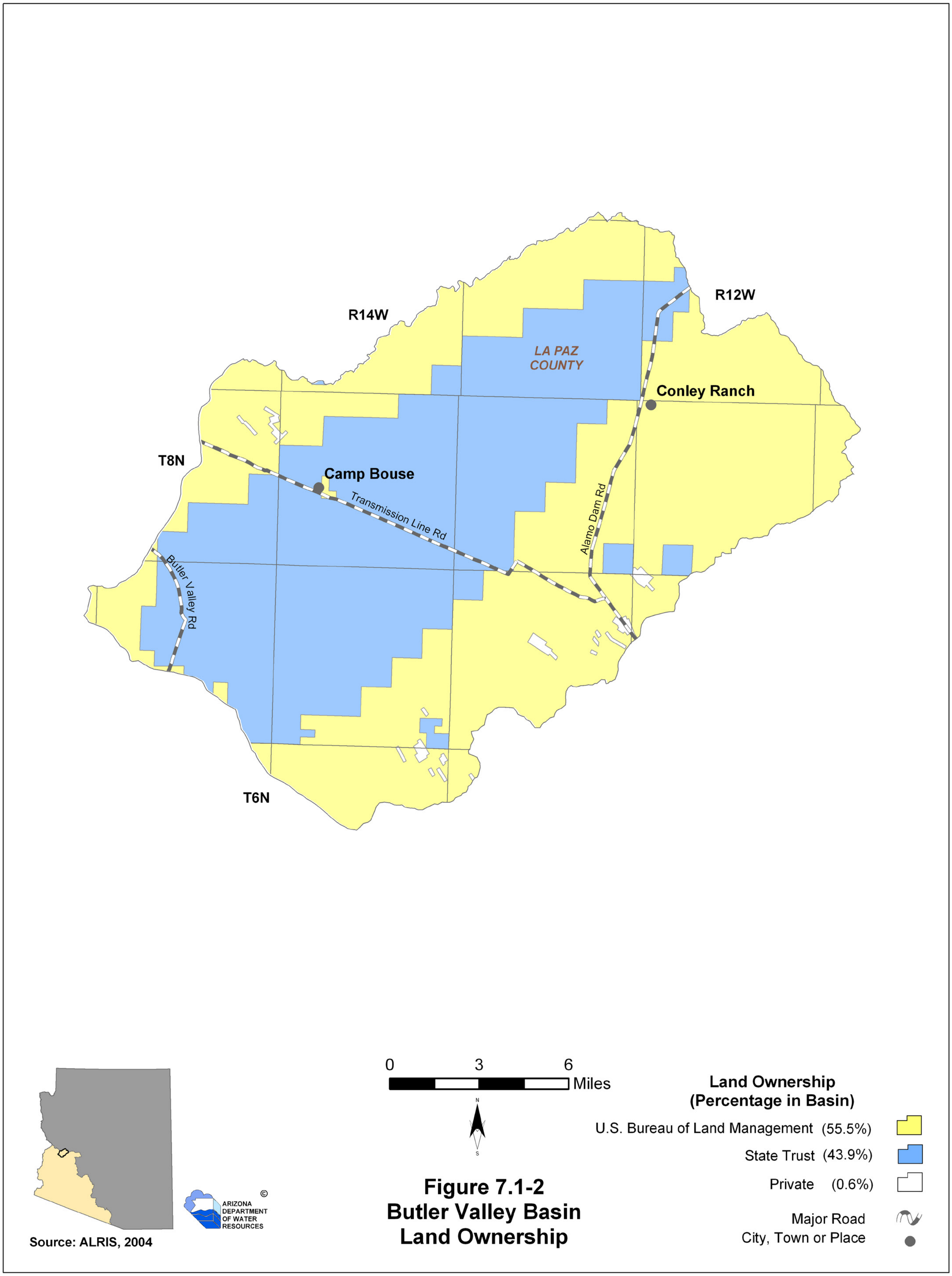


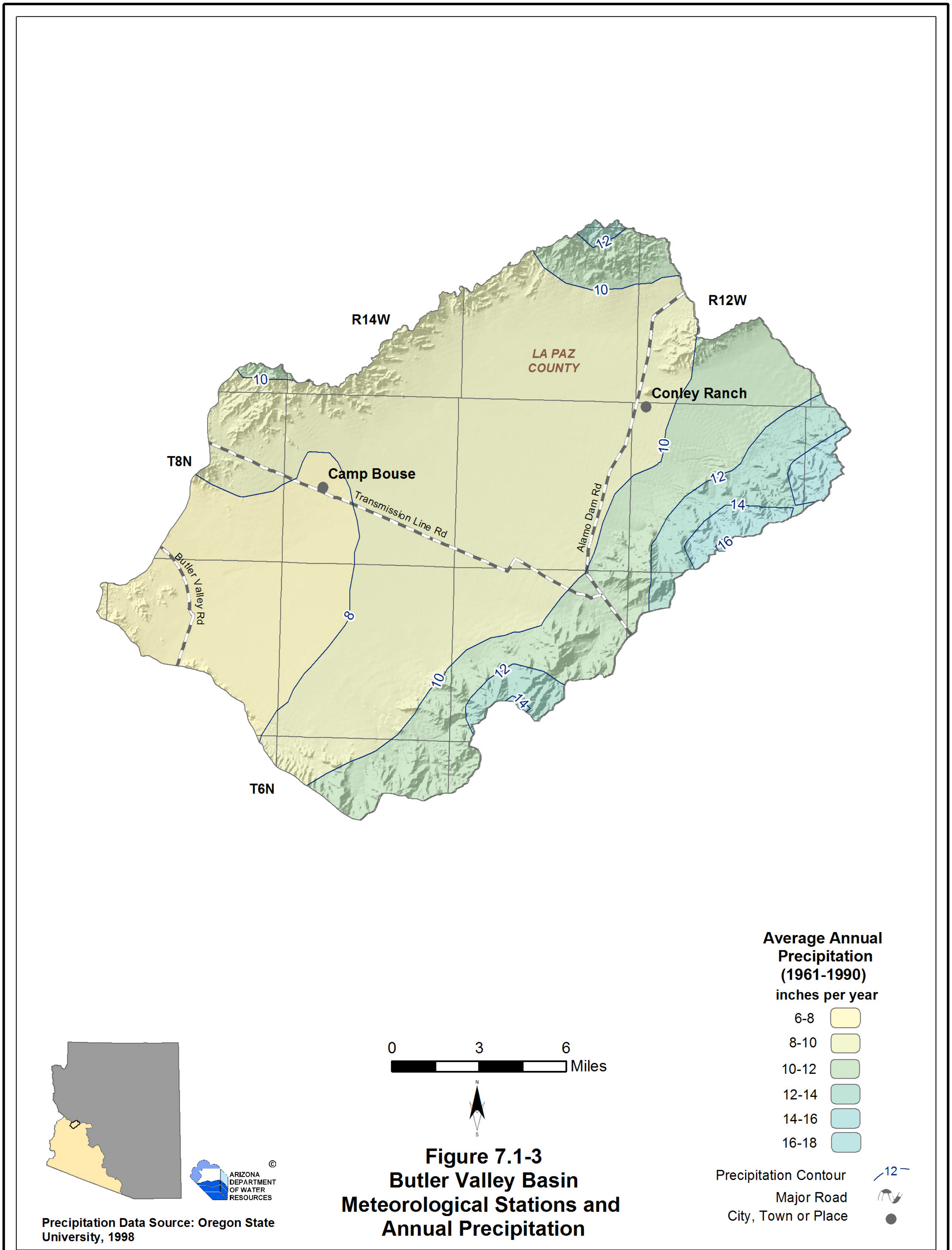
Figure 7.1-2
Butler Valley Basin
Land Ownership

7.1.3 Climate of the Butler Valley Basin

The Butler Valley Basin does not contain NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 7.1-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 7.1-3
- Average annual rainfall is as high as 18 inches along the central eastern basin boundary and as low as six inches in the western portion of the basin.



Precipitation Data Source: Oregon State University, 1998

Figure 7.1-3
Butler Valley Basin
Meteorological Stations and Annual Precipitation

7.1.4 Surface Water Conditions in the Butler Valley Basin

There are no streamflow data, flood ALERT equipment or USGS runoff contour data available for this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.1-1. The location of large reservoirs is shown on Figure 7.1-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Reservoirs and Stockponds

- Refer to Table 7.1-1.
- The basin contains one large reservoir, Cunningham Wash, with a maximum surface area of 143 acres. Its use was not available.
- There are no small reservoirs and seven registered stockponds in this basin.

Table 7.1-1 Reservoirs and Stockponds in the Butler 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	JURISDICTION
1	Cunningham Wash	NA	143	NA	Private

Source: Compilation of databases from ADWR & others

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

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

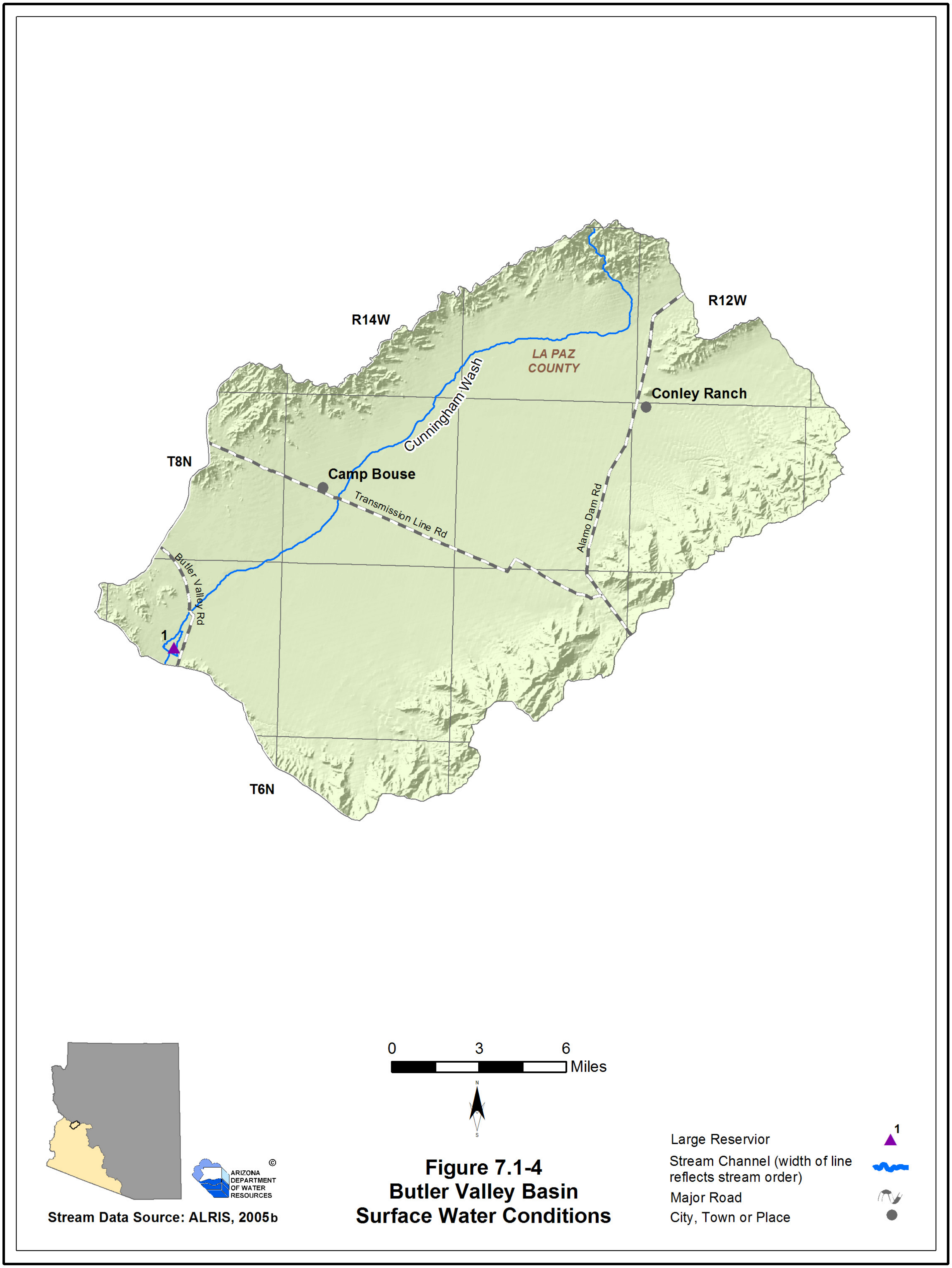
D. Other Small Reservoirs (between 5 and 50 acres surface area)

Total number: 0
Total surface area: 0 acres

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

Total number: 7

Notes:
[1]Capacity data is not available to ADWR
NA = Information is not available to ADWR



Stream Data Source: ALRIS, 2005b

Figure 7.1-4
Butler Valley Basin
Surface Water Conditions

7.1.5 Perennial/Intermittent Streams and Major Springs in the Butler Valley Basin

The total number of springs in the basin are shown in Table 7.1-2. There are no perennial or intermittent streams and no major or minor springs in the Butler Valley Basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- The total number of springs, regardless of discharge, identified by the USGS is one.

Table 7.1-2 Springs in the Butler 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)	Date Discharge Measured
	Latitude	Longitude		
None identified by ADWR at this time				

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

7.1.6 Groundwater Conditions of the Butler Valley Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.1-3. Figure 7.1-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.1-6 contains hydrographs for selected wells shown on Figure 7.1-5. Figure 7.1-7 shows well yields in four yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.1-3 and Figure 7.1-5.
- The major aquifer is basin fill.
- Flow direction is from northeast to southwest generally following Cunningham Wash.

Well Yields

- Refer to Table 7.1-3 and Figure 7.1-7.
- As shown on Figure 7.1-7, well yields generally range from 1,000 gallons per minute (gpm) to greater than 2,000 gpm.
- One source of well yield information, based on 17 reported wells, indicates that the median well yield is 2,200 gpm.

Natural Recharge

- Refer to Table 7.1-3.
- Natural recharge estimates range from less than 1,000 acre-feet per year (AFA) to 1,060 AFA.

Water in Storage

- Refer to Table 7.1-3.
- Storage estimates for this basin range from 2.0 million acre-feet (maf) at a depth of 1,200 feet to 20 maf at a depth of 1,000 feet.

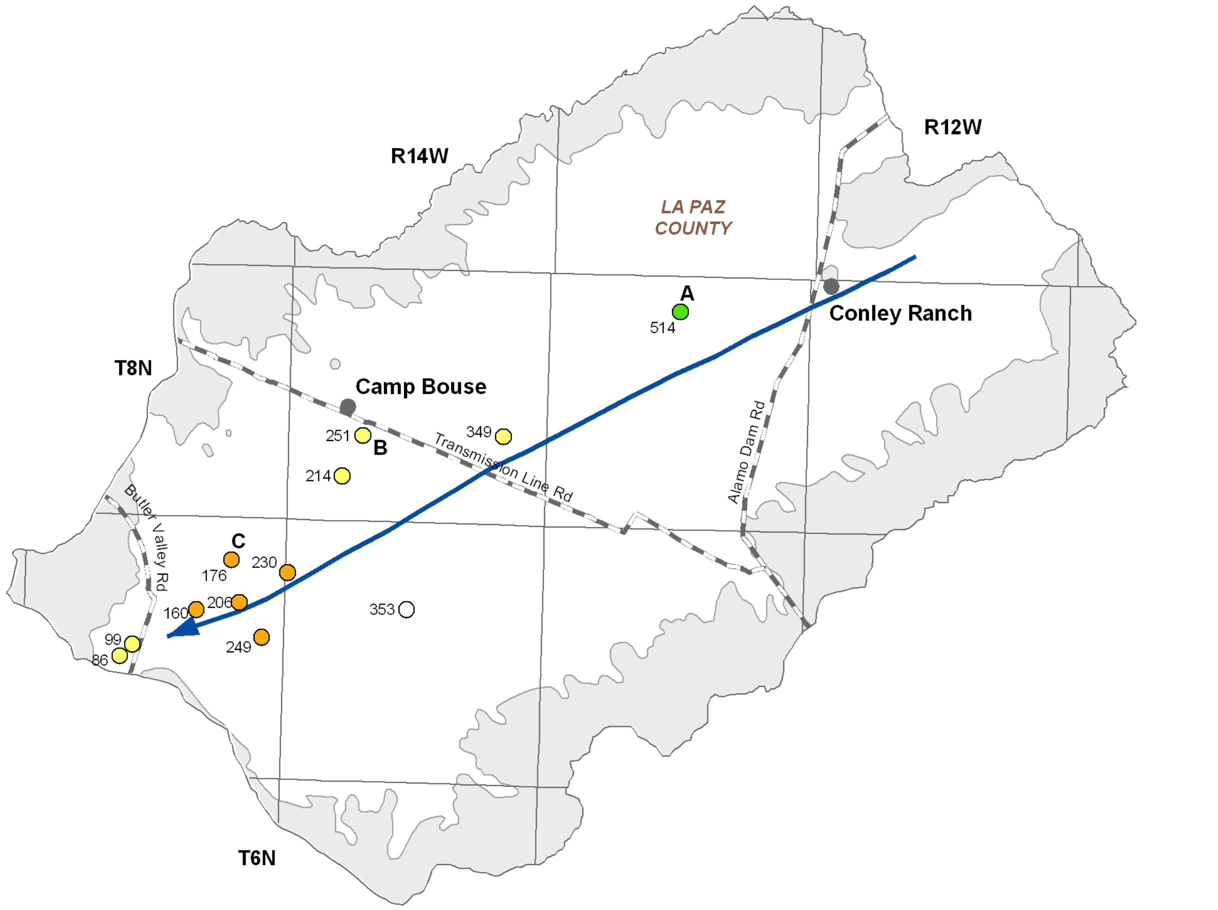
Water Level

- Refer to Figure 7.1-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures eleven index wells in this basin. Hydrographs for three index wells are shown on Figure 7.1-6.
- The deepest water level shown on the map is 514 feet west of Conley Ranch and the shallowest water level shown on the map is 86 feet near the southwestern basin boundary.

Table 7.1-3 Groundwater Data for the Butler Valley Basin

Basin Area, in square miles:	288	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 15.6-2,910 Median 1590 (5 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 100-3,200 Median 2,200 (17 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 300-1,000	ADWR (1990)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	<1,000	Freethey and Anderson (1986)
	1,060	Herndon (1985)
Estimated Water Currently in Storage, in acre-feet:	6,400,000 - 6,500,000 (to 1,200 ft)	ADWR (1990 and 1994b)
	2,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	5,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
	12,000,000 (to 700 ft)	Herndon (1985)
	20,000,000 (to 1,000 ft)	USBOR (1979)
Current Number of Index Wells:	13	
Date of Last Water-level Sweep:	2004 (24 wells measured)	

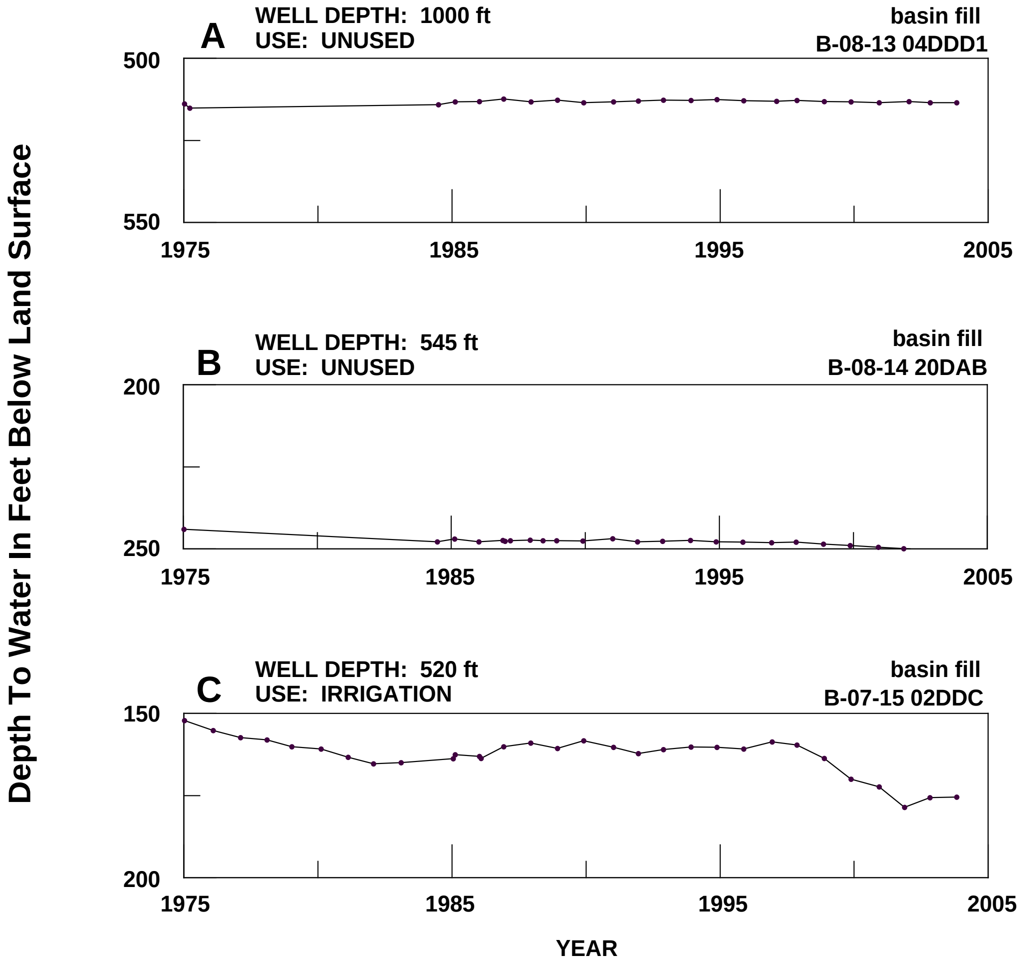
[1]Predevelopment Estimate

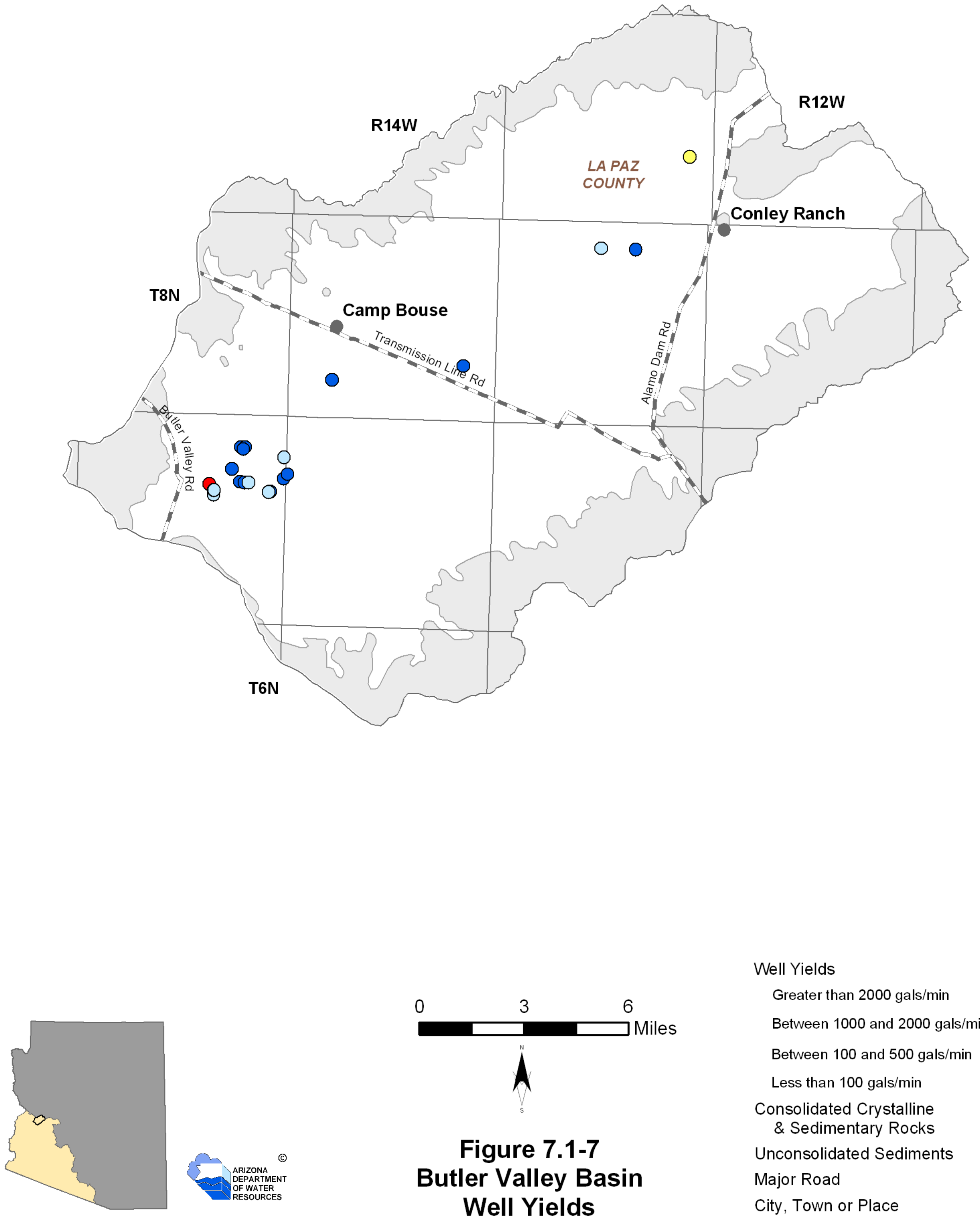


ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.1-5
Butler Valley Basin
Groundwater Conditions

Figure 7.1-6
Butler Valley Basin
Hydrographs Showing Depth to Water in Selected Wells





Well Yields

- Greater than 2000 gals/min
- Between 1000 and 2000 gals/min
- Between 100 and 500 gals/min
- Less than 100 gals/min

Consolidated Crystalline & Sedimentary Rocks
Unconsolidated Sediments
Major Road
City, Town or Place

Figure 7.1-7
Butler Valley Basin
Well Yields

7.1.7 Water Quality of the Butler Valley Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.1-4A. There are no impaired lakes or streams in this basin. Figure 7.1-8 shows the location of water quality occurrences keyed to Table 7.1-4. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.1-4A.
- Eight wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter most frequently equaled or exceeded was fluoride. Other parameters equaled or exceeded include arsenic, lead and nitrates.

Table 7.1-4 Water Quality Exceedences in the Butler Valley Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	8 North	14 West	20	As, F
2	Well	8 North	14 West	29	As, F, Pb
3	Well	7 North	15 West	2	F
4	Well	7 North	15 West	10	F
5	Well	7 North	15 West	12	As
6	Well	7 North	15 West	13	As
7	Well	7 North	15 West	15	F
8	Well	7 North	15 West	15	F, NO3

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1979 and 1998.

[2] As = Arsenic
NO3 = Nitrate
F = Fluoride
Pb = Lead

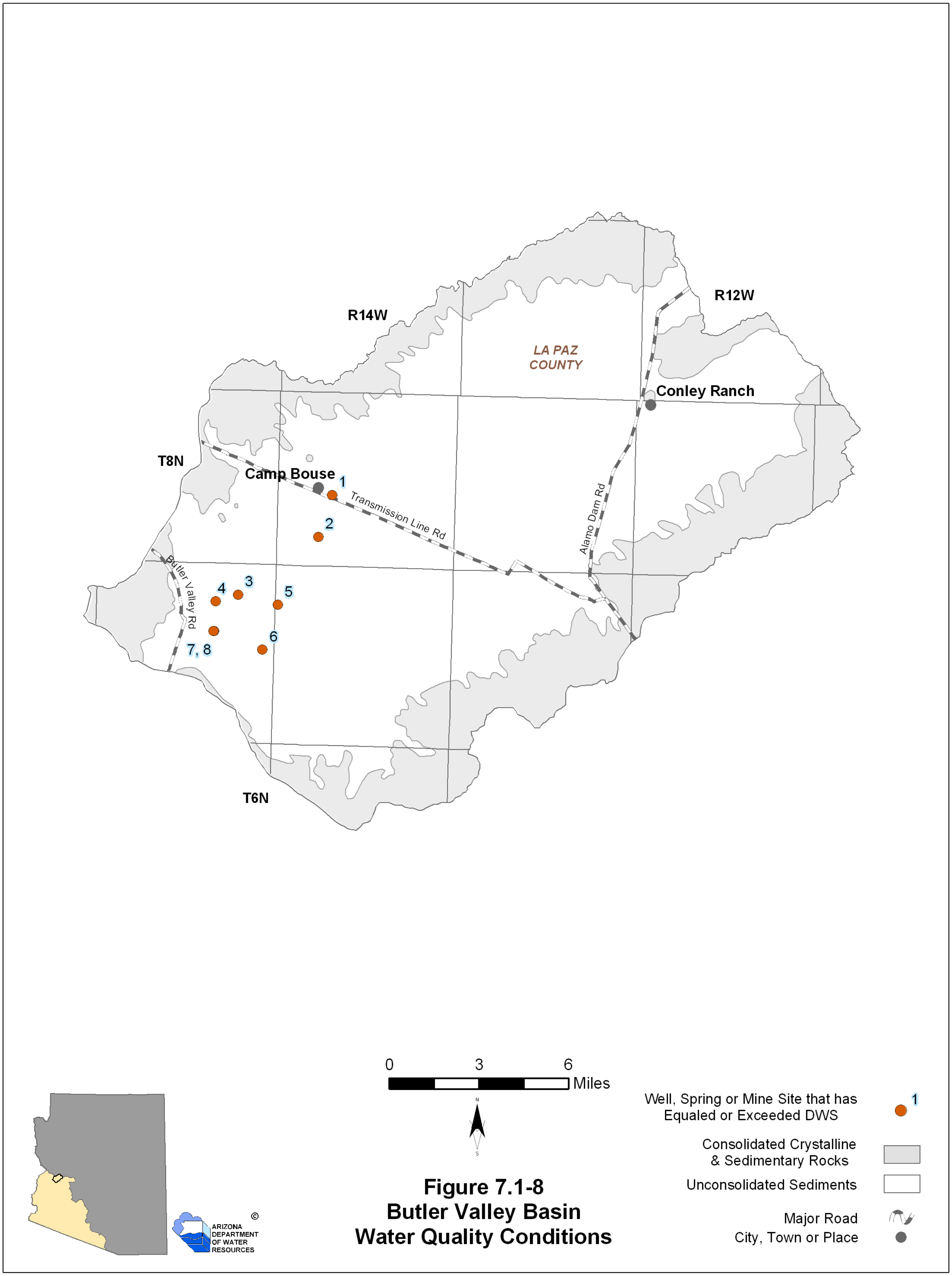


Figure 7.1-8
Butler Valley Basin
Water Quality Conditions

7.1.8 Cultural Water Demands in the Butler 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 7.1-5. Figure 7.1-9 shows the location of demand centers. There is no recorded effluent generation in this basin. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

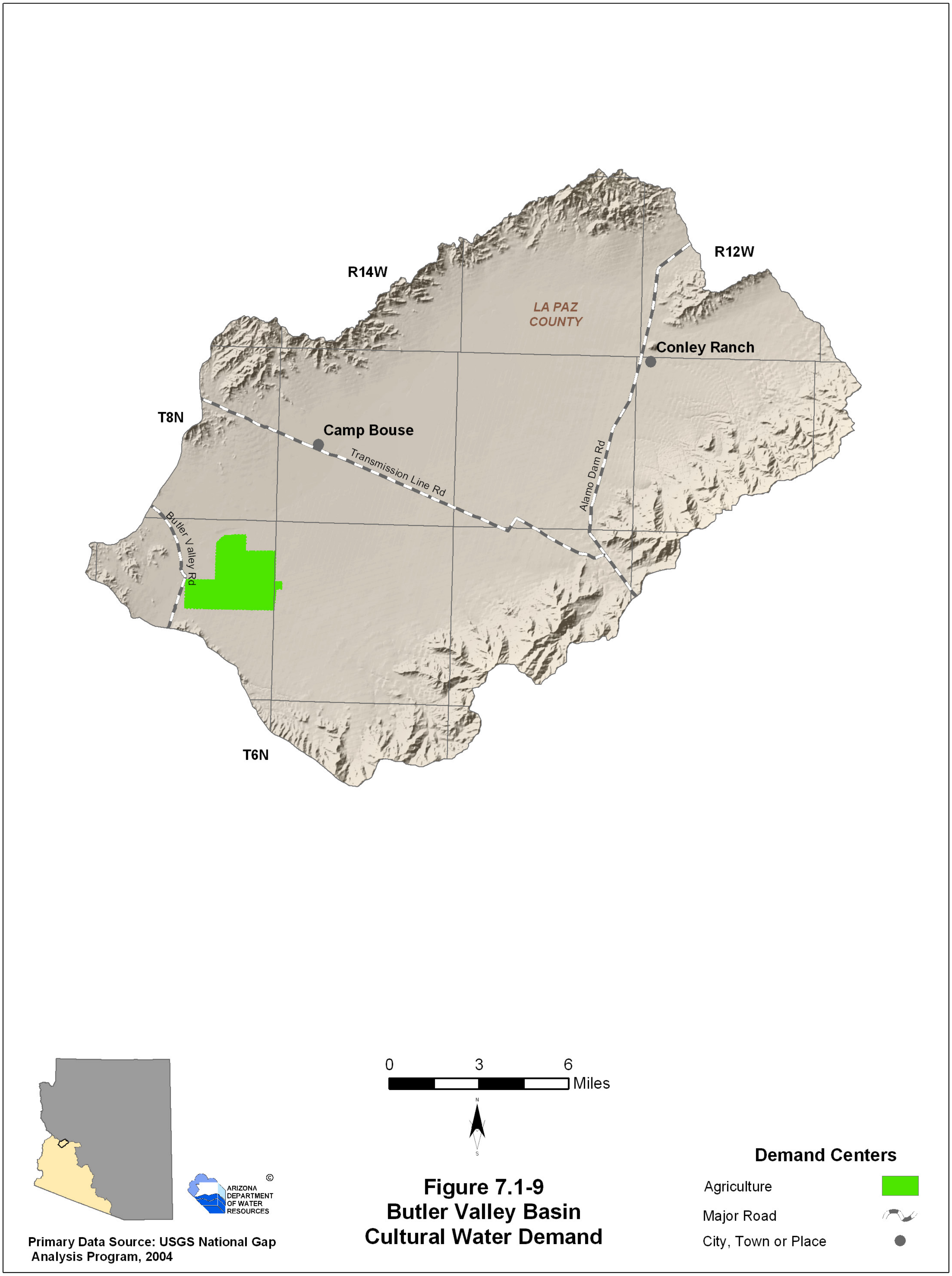
Cultural Water Demands

- Refer to Table 7.1-5 and Figure 7.1-9.
- Population in this basin is very small, with 15 residents in 2000.
- There are no surface water diversions in this basin. Most cultural water use is for irrigation east of Butler Valley Road in the southwestern portion of the basin. Agricultural water use increased 185% from 1991-2005 with 9,700 acre-feet of demand per year on average from 2001 to 2005.
- Municipal water demand is minimal and did not increase from 1991 to 2005.
- As of 2005 there were 18 registered wells with a pumping capacity of less than or equal to 35 gpm and 21 wells with a pumping capacity of more than 35 gpm.

Table 7.1-5 Cultural Water Demand in the Butler Valley Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971										
1972										
1973					4,000			NR		
1974										
1975										
1976		12[2]	19[2]							
1977										
1978					4,000			NR		
1979										
1980	5									ADWR (1994a)
1981	6									
1982	6									
1983	7	1	0		4,000			NR		
1984	7									
1985	8									
1986	8									
1987	9									
1988	9	2	0		4,000			NR		
1989	10									
1990	10									
1991	11									
1992	11									
1993	12	2	0	<300	NR	3,400[3]		NR		
1994	12									
1995	13									
1996	13									
1997	14									
1998	14	1	2	<300	NR	8,300		NR		USGS (2007)
1999	15									
2000	15									
2001	15									
2002	15									
2003	15	0	0	<300	NR	9,700		NR		
2004	15									
2005	15									
2010	15									
2020	15									
2030	16									
WELL TOTALS:		**18**	**21**							

[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Data not available for 1991-1993, average shown is 1994-1995
NR - Not reported



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 7.1-9
Butler Valley Basin
Cultural Water Demand

7.1.9 Water Adequacy Determinations in the Butler Valley Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.1-6. Figure 7.1-10 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in La Paz County. One water adequacy determination for 76 lots has been made in this basin through December 2008; all lots were inadequate.
- The reason for the inadequacy was because the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination.

Table 7.1-6 Adequacy Determinations in the Butler 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	Saguaro Acres	La Paz	7 North	13 West	7	76	53-402268	Inadequate	A1	9/6/2006	Dry Lot Subdivision

Source: ADWR 2008

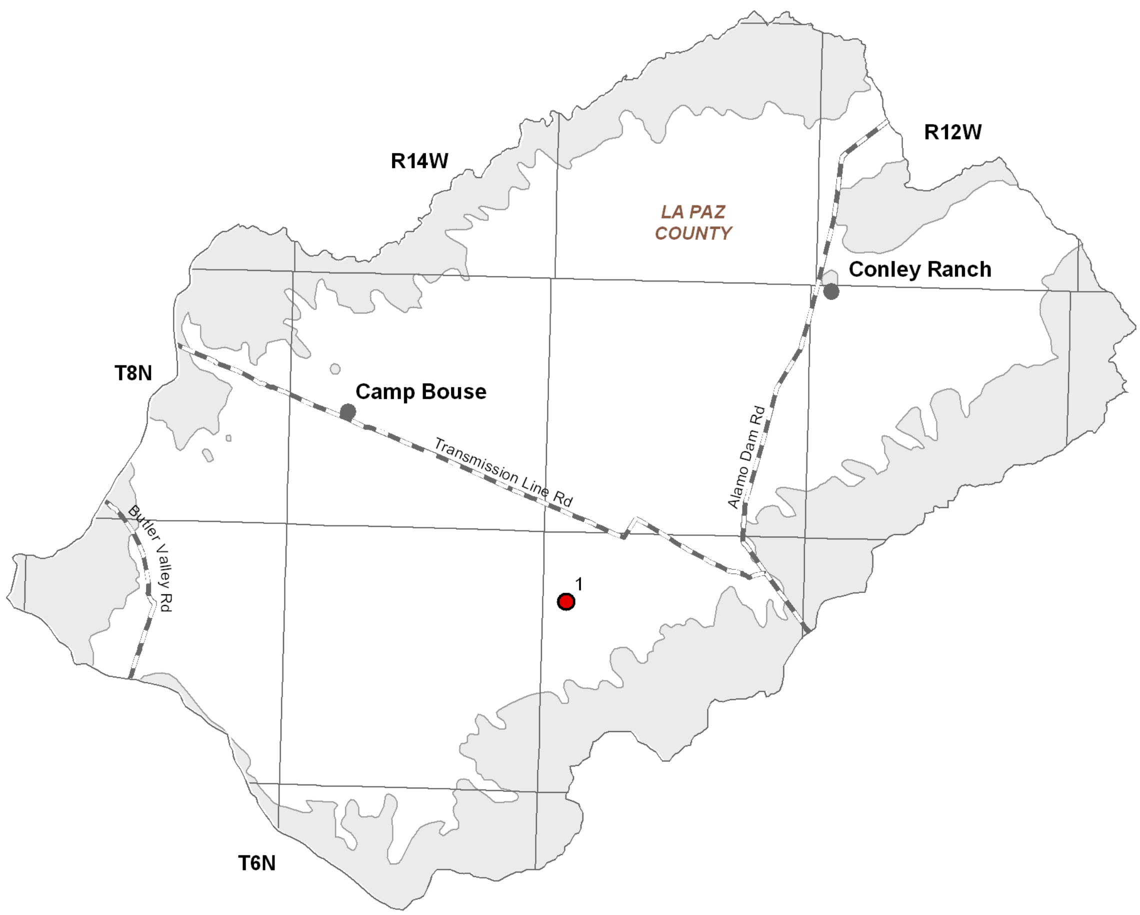
Notes:

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

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

[3] A. Physical/Continuous
1) Insufficient Data (applicant chose not to submit necessary information, and/or available hydrologic data insufficient to make determination)
2) Insufficient Supply (existing water supply unreliable or physically 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



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.1-10
Butler Valley Basin
Adequacy Determinations

Butler Valley Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Water Resources (ADWR), 2008, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Registry of surface water rights: ADWR Office of Water Management.

_____, 2005d, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning.

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Land Resource Information System (ALRIS), 2005, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

G

Gebert, W.A., D.J. Graczyk and W.R. Krug, 1987, Average annual runoff in the United States, 1951-1980: GIS Cover, accessed March 2006 at http://aa179.cr.usgs.gov/metadata/wrdmeta/runoff.htm. (Surface Water Conditions Map)

H

Herndon, R.L., 1985, Hydrogeology of Butler Valley, AZ: an artificial recharge and groundwater storage pre-feasibility study, University of Arizona, 106 p.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Bureau of Reclamation (USBOR), 1979, Butler Valley exploratory well no 1, Butler Valley, Arizona, reject stream replacement study: Colorado River Salintiy Control Project, Title I Division, Arizona.

United States Geological Survey (USGS), 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Anning, D.W., 2002, Estimation and analysis of the uncertainty in stream flow and change in reservoir-content data at selected stream flow-gauging stations in the Lower Colorado River network, 1995-99: University of Arizona, M.S. thesis.

Oram, P., 1987, Map showing groundwater conditions in the Butler Valley Basin La Paz County, Arizona: Arizona Department of Water Resources Hydrologic Map Series #13.

Robertson, F.N., 1991, Geochemistry of groundwater in alluvial basins of Arizona and adjacent parts of Nevada, New Mexico and California: USGS Professional Paper 1406-C, 87 p.

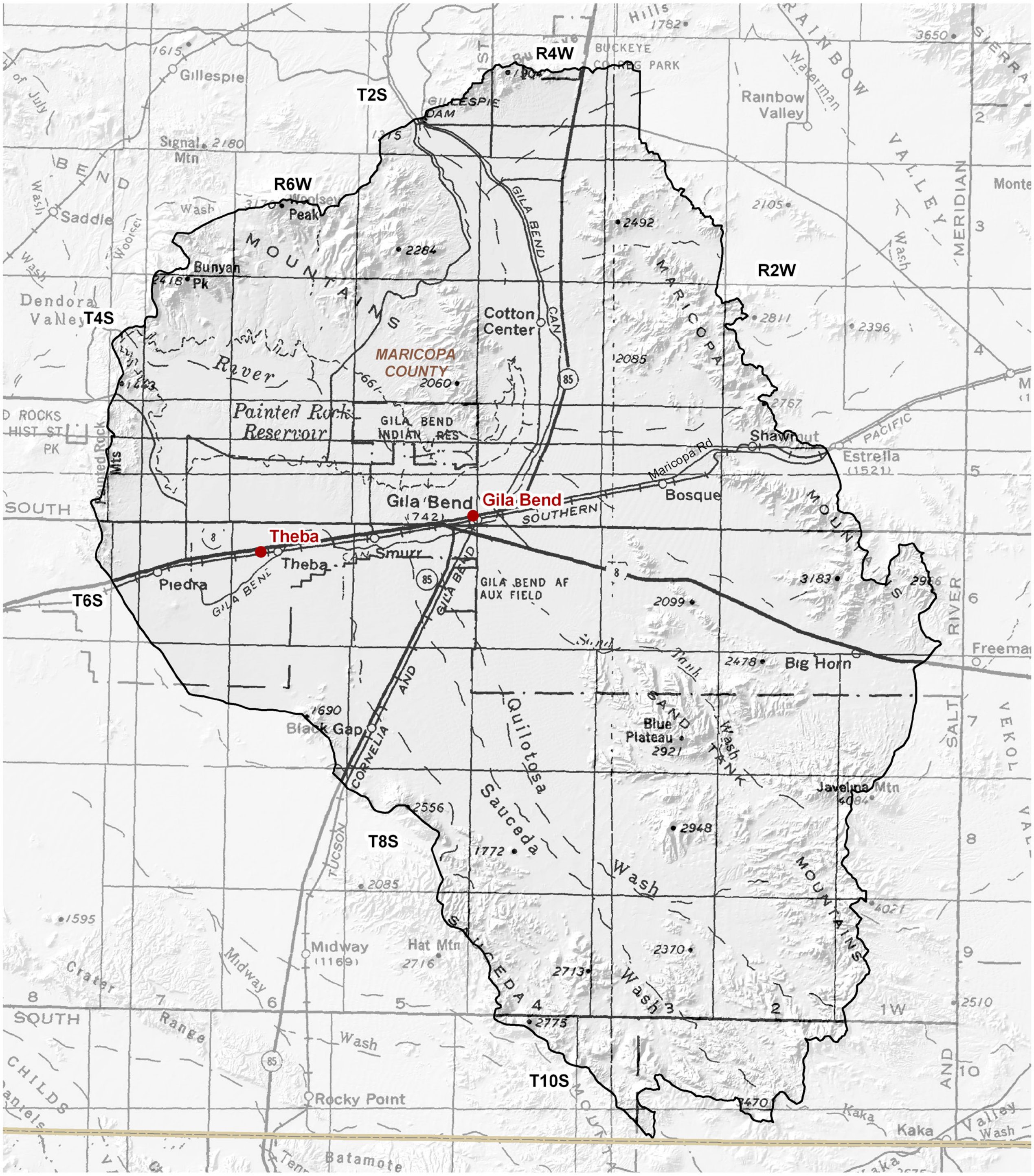
Santec Consulting, 1999, Small and minor watercourses analysis for La Paz County, Arizona, Arizona State Land Department, Final Report.

Section 7.2
Gila Bend Basin

7.2.1 Geography of the Gila Bend Basin

The Gila Bend Basin, located in the east central part of the planning area, is 1,284 square miles in area. Geographic features and principal communities are shown on Figure 7.2-1. The basin is characterized by washes and a series of small mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.2-1 are:
  - The Gila River running east to west in the northern portion of the basin and Painted Rock Reservoir, which during flood events impounds the river
  - Quilotosa and Sauceda Washes south of Gila Bend
  - Maricopa and Sand Tank Mountains in the eastern portion of the basin, the Sauceda Mountains in the south and the Gila Bend Mountains in the north
  - The highest point in the basin at 3,183 feet in the Maricopa Mountains
  - The lowest point in the basin about 660 feet at Painted Rock Dam where the Gila River exits the basin



0 3 6 Miles

Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES

Figure 7.2-1
Gila Bend Basin
Geographic Features

City, Town or Place

7.2.2 Land Ownership in the Gila Bend Basin

Land ownership, including the percentage of ownership by category, for the Gila Bend Basin is shown in Figure 7.2-2. Principal features of land ownership in this basin are the large areas of military and Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)
- 41.7% of the land is federally owned and managed by the Lower Sonoran Office of the Bureau of Land Management.
- BLM land in this basin includes 238,700 acres of the 487,000 acre Sonoran Desert National Monument and 49,000 acres of the 64,000 acre Woolsey Peak Wilderness. (See Figure 7.0-12)
- Land uses include resource conservation, recreation and grazing.

U.S. Military
- 33.5% of the land is federally owned and managed by the U.S. Military as the Barry Goldwater Air Force Range.
- Primary land use is military activity.

Private
- 15.7% of the land is private.
- The majority of the private land is in the center of the basin in the vicinity of Gila Bend, Highway 89 and Interstate 8.
- Land uses include domestic, commercial and ranching.

State Trust Land
- 6.2% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing.

Indian Reservation
- 2.8% of the land is under tribal ownership including all of the Gila Bend Indian Reservation and a small portion of the Tohono O'odham Indian Reservation. Both are part of the Tohono O'odham Nation
- Land uses include agriculture, domestic and grazing.

Other (Game and Fish, County and Bureau of Reclamation Lands)
- 0.1% of the land is owned by Maricopa County.
- County land is located on the northern basin boundary and is managed as the Buckeye Hills County Park.
- Primary land use is recreation.

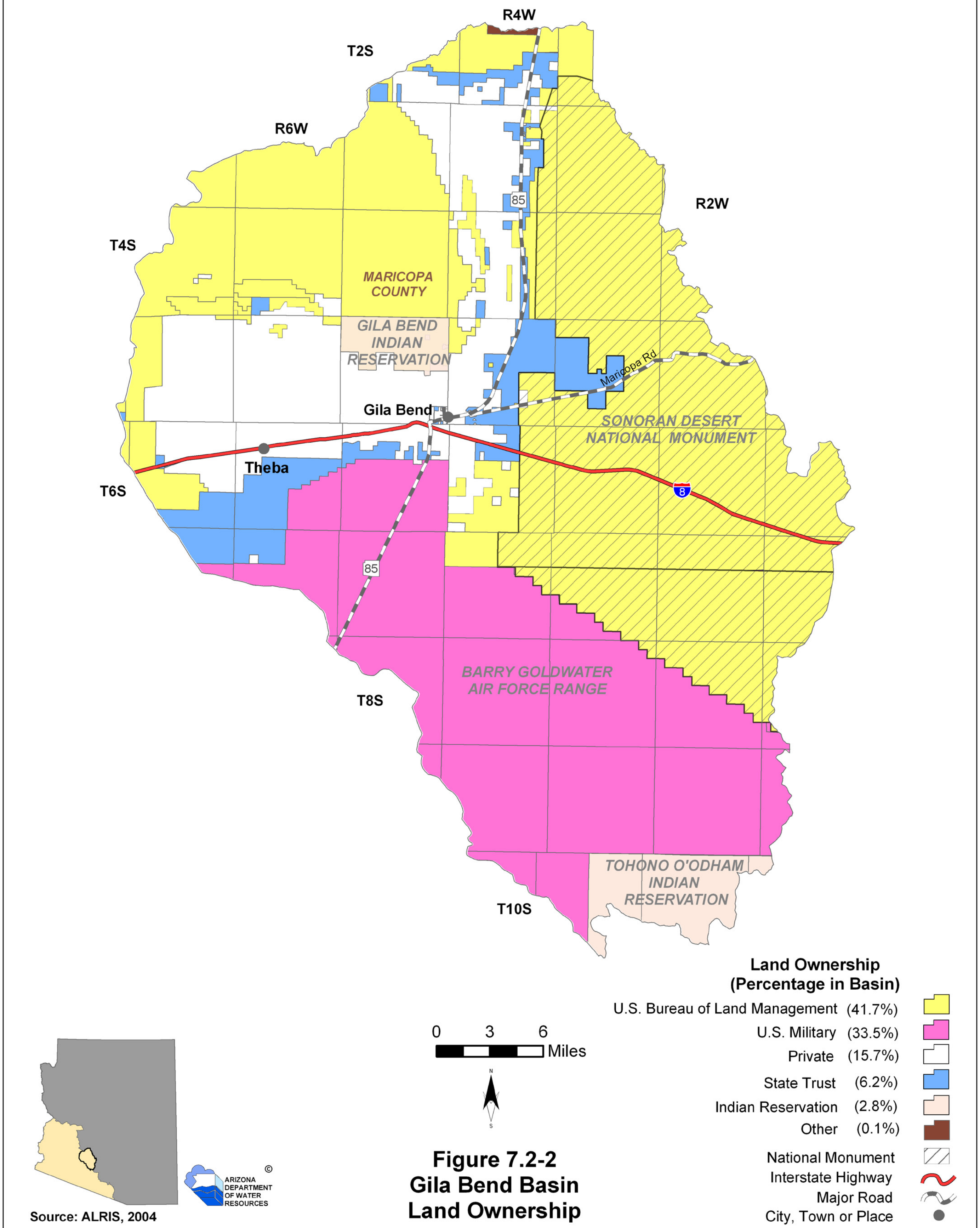


Figure 7.2-2
Gila Bend Basin
Land Ownership

7.2.3 Climate of the Gila Bend Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.2-1 and the locations are shown on Figure 7.2-3. Figure 7.2-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Gila Bend Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.2-1A
- There is one NOAA/NWS Co-op Network station in the basin, Gila Bend, with a maximum monthly temperature of 94.1°F in July and a minimum monthly temperature of 55.0°F in December and January.
- Highest average seasonal rainfall, 2.49 inches, occurs in both the summer (July-September) and fall (October-December) seasons when 66% of the annual average precipitation occurs.

AZMET

- Refer to Table 7.2-1C
- There is one evaporation pan station in the basin, Paloma. This pan is at 719 feet and has an annual evaporation rate of 75.27 inches.

SCAS Precipitation Data

- See Figure 7.2-3
- Additional precipitation data shows average annual rainfall as high as 14 inches at the southeastern tip of the basin and as low as four inches along the western basin boundary.

Table 7.2-1 Climate Data for the Gila Bend Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Gila Bend	730	1971 - 2000	94.1/Jul	55.0/Dec, Jan	2.21	0.39	2.49	2.49	7.01

Source: WRCC, 2005

B. Evaporation Pan:

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

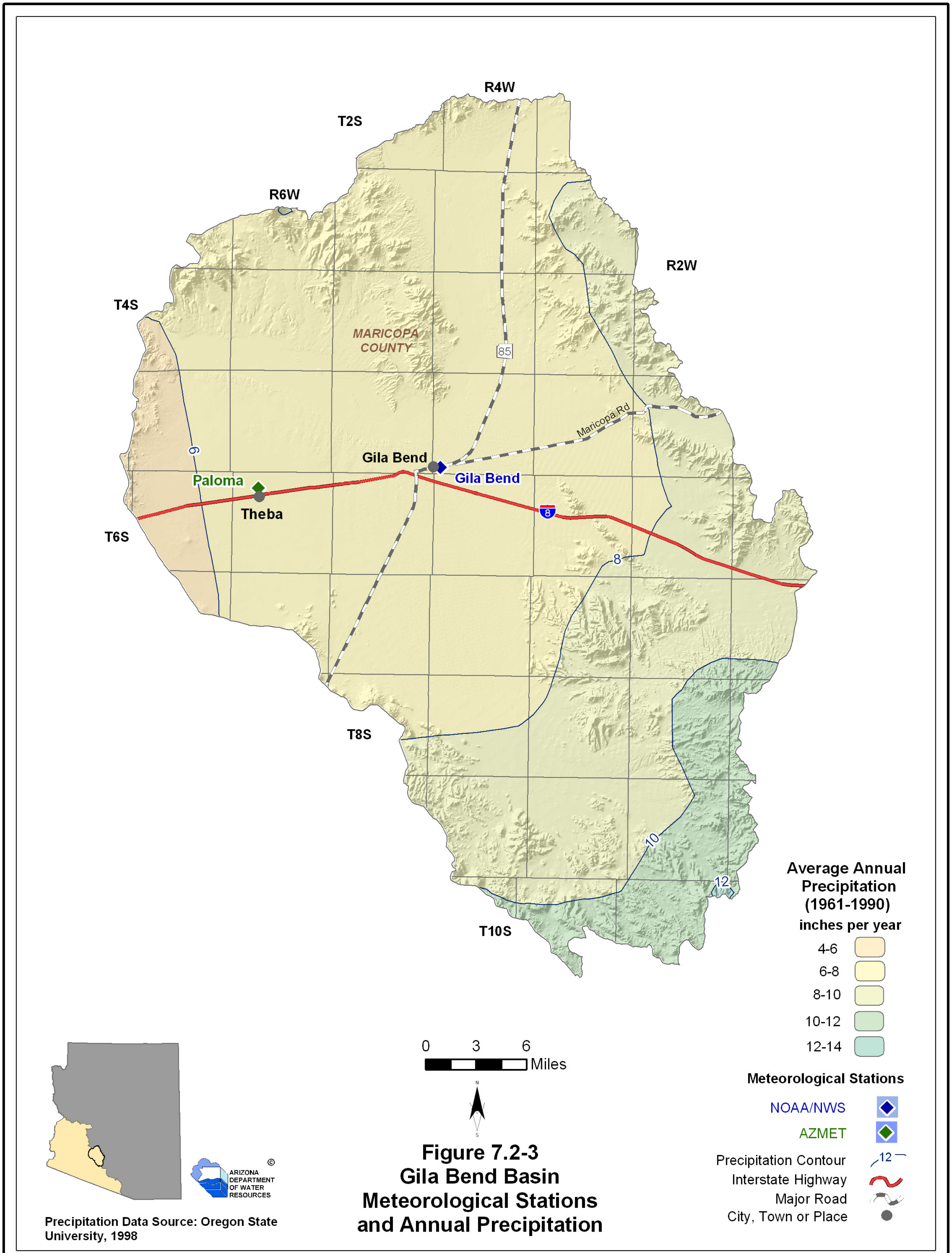
C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Paloma	719	1999 - current	75.27 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

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



Precipitation Data Source: Oregon State University, 1998

Figure 7.2-3
Gila Bend Basin
Meteorological Stations
and Annual Precipitation

7.2.4 Surface Water Conditions in the Gila Bend Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.2-2. Flood ALERT equipment in the basin is shown in Table 7.2-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.2-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 7.2-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 7.2-2.
- Data from three stations located at two watercourses are shown in the table and on Figure 7.2-4.
- Average seasonal flow is highest at most stations in the winter (January-March) or spring (April-June).
- The largest annual flow recorded in the basin is 5.7 million acre-feet (maf) in 1993 at the Gila River below Gillespie Dam station with a contributing drainage area of 49,650 square miles. Gillespie Dam was breached during the 1993 flood.

Flood ALERT Equipment

- Refer to Table 7.2-3.
- As of October 2005 there were nine stations in this basin.

Reservoirs and Stockponds

- Refer to Table 7.2-4.
- The basin contains one large reservoir, Painted Rock, with a maximum storage of 4,831,500 acre-feet. This reservoir is used for flood control and is only filled during flood events.
- Surface water is stored or could be stored in two small reservoirs in the basin.
- There are 24 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.2-4.
- Average annual runoff is highest, 0.2 inches per year or 10.66 acre-feet per square mile, in the southernmost portion of the basin and decreases to 0.1 inches, or 5.33 acre-feet per square mile, in the remainder of the basin.

Table 7.2-2 Streamflow Data for the Gila Bend Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9519500	Gila River below Gillespie Dam	49,650	753	8/1921-current	66	13	7	13	0 (1956)	43,185	327,935	5,675,984 (1993)	84
9519760	Sauceda Wash near Gila Bend	126	900	10/1989-9/1994 (discontinued)	6	0	83	10	4 (1992)	195	385	1,144 (1990)	4
9519800	Gila River below Painted Rock Dam	50,910	519	10/1959-current (real time)	36	36	16	13	0 (1962, 2002)	5,185	330,347	5,088,672 (1993)	43

Source: USGS (NWIS) 2005 & 2008

Notes:
NA = Not available
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Annual Flow/Year statistics were only completed for those gages that had at least 3 years of 12 month records
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retrieved in 2005

Table 7.2-3 Flood ALERT Equipment in the Gila Bend Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5060	G&F Woolsey Peak	Weather Station/Stage	6/25/2003	Maricopa County FCD
6905	Gillespie Dam	Precipitation	4/12/1994	Maricopa County FCD
6910	Gila Bend Landfill	Weather Station	4/7/1993	Maricopa County FCD
6920	Sauceda Wash	Precipitation/Stage	2/28/1990	Maricopa County FCD
6930	Sand Tank @ I-8	Precipitation/Stage	6/28/2001	Maricopa County FCD
6940	Sand Tank Wash	Precipitation	7/21/1983	Maricopa County FCD
6950	Rainbow Wash	Precipitation/Stage	11/6/2000	Maricopa County FCD
6955	Maricopa Mountains	Precipitation	4/21/2005	Maricopa County FCD
6960	Bender Wash	Precipitation/Stage	1/12/1982	Maricopa County FCD

Source: ADWR 2005b

Notes:
FCD = Flood Control District

Table 7.2-4 Reservoirs and Stockponds in the Gila Bend 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	Painted Rock	Bureau of Reclamation	4,831,500	C	Federal

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

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

Source: Compilation of databases from ADWR & others

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

Total number: 2
Total maximum storage: 171 acre-feet

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

Total number: 0
Total surface area: 0 acres

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

Total number: 24

Notes:
[1]C = Flood control

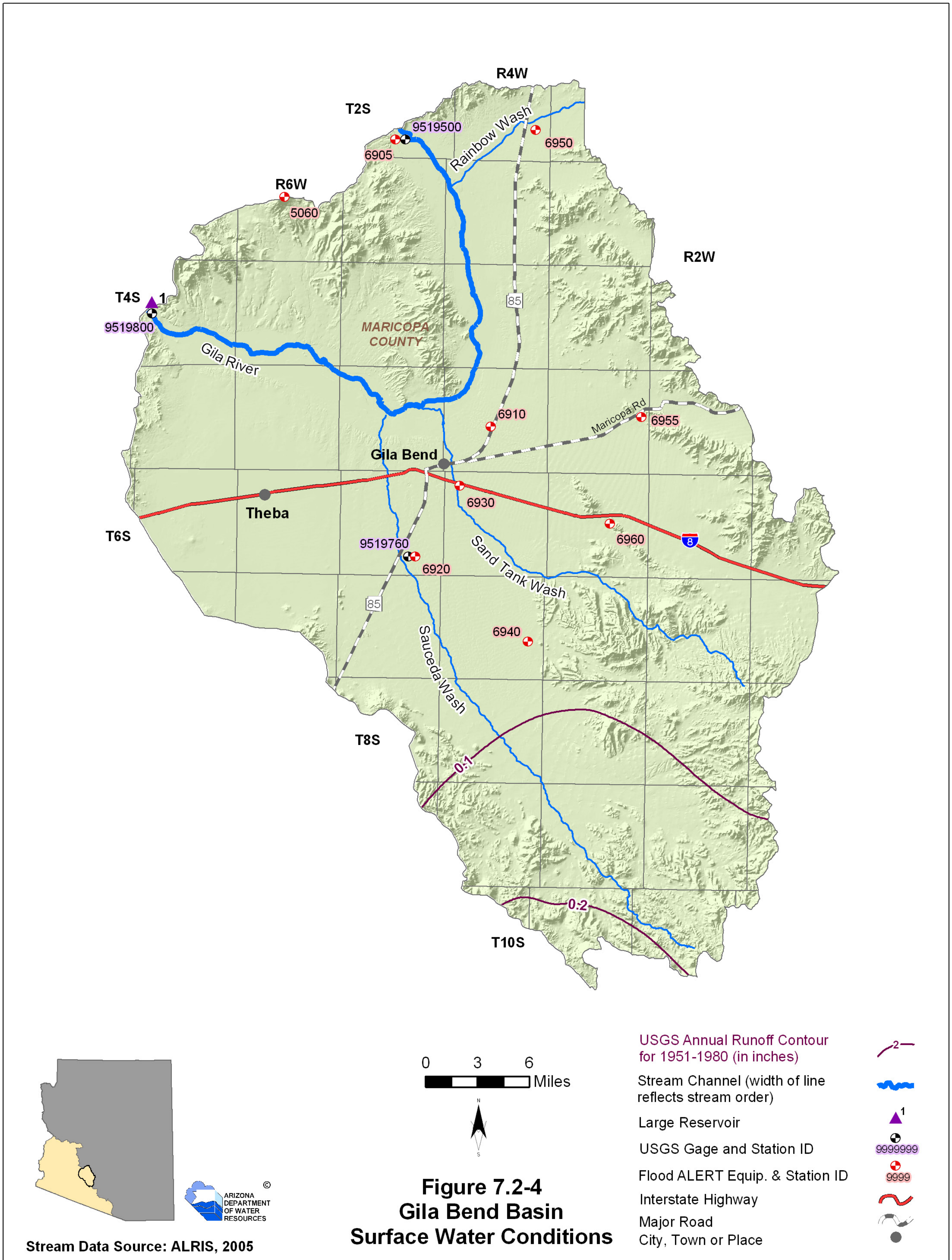


Figure 7.2-4
Gila Bend Basin
Surface Water Conditions

7.2.5 Perennial/Intermittent Streams and Major Springs in the Gila Bend Basin

The total number of springs in the basin are shown in Table 7.2-5. The locations of perennial streams are shown on Figure 7.2-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are no perennial streams and one intermittent stream, the Gila River.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS varies from zero to one, depending on the database reference.

Table 7.2-5 Springs in the Gila Bend Basin

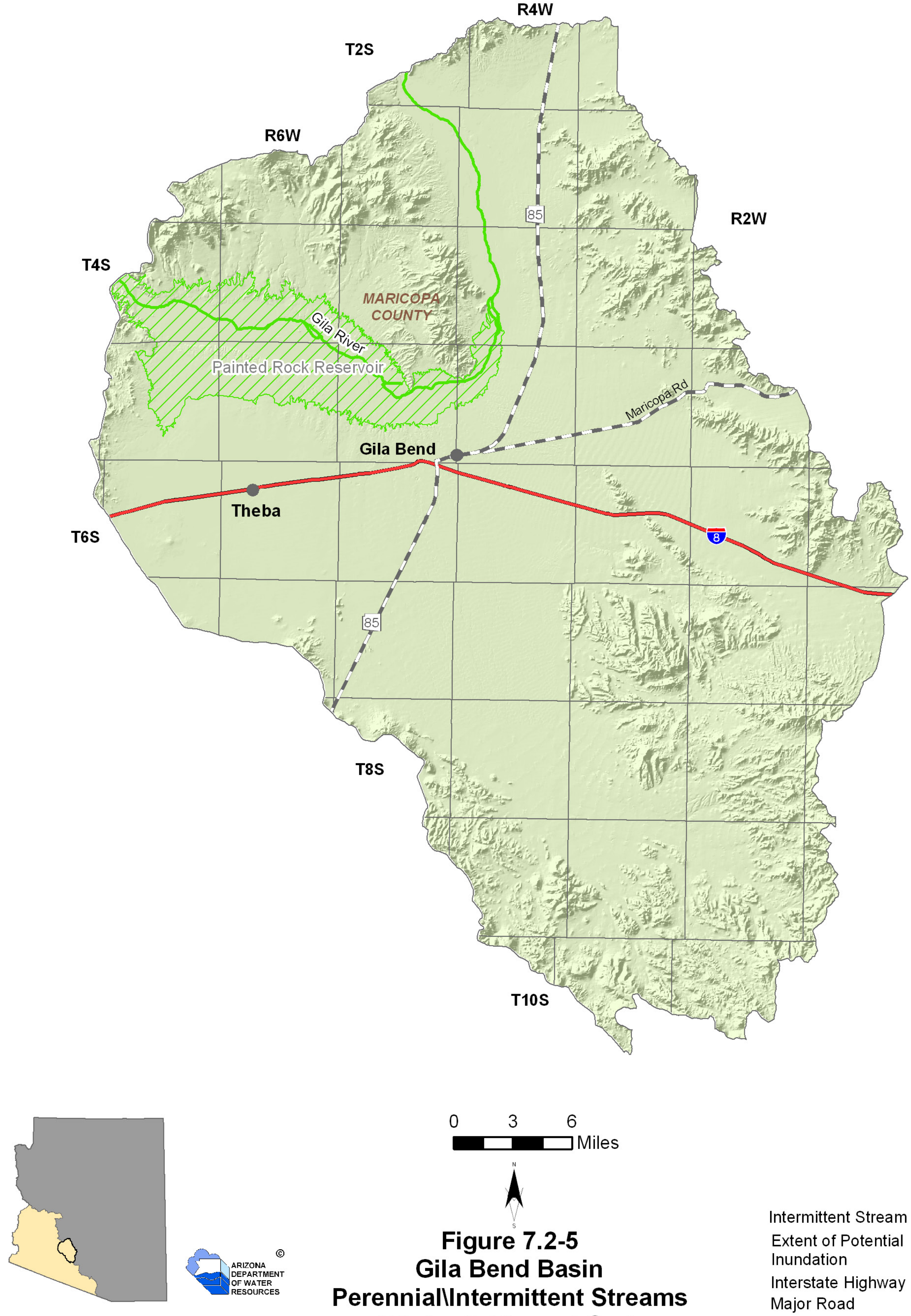
A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 0 to 1



Stream Data Source: AGFD, 1993 & 1997

Figure 7.2-5
Gila Bend Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.2.6 Groundwater Conditions of the Gila Bend Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.2-6. Figure 7.2-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.2-7 contains hydrographs for selected wells shown on Figure 7.2-6. Figure 7.2-8 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.2-6 and Figure 7.2-6
- The major aquifer is basin fill.
- Flow direction is from north to southwest in the center of the basin and from the west to east in the northern portion of the basin.

Well Yields

- Refer to Table 7.2-6 and Figure 7.2-8
- As shown on Figure 7.2-8, well yields are generally greater than 2,000 gallons per minute (gpm).
- One source of well yield information, based on 242 reported wells, indicates that the median well yield is 2,700 gpm.

Natural Recharge

- Refer to Table 7.2-6
- Natural recharge estimates range from 10,000 acre-feet per year (AFA) to 37,000 AFA.
- The largest source of natural recharge in the basin occurs from Gila River flood events and infiltration of water impounded behind Painted Rock Dam (ADWR 1994b).

Water in Storage

- Refer to Table 7.2-6
- Storage estimates for this basin range from 17maf to 61 maf, both to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.2-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 30 index wells in this basin. Hydrographs for seven index wells are shown on Figure 7.2-7.
- The deepest water level shown on the map is 639 feet south of Maricopa Road and the shallowest is 34 feet near the western basin boundary.

Table 7.2-6 Groundwater Data for the Gila Bend Basin

Basin Area, in square miles:	1,284	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 300-4,266 Median 2,221 (107 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 7-5,800 Median 2,700 (242 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 300-3,000	ADWR (1990)
	Range 0-2,500	Anning and Duet (1994)
	Range 1,000-5,000	ADWR HMS 29 (1996)
Estimated Natural Recharge, in acre-feet/year:	26,000	ADWR (1996)
	37,000	Freethey and Anderson (1986)
	10,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	27,600,000 (to 1,200 ft)	ADWR (1994b)
	17,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	61,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	31	
Date of Last Water-level Sweep:	2008 (241 wells measured)	

[1]Predevelopment Estimate

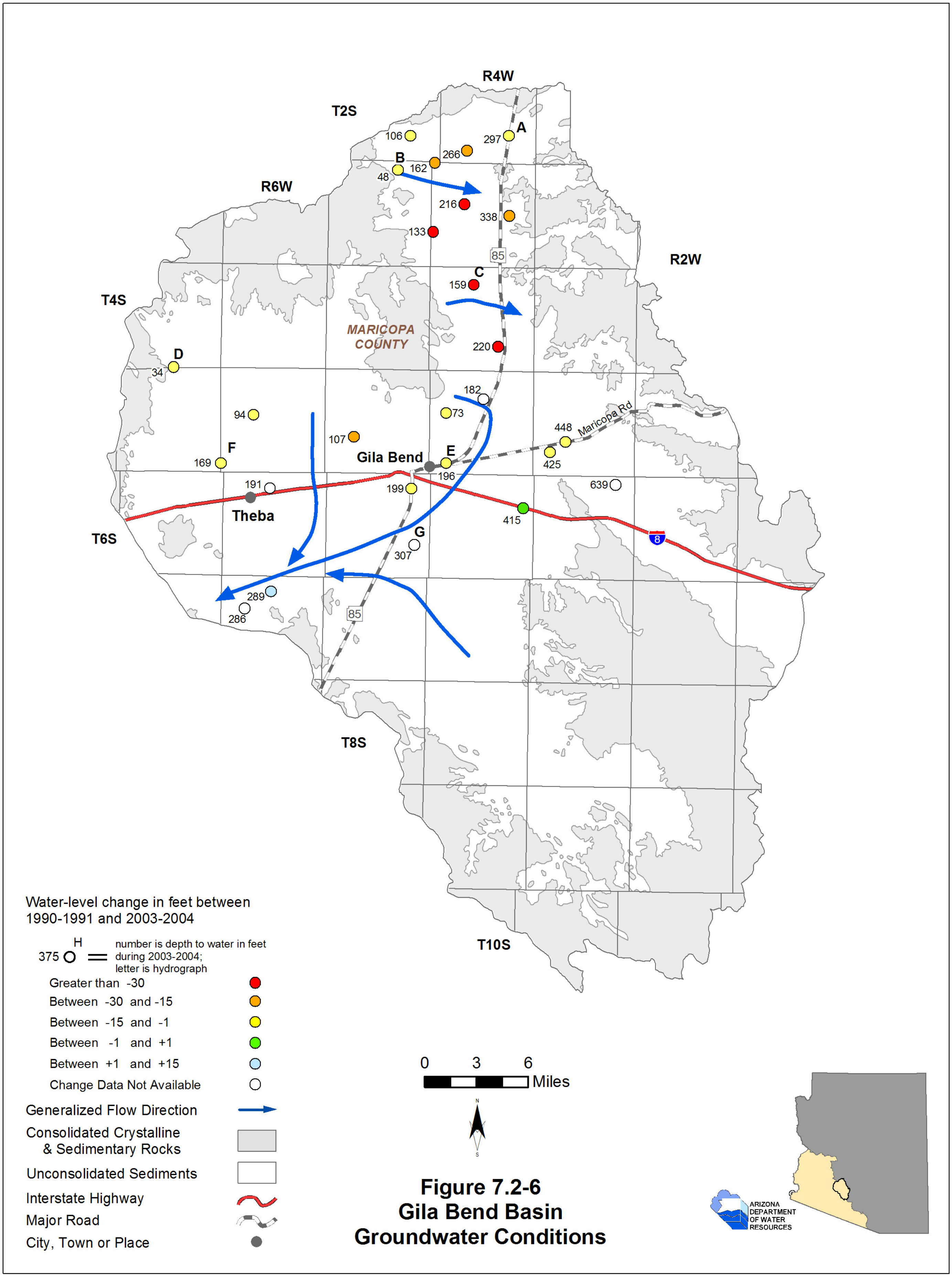


Figure 7.2-6
Gila Bend Basin
Groundwater Conditions

Figure 7.2-7
Gila Bend Basin
Hydrographs Showing Depth to Water in Selected Wells

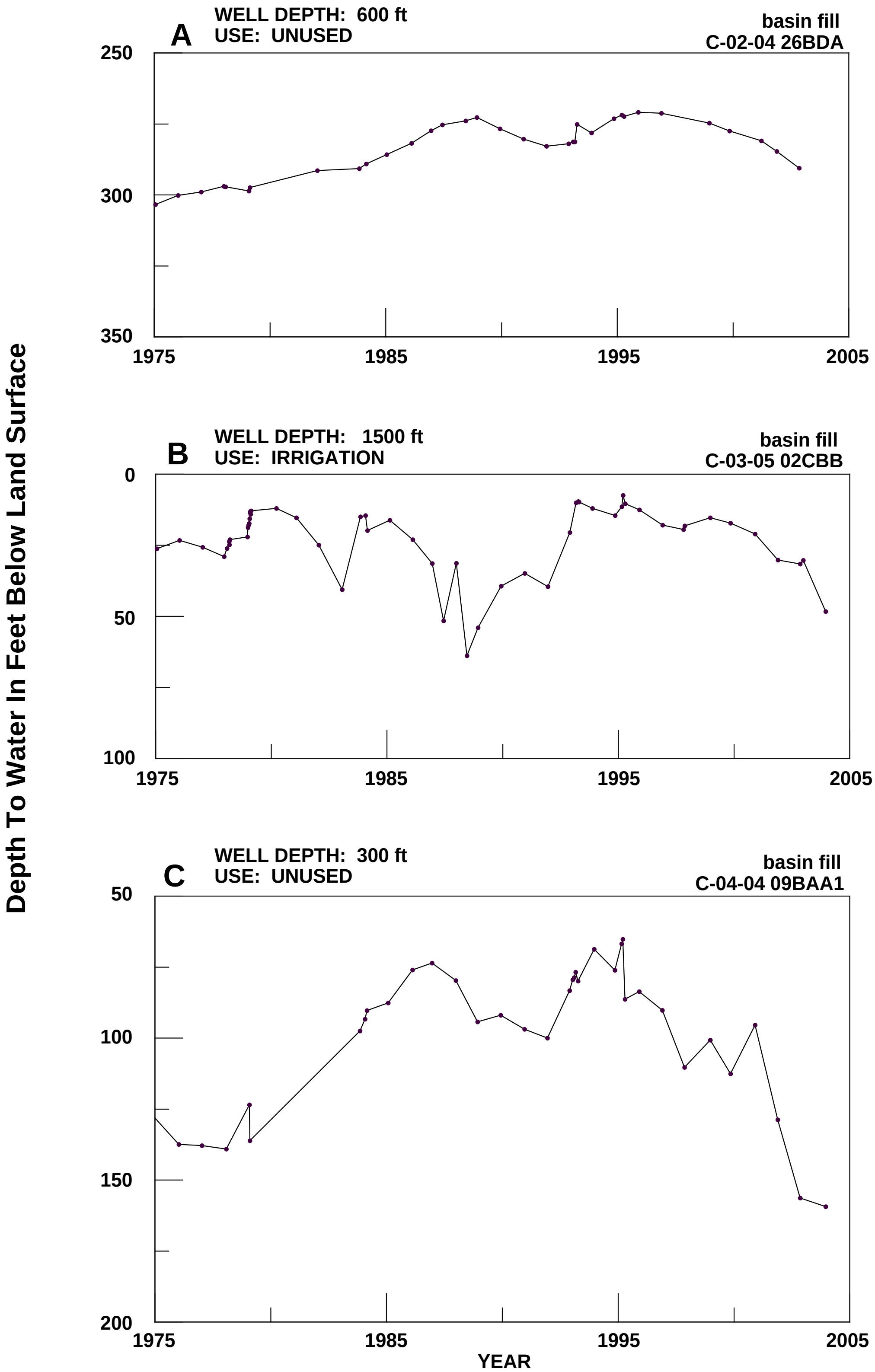
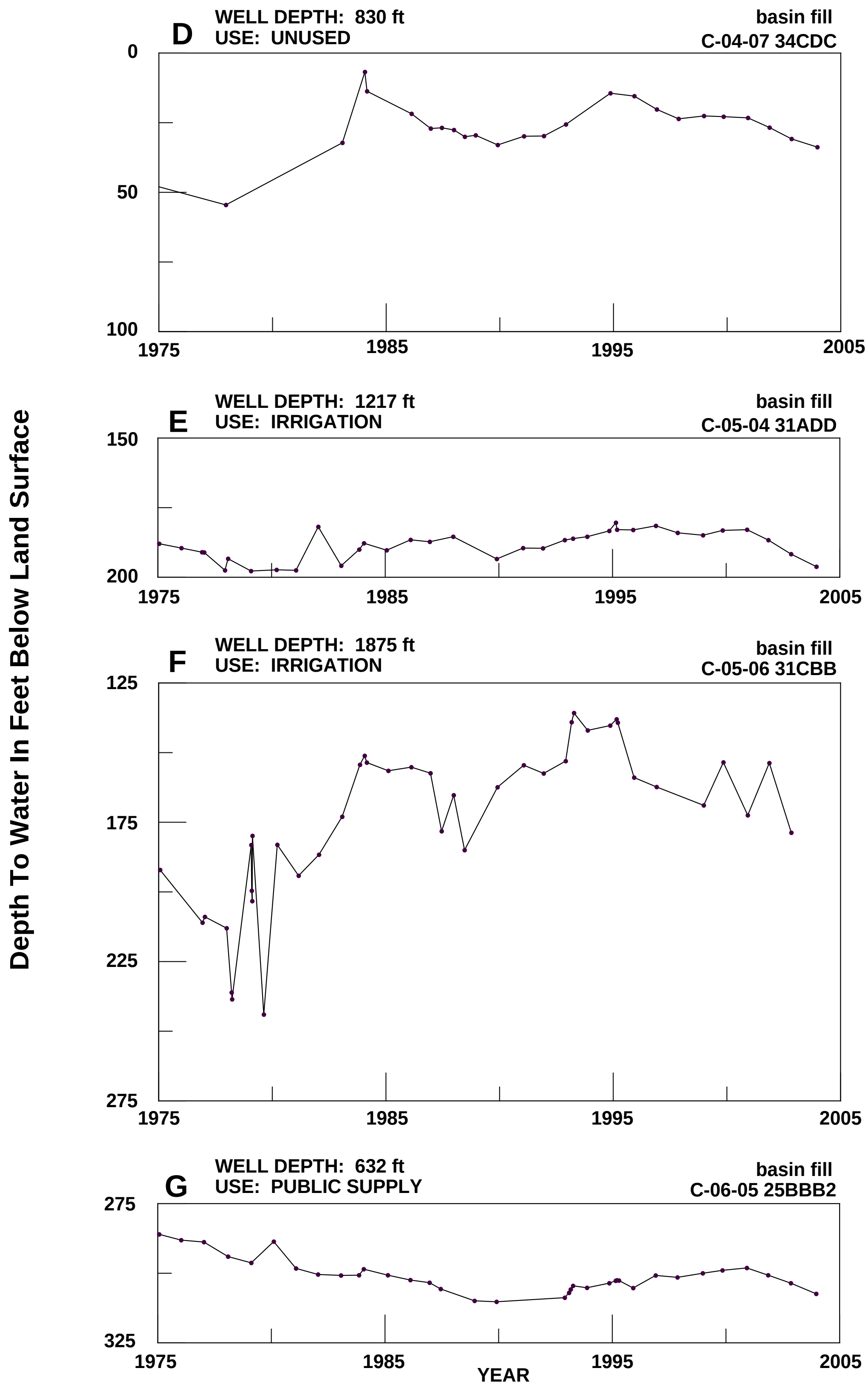


Figure 7.2-7 (Cont)
Gila Bend Basin
Hydrographs Showing Depth to Water in Selected Wells



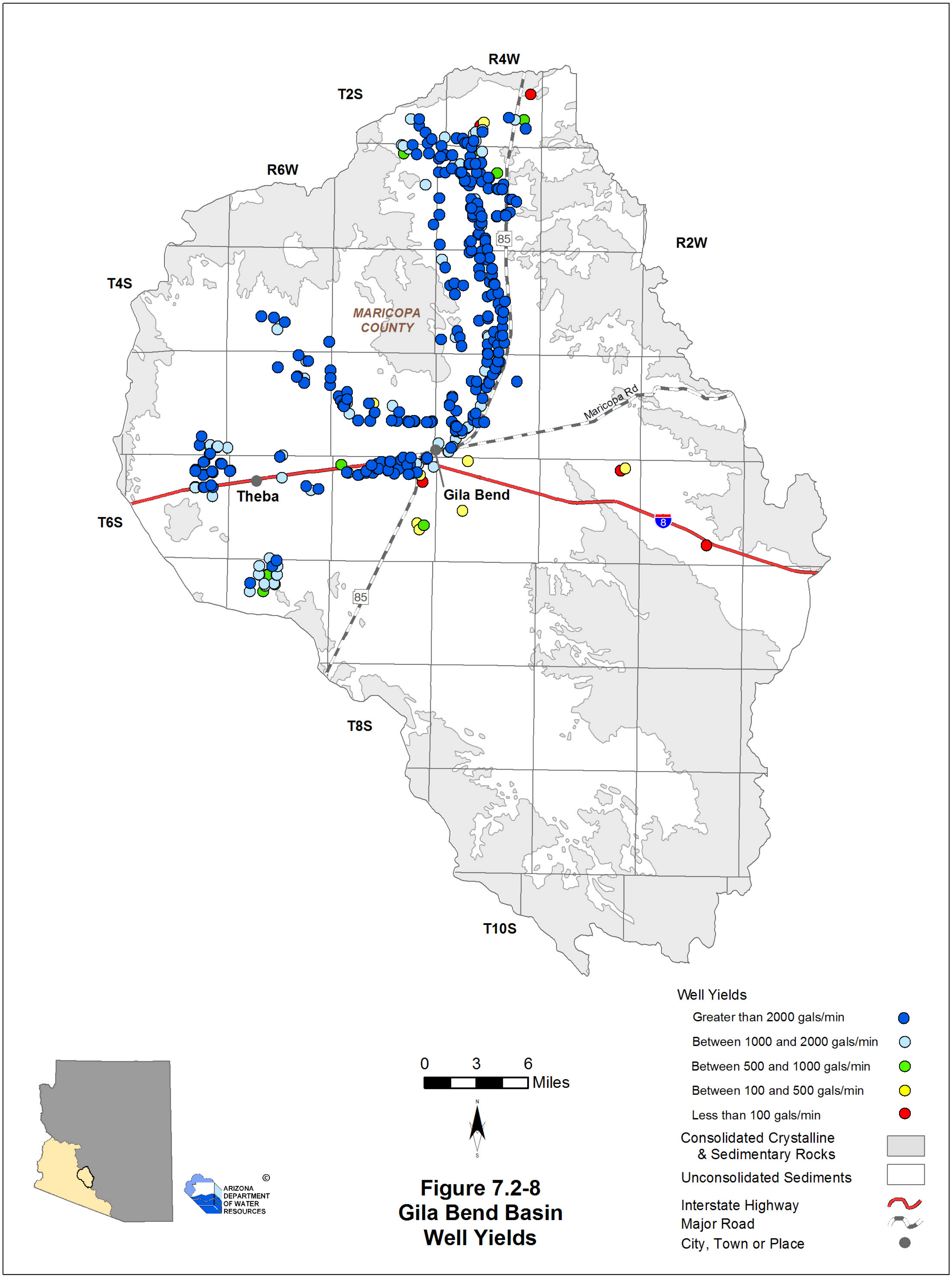


Figure 7.2-8
Gila Bend Basin
Well Yields

7.2.7 Water Quality of the Gila Bend Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.2-7A. Impaired lakes and streams with site type, name, length of impaired reach, area of impaired lake, designated use standard and parameter(s) exceeded is shown in Table 7.2-7B. Figure 7.2-9 shows the location of water quality occurrences keyed to Table 7.2-7. All community water systems are regulated under the Safe Drinking Water Act and treat water supplies to meet drinking water standards. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.2-7A.
- One hundred and twenty-two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Ninety-two percent of the wells measured equaled or exceeded the parameter for fluoride.
- Other parameters equaled or exceeded include arsenic, nitrate, mercury, selenium and total dissolved solids.

Lakes and Streams with impaired waters

- Refer to Table 7.2-7B.
- The water quality standard for organics was equaled or exceeded in three reaches of the Gila River totaling 41 miles. The standard for organics was also equaled or exceeded in 100 acres of the Painted Rock Reservoir.
- None of the reaches or the lake are part of the ADEQ water quality improvement effort, the Total Maximum Daily Load (TMDL) Program, at this time.

Effluent Dependent Reaches

- See Figure 7.2-9
- There is one effluent dependent reach north of Gila Bend. This reach receives effluent from the Gila Bend Wastewater Treatment Plant.

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	2 South	4 West	25	F
2	Well	2 South	4 West	25	F
3	Well	2 South	4 West	32	F
4	Well	2 South	4 West	32	F
5	Well	2 South	4 West	33	F
6	Well	2 South	4 West	33	F, NO3, TDS
7	Well	2 South	4 West	33	F
8	Well	2 South	4 West	33	F
9	Well	3 South	4 West	5	F
10	Well	3 South	4 West	9	F, NO3
11	Well	3 South	4 West	9	F
12	Well	3 South	4 West	9	F
13	Well	3 South	4 West	15	F
14	Well	3 South	4 West	15	F
15	Well	3 South	4 West	16	F
16	Well	3 South	4 West	23	F
17	Well	3 South	4 West	27	F
18	Well	3 South	4 West	28	TDS
19	Well	4 South	4 West	3	NO3
20	Well	4 South	4 West	4	NO3, TDS
21	Well	4 South	4 West	10	F
22	Well	4 South	4 West	21	F, TDS
23	Well	4 South	4 West	22	F
24	Well	4 South	4 West	28	F
25	Well	4 South	4 West	32	NO3
26	Well	4 South	6 West	28	F
27	Well	4 South	6 West	36	F
28	Well	5 South	4 West	3	NO3
29	Well	5 South	4 West	3	F
30	Well	5 South	4 West	4	F
31	Well	5 South	4 West	9	F
32	Well	5 South	4 West	10	F
33	Well	5 South	4 West	10	F
34	Well	5 South	4 West	16	F
35	Well	5 South	4 West	16	F
36	Well	5 South	4 West	17	F
37	Well	5 South	4 West	18	F
38	Well	5 South	4 West	21	F
39	Well	5 South	4 West	21	F
40	Well	5 South	4 West	29	F
41	Well	5 South	4 West	29	F
42	Well	5 South	4 West	29	F
43	Well	5 South	4 West	31	F
44	Well	5 South	4 West	31	F
45	Well	5 South	4 West	31	F
46	Well	5 South	4 West	31	As, F, Hg
47	Well	5 South	4 West	31	F
48	Well	5 South	5 West	18	TDS
49	Well	5 South	5 West	18	F

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
50	Well	5 South	5 West	19	F
51	Well	5 South	5 West	20	F
52	Well	5 South	5 West	21	F
53	Well	5 South	5 West	22	F
54	Well	5 South	5 West	22	F
55	Well	5 South	5 West	23	F
56	Well	5 South	5 West	24	F
57	Well	5 South	5 West	24	F
58	Well	5 South	5 West	36	F
59	Well	5 South	6 West	3	F
60	Well	5 South	6 West	11	F
61	Well	5 South	6 West	11	F
62	Well	5 South	6 West	16	TDS
63	Well	5 South	6 West	31	F, As
64	Well	5 South	6 West	31	F
65	Well	5 South	6 West	34	F, TDS
66	Well	5 South	7 West	26	F
67	Well	5 South	7 West	35	F
68	Well	5 South	7 West	35	F
69	Well	5 South	7 West	36	F
70	Well	5 South	7 West	36	F
71	Well	5 South	7 West	36	F
72	Well	6 South	3 West	18	As, F
73	Well	6 South	3 West	19	F
74	Well	6 South	4 West	20	F
75	Well	6 South	4 West	20	As, F
76	Well	6 South	4 West	20	F
77	Well	6 South	5 West	2	F
78	Well	6 South	5 West	2	F
79	Well	6 South	5 West	2	F
80	Well	6 South	5 West	2	As, F
81	Well	6 South	5 West	2	F
82	Well	6 South	5 West	2	F
83	Well	6 South	5 West	3	F
84	Well	6 South	5 West	3	F
85	Well	6 South	5 West	3	F
86	Well	6 South	5 West	3	F
87	Well	6 South	5 West	4	As, F
88	Well	6 South	5 West	4	As, F
89	Well	6 South	5 West	4	F
90	Well	6 South	5 West	5	F
91	Well	6 South	5 West	6	F, NO3, TDS
92	Well	6 South	5 West	8	As, F
93	Well	6 South	5 West	25	As, F
94	Well	6 South	6 West	4	F
95	Well	6 South	6 West	4	F
96	Well	6 South	6 West	6	F
97	Well	6 South	6 West	10	F, Se
98	Well	6 South	6 West	11	F

Table 7.2-7 Water Quality Exceedences in the Gila Bend Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
99	Well	6 South	6 West	33	As, F
100	Well	6 South	7 West	2	F
101	Well	6 South	7 West	2	F
102	Well	6 South	7 West	11	F
103	Well	6 South	7 West	11	As, F
104	Well	6 South	7 West	11	F
105	Well	6 South	7 West	11	F
106	Well	6 South	7 West	12	F
107	Well	7 South	6 West	4	As, F
108	Well	7 South	6 West	4	As
109	Well	7 South	6 West	4	As, F
110	Well	7 South	6 West	4	F
111	Well	7 South	6 West	4	F
112	Well	7 South	6 West	5	F
113	Well	7 South	6 West	5	F
114	Well	7 South	6 West	8	As, F
115	Well	7 South	6 West	8	As, F
116	Well	7 South	6 West	9	As, F
117	Well	7 South	6 West	9	As, F
118	Well	7 South	6 West	9	As
119	Well	7 South	6 West	9	F
120	Well	7 South	6 West	9	F
121	Well	7 South	6 West	9	F
122	Well	7 South	6 West	9	As, F

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Gila River (Gillespie Dam to Rainbow Wash)	5	NA	FC	Organics
b	Stream	Gila River (Rainbow Wash to Sand Tank)	17	NA	FC	Organics
c	Stream	Gila River (Sand Tank to Painted Rock Reservoir)	19	NA	FC	Organics
d	Lake	Painted Rock Reservoir	NA	100	FC	Organics

Source: ADEQ 2005d

Notes:

[1] Water quality samples collected between 1975 and 2001. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.

[2] As = Arsenic
NO3 = Nitrate
F = Fluoride
Hg = Mercury
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
Se = Selenium
TDS = Total Dissolved Solids

[3]FC = Fish Consumption

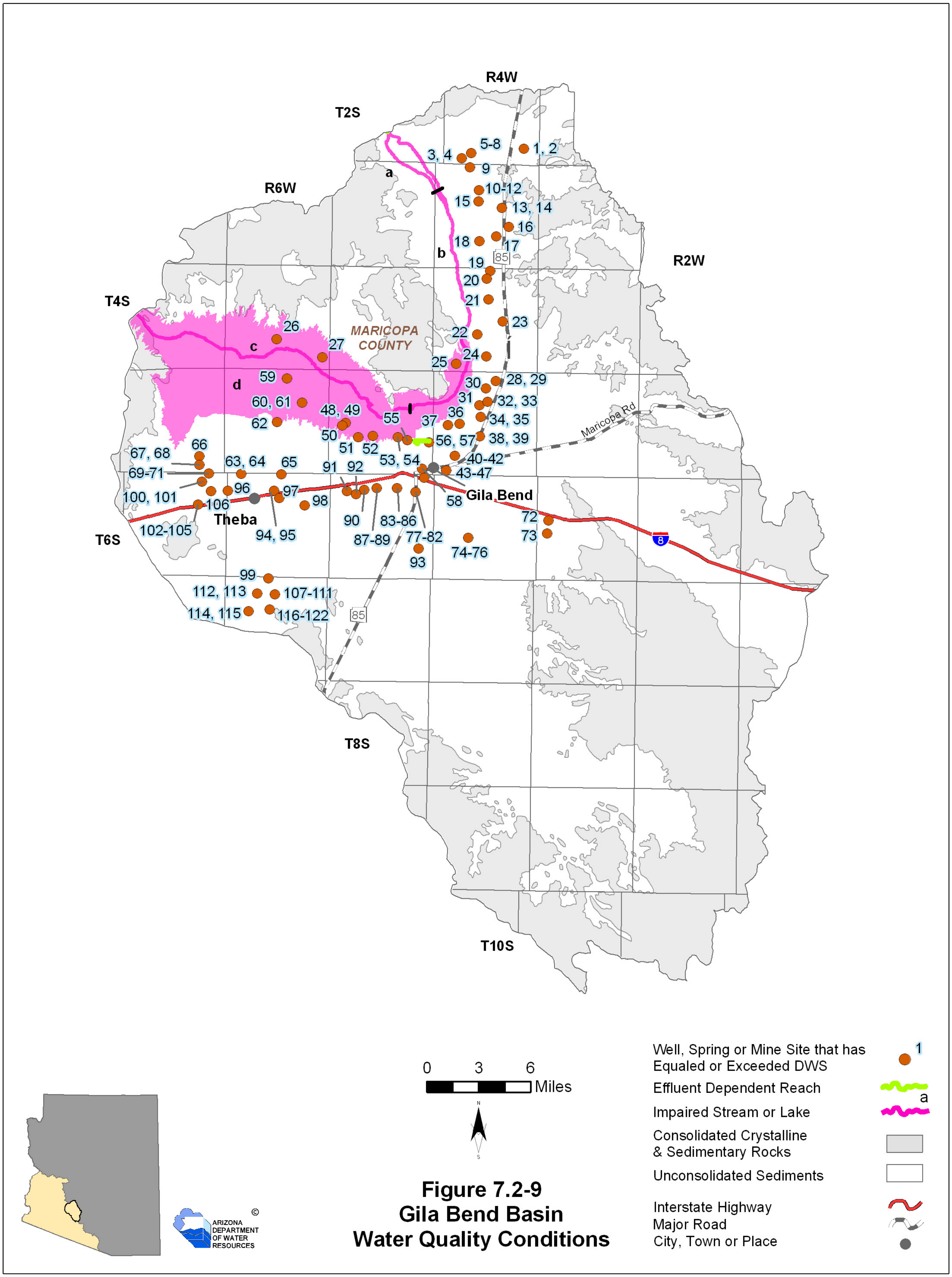


Figure 7.2-9
Gila Bend Basin
Water Quality Conditions

7.2.8 Cultural Water Demands in the Gila Bend 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 7.2-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.2-9. Figure 7.2-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.2-8 and Figure 7.2-10.
- Population in this basin decreased from 3,437 in 1980 to 4,256 in 2000.
- Most cultural water use is for irrigation in the northern portion of the basin.
- Agricultural groundwater demand increased 18% and surface water demand decreased 25% from 1991 to 2005.
- There was no reported industrial groundwater demand prior to 2003. In 2003 the Gila River Power Plant and the Citrus Valley Dairy began operation. The Painted Rock Dairy began operation in 2004. Total average water demand for the three uses was 4,700 AFA from 2003-2005.
- Municipal groundwater demand is small and increased 18% from 1991 to 2005.
- As of 2005 there were 146 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 391 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.2-9.
- There are four wastewater treatment facilities in this basin.
- Information on population served was available for three facilities and information on the volume of effluent generated was available for two facilities. These facilities serve almost 4,900 people, 3,400 of which are at the Lewis Prison, and generate almost 800 acre-feet of effluent per year.
- Effluent is discharged to evaporation ponds and a watercourse (overland flow) and is not reused.

Table 7.2-8 Cultural Water Demand in the Gila Bend Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971										
1972										
1973				237,000			78,000			
1974										
1975										
1976		98[2]	307[2]							
1977										
1978				274,000			102,000			
1979										
1980	3,437									ADWR (1994a)
1981	3,402									
1982	3,367									
1983	3,332	8	18	245,000			117,000			
1984	3,297									
1985	3,262									
1986	3,227									
1987	3,192									
1988	3,157	6	16	179,000			99,000			
1989	3,122									
1990	3,087									
1991	3,204									
1992	3,321									
1993	3,438	3	17	700	NR	237,000	NR	NR	71,500	
1994	3,555									
1995	3,672									
1996	3,789									
1997	3,905									
1998	4,022	8	16	700	NR	244,000	NR	NR	68,500	USGS (2007) ADWR (2008b)
1999	4,139									
2000	4,256									
2001	4,688									
2002	5,119									
2003	5,551	23	27	800	4,700[3]	289,000	NR	NR	54,000	
2004	5,983									
2005	6,415									
2010	8,573									
2020	10,268									
2030	15,392									
	WELL TOTALS:	**146**	**391**							

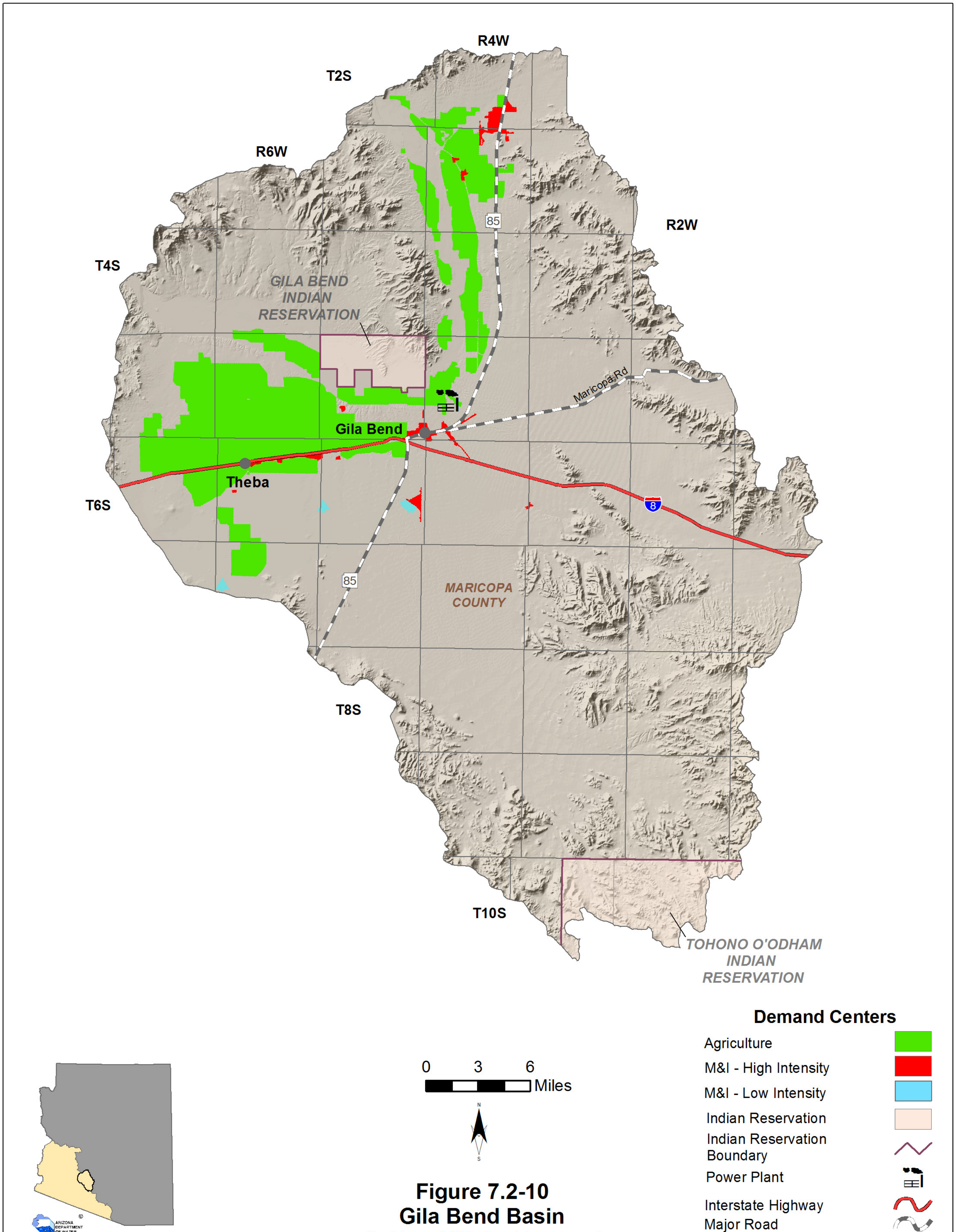
[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Water use shown is for the Gila River Power Plant (4,600 acre-feet) and the Citrus Valley Dairy (100 acre-feet) that opened in 2003 and the Painted Rock Dairy that opened 2004 (60 acre-feet).
NR - Not reported

Table 7.2-9 Effluent Generation in the Gila Bend Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method								Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course/Turf/ Landscape	Wildlife Area	Discharged to Another Facility	Infiltration Basins	Other (Overland Flow)			
Auxiliary Field	US Air Force	Airfield	70	NA											
Gila Bend WWTP	Municipal	Gila Bend	1,440	392								X	Adv. Trt.I	600	2003
Lewis WWTP	Arizona Department of Corrections	Prison	3,400	403		X							Adv.Tr.I	NA	2004
Panda Gila River Project	Private	Power plant	Industrial	NA		X							NA		
Total			**4,910**	**795**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
WWTP: Waste Water Treatment Plant
Adv. Trt. I: Advanced Treatment Level I



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 7.2-10
Gila Bend Basin
Cultural Water Demand

7.2.9 Water Adequacy Determinations in the Gila Bend Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.2-10. Figure 7.2-11 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in Maricopa County. Six water adequacy determinations for 222 lots have been made in this basin through December 2008. Forty-three lots, or 18%, were determined to be adequate.
- Reasons for a determination of inadequacy included water quality and because the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination.
- There are five analysis of Adequate Water Supply applicants for a total of 37,577 lots.

Table 7.2-10 Adequacy Determinations in the Gila Bend Basin[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
2	Current Place Subdivision, Unit 1	Maricopa	5 South	4 East	31	30	53-300552	Inadequate	A1	10/23/1998	Town of Gila Bend
3	Dos Lagos, Lots 1 through 64, Tracts A through N	Maricopa	4 South	4 East	3	64	53-700383	Inadequate	A1	7/27/2007	Town of Gila Bend
5	Gila Bend Estates	Maricopa	5 South	5 East	36	35	53-400726	Inadequate	A1,C	7/10/2002	Town of Gila Bend
8	Palo Verde Heights Unit I	Maricopa	5 South	4 East	31	24	53-400094	Adequate		6/22/1999	Town of Gila Bend
10	Spring Mountain Ski Ranch	Maricopa	2 South	5 East	35	50	53-401600	Inadequate	A1	3/4/2005	Unformed HOA
11	Zuni Estates	Maricopa	5 South	5 East	36	19	53-501721	Adequate		12/1/1975	Town of Gila Bend

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
1	Belvedere	Maricopa	3 South	4 East	6	13,120	43-401992	7/7/2006	NA
4	Enterprise Ranch	Maricopa	2 South	5 East	28, 32, 34	8,393	43-500008	10/14/2008	Undetermined
			3 South	4 East	19, 30, 31				
			3 South	5 East	3, 11, 12, 13, 24, 25				
			4 South	4 East	6				
6	Insignia	Maricopa	2 South	5 East	36	2,091	43-500090	6/12/2007	Town of Buckeye
7	Ladera	Maricopa	2 South	4 East	28, 29, 31, 32, 33	5,864	43-500044	3/5/2008	NA
			3 South	4 East	5, 6				
9	Sonoran Trails	Maricopa	5 South	4 East	3, 10	8,109	43-700427	5/9/2008	NA
			4 South	4 East	9, 10, 15, 22, 27, 34				

Notes:

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

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

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

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

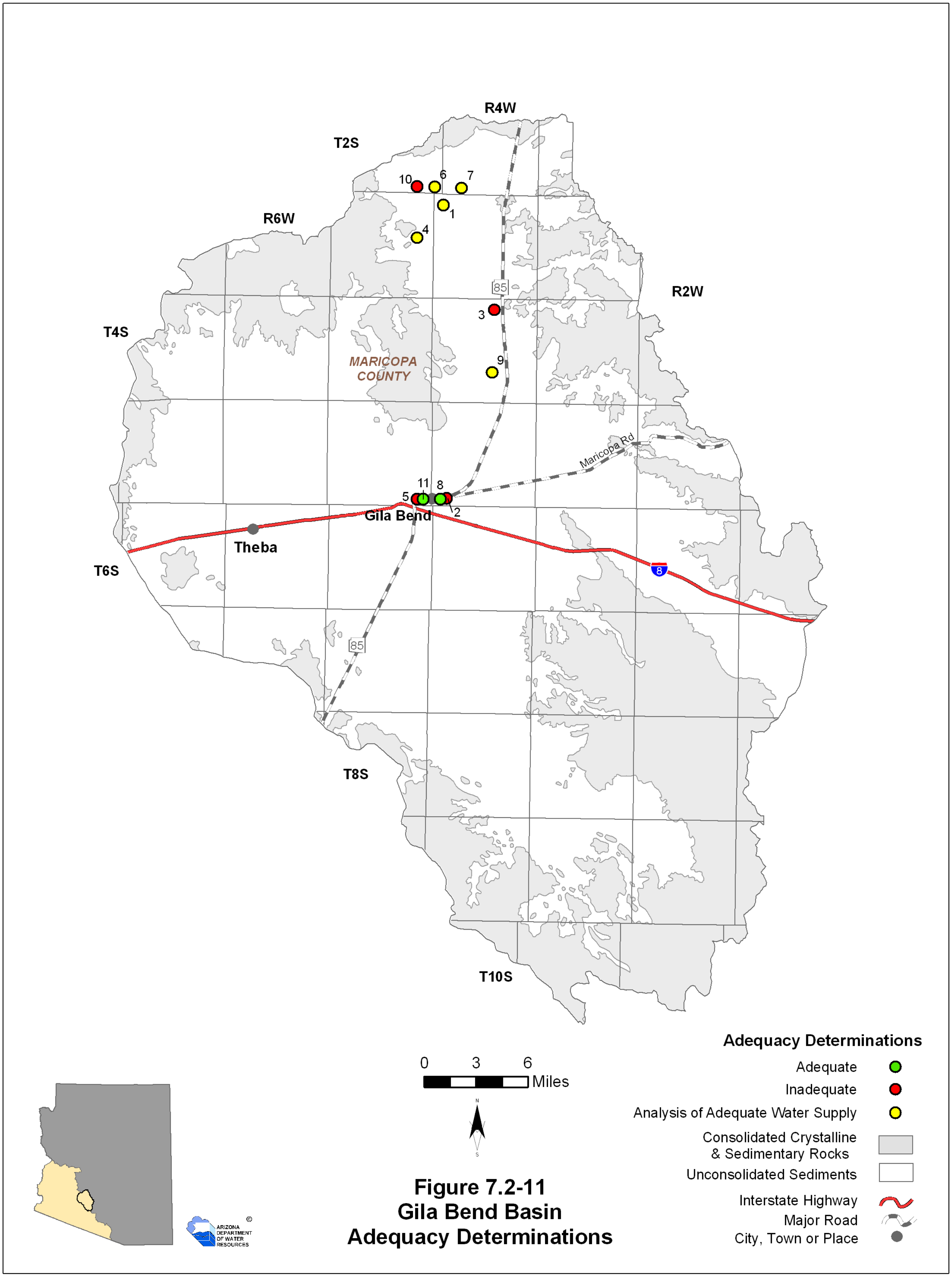


Figure 7.2-11
Gila Bend Basin
Adequacy Determinations

Gila Bend Basin

References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2005a, ADEQSWI: Data file, received September 2005. (Effluent table)

_____, 2005b, ADEQWWTP: Data file, received August 2005. (Effluent Table)

_____, 2005c, Effluent dependent waters: GIS cover, received December 2005. (Water Quality Map)

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

_____, 2005e, WWTP and permit files: Miscellaneous working files, received July 2005. (Effluent Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2005a, Agricultural Surface Water Use Estimates: Unpublished analysis, ADWR Office of Resource Assessment Planning.

_____, 2005b, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005c, Inspected dams: Database, ADWR Office of Dam Safety. (Reservoirs Table)

_____, 2005d, Non-jurisdictional dams: Database, ADWR Office of Dam Safety. (Reservoirs Table)

_____, 2005e, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005f, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs Table)

_____, 2005g, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Game and Fish Department (AZGF), 1997, Remote Sensing Mapping of Arizona Intermittent Stream Riparian Areas: GIS cover.

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005b Streams: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html

_____ (ALRIS), 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.

az.us/alris/index.html.
Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.
Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

E

Environmental Protection Agency (EPA), 2005, Surf Your Watershed: Facility reports, accessed April 2005 at http://oaspub.epa.gov/enviro/ef_home2.water. (Effluent Table)
_____, 2005, 2000 and 1996, Clean Watershed Needs Survey: datasets, accessed March 2005 at http://www.epa.gov/owm/mtb/cwns/index.htm. (Effluent Table)

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

G

Gebert, W.A., D.J. Graczyk and W.R. Krug, 1987, Average annual runoff in the United States, 1951-1980: GIS Cover, accessed March 2006 at http://aa179.cr.usgs.gov/metadata/wrdmeta/runoff.htm. (Surface Water Conditions Map)

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 2006, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

US Army Corps of Engineers, 2004 and 2005, National Inventory of Dams: Arizona Dataset, accessed November 2004 to April 2005 at http://crunch.tec.army.mil/nid/webpages/nid.cfm (Reservoirs Table)
United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.
_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.
_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.
_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.
_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.
_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Pan evaporation stations: Data file accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

_____, 2005, Precipitation and temperature stations: Data file, accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Anning, D.W., 2002, Estimation and analysis of the uncertainty in stream flow and change in reservoir-content data at selected stream flow-gaging stations in the Lower Colorado River network, 1995-99: University of Arizona, M.S. thesis.

Errol L. Montgomery & Associates, Inc., 2006, Hydrologic Study for Demonstration of Adequate Water Supply for the John's Ranch Parcel Near Gila Bend, Maricopa County, Arizona. Prepared for Arizona Department of Water Resources.

Fluid Solutions, 2000, Hydrologic Study, Spring Mountain Ski Ranch, Township 2 South, Range 5 West, East Half Section 35. Prepared for Arizona Department of Water Resources.

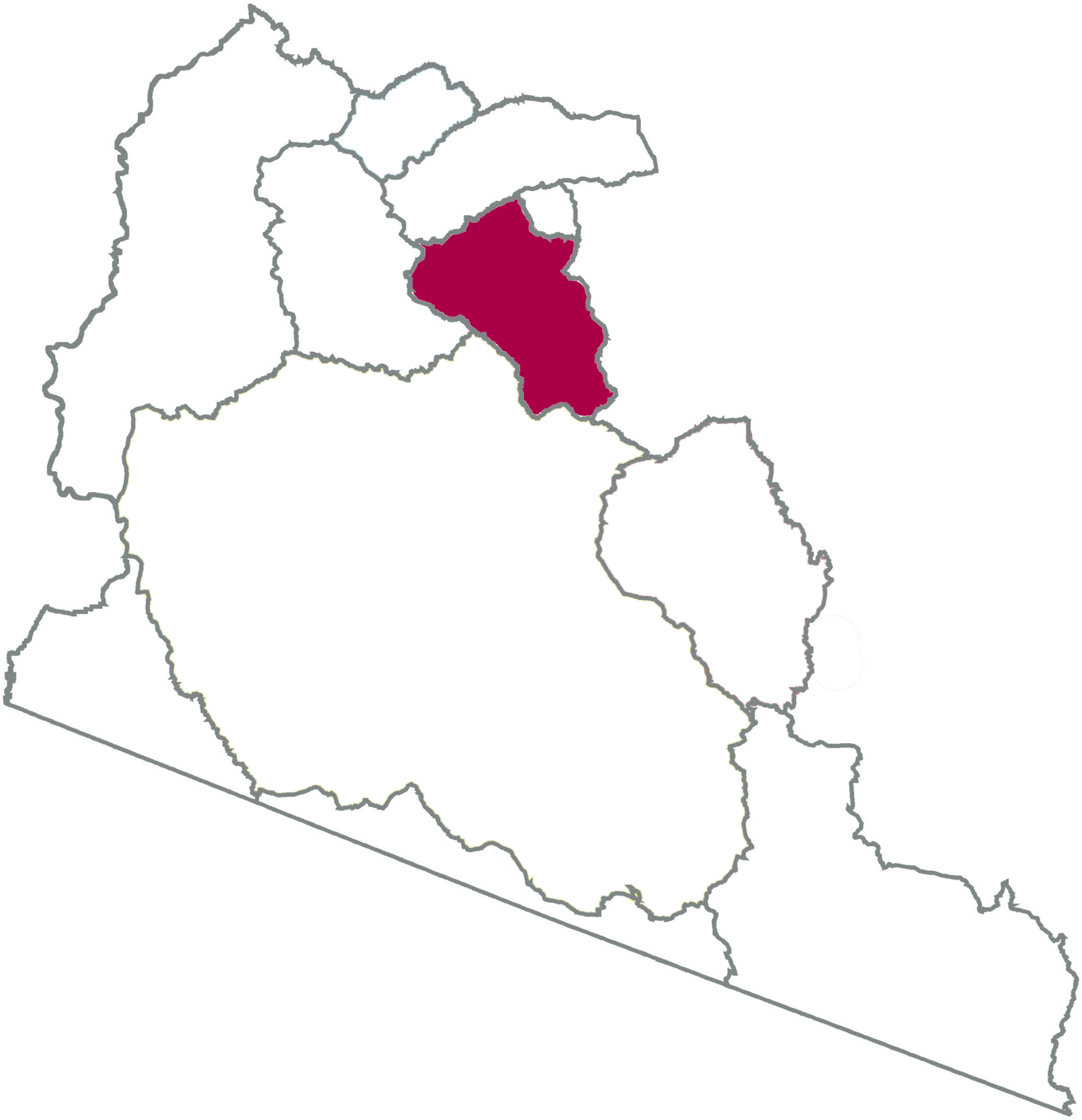
Gebler, J. B., 1998, Water quality of selected effluent dependent stream reaches in southern Arizona as indicated by concentrations of periphytic chlorophyll *a* and aquatic invertebrate communities: USGS Water Resources Investigations Report 98-4199, 12 p.

Huckleberry, G., 1996, Historical geomorphology of the Gila River: AZGS Open –File Report 96-14, 31 p.

King, K. A. and D.L. Baker, 1995, Contaminants in fish and wildlife of the middle Gila River, Arizona: USFWS unnumbered report, 17 p.

Rascona, S.J., 1996, Maps showing groundwater conditions in the Gila Bend basin, Maricopa County, Arizona 1993: Arizona Department of Water Resources, Hydrologic Map Series Report #29.

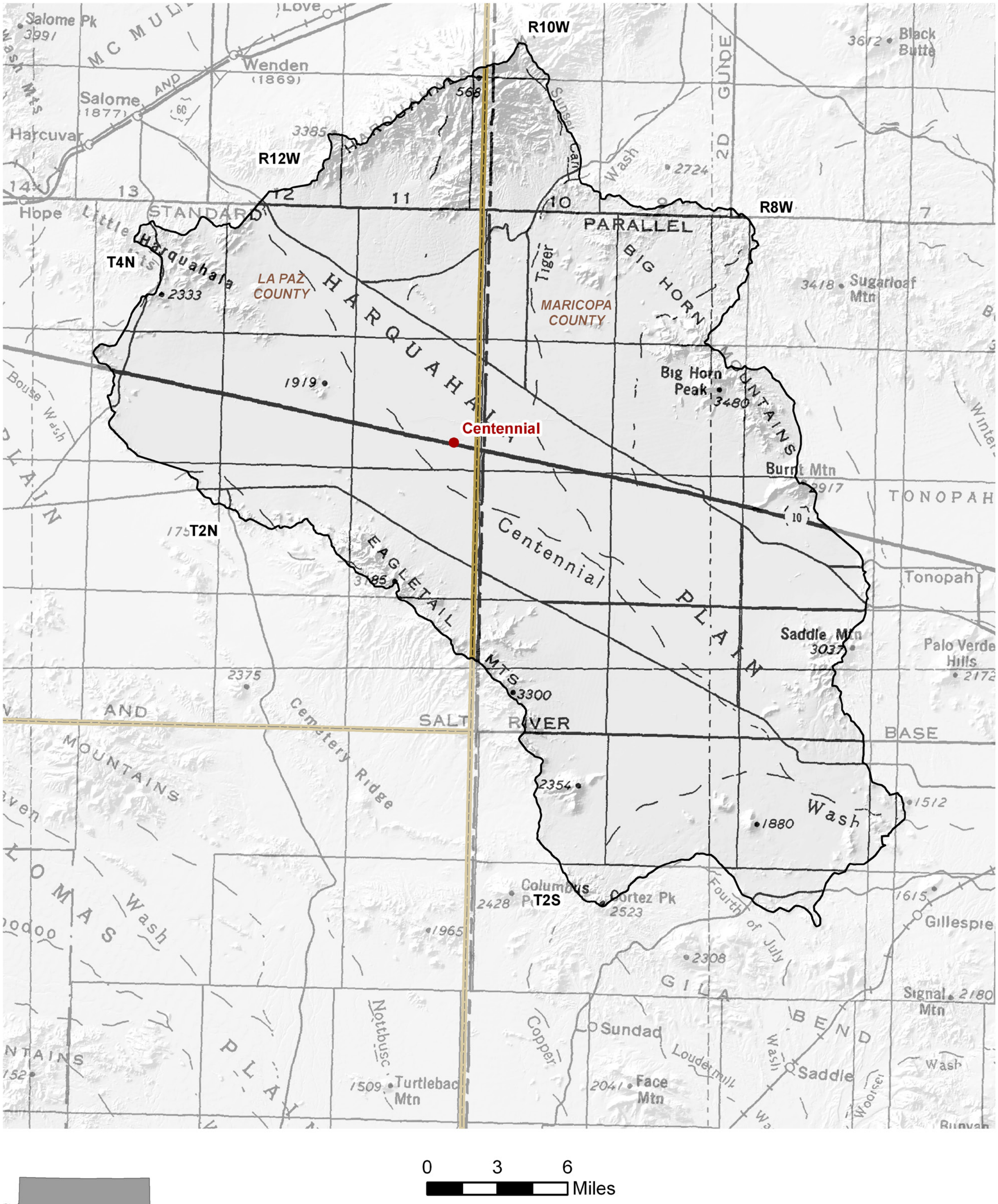
Section 7.3
Harquahala Basin



7.3.1 Geography of the Harquahala Basin

The Harquahala Basin, located in the northeastern part of the planning area, is 766 square miles in area. Geographic features and principal places are shown on Figure 7.3-1. The basin is characterized by a plain bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub and a small amount of interior chaparral on the northern basin boundary. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.3-1 are:
    - Centennial Wash running through the center of the basin
    - The Harquahala Plain in the center of the basin bordered by the Big Horn Mountains in the east, the Little Harquahala Mountains in the north and the Eagletail Mountains in the west
    - The highest point in the basin, Big Horn Peak, at 3,480 feet in the Big Horn Mountains
    - The lowest point in the basin at 1,000 feet where Centennial Wash exits the basin in T4N R12W.



Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.3-1
Harquahala Basin
Geographic Features

COUNTY
City, Town or Place

7.3.2 Land Ownership in the Harquahala Basin

Land ownership, including the percentage of ownership by category, for the Harquahala Basin is shown in Figure 7.3-2. The principal feature of land ownership in this basin is the large amount of U.S. Bureau of Land Management Land. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 62.2% of the land is federally owned and managed by the Lower Sonoran Field Office of the Bureau of Land Management.
- This basin contains 52,800 acres of wilderness. This includes 24,000 acres of the 100,000 acre Eagletail Mountains Wilderness, 18,000 acres of the 21,000 acre Big Horn Mountains Wilderness, 5,500 acres of the 31,000 acre Hummingbird Springs Wilderness and 5,300 acres of the 23,000 acre Harquahala Mountains Wilderness. (see Figure 7.0-11)
- Land uses include resource conservation, recreation and grazing.

Private

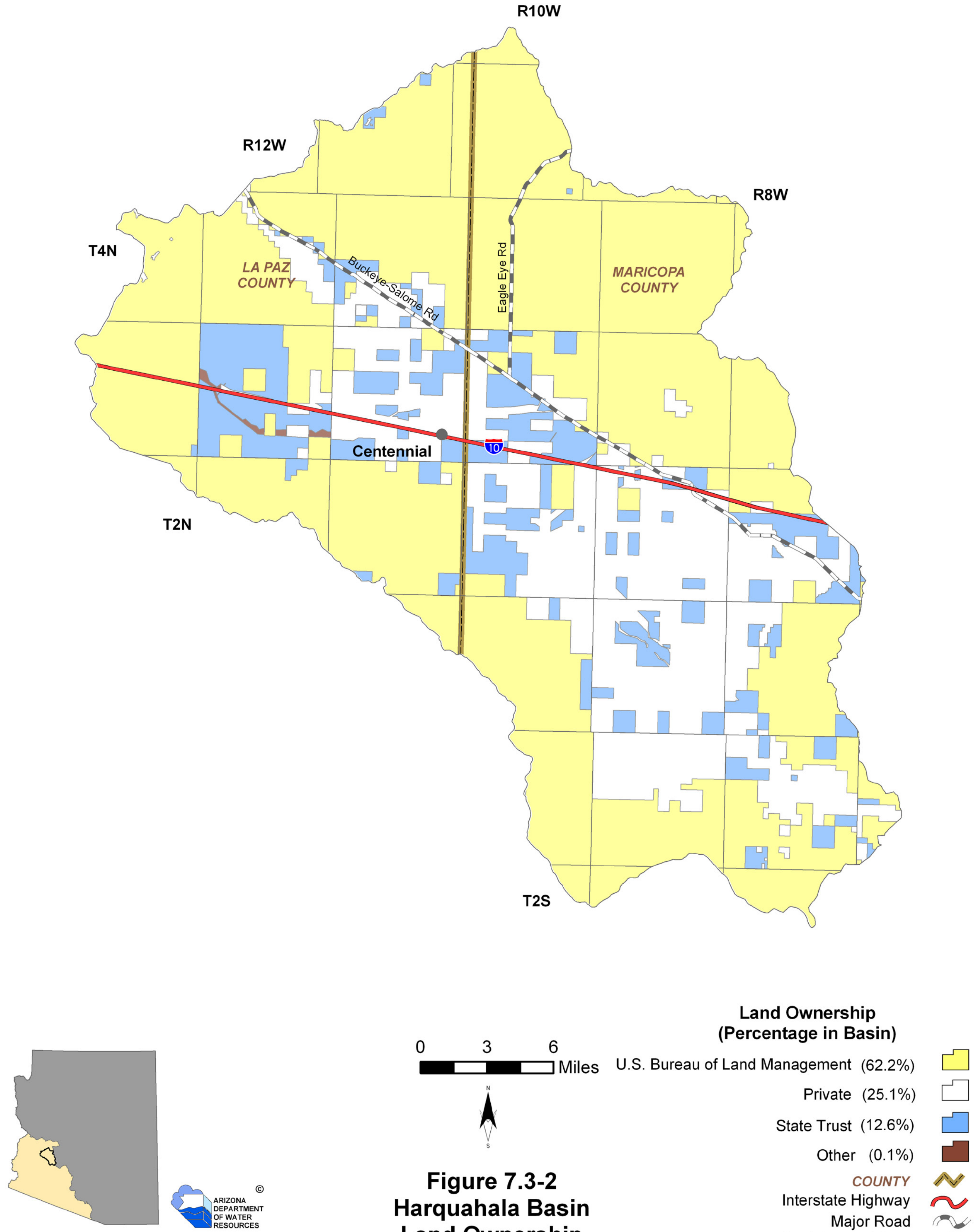
- 25.1% of the land is private.
- Land uses include domestic, commercial and grazing.

State Trust Land

- 12.6% of the land is held in trust for the public schools, the Pioneer Home and both the Dept of Corrections and Juvenile Corrections and county bonds under the State Trust Land system.
- Primary land use is grazing.

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

- 0.1% of the land is federally owned by the U.S. Bureau of Reclamation (USBOR)
- USBOR lands are located in the western portion of the basin in the vicinity of Interstate 10 where they surround the Central Arizona Project aqueduct.



Source: ALRIS, 2004

Figure 7.3-2
Harquahala Basin
Land Ownership

7.3.3 Climate of the Harquahala Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.3-1 and the locations are shown on Figure 7.3-3. Figure 7.3-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Harquahala Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of the climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.3-1A
- Temperatures at the two NOAA/NWS Co-op Network stations in the basin range from a maximum monthly temperature of 91.0°F at Salome 17 SE in July to a minimum monthly temperatuer of 48.0°F at Harquahala Plains in January.
- Average seasonal rainfall follows a bi-modal pattern with approximately one-third of the average seasonal rainfall occurring in the winter (January-March) season and one-third in the summer (July-September) season. The highest average annual rainfall in the basin is 6.36 inches at the Salome 17 SE station.

AZMET

- Refer to Table 7.3-1C
- There is one AZMET station in the basin, Harquahala. This station is at 1,150 feet and has an annual reference evaportranspiration rate of 82.13 inches.

SCAS Precipitation Data

- See Figure 7.3-3
- Additional precipitation data shows average annual rainfall as high as 18 inches in the Harquahala Mountains at the northern tip of the basin and as low as four inches in the southern and western portions of the basin.

Table 7.3-1 Climate Data for the Harquahala Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Harquahala Plains	1220	1952 - 1979[1]	89.5/Jul	48.0/Jan	2.03	0.31	2.10	1.71	6.14
Salome 17 SE	1600	1987 - 1998[1]	91.0/Jul	49.1/Dec	2.49	0.43	2.06	1.38	6.36

Source: WRCC, 2005

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

B. Evaporation Pan:

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

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Harquahala	1,150	1999 - current	81.55 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

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

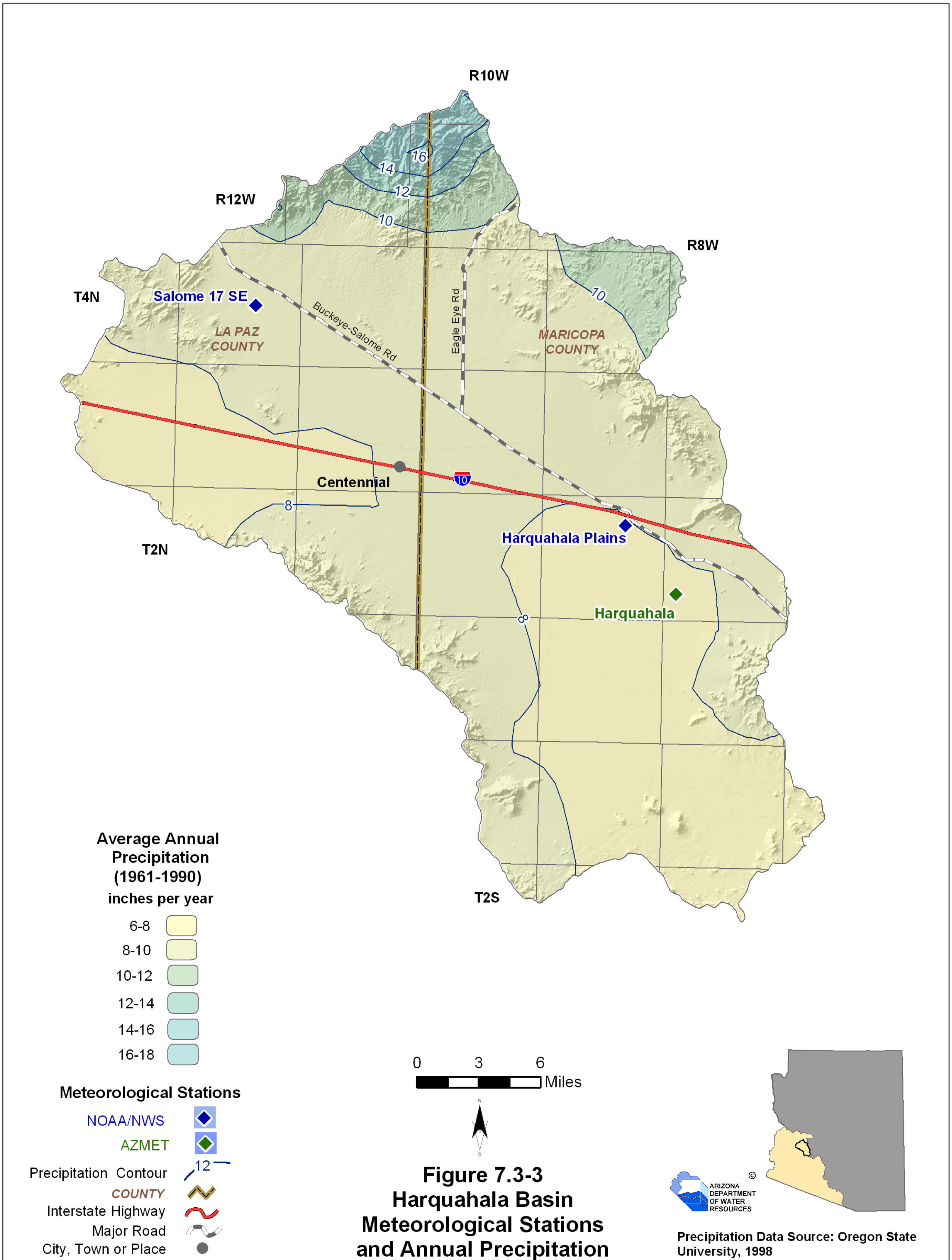


Figure 7.3-3
Harquahala Basin
Meteorological Stations
and Annual Precipitation

Precipitation Data Source: Oregon State University, 1998

7.3.4 Surface Water Conditions in the Harquahala Basin

Flood ALERT equipment in the basin is shown in Table 7.3-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.3-3. The location of flood ALERT equipment and large reservoirs are shown on Figure 7.3-4. There are no USGS streamflow gages or runoff contour data available for this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Flood ALERT Equipment

- Refer to Table 7.3-2.
- As of October 2005 there were 10 stations in this basin.

Reservoirs and Stockponds

- Refer to Table 7.3-3.
- There are 42 registered stockponds in this basin.

Table 7.3-2 Flood ALERT Equipment in the Harquahala Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5065	Eagle Eye Rd. @ CAP	Precipitation	6/17/2003	Maricopa County FCD
5080	Buckeye @ 547th Ave.	Precipitation	6/13/2000	Maricopa County FCD
5085	Baseline @ 547th Ave.	Precipitation	5/24/2000	Maricopa County FCD
5110	Saddleback FRS	Precipitation/Stage	12/16/1988	Maricopa County FCD
5120	Centennial Levee	Precipitation/Stage	3/7/1994	Maricopa County FCD
5125	Harquahala FRS	Precipitation/Stage	9/15/1993	Maricopa County FCD
5140	Tiger Wash Fan	Weather Station	9/21/1994	Maricopa County FCD
5150	Narrows Damsite	Precipitation	9/1/1994	Maricopa County FCD
5160	Tiger Wash	Precipitation/Stage	9/15/1999	Maricopa County FCD
5185	Harquahala Mtn. Repeater	Repeater/Precipitation	2/11/1994	Maricopa County FCD

Source: ADWR 2005a

Notes:
FCD = Flood Control District
FRS = Flood Retention Structure

Table 7.3-3 Reservoirs and Stockponds in the Harquahala Basin

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

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

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

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

Source: Compilation of databases from ADWR & others

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

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

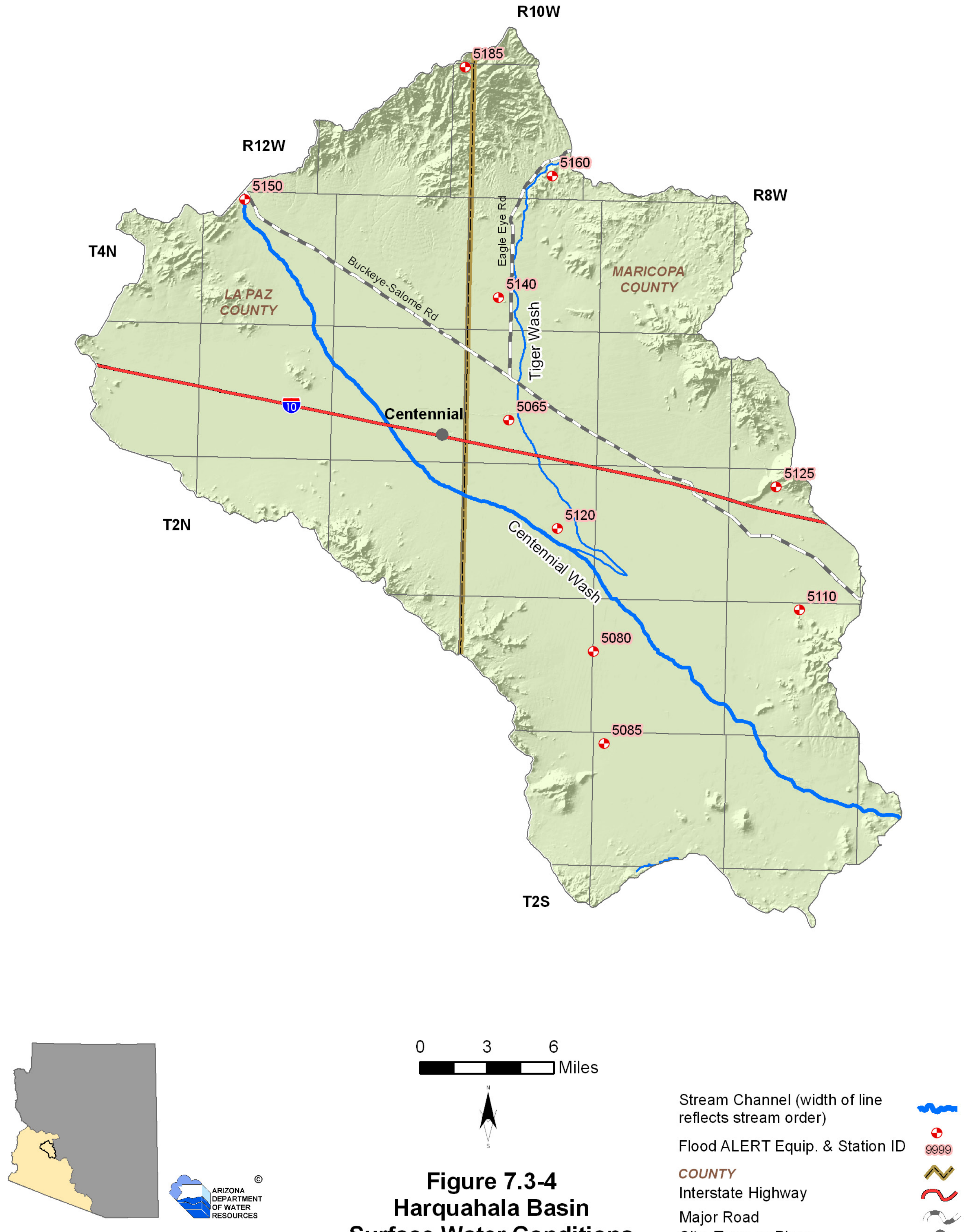
D. Other Small Reservoirs (between 5 and 50 acres surface area)[1]

Total number: 1
Total surface area: 17 acres

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

Total number: 42

Notes:
[1]Capacity data is not available to ADWR



Stream Data Source: ALRIS, 2005

Figure 7.3-4
Harquahala Basin
Surface Water Conditions

7.3.5 Perennial/Intermittent Streams and Major Springs in the Harquahala Basin

The total number of springs in the basin are shown in Table 7.3-4. There are no perennial or intermittent streams and no major or minor springs in the Harquahala Basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- The total number of springs, regardless of discharge, identified by the USGS varies from zero to one, depending on the database reference.

Table 7.3-4 Springs in the Harquahala Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 0 to 1

7.3.6 Groundwater Conditions of the Harquahala Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.3-5. Figure 7.3-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.3-6 contains hydrographs for selected wells shown on Figure 7.3-5. Figure 7.3-7 shows well yields in six yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A

Major Aquifers

- Refer to Table 7.3-5 and Figure 7.3-5.
- The major aquifer in this basin is basin fill.
- Flow direction is generally from northwest to southeast and to a cone of depression in the central portion of the basin.
- As shown on Figure 7.3-5, the water level in the area of the cone of depression has risen by at least one foot and as much as 30+ feet between 1990-1991 and 2003-2004 due to use of Central Arizona Project (CAP) water in place of groundwater and CAP recharge at the Vidler Recharge Facility west of Centennial.

Well Yields

- Refer to Table 7.3-5 and Figure 7.3-7
- As shown on Figure 7.3-7, well yields are generally between 1,000 gallons per minute (gpm) to greater than 2,000 gpm.
- One source of well yield information, based on 157 reported wells, indicates that the median well yield is 1,620 gpm.

Natural Recharge

- Refer to Table 7.3-5
- Natural recharge estimates range from less than 1,000 acre-feet per year (AFA) to less than 1,200 AFA.
- The largest source of natural recharge is runoff infiltration through the Centennial Wash alluvium (ADWR 1994b).

Water in Storage

- Refer to Table 7.3-5
- Storage estimates for this basin range from 13 million acre-feet (maf) to 27 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.3-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 34 index wells in this basin. Hydrographs for 11 index wells are shown on Figure 7.3-6.
- The deepest water level shown on the map is 561 feet in the southwestern portion of the basin and the shallowest is 25 feet in T1N R8W.

Table 7.3-5 Groundwater Data for the Harquahala Basin

Basin Area, in square miles:	766	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 207-3,007 Median 1,613.5 (84 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 7-3,500 Median 1,620 (157 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 300-3,000	ADWR (1990 and 1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	<1,200[1]	Anderson and Freethey (1995)
	1,000	Freethey and Anderson (1986)
	<1,000[1]	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	15,500,000 (to 1,200 ft)	ADWR (1994b)
	13,000,000[2] (to 1,200 ft)	Freethey and Anderson (1986)
	27,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	34	
Date of Last Water-level Sweep:	2004 (115 wells measured)	

[1]Includes Tiger Wash Basin
[2]Predevelopment Estimate

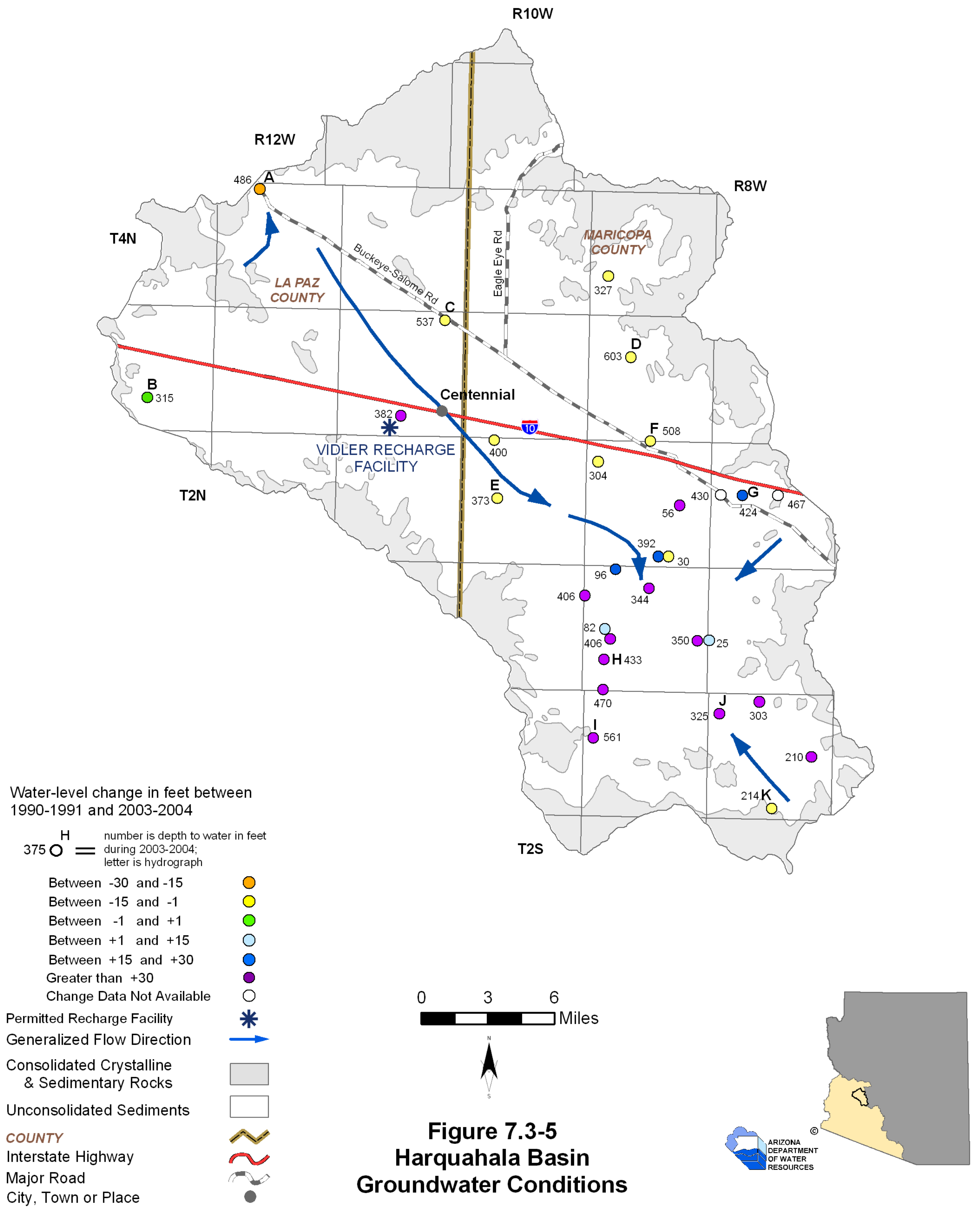


Figure 7.3-5
Harquahala Basin
Groundwater Conditions

Figure 7.3-6
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

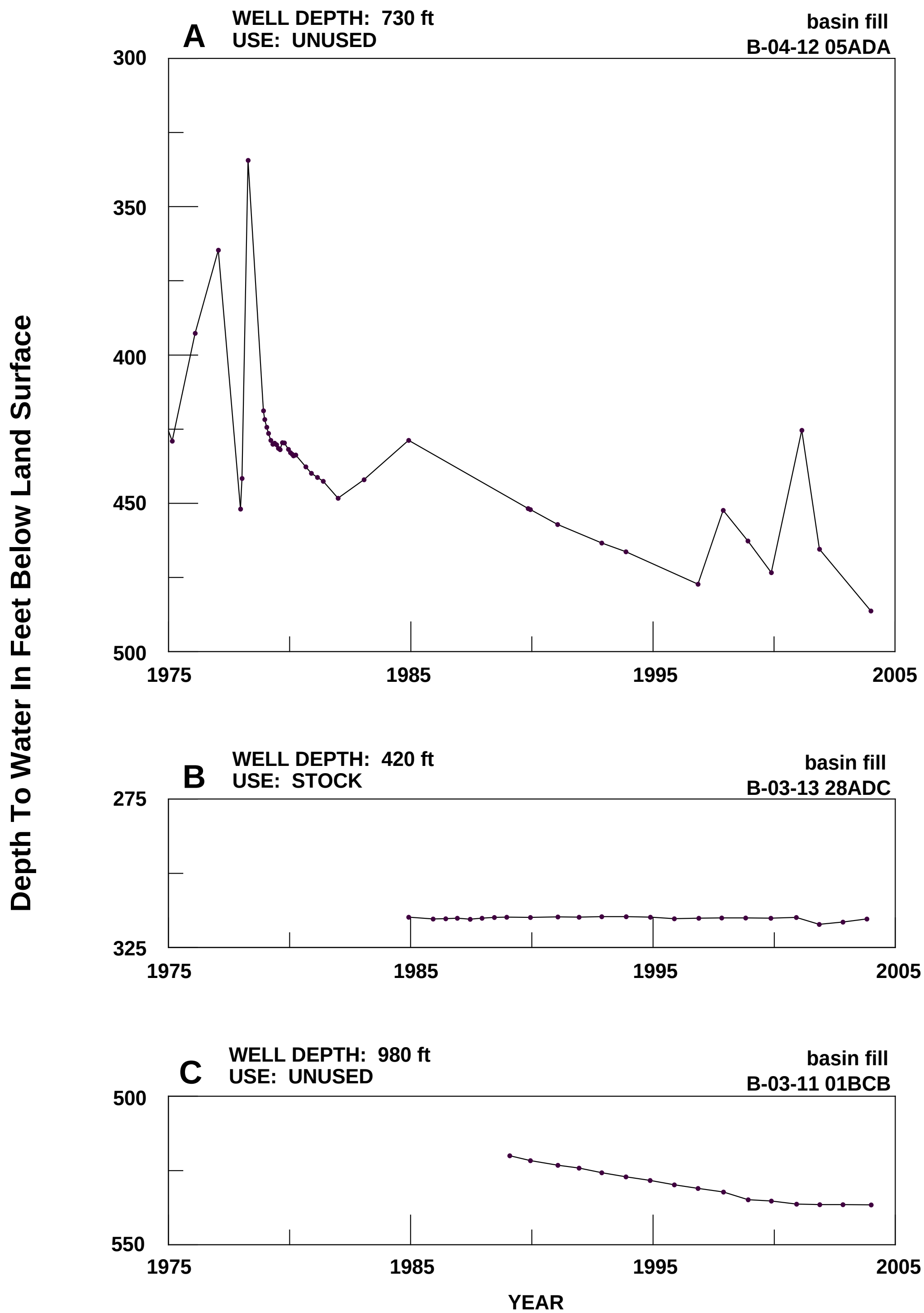


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

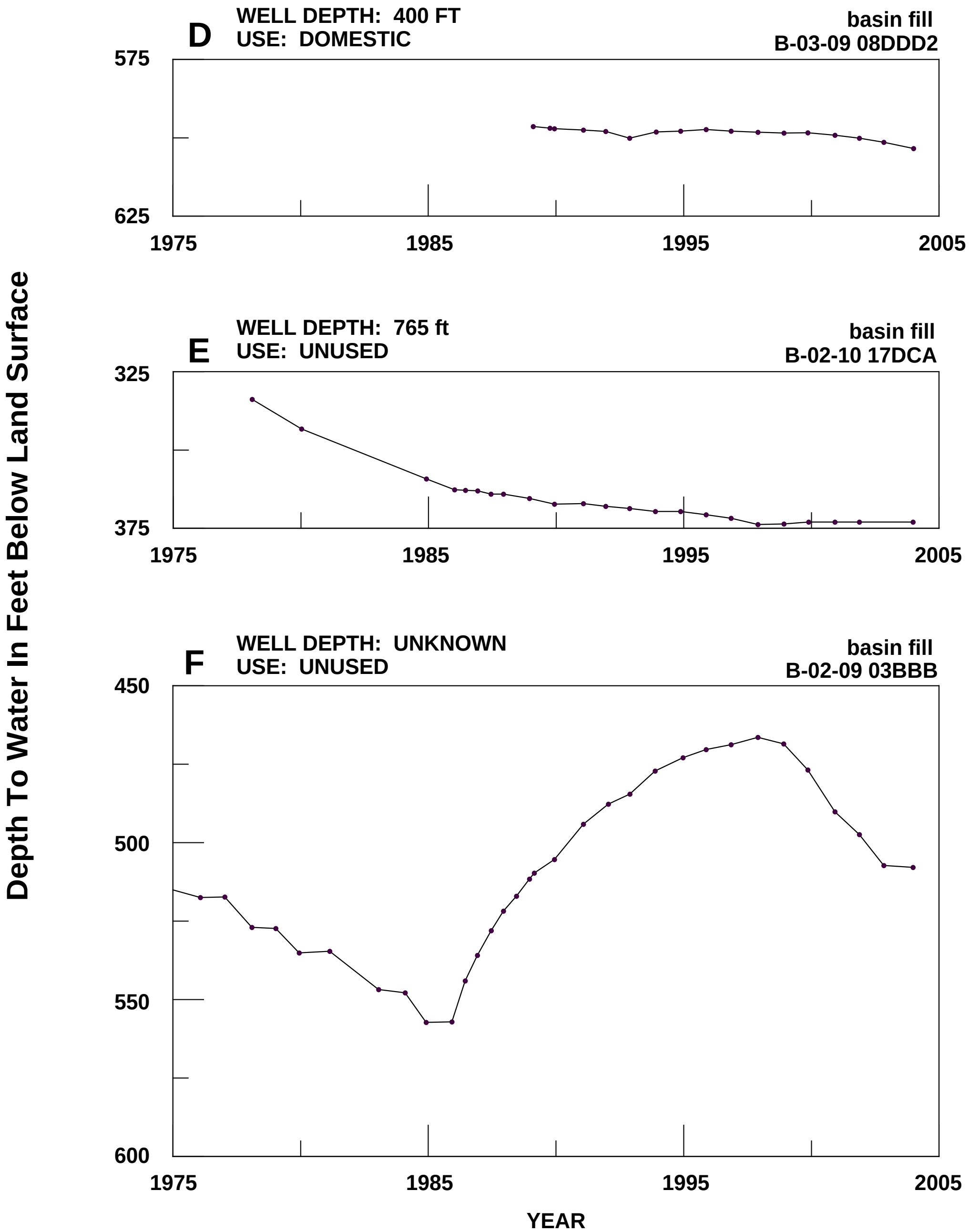


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

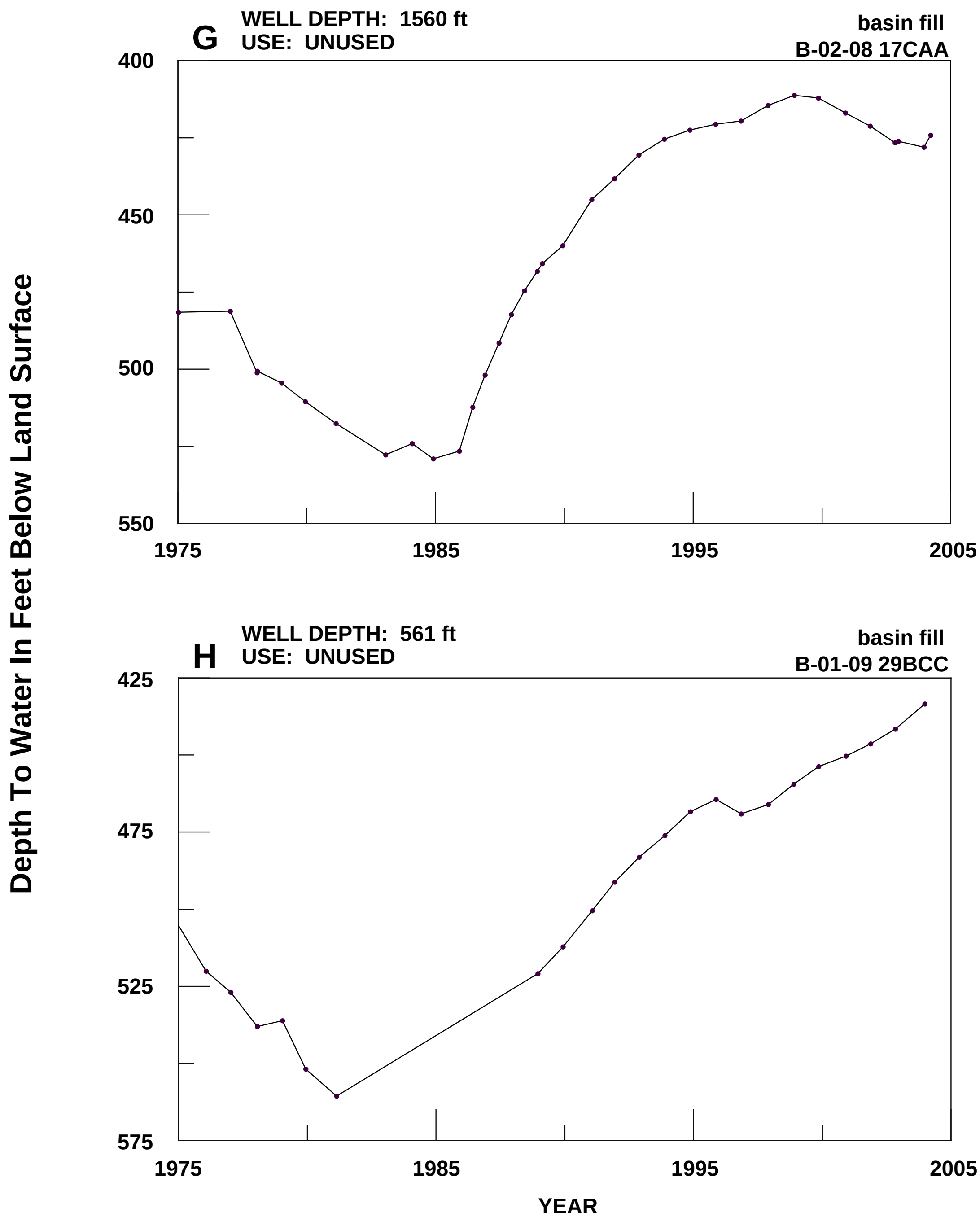


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells

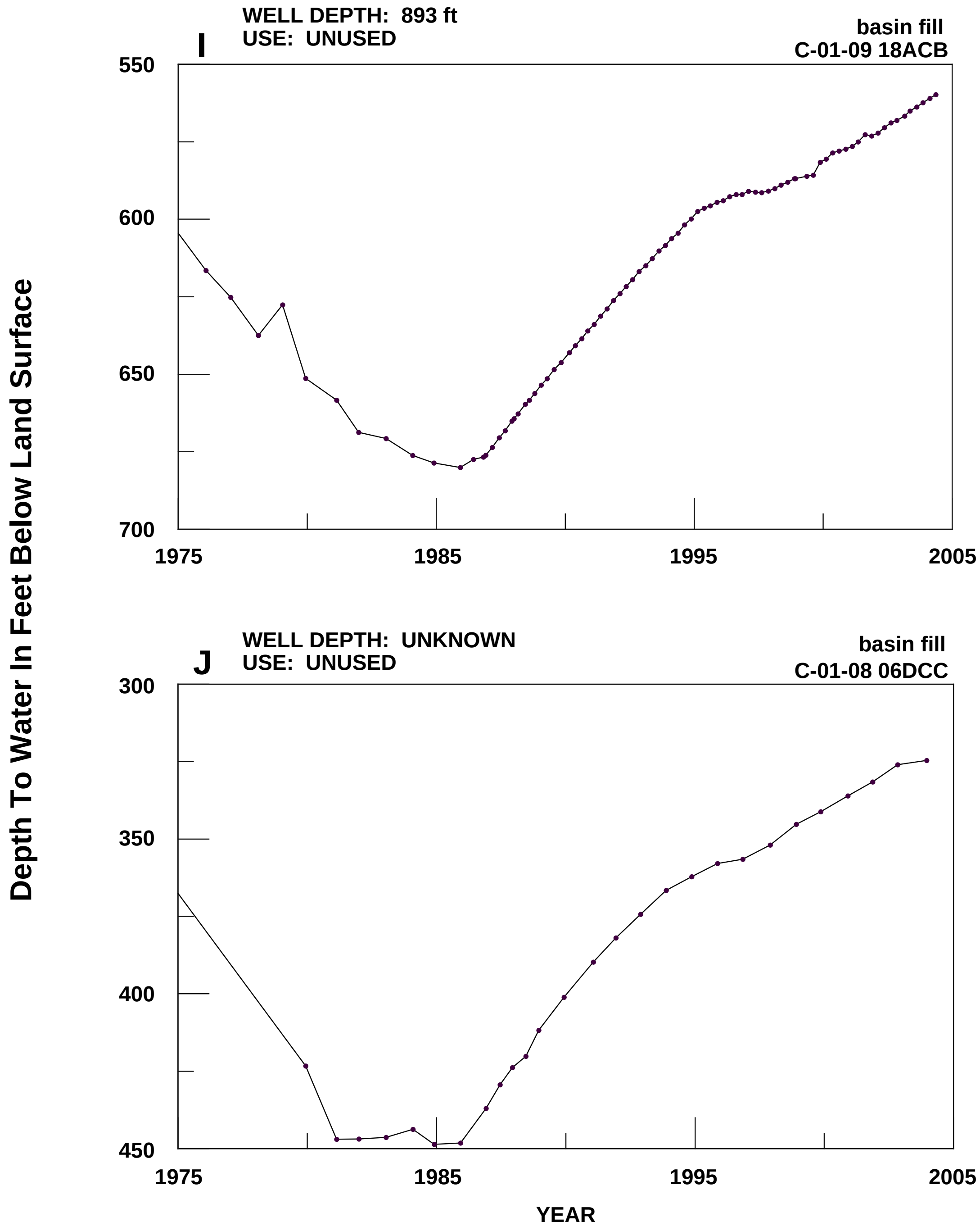
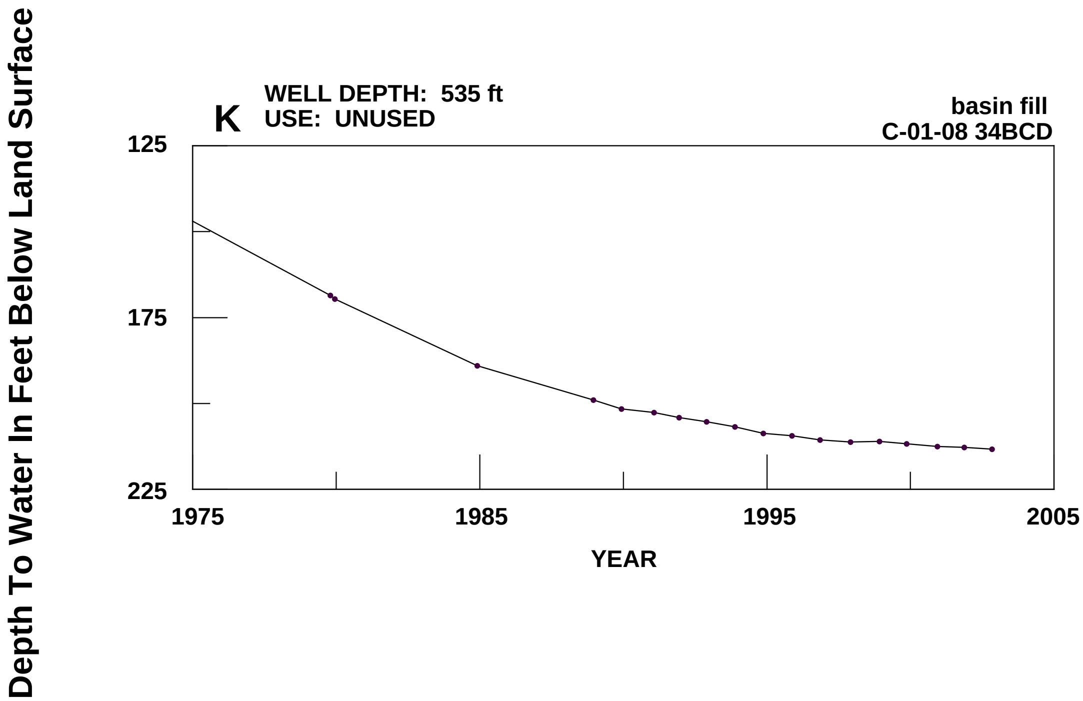


Figure 7.3-6 (cont'd)
Harquahala Basin
Hydrographs Showing Depth to Water in Selected Wells



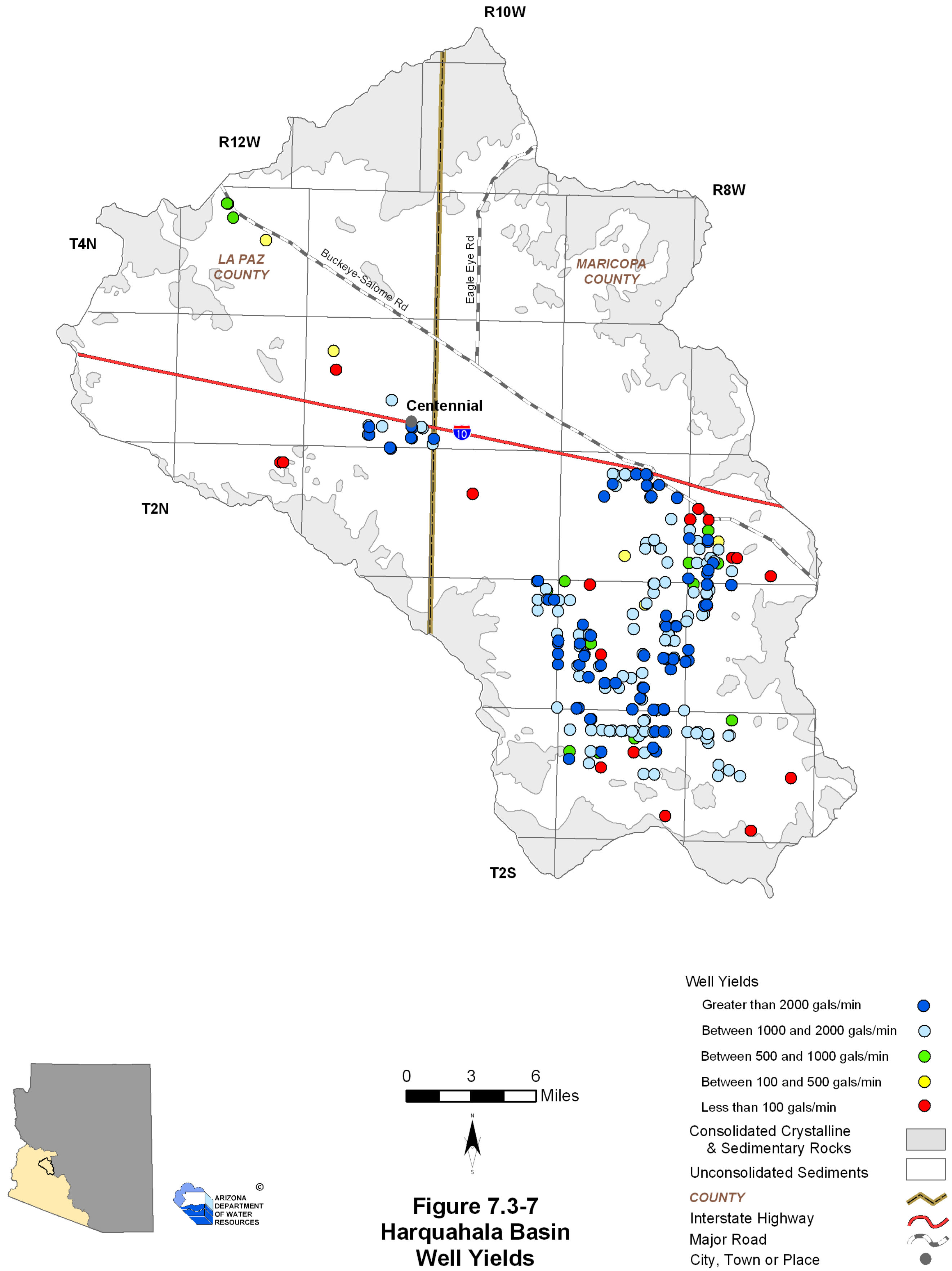


**Figure 7.3-7
Harquahala Basin
Well Yields**

7.3.7 Water Quality of the Harquahala Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.3-6A. There are no impaired lakes or streams in this basin. Figure 7.3-8 shows the location of water quality occurrences keyed to Table 7.3-6. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.3-6A.
- Eighty-two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter most frequently equaled or exceeded was fluoride.
- Other parameters equaled or exceeded include arsenic, lead, chromium, total dissolved solids and nitrates.

Table 7.3-6 Water Quality Exceedences in the Harquahala Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	4 North	9 West	30	F
2	Well	4 North	12 West	9	F
3	Well	4 North	12 West	14	NO3
4	Well	3 North	9 West	8	F
5	Well	3 North	10 West	31	F
6	Well	3 North	11 West	8	F, Hg
7	Well	3 North	11 West	13	F
8	Well	3 North	12 West	19	F
9	Well	2 North	8 West	17	F
10	Well	2 North	8 West	19	As
11	Well	2 North	8 West	28	F
12	Well	2 North	8 West	30	As, NO3
13	Well	2 North	9 West	3	F
14	Well	2 North	9 West	11	As
15	Well	2 North	9 West	11	NO3
16	Well	2 North	9 West	13	F
17	Well	2 North	9 West	14	As, F, NO3, TDS
18	Well	2 North	9 West	16	F
19	Well	2 North	9 West	24	As
20	Well	2 North	9 West	26	F
21	Well	2 North	9 West	26	As
22	Well	2 North	9 West	26	F, TDS
23	Well	2 North	9 West	35	F
24	Well	2 North	10 West	17	F
25	Well	2 North	10 West	26	F
26	Well	2 North	10 West	26	F
27	Well	2 North	11 West	2	F
28	Well	1 North	8 West	6	F, NO3
29	Well	1 North	8 West	7	F
30	Well	1 North	8 West	19	F, NO3, TDS
31	Well	1 North	8 West	19	As, F, NO3
32	Well	1 North	9 West	4	F
33	Well	1 North	9 West	5	NO3
34	Well	1 North	9 West	6	F
35	Well	1 North	9 West	11	F
36	Well	1 North	9 West	12	F, NO3
37	Well	1 North	9 West	12	F
38	Well	1 North	9 West	13	F
39	Well	1 North	9 West	16	F
40	Well	1 North	9 West	17	TDS
41	Well	1 North	9 West	17	F
42	Well	1 North	9 West	17	F
43	Well	1 North	9 West	17	F, Pb
44	Well	1 North	9 West	18	F
45	Well	1 North	9 West	20	F, NO3
46	Well	1 North	9 West	21	F
47	Well	1 North	9 West	21	F
48	Well	1 North	9 West	22	F
49	Well	1 North	9 West	22	F
50	Well	1 North	9 West	23	F, NO3
51	Well	1 North	9 West	24	F

Table 7.3-6 Water Quality Exceedences in the Harquahala Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
52	Well	1 North	9 West	26	F
53	Well	1 North	9 West	31	As, F
54	Well	1 North	9 West	36	F
55	Well	1 North	10 West	1	F
56	Well	1 North	10 West	1	F
57	Well	1 North	10 West	12	F
58	Well	1 South	7 West	19	F
59	Well	1 South	8 West	4	F
60	Well	1 South	8 West	6	As, Pb
61	Well	1 South	8 West	6	As, F
62	Well	1 South	8 West	6	F
63	Well	1 South	8 West	8	Cr, F
64	Well	1 South	8 West	8	F
65	Well	1 South	8 West	9	As, F, Pb
66	Well	1 South	8 West	14	F
67	Well	1 South	8 West	14	As
68	Well	1 South	8 West	20	F
69	Well	1 South	8 West	22	F
70	Well	1 South	8 West	27	F
71	Well	1 South	8 West	27	F
72	Well	1 South	8 West	27	F
73	Well	1 South	9 West	1	F
74	Well	1 South	9 West	2	F
75	Well	1 South	9 West	2	NO3
76	Well	1 South	9 West	3	Pb, NO3
77	Well	1 South	9 West	5	F
78	Well	1 South	9 West	7	F
79	Well	1 South	9 West	10	F
80	Well	1 South	9 West	11	F
81	Well	1 South	9 West	11	F
82	Well	1 South	9 West	11	F

Source: Compilation of databases from ADWR & others

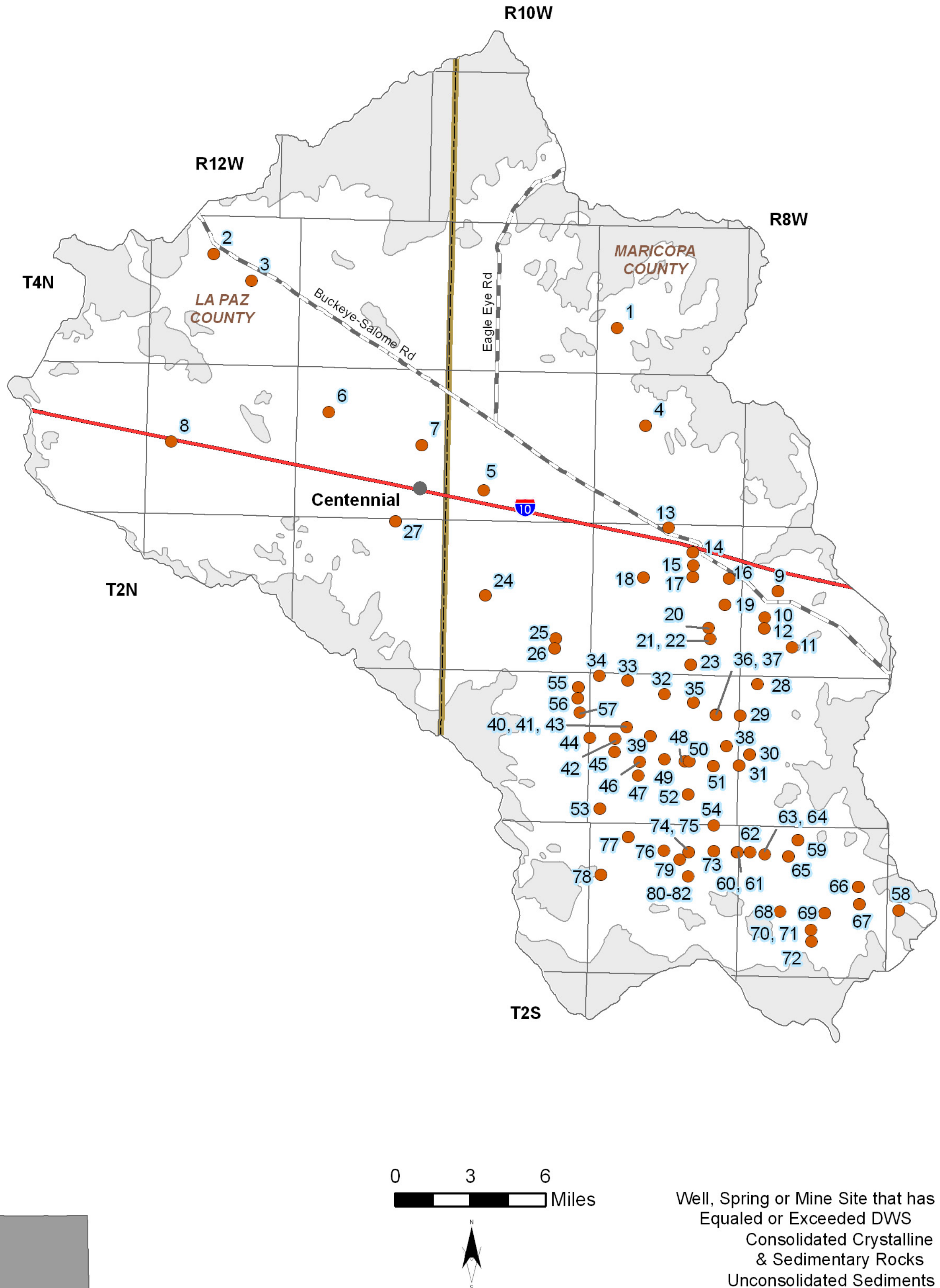
B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.

[2] As = Arsenic
Cr = Chromium
NO3 = Nitrate
F = Fluoride
Pb = Lead
TDS = Total Dissolved Solids



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.3-8
Harquahala Basin
Water Quality Conditions

7.3.8 Cultural Water Demands in the Harquahala 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 7.3-7. Figure 7.3-9 shows the location of demand centers. There is no recorded effluent generation in this basin. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.3-7 and Figure 7.3-9.
- Population in this basin increased from 359 in 1980 to 608 in 2000.
- Most cultural water use is for irrigation in the southern and northwestern portions of the basin.
- Groundwater use for agriculture increased from 9,500 AFA between 1991-1995 to 36,500 between 2001-2005; however, long-term agricultural groundwater use declined 68% from 1971 to 2005. The entire Harquahala Basin is within an Irrigation Non-Expansion Area (INA). The Harquahala INA was created in 1981; no new agricultural lands can be irrigated with groundwater in an INA.
- Surface water use for irrigation began in 1986 with deliveries of Central Arizona Project water to the basin. Agricultural surface water demand increased from 79,000 AFA between 1986-1990 to 85,000 AFA between 1996-2000; but decreased to 69,600 AFA in 2001-2005.
- There was no reported industrial groundwater demand prior to 2001-2005. The Harquahala Generating Project began operating in 2001. This plant used an average of 2,500 AFA from 2001 to 2005.
- As of 2005 there were 196 registered wells with a pumping capacity of less than or equal to 35 gpm and 212 wells with a pumping capacity of more than 35 gpm.

Table 7.3-7 Cultural Water Demand in the Harquahala Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="6">Average Annual Demand (in acre-feet)</th><th rowspan="3">Data Source</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">111[2]</td><td rowspan="10">179[2]</td><td colspan="3" rowspan="5">117,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a) USGS (2007)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5">111,000</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>359</td></tr>
<tr><td>1981</td><td>405</td><td rowspan="5">13</td><td rowspan="5">8</td><td colspan="3" rowspan="5">79,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>451</td></tr>
<tr><td>1983</td><td>498</td></tr>
<tr><td>1984</td><td>544</td></tr>
<tr><td>1985</td><td>590</td></tr>
<tr><td>1986</td><td>636</td><td rowspan="5">10</td><td rowspan="5">6</td><td colspan="3" rowspan="5">6,000</td><td colspan="3" rowspan="5">79,000</td></tr>
<tr><td>1987</td><td>682</td></tr>
<tr><td>1988</td><td>729</td></tr>
<tr><td>1989</td><td>775</td></tr>
<tr><td>1990</td><td>821</td></tr>
<tr><td>1991</td><td>800</td><td rowspan="5">5</td><td rowspan="5">3</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">9,500</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5">47,500</td><td rowspan="15">USGS (2007) ADWR (2008b)</td></tr>
<tr><td>1992</td><td>779</td></tr>
<tr><td>1993</td><td>757</td></tr>
<tr><td>1994</td><td>736</td></tr>
<tr><td>1995</td><td>715</td></tr>
<tr><td>1996</td><td>694</td><td rowspan="5">19</td><td rowspan="5">9</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">23,500</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5">85,000</td></tr>
<tr><td>1997</td><td>673</td></tr>
<tr><td>1998</td><td>651</td></tr>
<tr><td>1999</td><td>630</td></tr>
<tr><td>2000</td><td>608</td></tr>
<tr><td>2001</td><td>642</td><td rowspan="5">38</td><td rowspan="5">7</td><td rowspan="5"><300</td><td rowspan="5">2,500</td><td rowspan="5">36,500</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td rowspan="5">69,600</td></tr>
<tr><td>2002</td><td>677</td></tr>
<tr><td>2003</td><td>711</td></tr>
<tr><td>2004</td><td>745</td></tr>
<tr><td>2005</td><td>780</td></tr>
<tr><td>2010</td><td>951</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>1,697</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>2,443</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>WELL TOTALS:</td><td>196</td><td>212</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Industrial demand 1971-1990 includes a small amount of well pumpage in the Tiger Wash Basin.
NR - Not reported

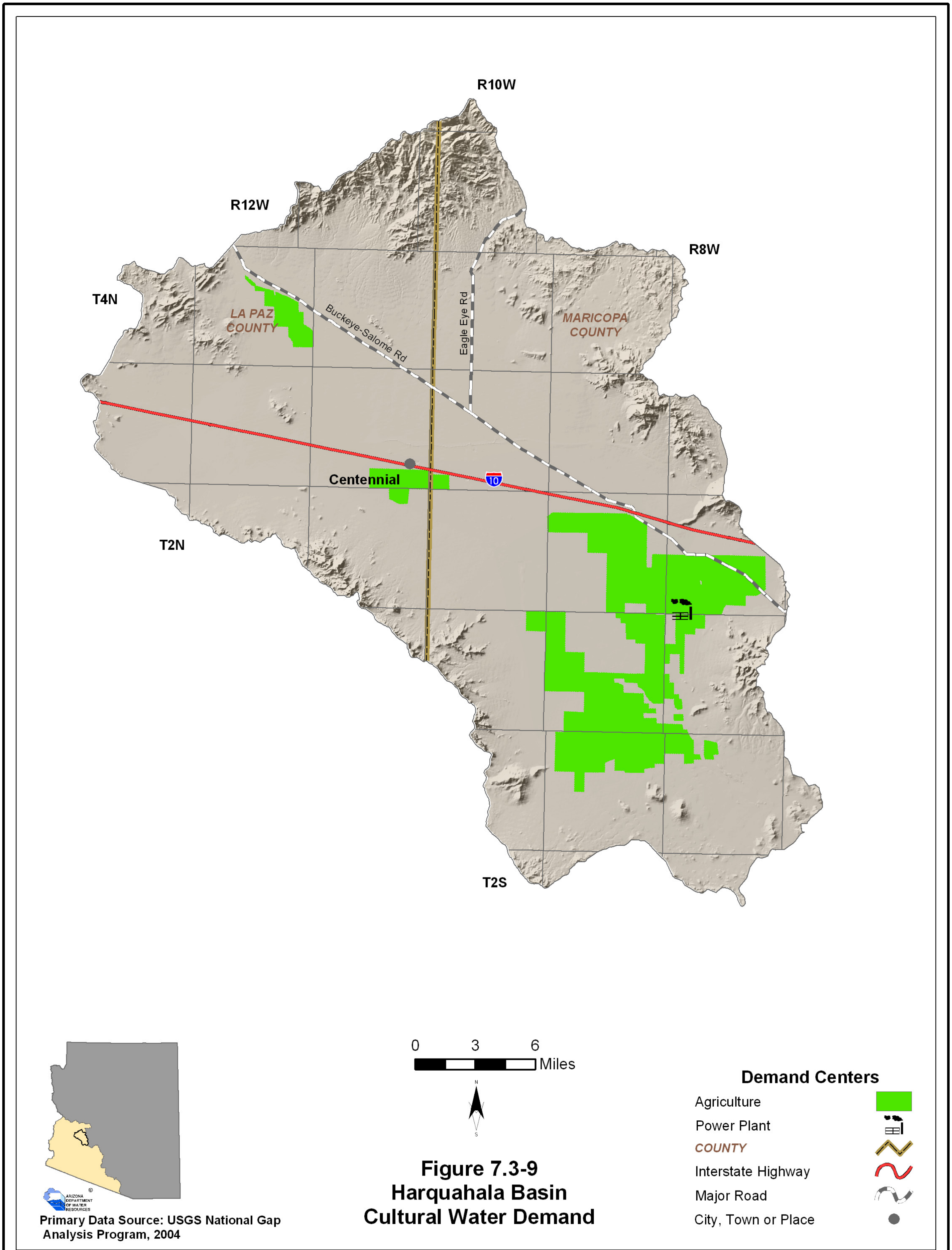


Figure 7.3-9
Harquahala Basin
Cultural Water Demand

7.3.9 Water Adequacy Determinations in the Harquahala Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.3-8. Figure 7.3-10 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in Maricopa County. Four water adequacy determinations for 301 lots have been made in this basin through December 2008. Two hundred and one lots in two subdivision, or 67% of lots, were determined to be adequate.
- One subdivision received a determination of inadequacy because of an insufficient supply and the other because the applicant did not submit the necessary information and/or the available hydrologic data was insufficient to make a determination.
- There are three Analysis of Adequate Water Supply applications for a total of 8,901 lots.

Table 7.3-8 Adequacy Determinations in the Harquahala Basin[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Big Horn Farms	Maricopa	1 North	9 West	11	32	53-300288	Inadequate	A2	5/12/1997	NA
4	Harquahala Ranches Unit I, II, III	Maricopa	1 South	9 East	5, 6, 7	68	53-700461	Inadequate	A1	1/15/2008	Eagletail Water Co.
5	Harquahala Ranchitos Units 1 & 2	Maricopa	2 North	8 West	22	19	53-300114	Adequate		2/26/1996	Dry Lot Subdivision
7	Rose View Estates	Maricopa	1 North	8 West	4	182	53-501343	Adequate		4/6/1995	Water Utility of Greater Tonopah

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
2	Centennial Complex	La Paz	3 North	10 West	25	770	43-700451	12/5/2007	Centennial Community Facilities District
			3 North	11 West	24, 30				
3	Centennial Interchange Development	La Paz	3 North	11 West	26	31	43-402080	9/21/2006	NA
6	La Paz - K Lazy B Ranch	La Paz	4 North	12 West	9	8,100	43-402253	11/13/2007	NA

Source: ADWR 2008a

Notes:

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

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

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

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

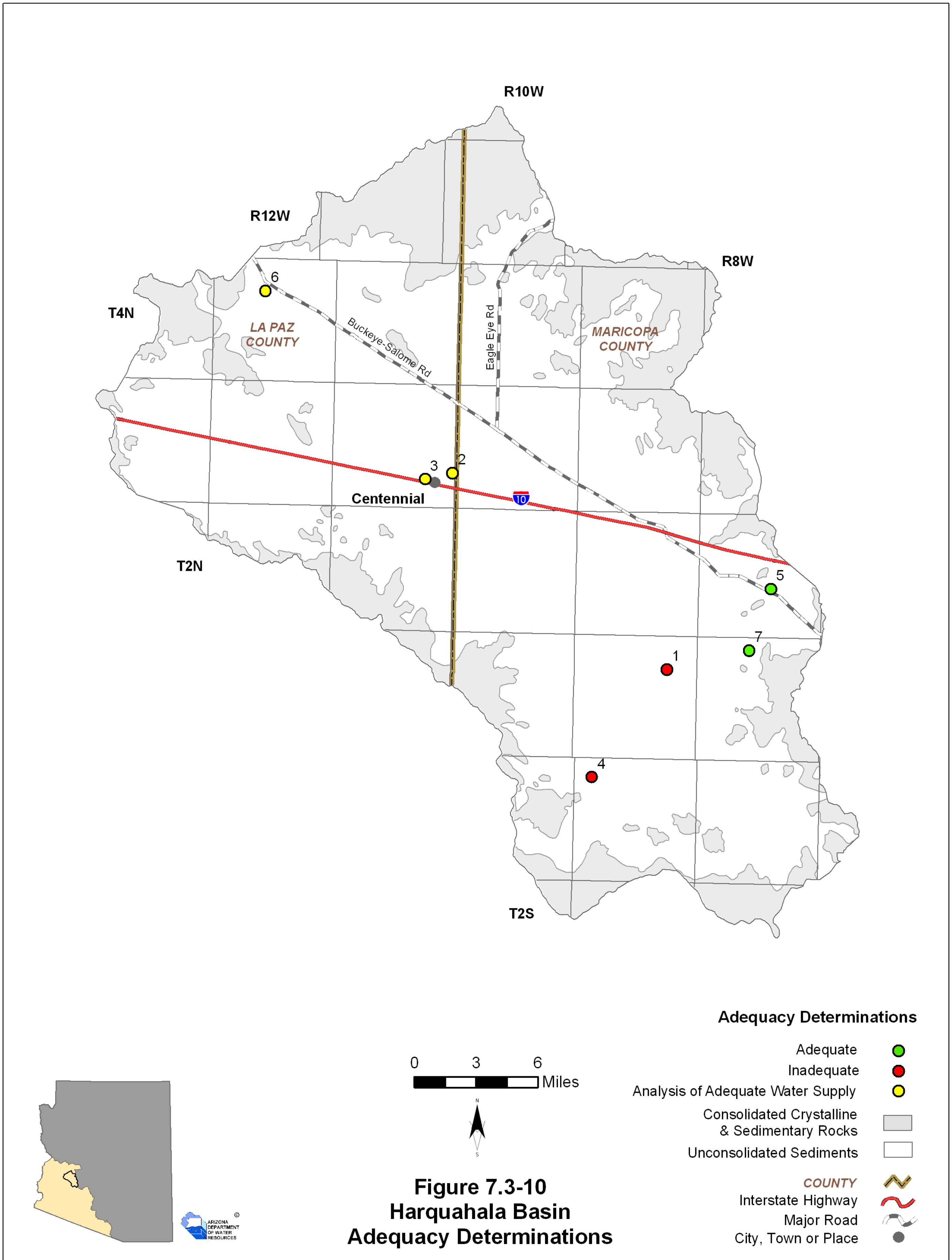


**Figure 7.3-10
Harquahala Basin
Adequacy Determinations**

Harquahala Basin
References and Supplemental Reading

References

A

Anderson, T.W. and G.W. Freethey, 1995, Simulation of groundwater flow in alluvial basins in south central Arizona and parts of adjacent states: USGS Professional Paper 1406-D.

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005d, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005b Streams: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html

_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 2006, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.

_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Pan evaporation stations: Data file accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Anning, D.W., 2002, Estimation and analysis of the uncertainty in stream flow and change in reservoir-content data at selected stream flow-gaging stations in the Lower Colorado River network, 1995-99: University of Arizona, M.S. thesis.

Headly, J.D., 1990, Groundwater conditions in the Harquahala Irrigation Non-Expansion area and Tiger Wash Basin, Arizona Department of Water Resources Hydrologic Map Series No. 17

HydroSystems, Inc., 1997, Physical Availability Demonstration For MBT Ranch Properties In Support Of The Transportation Of Groundwater From The Harquahala Irrigation Non-Expansion Area. Prepared for Arizona Department of Water Resources.

____, 1998, Additional Regional Groundwater Level Decline Analysis Addendum To: Physical Availability Demonstration For MBT Ranch Properties In Support Of The Transportation Of Groundwater From The Harquahala Irrigation Non-Expansion Area. Prepared for Arizona Department of Water Resources.

_____, 1998, Physical Availability Demonstration For Harquahala Valley Farms In Support

Of The Transportation Of Groundwater From The Harquahala Irrigation Non-Expansion Area, Maricopa County, Arizona. Prepared for Arizona Department of Water Resources.

Montgomery Watson, 1995, Water Supply Adequacy Report for the Proposed Harquahala Ranchitos Units 1 and 2. Prepared for Arizona Department of Water Resources.

______, 1995, Water Supply Adequacy Report for the Proposed Rose View Estates. Prepared for Arizona Department of Water Resources.

Richard, S.M., 1999, Geology of the Socorro Mine –White Marble Mine area, western Harquahala Mountains, west central Arizona: AZGS Open-File Report 99-9, 35 p.

Robertson, F.N., 1991, Geochemistry of groundwater in alluvial basins of Arizona and adjacent parts of Nevada, New Mexico and California: USGS Professional Paper 1406-C, 87 p.

Santec Consulting, 1999, Small and minor watercourses analysis for La Paz County, Arizona, Arizona State Land Department, Final Report.

Section 7.4
Lower Gila Basin

7.4.1 Geography of the Lower Gila Basin

The Lower Gila Basin, located in the center of the planning area is 7,309 square miles in area, the largest basin in the planning area. Geographic features and principal communities are shown on Figure 7.4-1. The basin is characterized by plains and valleys surrounded by low elevation mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub. (See Figure 7.0-9) Riparian vegetation includes tamarisk along the Colorado River and Gila River.

- Principal geographic features shown on Figure 7.4-1 are:
    - The Colorado River on the western basin boundary in the vicinity of Fishers Landing
    - The Gila River running east to west through the center of the basin
    - Numerous valleys and plains including Mohawk, San Cristobal, Growler and Childs Valleys in the southern portion of the basin and Castle Dome and Palomas Plains and King and Hyder Valleys in the northern portion of the basin
    - Mountain ranges including the Cabeza Prieta, Mohawk, Granite and Growler Mountains in the southern portion of the basin and the Castle Dome, Tank, Kofa and Gila Bend Mountains in the northern portion of the basin
    - The highest point in the basin, Castle Dome Peak, at 3,788 feet in the Castle Dome Mountains west of Fishers Landing
    - The lowest point in the basin at 160 feet west of Dome where the Gila River exits the basin.

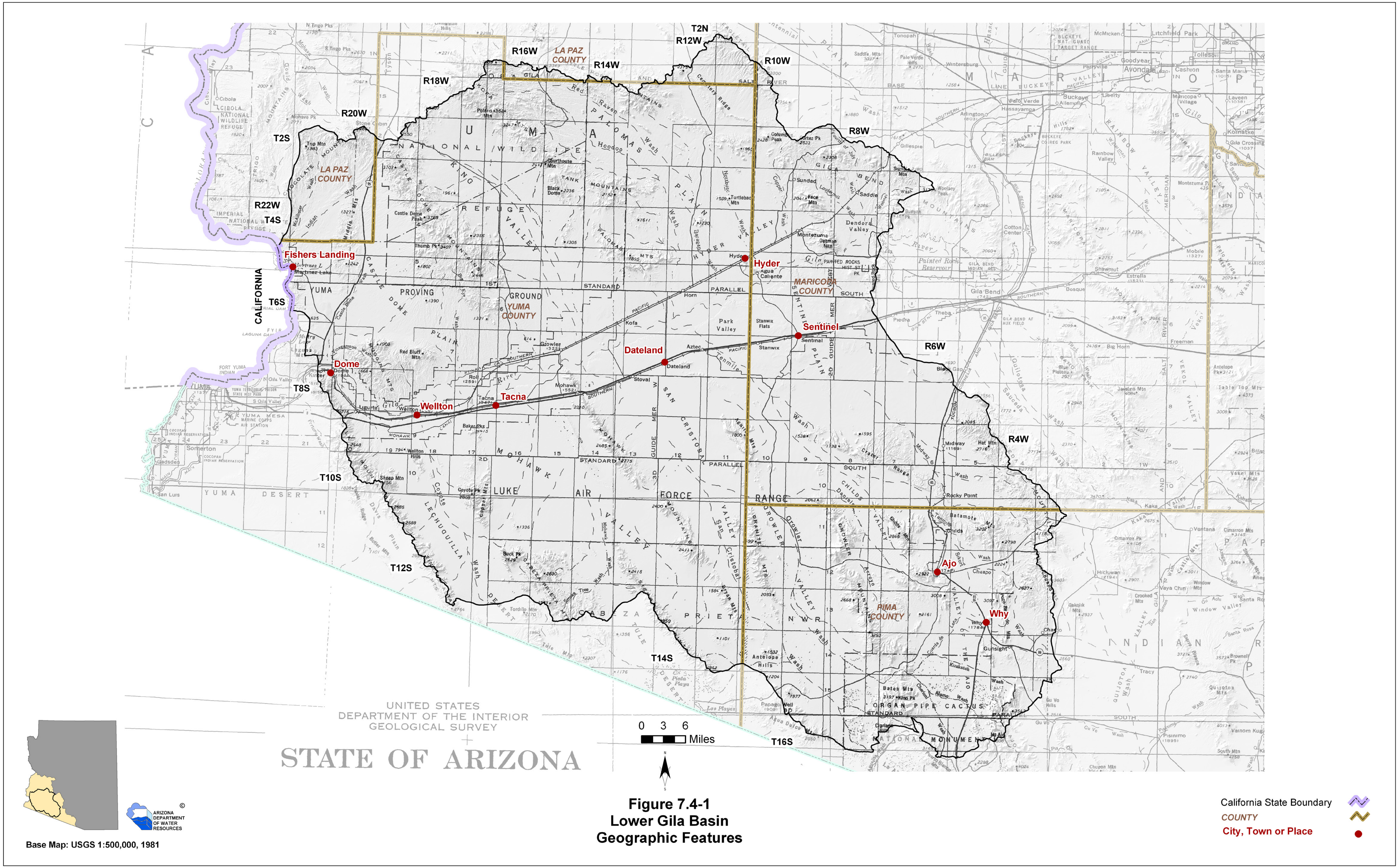


Figure 7.4-1
Lower Gila Basin
Geographic Features

7.4.2 Land Ownership in the Lower Gila Basin

Land ownership, including the percentage of ownership by category, for the Lower Gila Basin is shown in Figure 7.4-2. Principal features of land ownership in this basin are the large areas of military and national wildlife refuge lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Military
- 38.8% of the land is federally owned and managed by the U.S. Military.
- U.S. Military lands in the basin include the Yuma Proving Ground and the Barry Goldwater Air Force Range.
- Primary land use is military activity.

Wildlife Refuge
- 23.4% of the land is federally owned and managed as National Wildlife Refuges (NWR).
- Most of two National Wildlife Refuges are located in this basin, the 665,000 acre Kofa NWR and the 857,000 acre Cabeza Prieta NWR. Part of the Imperial NWR is located along the California State boundary.
- Land uses include resource conservation, wildlife protection and recreation.

U.S. Bureau of Land Management (BLM)
- 20.9% of the land is federally owned and managed by the Lower Sonoran and Yuma Field Offices of the Bureau of Land Management.
- This basin contains 138,700 acres of wilderness, including 64,000 acres of the 100,000 acre Eagletail Mountains Wilderness, the 38,000 acre Muggins Mountains Wilderness, 15,000 acres of the 64,000 acre Woolsey Peak Wilderness and 12,000 acres of the 13,000 acre Signal Mountain Wilderness. (See Figure 7.0-12)
- Land uses include grazing, resource conservation and recreation.

Private
- 5.8% of the land is private.
- Land uses include agriculture, domestic and commercial.

State Trust Land
- 4.5% of the land is held in trust for the public schools and five other beneficiaries under the State Trust Land system.
- Land uses include agriculture and grazing.

National Park Service (NPS)
- 3.9% of the land is federally owned and managed by the National Park Service as the Organ Pipe Cactus National Monument.
- Land uses include resource conservation and recreation.

Indian Reservation

- 2.3% of the land is under tribal ownership as the Tohono O'odham Indian Reservation.
- Primary land use is grazing.

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

- 0.4% of the land is federally owned and managed by the U.S. Bureau of Reclamation (USBOR).
- This land contains pump stations for the canals that are operated by the USBOR.

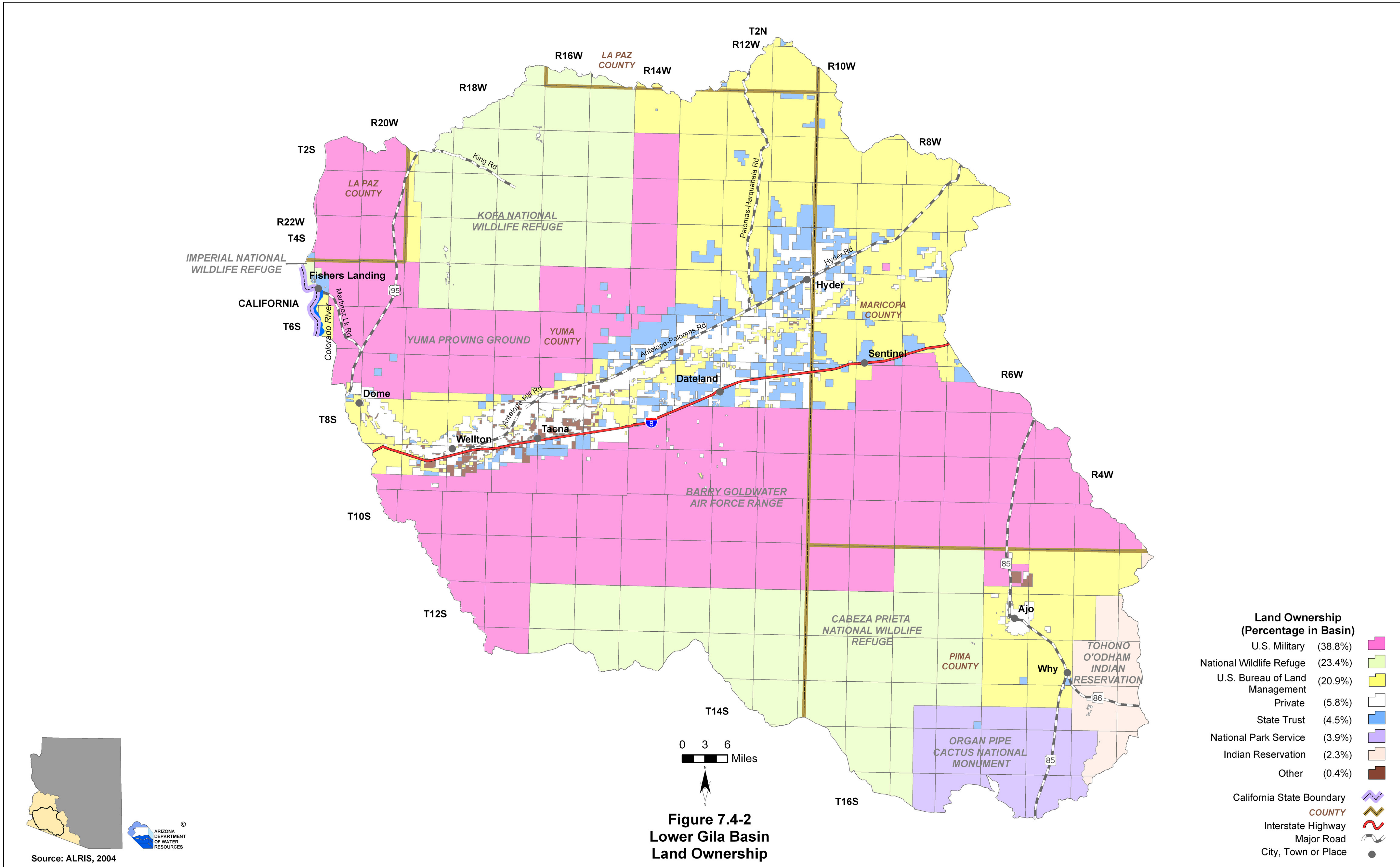


Figure 7.4-2
Lower Gila Basin
Land Ownership

7.4.3 Climate of the Lower Gila Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.4-1 and the locations are shown on Figure 7.4-3. Figure 7.4-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Lower Gila Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.4. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.4-1A
- There are eight NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 94.6°F at Mohawk and 89.5°F at Dateland Whitewing R. The average monthly minimum temperature occurs in January or December and ranges between 51.1°F at Wellton to 55.9°F at Kofa Mine.
- Highest average seasonal rainfall occurs at most stations in the summer (July-September). For the period of record used, the highest annual rainfall is 7.74 inches at the Ajo station and the lowest is 3.80 inches at Yuma Proving Ground.

AZMET

- Refer to Table 7.4-1C
- There are two AZMET stations in the basin. The stations are at 299 feet and 535 feet and have an average annual reference evapotranspiration of 77.8 inches and 88.06 inches respectively.

SCAS Precipitation Data

- See Figure 7.4-3
- Additional precipitation data show average annual rainfall as high as 16 inches in the Gunsight Hills south of Why and as low as four inches or less along the Colorado River in the western portion of the basin.

Table 7.4-1 Climate Data for the Lower Gila Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Ajo	1,800	1971 - 2000	89.9/Jul	54.5/Jan	2.10	0.43	3.20	2.01	7.74
Dateland Whitewing R	550	1971 - 2000	89.5/Jul	53.6/Dec	1.58	0.18	1.59	1.25	4.60
Kofa Mine	1,780	1971 - 2000	91.1/Jul	55.9/Dec, Jan	2.32	0.39	2.69	1.59	6.99
Mohawk	540	1900-1951	94.6/Jul	54.4/Jan	1.16	0.25	1.69	1.15	4.23
Sentinel	690	1899-1960	92.3/Jul	51.7/Dec	1.35	0.37	1.90	1.01	4.63
Tacna 3 NE	320	1971 - 2000	92.1/Jul	51.6/Dec	1.39	0.31	1.60	1.05	4.35
Wellton	260	1922-1980[1]	91.0/Jul	51.1/Jan	1.46	0.30	1.57	1.13	4.44
Yuma Proving Ground	320	1971 - 2000	93.1/Jul	55.3/Dec	1.23	0.26	1.33	0.98	3.80

Source: WRCC, 2005

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

B. Evaporation Pan:

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

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches *(Number of years to calculate averages)*
Dateland	535	1990 - 1996 (discontinued)	88.06 *(6)*
Roll	299	1997 - current	77.80 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

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

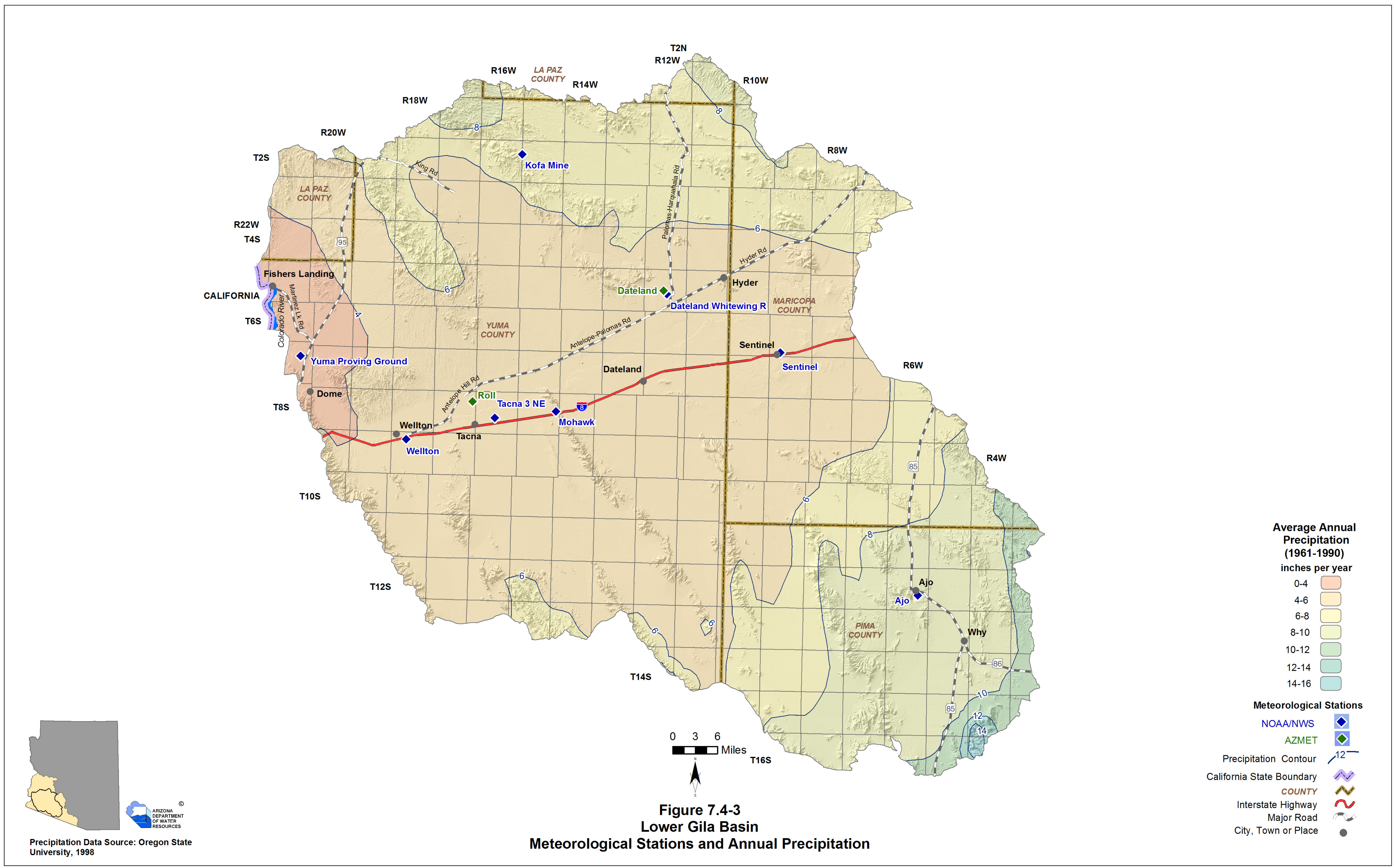


Figure 7.4-3
Lower Gila Basin
Meteorological Stations and Annual Precipitation

7.4.4 Surface Water Conditions in the Lower Gila Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.4-2. Flood ALERT equipment in the basin is shown in Table 7.4-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.4-4. The location of streamflow gages identified by USGS number, flood ALERT equipment, USGS runoff contours and large reservoirs are shown on Figure 7.4-4. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 7.4-2.
- Data from four stations located at three watercourses are shown in the table and on Figure 7.4-4. Two stations have been discontinued and two are real-time stations.
- Average seasonal flow varies at the four stations. At one station, Colorado River below Imperial Dam, the average seasonal flow is similar in all seasons due to releases from Imperial Dam. The Rio Comez station near Ajo, with a small, local drainage area, receives 79% of its average seasonal flow in the summer season (July-September). The Gila River stations report highest average seasonal flow in the spring (April-June) season.
- The largest annual flow recorded in the basin is 10 million acre-feet (maf) in 1984 at the Colorado River below Imperial Dam station with a contributing drainage area of 188,500 square miles.

Flood ALERT Equipment

- Refer to Table 7.4-3.
- As of October 2005 there were nine stations in this basin.

Reservoirs and Stockponds

- Refer to Table 7.4-4.
- The basin contains five large reservoirs. The largest, Imperial, has a maximum surface area of 1,402 acres.
- Surface water is stored or could be stored in six small reservoirs in the basin.
- There are 65 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.4-4.
- Average annual runoff is highest, 0.2 inches per year or 10.66 acre-feet per square mile, in the southeastern portion of the basin and decreases to 0.1 inches, or five acre-feet per square mile, in the remainder of the basin.

Table 7.4-2 Streamflow Data for the Lower Gila Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9429500	Colorado River below Imperial Dam[1]	188,500	162	1961-current (real time)	24	21	31	24	233,128 (1971)	350,416	1,292,340	10,049,120 (1984)	31
9520170	Rio Cornez near Ajo	243	1,309	1/1967-9/1978 (discontinued)	8	1	79	11	615 (1969)	2,440	3,085	8,543 (1976)	11
9520280	Gila River near Dateland	55,000	363	10/1993-current (real time)	2	46	18	35	0 (2000, 2001, 2002)	4	69,331	610,467 (1995)	9
9520360	Gila River near Mohawk	55,430	300	2/1966-7/1994 (discontinued)	36	38	15	12	0 (1975-1976, 1987-1991)	413	317,233	2,029,309 (1980)	19

Source: USGS (NWIS) 2005 & 2008

Notes:
[1]Station in California
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Annual Flow/Year statistics were only completed for those gages that had at least 3 year of 12 month records
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retrieved in 2005

Table 7.4-3 Flood ALERT Equipment in the Lower Gila Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5000	Mt. Oatman	Repeater/Precipitation	4/1/1981	Maricopa Country FCD
5010	Columbus Wash	Precipitation/Stage	9/21/1999	Maricopa County FCD
5030	Copper Wash	Precipitation/Stage	2/20/2001	Maricopa County FCD
5040	4th of July Wash	Precipitation/Stage	3/14/2002	Maricopa County FCD
5050	Gila Bend Mountains	Weather Station	6/1/1988	Maricopa County FCD
7202	Kofa	Precipitation	12/6/2001	ADWR
7204	Dateland	Precipitation	12/5/2001	ADWR
7210	Wellton Weather Station	Weather Station	4/29/2004	ADWR
7220	Cabeza Prieta aka Ajo	Weather Station	7/31/2004	ADWR

Source: ADWR 2005a

Notes:
ADWR = Arizona Department of Water Resources
FCD = Flood Control District
NA = Information is not available at this time

Table 7.4-4 Reservoirs and Stockponds in the Lower Gila 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	Imperial	Bureau of Reclamation	160,000[2]	S,I	Federal

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
2	Martinez	Bureau of Reclamation	640	R,F	Federal
3	Painted Rock Borrow Pit	Bureau of Reclamation	350	F	Federal
4	Unnamed[4]	USAF	100	NA	Federal
5	Unnamed[4]	USAF	69	NA	Federal

Source: Compilation of databases from ADWR & others

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

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

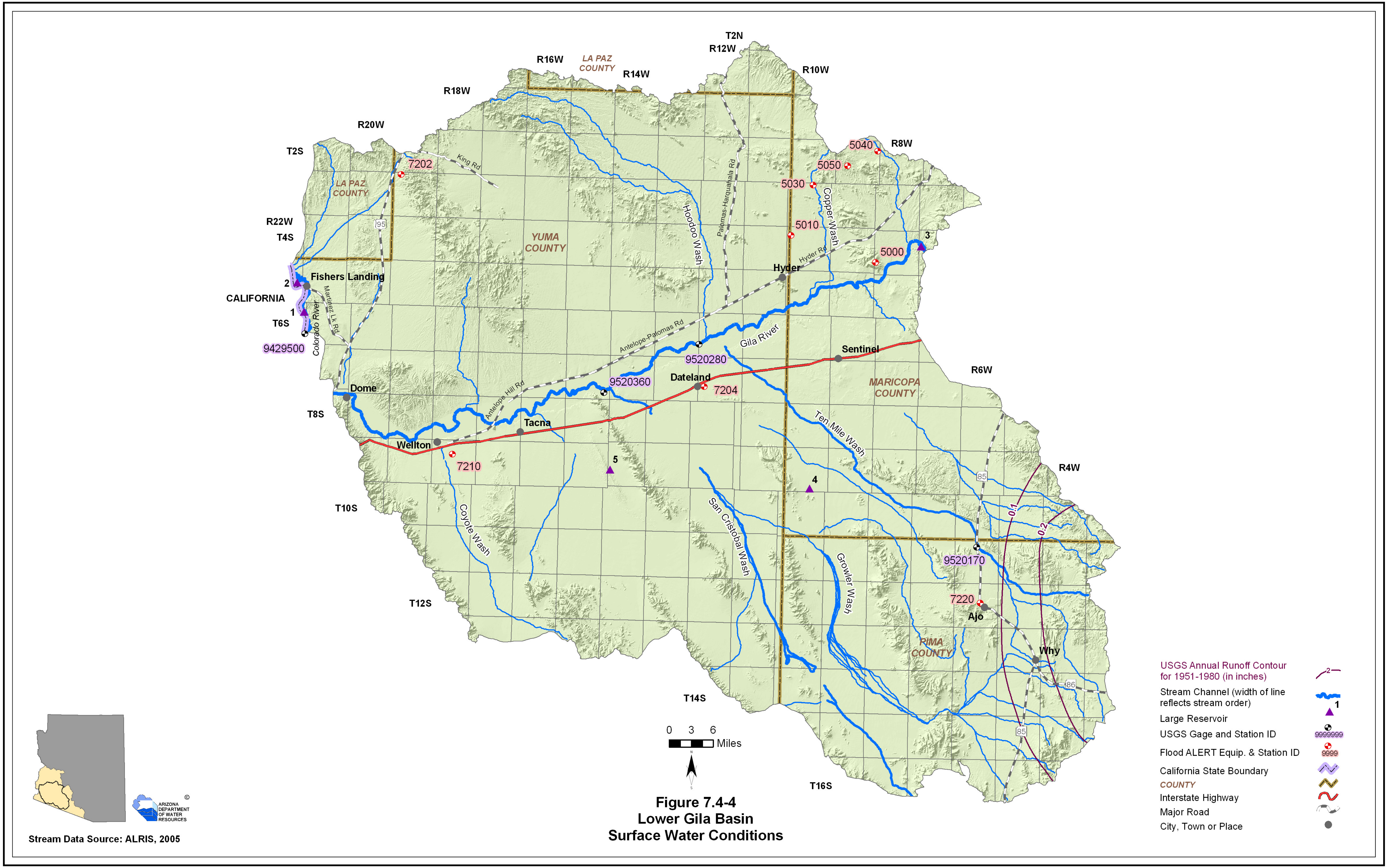
D. Other Small Reservoirs (between 5 and 50 acres surface area)[3]

Total number: 6
Total surface area: 70 acres

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

Total number: 65

Notes:
[1] I = Irrigation, S = Water Supply, R = Recreation, F = fish & wildlife pond
[2] Much of the storage is in CA.
[3] Capacity data is not available to ADWR
[4] Dry lake
USAF = United States Air Force



Stream Data Source: ALRIS, 2005

Figure 7.4-4
Lower Gila Basin
Surface Water Conditions

7.4.5 Perennial/Intermittent Streams and Major Springs in the Lower Gila Basin

The total number of springs in the basin are shown in Table 7.4-5. The locations of perennial streams are shown on Figure 7.4-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one intermittent stream, the Gila River and one perennial stream, the Colorado River.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS varies from six to eight, depending on the database reference.

Table 7.4-5 Springs in the Lower Gila Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 6 to 8

Figure 7.4-5
Lower Gila Basin
Perennial\Intermittent Streams
and Major (>10 gpm) Springs

7.4.6 Groundwater Conditions of the Lower Gila Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.4-6. Figure 7.4-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.4-7 contains hydrographs for selected wells shown on Figure 7.4-6. Figure 7.4-8 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.4-6 and Figure 7.4-6
- The major aquifers are recent stream alluvium and basin fill.
- The basin contains three sub-basins: Childs Valley, Dendora Valley and Wellton Mohawk.
- Predevelopment flow direction was from the north and southeast edges of the basin to the Gila River and downstream to the southwest. Extensive agricultural development has created a series of cones of depression including the Hyder Valley cone that pulls water from the Hyder area to the north and a cone east of Dateland.

Well Yields

- Refer to Table 7.4-6 and Figure 7.4-8
- As shown on Figure 7.4-8, well yields are generally greater than 1,000 gallons per minute (gpm).
- One source of well yield information, based on 597 reported wells, indicates that the median well yield is 1,600 gpm.

Natural Recharge

- Refer to Table 7.4-6
- Estimates of natural recharge range from greater than 9,000 acre-feet per year (AFA) to 88,000 AFA.
- The largest source of natural recharge is runoff in washes and the Gila River floodplain. In the western portion of the basin, “artificial” recharge from infiltration of irrigation water requires pumping of excess groundwater into drainage canals for removal from the basin. (ADWR 1994b)

Water in Storage

- Refer to Table 7.4-6
- Estimates of water in storage range from 100 million acre-feet (maf) to a depth of 1,200 feet to 246 maf to an unknown depth.

Water Level

- Refer to Figure 7.4-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 33 index wells in this basin. Hydrographs for 10 index wells and one other well (B) are shown on Figure 7.4-7.
- The deepest water level shown on the map is 809 feet in the vicinity of Why and the shallowest is five feet northeast of Wellton.

Table 7.4-6 Groundwater Data for the Lower Gila Basin

Basin Area, in square miles:	7,309	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Basin Fill	
Well Yields, in gal/min:	Range 184-5,095 Median 1,823.5 (56 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 10-6,000 Median 1,600 (597 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 100-2,500	ADWR (1990 and 1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	88,000	Freethey and Anderson (1986)
	>9,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	143,900,000 (to 1,200 ft)	ADWR (1990)
	100,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	246,000,000	Arizona Water Commission (1975)
Current Number of Index Wells:	33	
Date of Last Water-level Sweep:	1992 (589 wells measured)	

[1]Predevelopment Estimate

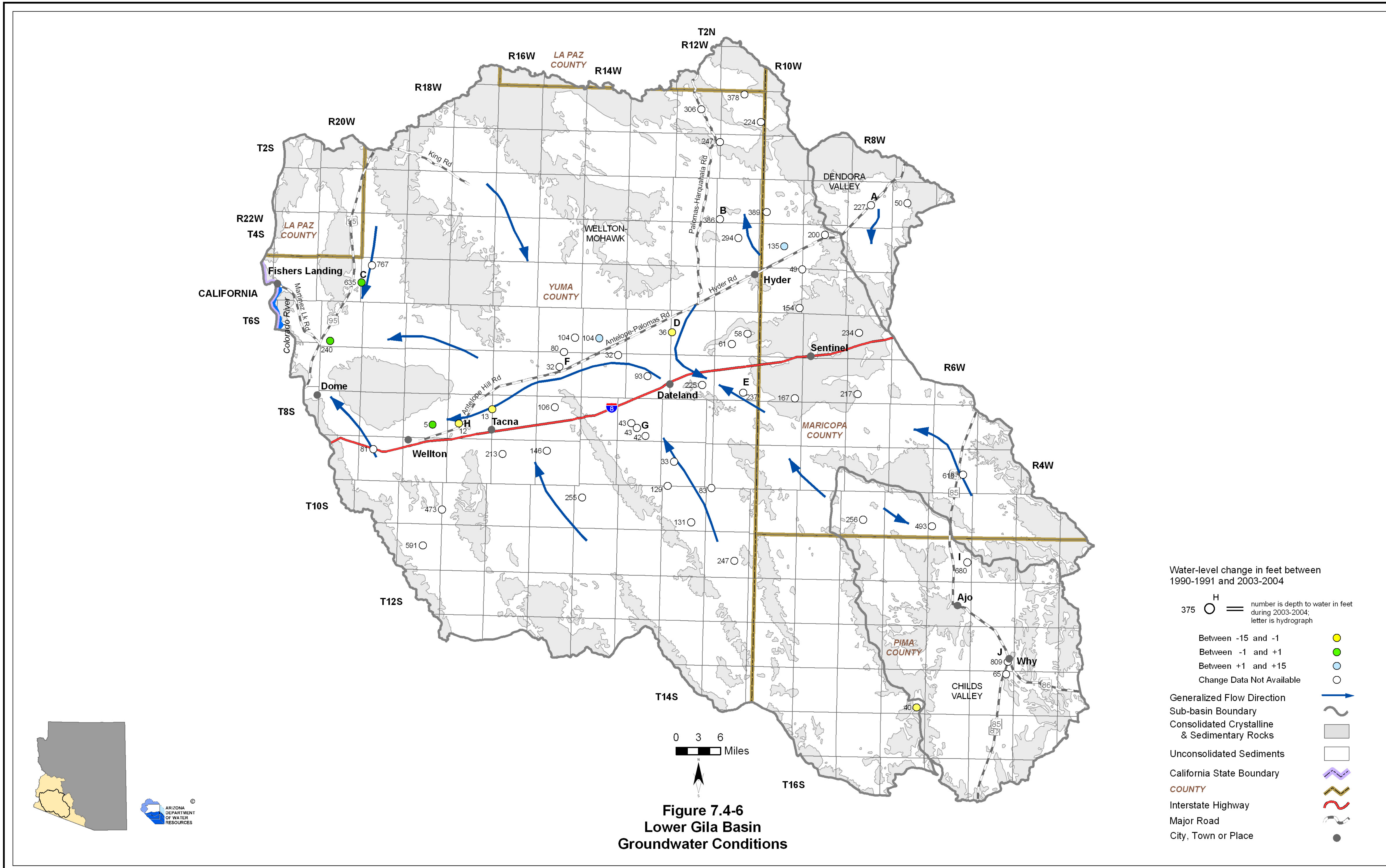


Figure 7.4-6
Lower Gila Basin
Groundwater Conditions

Figure 7.4-7
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells

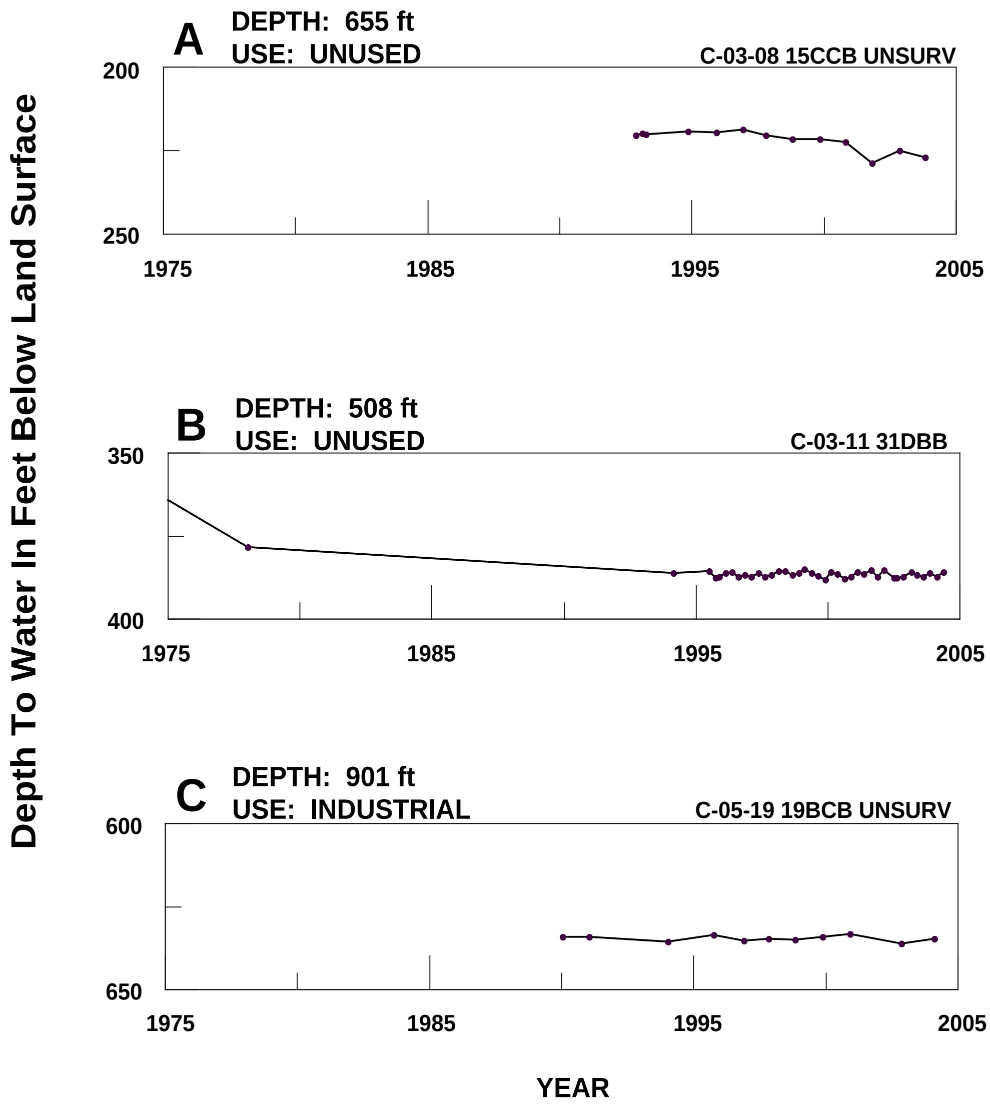


Figure 7.4-7 (cont'd)
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells

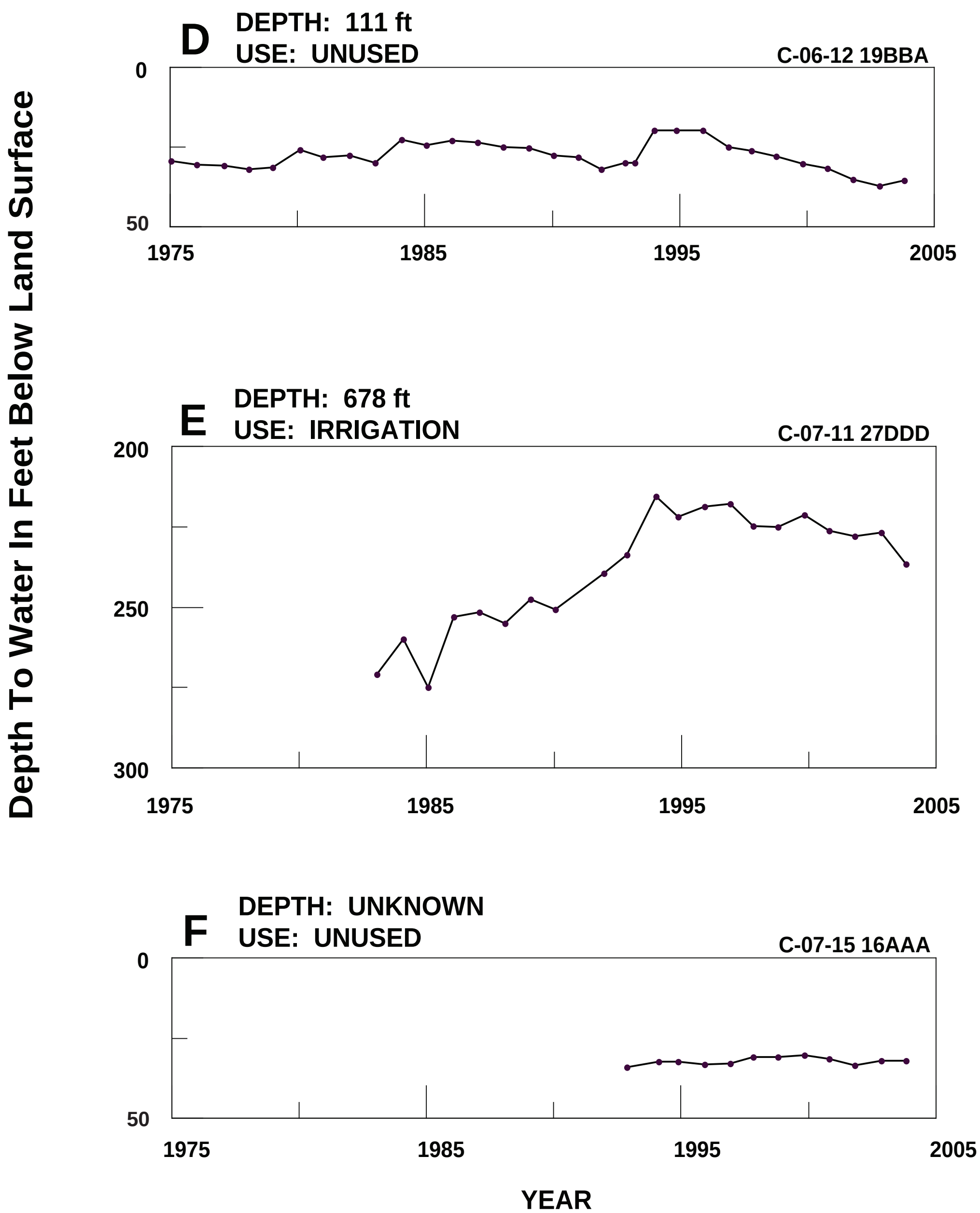
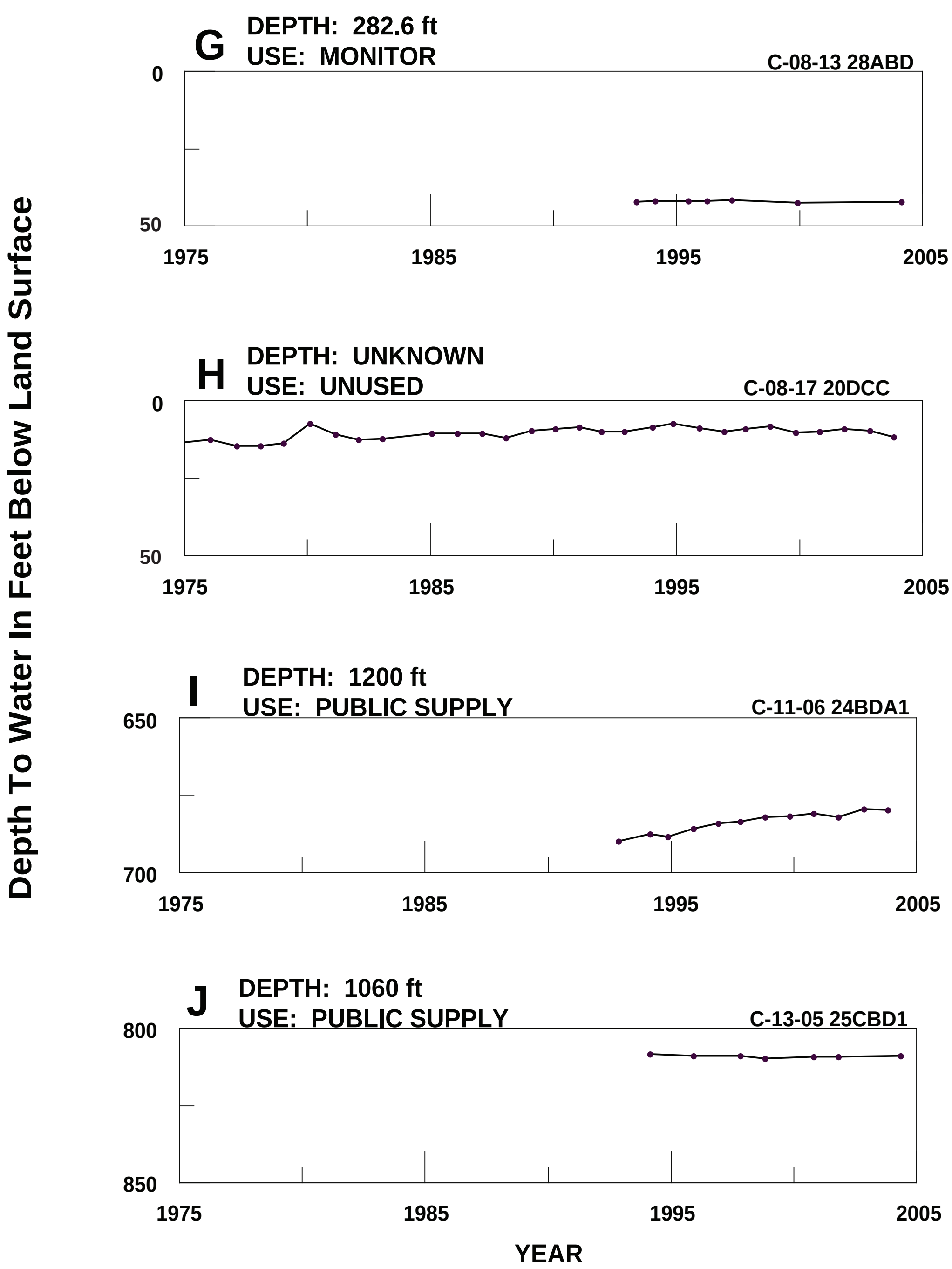


Figure 7.4-7 (cont'd)
Lower Gila Basin
Hydrographs Showing Depth to Water in Selected Wells



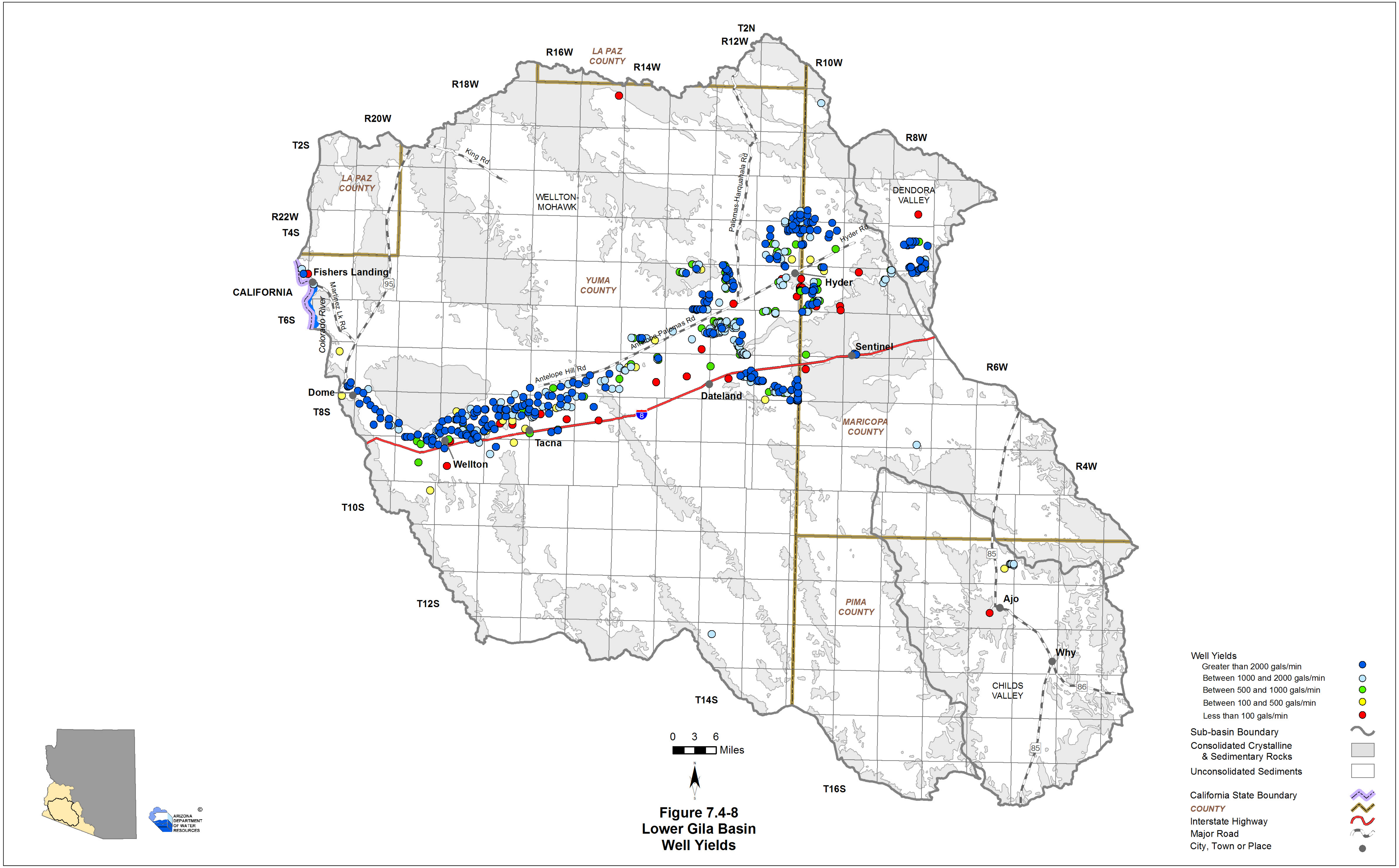


Figure 7.4-8
Lower Gila Basin
Well Yields

7.4.7 Water Quality of the Lower Gila Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.4-7A. Impaired lakes and streams with site type, name, length of impaired reach, area of impaired lake, designated use standard and parameter(s) exceeded is shown in Table 7.4-7B. Figure 7.4-9 shows the location of water quality occurrences keyed to Table 7.4-7. All community water systems are regulated under the Safe Drinking Water Act and treat water supplies to meet drinking water standards. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.4-7A.
- Two hundred and forty-six wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The most common parameter equaled or exceeded was fluoride.
- Other parameters equaled or exceeded include arsenic, cadmium, lead, nitrate, selenium and total dissolved solids.

Lakes and Streams with impaired waters

- Refer to Table 7.4-7B.
- The water quality standard for boron and selenium was equaled or exceeded in one 28 mile reach of the Gila River, a portion of this reach is also in the Yuma Basin. The standard for organics and dissolved oxygen was equaled or exceeded at Painted Rock Borrow Pit Lake.
- Neither the reach of the Gila River nor the lake are part of the ADEQ water quality improvement effort, the Total Maximum Daily Load (TMDL) Program, at this time.

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
1	M	Well	1 South	15 West	18	1	F
2	M	Well	2 South	17 West	1	1	NO3
3	M	Well	4 South	8 West	16	1	NO3
4	M	Well	4 South	8 West	33	1	As, F
		Well	4 South	8 West	33	1	F
5	M	Well	4 South	8 West	34	2	F
6	M	Well	4 South	8 West	35	5	F
7	M	Well	4 South	9 West	9	1	As, F
8	M	Well	4 South	10 West	2	1	As, F
9	M	Well	4 South	10 West	5	2	F
10	M	Well	4 South	10 West	6	1	F
11	M	Well	4 South	10 West	7	1	F
12	M	Well	4 South	10 West	8	2	F
13	M	Well	4 South	10 West	17	1	F
14	M	Well	4 South	10 West	18	1	F
15	M	Well	4 South	10 West	19	1	F
16	M	Well	4 South	10 West	21	1	As, F
17	M	Well	4 South	11 West	1	3	F
18	M	Well	4 South	11 West	2	2	As, F
19	M	Well	4 South	11 West	8	1	As
20	M	Well	4 South	11 West	12	1	F
21	M	Well	4 South	11 West	21	1	NO3
		Well	4 South	11 West	21	1	As, F, NO3
		Well	4 South	11 West	21	1	F
22	M	Well	4 South	11 West	29	1	As, F
23	M	Well	4 South	11 West	33	1	F
24	M	Well	4 South	11 West	35	1	F
25	M	Well	4 South	19 West	21	1	NO3
26	M	Well	5 South	8 West	3	1	As
		Well	5 South	8 West	3	1	F
27	M	Well	5 South	8 West	6	2	F
28	M	Well	5 South	9 West	12	2	F
		Well	5 South	9 West	12	1	As, F
29	M	Well	5 South	9 West	13	1	F
30	M	Well	5 South	10 West	3	2	F
31	M	Well	5 South	10 West	16	1	F
		Well	5 South	10 West	16	1	As, NO3, TDS
32	M	Well	5 South	10 West	20	1	F
33	M	Well	5 South	10 West	28	1	As, F
34	M	Well	5 South	10 West	32	1	F
35	M	Well	5 South	10 West	36	1	F
36	M	Well	5 South	11 West	2	1	F
37	M	Well	5 South	11 West	15	1	F
		Well	5 South	11 West	15	1	As, NO3
38	M	Well	5 South	12 West	4	4	F
39	M	Well	5 South	12 West	5	1	F
40	M	Well	5 South	12 West	9	2	F
41	M	Well	5 South	12 West	16	1	F
		Well	5 South	12 West	16	1	As, NO3
42	M	Well	5 South	12 West	22	1	As
43	M	Well	5 South	13 West	36	3	F
44	M	Well	5 South	19 West	5	1	F
45	M	Well	5 South	21 West	19	1	As, F
46	M	Well	6 South	8 West	17	1	F
47	M	Well	6 South	9 West	5	1	F
48	M	Well	6 South	9 West	32	1	As, F

75

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
49	M	Well	6 South	10 West	35	1	Pb
		Well	6 South	10 West	35	1	F
50	M	Well	6 South	12 West	8	1	F
51	M	Well	6 South	12 West	10	1	F, TDS
52	M	Well	6 South	12 West	17	1	F
53	M	Well	6 South	12 West	18	2	F
54	M	Well	6 South	12 West	19	1	NO3, TDS
55	M	Well	6 South	12 West	27	1	F
56	M	Well	6 South	12 West	30	1	F
57	M	Well	6 South	12 West	35	5	F
58	M	Well	6 South	13 West	3	1	As
59	M	Well	6 South	14 West	22	1	As
60	M	Well	6 South	15 West	15	1	F
61	M	Well	6 South	18 West	32	1	F
62	M	Well	6 South	20 West	21	2	F
63	M	Well	6 South	20 West	32	1	F
64	M	Well	6 South	21 West	10	1	F
65	M	Well	6 South	21 West	23	1	F
66	M	Well	6 South	21 West	34	1	F
67	M	Well	7 South	10 West	7	1	F
68	M	Well	7 South	10 West	22	2	F
69	M	Well	7 South	10 West	36	1	F
70	M	Well	7 South	11 West	19	1	F
71	M	Well	7 South	11 West	24	1	F
72	M	Well	7 South	11 West	25	4	F
73	M	Well	7 South	11 West	26	2	F
74	M	Well	7 South	11 West	28	2	F
75	M	Well	7 South	11 West	32	1	F
76	M	Well	7 South	11 West	36	4	F
		Well	7 South	11 West	36	1	As, F
77	M	Well	7 South	12 West	7	1	As, F
78	M	Well	7 South	12 West	8	1	As, F
79	M	Well	7 South	12 West	13	2	F
		Well	7 South	12 West	13	1	As, F
80	M	Well	7 South	12 West	14	1	F
81	M	Well	7 South	12 West	17	1	F
82	M	Well	7 South	12 West	21	1	F
83	M	Well	7 South	12 West	23	1	F
84	M	Well	7 South	12 West	25	1	F
85	M	Well	7 South	13 West	13	1	F
86	M	Well	7 South	13 West	21	1	F
87	M	Well	7 South	13 West	24	1	TDS
		Well	7 South	13 West	24	2	As, F
		Well	7 South	13 West	24	3	F
88	M	Well	7 South	14 West	24	2	F
89	M	Well	7 South	15 West	13	1	TDS
90	M	Well	7 South	15 West	14	1	TDS
91	I	Well	7 South	15 West	20	2	TDS
92	M	Well	7 South	15 West	22	2	TDS
93	M	Well	7 South	15 West	26	1	As, F, TDS
94	I	Well	7 South	15 West	29	1	TDS
95	I	Well	7 South	15 West	30	3	TDS
96	I	Well	7 South	16 West	25	1	F, TDS
97	I	Well	7 South	16 West	26	1	TDS
98	I	Well	7 South	16 West	31	1	F
99	I	Well	7 South	16 West	33	1	TDS
100	I	Well	7 South	16 West	34	1	TDS
101	I	Well	7 South	17 West	35	1	As, NO3, TDS
102	M	Well	7 South	19 West	14	1	Pb

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
103	M	Well	7 South	21 West	10	1	F
		Well	7 South	21 West	10	1	As
104	M	Well	7 South	21 West	11	1	F
105	M	Well	8 South	13 West	6	1	Pb, TDS
106	M	Well	8 South	13 West	20	1	NO3, TDS
107	M	Well	8 South	13 West	28	1	NO3, TDS
108	M	Well	8 South	13 West	34	1	TDS
109	M	Well	8 South	14 West	16	2	F
110	I	Well	8 South	16 West	2	1	As
111	I	Well	8 South	16 West	4	1	TDS
112	I	Well	8 South	16 West	5	1	As, TDS
113	I	Well	8 South	16 West	7	1	NO3
114	I	Well	8 South	16 West	9	2	TDS
115	I	Well	8 South	16 West	11	1	F, NO3
		Well	8 South	16 West	11	1	TDS
116	I	Well	8 South	17 West	1	1	TDS
117	I	Well	8 South	17 West	3	1	TDS
		Well	8 South	17 West	3	1	As, NO3
		Well	8 South	17 West	3	1	As, F
118	I	Well	8 South	17 West	9	1	NO3, TDS
		Well	8 South	17 West	9	1	As, TDS
119	I	Well	8 South	17 West	10	2	TDS
120	I	Well	8 South	17 West	13	1	TDS
121	I	Well	8 South	17 West	14	1	As, F
122	I	Well	8 South	17 West	17	1	TDS
123	I	Well	8 South	17 West	18	3	TDS
124	I	Well	8 South	17 West	25	2	As
125	I	Well	8 South	18 West	14	2	F, TDS
126	I	Well	8 South	18 West	20	1	As, TDS
127	I	Well	8 South	18 West	21	1	F, TDS
		Well	8 South	18 West	21	1	TDS
128	I	Well	8 South	18 West	22	1	TDS
129	I	Well	8 South	18 West	25	1	As
130	I	Well	8 South	18 West	26	1	TDS
131	I	Well	8 South	18 West	27	1	TDS
132	I	Well	8 South	18 West	29	1	F
		Well	8 South	18 West	29	1	As, TDS
133	I	Well	8 South	18 West	31	1	TDS
134	I	Well	8 South	18 West	34	1	As
135	I	Well	8 South	18 West	36	1	NO3
136	I	Well	8 South	19 West	25	1	TDS
137	I	Well	8 South	19 West	31	1	TDS
138	I	Well	8 South	19 West	36	2	TDS
139	M	Well	8 South	20 West	9	1	As, TDS
		Well	8 South	20 West	9	1	NO3, TDS
		Well	8 South	20 West	9	1	TDS
140	M	Well	8 South	20 West	15	1	As, TDS
141	M	Well	8 South	20 West	25	1	As, TDS
142	M	Well	8 South	20.5 West	6	1	TDS
143	M	Well	8 South	21 West	1	1	TDS
		Well	8 South	21 West	1	1	As
144	M	Well	9 South	6 West	23	1	F
145	M	Well	9 South	7 West	29	1	As
146	M	Well	9 South	11.5 West	36	1	F
147	M	Well	9 South	12 West	16	1	NO3, TDS
148	M	Well	9 South	12 West	31	1	As, F
149	I	Well	9 South	17 West	4	1	TDS
150	I	Well	9 South	17 West	9	1	F

66

Table 7.4-7 Water Quality Exceedences in the Lower Gila Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Map Location[2]	Site Type	Site Location			Number of Sampling Sites	Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[3]
			Township	Range	Section		
151	I	Well	9 South	18 West	6	1	F
152	I	Well	9 South	18 West	10	1	F, NO3, TDS
153	I	Well	9 South	18 West	11	1	F
154	I	Well	9 South	18 West	19	2	F, TDS
155	I	Well	9 South	18 West	20	1	F
156	I	Well	9 South	19 West	1	1	As, TDS
		Well	9 South	19 West	1	1	F
157	I	Well	9 South	19 West	2	1	As
158	I	Well	9 South	19 West	3	1	TDS
		Well	9 South	19 West	3	1	As, F
159	I	Well	9 South	19 West	4	1	As, TDS
		Well	9 South	19 West	4	1	TDS
160	I	Well	9 South	19 West	6	1	F, TDS
161	I	Well	9 South	19 West	13	1	As, F
162	I	Well	9 South	19 West	24	1	TDS
163	M	Well	10 South	6 West	30	1	F
164	M	Well	10 South	8 West	22	1	F
165	M	Well	11 South	6 West	24	2	As, F
166	M	Well	12 South	8 West	1	1	NO3
167	M	Well	12 South	8 West	17	1	NO3, TDS
168	M	Well	13 South	3 West	32	1	As
169	M	Well	13 South	5 West	25	2	As, Cd
						25	

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard[4]	Parameter(s) Exceeding Use Standard[3]
a	Stream	Gila River (Coyote Wash to Fortuna Wash)	28	NA	A&W	Bo, Se
b	Lake	Painted Rock Borrow Pit Lake	NA	186	A&W, FC	DO, Organics

Source: ADEQ 2005d

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water

[2] M = main map, I = inset

[3] As = Arsenic
Bo = Boron
Cd = Cadmium
DO = Dissolved Oxygen
F = Fluoride
Pb = Lead
NO3 = Nitrate
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
TDS = Total Dissolved Solids
Se = Selenium

[4] A&W = Aquatic and Wildlife
FC = Fish Consumption

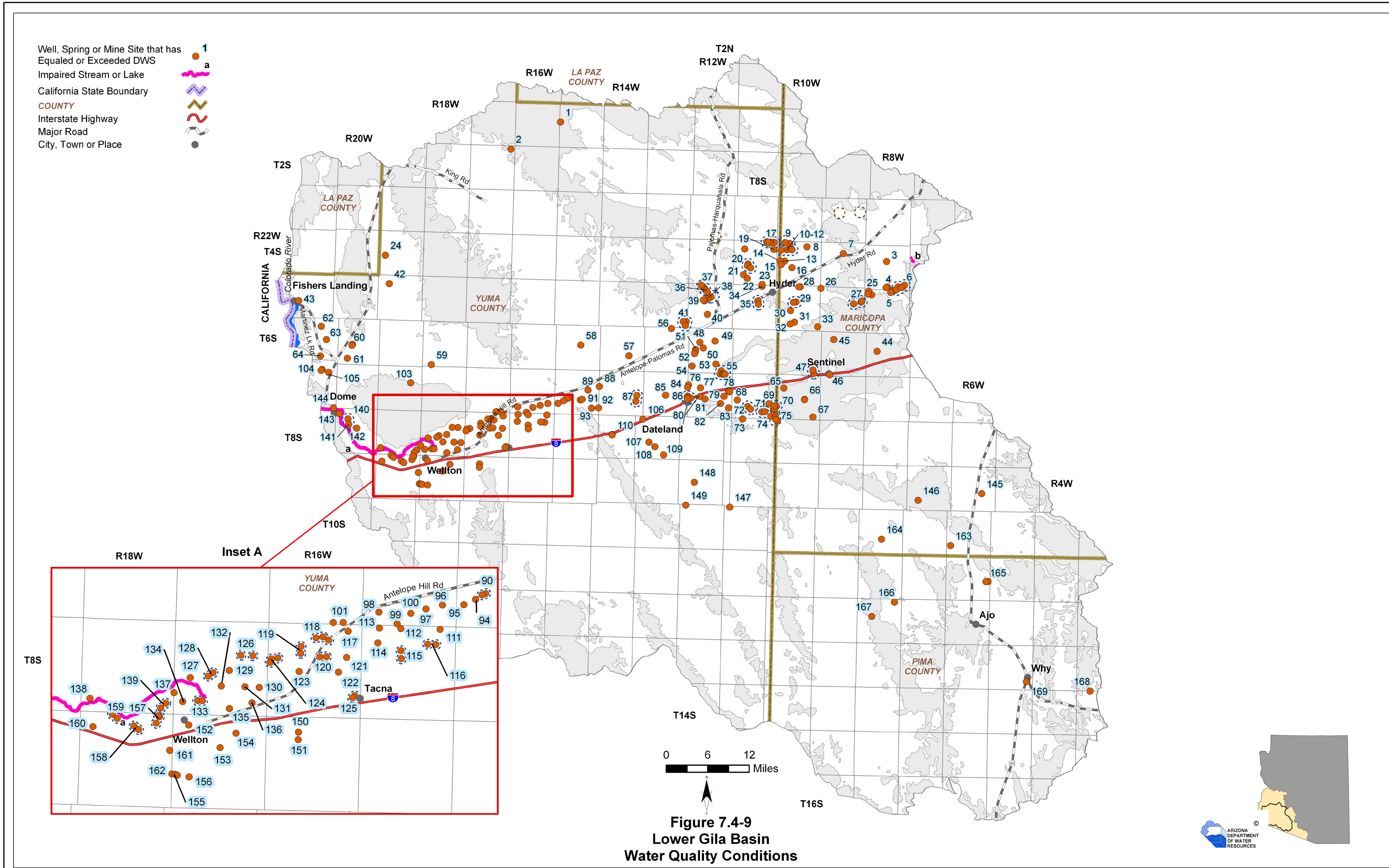


Figure 7.4-9
Lower Gila Basin
Water Quality Conditions

7.4.8 Cultural Water Demands in the Lower Gila 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 7.4-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.4-9. Figure 7.4-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.4-8 and Figure 7.4-10.
- Population in this basin increased from 9,873 in 1980 to 11,297 in 2000.
- Most cultural water use is for irrigation primarily near the Gila River.
- Agricultural groundwater demand decreased from 254,000 AFA in 1991-1995 to 246,000 AFA in 2001-2005. Total agricultural water demand increased from 619,000 AFA in 1991-1995 to 629,000 AFA in 2001-2005.
- Industrial groundwater demand is relatively small but increased from 3,400 AFA in 1991-1995 to 3,600 AFA in 2001-2005. Industrial uses in the basin include multiple dairies and a large feedlot.
- Municipal groundwater demand is relatively small and increased from 1,800 AFA in 1991-1995 to 2,000 AFA in 2001-2005. Municipal surface water use is also minimal but increased from 400 AFA in 1991-1995 to 500 AFA in 2001-2005.
- As of 2005 there were 718 registered wells with a pumping capacity of less than or equal to 35 gpm and 850 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 7.4-9.
- There are eight known wastewater treatment facilities in this basin.
- Information on disposal method was available for seven facilities. Six facilities discharge to evaporation ponds and one facility discharges to golf course irrigation.

Table 7.4-8 Cultural Water Demand in the Lower Gila Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="6">Average Annual Demand (in acre-feet)</th><th rowspan="3">Data Source</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">389[2]</td><td rowspan="10">580[2]</td><td colspan="3" rowspan="5">360,000</td><td colspan="3" rowspan="5">1,251,000[5]</td><td rowspan="20">ADWR (1994a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5">404,000</td><td colspan="3" rowspan="5">1,102,000[5]</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>9,873</td></tr>
<tr><td>1981</td><td>9,813</td><td rowspan="5">42</td><td rowspan="5">96</td><td colspan="3" rowspan="5">348,000</td><td colspan="3" rowspan="5">1,130,000[5]</td></tr>
<tr><td>1982</td><td>9,752</td></tr>
<tr><td>1983</td><td>9,692</td></tr>
<tr><td>1984</td><td>9,632</td></tr>
<tr><td>1985</td><td>9,571</td></tr>
<tr><td>1986</td><td>9,511</td><td rowspan="5">73</td><td rowspan="5">79</td><td colspan="3" rowspan="5">402,000</td><td colspan="3" rowspan="5">1,229,000[5]</td></tr>
<tr><td>1987</td><td>9,451</td></tr>
<tr><td>1988</td><td>9,390</td></tr>
<tr><td>1989</td><td>9,330</td></tr>
<tr><td>1990</td><td>9,270</td></tr>
<tr><td>1991</td><td>9,472</td><td rowspan="5">46</td><td rowspan="5">28</td><td rowspan="5">1,800</td><td rowspan="5">3,400</td><td rowspan="5">254,000</td><td rowspan="5">400</td><td rowspan="5">NR</td><td rowspan="5">365,000</td><td rowspan="15">USGS (2007) ADWR (2008b) ADWR (2008c)</td></tr>
<tr><td>1992</td><td>9,675</td></tr>
<tr><td>1993</td><td>9,878</td></tr>
<tr><td>1994</td><td>10,081</td></tr>
<tr><td>1995</td><td>10,283</td></tr>
<tr><td>1996</td><td>10,486</td><td rowspan="5">66</td><td rowspan="5">32</td><td rowspan="5">1,900</td><td rowspan="5">3,500</td><td rowspan="5">261,100</td><td rowspan="5">400</td><td rowspan="5">NR</td><td rowspan="5">391,000</td></tr>
<tr><td>1997</td><td>10,689</td></tr>
<tr><td>1998</td><td>10,892</td></tr>
<tr><td>1999</td><td>11,094</td></tr>
<tr><td>2000</td><td>11,297</td></tr>
<tr><td>2001</td><td>11,556</td><td rowspan="5">102</td><td rowspan="5">35</td><td rowspan="5">2,000</td><td rowspan="5">3,600</td><td rowspan="5">246,000</td><td rowspan="5">500</td><td rowspan="5">NR</td><td rowspan="5">383,200</td></tr>
<tr><td>2002</td><td>11,816</td></tr>
<tr><td>2003</td><td>12,075</td></tr>
<tr><td>2004</td><td>12,334</td></tr>
<tr><td>2005</td><td>12,594</td></tr>
<tr><td>2010</td><td>13,890</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>17,192</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>20,967</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">WELL TOTALS:</td><td>718</td><td>850</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

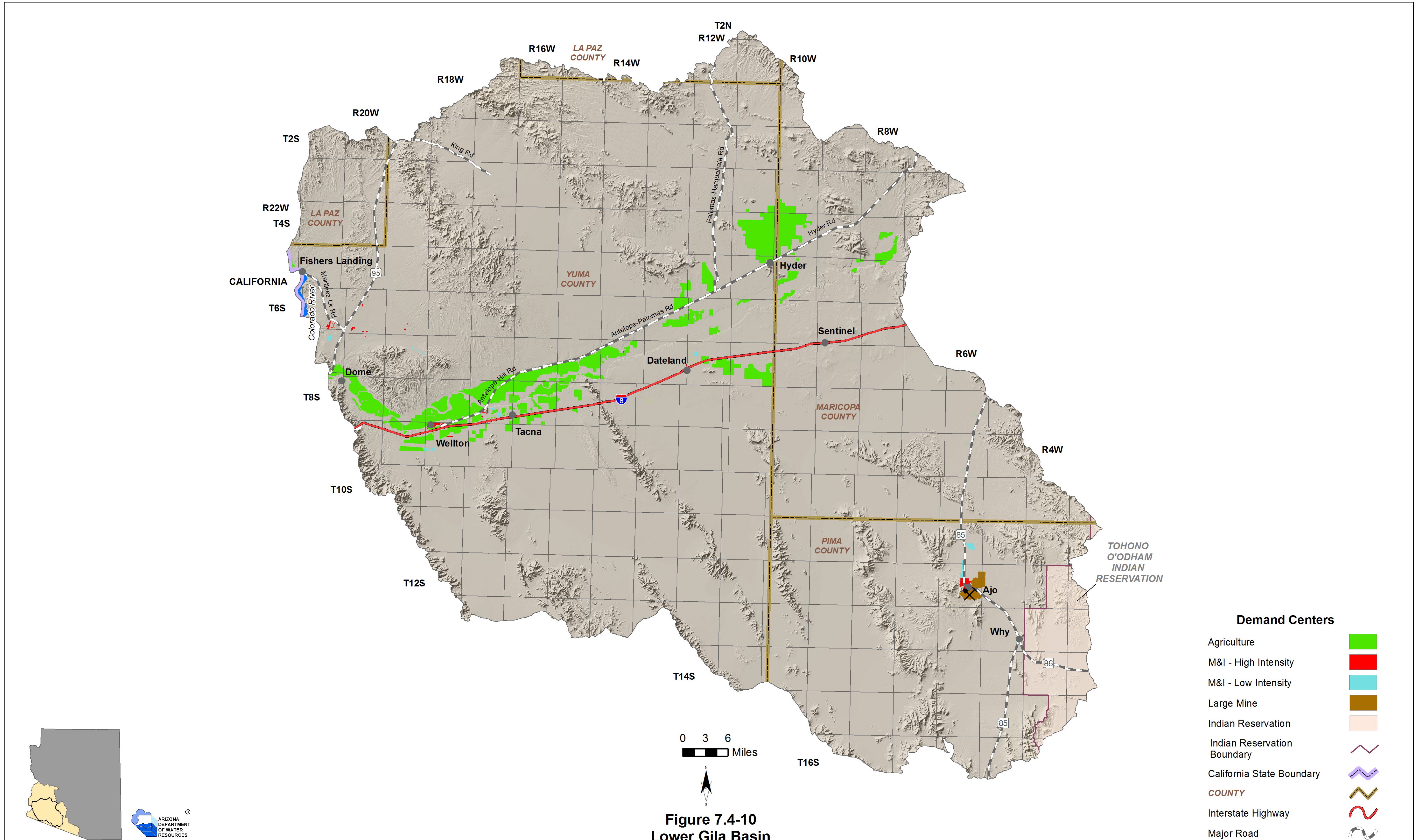
[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Includes pumpage and diversion of Colorado River Contract Water.
[4] Well pumpage for irrigation includes drainage wells.
[5] Includes surface-water diversions in Parker and Yuma basins.
NR - Not reported

Table 7.4-9 Effluent Generation in the Lower Gila 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	Evaportion Pond	Irrigation	Golf Course/Turf/ Landscape	Wildlife Area	Discharged to Another Facility	Infiltration Basins	Overland flow			
Ajo WWTF	Ajo ID	Ajo	1,089	144		X							Secondary	NA	2007
Fisher's Landing	Private	Fishers Landing	72	41		X							NA		2004
Links @ Coyote Wash WWTP	Private	Wellton	190	36				X					Secondary	NA	2007
Yuma Proving Ground-Laguna Airfield	US Army	Airfield	NA			X							NA		
Yuma Proving Ground-Kofa Firing Range	US Army	Army Base	NA	56		X							NA		
Yuma Proving Ground-Garrison Main WWTF	US Army	Army Base	NA			X							NA		
Yuma Proving Ground-Main Adminisitration Area WWTF	US Army	Army Base	1,000	NA		X							NA		
Yuma Proving Ground-Material Test Area WWTP	US Army	Army Base	NA												
Total			**2,351**	**277**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
ID: Improvement District



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 7.4-10
Lower Gila Basin
Cultural Water Demand

7.4.9 Water Adequacy Determinations in the Lower Gila Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.4-10. Figure 7.4-11 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- Thirty water adequacy determinations for 3,087 lots have been made in this basin through December 2008.
- Six determinations of inadequacy have been made; the most common reason for an inadequacy determination was 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
Pima County	583	583	100%
Yuma County	2,504	2,173	87%

Table 7.4-10 Adequacy Determinations in the Lower Gila Basin[1]

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.2	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination3	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	Antelope Acres and Antelope Heights	Yuma	8 South	17 East	28	72	53-700428	Adequate		10/25/2007	Antelope Water Company
2	Arletta Estates	Yuma	9 South	19 East	14	8	53-500296	Inadequate	C	2/5/1975	Dry Lot Subdivision
3	Butterfield Bluff	Yuma	9 South	18 East	4, 5	201	53-500373	Adequate		10/29/1987	Town of Wellton
4	Butterfield bluff #4	Yuma	9 South	18 East	4	21	53-400385	Adequate		7/25/2000	Town of Wellton
5	Caballo Farms	Yuma	6 South	15 East	31	60	53-500375	Inadequate	C	5/19/1975	Dry Lot Subdivision
6	Cameron Place Addition	Pima	12 South	6 East	15	97	53-500384	Adequate		12/20/1985	Ajo Improvement Company
7	Camino Viejo	Yuma	9 South	18 East	6	18	53-400480	Adequate		4/25/2001	Town of Wellton
8	Citrus Park	Yuma	8 South	16 East	31	656	53-500461	Adequate		6/1/1973	Mohawk Water Co
9	Copper Ridge, Unit A	Yuma	9 South	18 East	5	8	53-400197	Adequate		12/13/1999	Town of Wellton
10	Coyote Wash Condominiums	Yuma	9 South	18 East	8	80	53-401632	Adequate		3/23/2005	Town of Wellton
11	Coyote Wash Condominiums Phase 2	Yuma	9 South	18 East	8	56	53-500092	Adequate		9/5/2007	Town of Wellton
12	Crystal Sands	Yuma	7 South	13 East	12, 13	15	53-500542	Inadequate	C	7/1/1974	Dry Lot Subdivision
13	Erickson	Yuma	9 South	16 East	4	8	53-400426	Adequate		5/12/2001	Town of Wellton
14	Grande Vista	Yuma	8 South	17 East	21, 22, 27, 28	20	53-400243	Adequate		2/2/2000	Dry Lot Subdivision
15	Hankins Subdivision	Yuma	9 South	18 East	5	17	53-500771	Adequate		7/18/1986	Town of Wellton
16	Jojoba Farms #1	Yuma	7 South	12 East	16	20	53-500821	Adequate		6/23/1983	Dry Lot Subdivision
17	Morisse	Yuma	3 South	19 East	29	30	53-501014	Adequate		5/5/1978	NA
18	New Cornelia Addition	Pima	12 South	6 East	14, 15, 22, 23	486	53-501046	Adequate		2/14/1986	Ajo Improvement Company
19	New Tacna Townsite	Yuma	8 South	17 East	25	10	53-501047	Inadequate	C	1/15/1987	Tacna Water Company
20	Orange Grove Ranch Estates	Yuma	9 South	18 East	3	122	53-501085	Inadequate	C	1/15/1975	Dry Lot Subdivision
21	Rio Lindo Shores	Yuma	11 South	18 East	31	36	53-501305	Adequate		2/29/1980	Graham Water Service
22	Rio Salado Ranches #1&2	Yuma	6 South	11 East	24, 25	116	53-501310	Inadequate	D	3/14/1974	Dry Lot Subdivision
23	Sandpiper, The #1	Yuma	10 South	19 East	15	73	53-501368	Adequate		1/14/1982	Graham Water Service
24	Sports Valley Condominiums	Yuma	10 South	19 East	22	24	53-501444	Adequate		9/1/1982	Graham Water Service
25	Tacna Manor	Yuma	8 South	17 East	25	16	53-501533	Adequate		8/12/1981	Tacna Water Company
26	The Links at Coyote Wash	Yuma	9 South	18 East	7	171	53-401007	Adequate		8/13/2003	Town of Wellton
27	The Links at Coyote Wash Unit #2	Yuma	9 South	18 East	7	333	53-401286	Adequate		5/18/2004	Town of Wellton
28	The Links at Coyote Wash, Unit 3	Yuma	9 South	19 East	11, 12, 13, 14	250	53-401820	Adequate		11/2/2005	Town of Wellton
29	Valley View Estates	Yuma	9 South	19 East	1	45	53-700201	Adequate		2/1/2007	Town of Wellton
30	VanGelder Subdivision	Yuma	9 South	18 East	6	18	53-501606	Adequate		1/24/1986	Town of Wellton

Source: ADWR 2008a

Notes:

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

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

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

NA = Not available to ADWR at this time

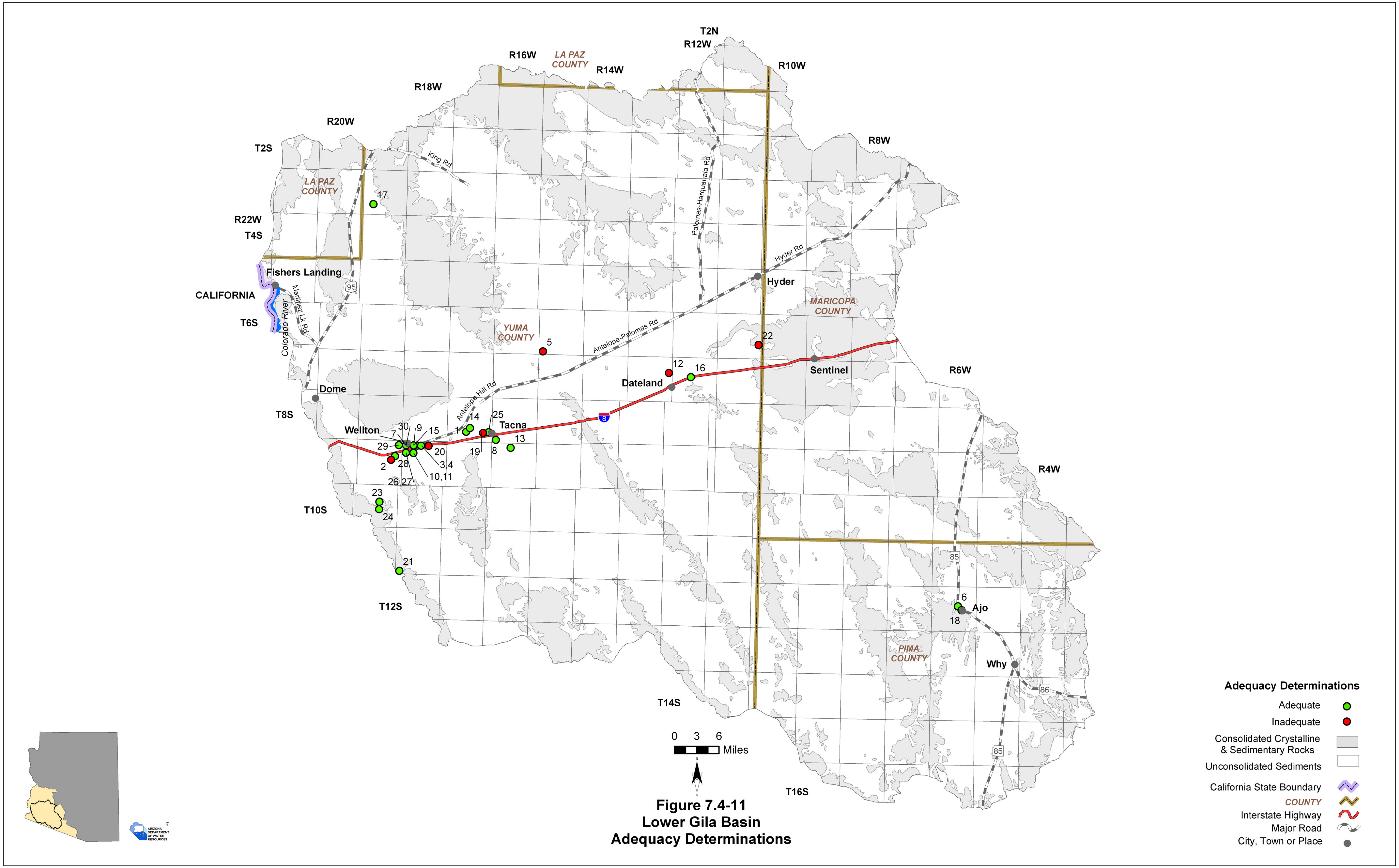


Figure 7.4-11
Lower Gila Basin
Adequacy Determinations

Lower Gila Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Corporation Commission (ACC), 2005, Annual reports, Private Sewer companies, 1990 to 2005: ACC Utilities Division. (Effluent Table)

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2005a, ADEQSWI: Data file, received September 2005.

_____, 2005b, ADEQWWTP: Data file, received August 2005.

_____, 2005c, Azurite: Data file, received September 2005.

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

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

_____, 2004a, Water quality exceedences by watershed: Data file, received June 2004. (Water Quality Map and Table)

_____, 2004b, Water quality exceedences for drinking water providers in Arizona: Data file, received September 2004. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2008c, Municipal surface water demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005d, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Game and Fish Department (AZGF), 2005, Arizona Waterways: Data file, received April 2005. (Reservoirs and Stockponds Table)

_____, 1997, Remote Sensing Mapping of Arizona Intermittent Stream Riparian Areas: GIS cover.

_____, 1993, Arizona Riparian Inventory and Mapping Project: GIS cover.

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005, Water features: GIS cover, accessed July 2005 at http://www.land.state.az.us/alris/index.html. (Reservoirs and Stockponds Table)

_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

E

Environmental Protection Agency (EPA), 2005, Surf Your Watershed: Facility reports, accessed April 2005 at http://oaspub.epa.gov/enviro/ef_home2.water. (Effluent Generation Table)

_____, 2005, 2000 and 1996, Clean Watershed Needs Survey: datasets, accessed March 2005 at http://www.epa.gov/owm/mtb/cwns/index.htm. (Effluent Generation Table)

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

G

Gebert, W.A., D.J. Graczyk and W.R. Krug, 1987, Average annual runoff in the United States, 1951-1980: GIS Cover, accessed March 2006 at http://aa179.cr.usgs.gov/metadata/wrdmeta/runoff.htm. (Surface Water Conditions Map)

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.

_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

Supplemental Reading

Andersen, Mark, 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Anning, D.W., 2002, Estimation and analysis of the uncertainty in stream flow and change in reservoir-content data at selected stream flow-gaging stations in the Lower Colorado River network, 1995-99: University of Arizona, M.S. thesis.

Biggs, T. H., Dempsey, K.A., and Pearthree, P.A., 2002, Surficial geology and geomorphology of the Tinajas Altas Area, Barry M. Goldwater Air Force Range, Yuma County, Southwestern Arizona: AZGS Open File Report 02-02, 21 p.

Bureau of Reclamation, 2000, Colorado River Interim Surplus Criteria: Final Environmental Impact Statement.

Clean Colorado River Alliance, 2006, Recommendations to Address Colorado River Water Quality.

Colorado River Basin Salinity Control Forum, 2005, Water Quality Standards for Salinity: Colorado River System.

Cordy, G., 2004, Pharmaceuticals and other organic wastewater compounds in Arizona's effluent, and its implications for water reuse: in The Value of Water: Proceedings from the 17th annual Arizona Hydrological Society symposium, September 2004, Tucson Arizona.

Davey-Cairo Engineering Inc., 2005, Hydrologic Study, Tacna Water Company, Water Service Area Expansion. Prepared for Arizona Department of Water Resources.

Harris, R.C. 1999, Bibliography and review of water quality studies in the upper Gila River watershed, Arizona: AZGS Open-File Report 99-25, 67 p.

Hart, R., 1999, Water quality of the Colorado River monitored by the USGS national stream accounting network: in Water Issues and Partnerships for Rural Arizona: Proceedings from the 12th annual Arizona Hydrological Society Symposium, September 1999, White Mountains Arizona.

Huckleberry, G., 1996, Historical geomorphology of the Gila River: AZGS Open –File Report 96-14, 31 p.

Kepner, W. G., 1987, Organochlorine contaminant investigation of the lower Gila River, Arizona: USWFS unnumbered report, 17 p.

King, K. A., and Baker, D. L., 1995, Contaminants in fish and wildlife of the middle Gila River, Arizona: USFWS unnumbered report, 17 p.

King, K. A., Andrews, B. J., Martinez, C. T., and Kepner, W. G., 1997, Environmental contaminants in fish and wildlife of the lower Gila River, Arizona: USFWS Project No. 22410-1130-2F30, 71 p.

Klawon, J.E., and Pearthree, P.A. 2001, Geomorphology of the western crater range, Barry Goldwater Air Force Range, Southeastern Arizona: AZGS Open File Report 01-03, 19 p.

R.B. Williams and Associates, Inc., 1974, Water Report for Orange Grove Ranch Estates, Yuma, Arizona. Prepared for Arizona Department of Water Resources.

_____, 1975, Water Report for Arletta Estates Subdivision, Wellton, Arizona. Prepared for Arizona Department of Water Resources.

Santec Consulting, 1999, Small and minor watercourses analysis for Yuma County, Arizona, Arizona State Land Department, Final Report.

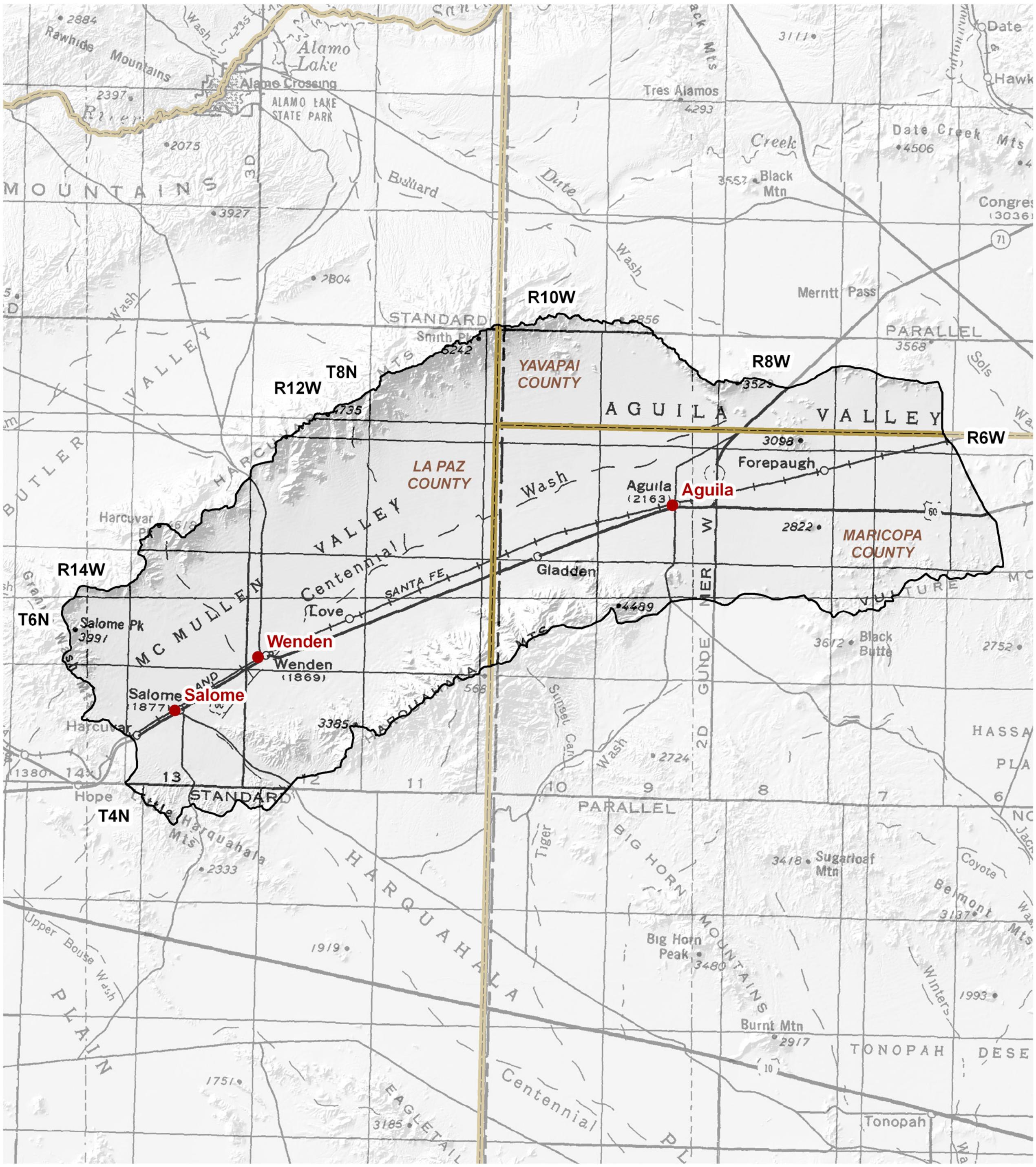
W.S. Gookin & Associates, 1974, Adequacy of Water Supply for Crystal Sands and San Cristobal Subdivisions, Yuma County, Arizona. Prepared for Arizona Department of Water Resources.

Section 7.5
McMullen Valley Basin

7.5.1 Geography of the McMullen Valley Basin

The McMullen Valley Basin, located in the northeastern part of the planning area, is 649 square miles in area. Geographic features and principal communities are shown on Figure 7.5-1. The basin is characterized by two valleys bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub with small amounts of interior chaparral and semi-desert grassland. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.5-1 are:
  - Centennial Wash running east to west through the center of the basin
  - McMullen Valley in the western portion of the basin and Aguila Valley in the eastern portion of the basin
  - Harquahala Mountains along the southern basin boundary and the Harcuvar Mountains on the northern basin boundary with the highest point in the basin at 5,242 feet.
  - The lowest point in the basin at approximately 1,680 feet where Centennial Wash exits the basin southwest of Salome.



Base Map: USGS 1:500,000, 1981

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.5-1
McMullen Valley Basin
Geographic Features

COUNTY
City, Town or Place

7.5.2 Land Ownership in the McMullen Valley Basin

Land ownership, including the percentage of ownership by category, for the McMullen Valley Basin is shown in Figure 7.5-2. The principal feature of land ownership in this basin is the limited number of land ownership types. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 51.8% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- This basin contains 9,000 acres of the 23,000 acre Harquahala Mountains Wilderness and 14,000 acres of the 25,000 acre Harcuvar Mountains Wilderness. (see Figure 7.0-12)
- Land uses include grazing, resource conservation and recreation.

State Trust Land

- 33.4% of the land is held in trust for the public schools under the State Trust Land system.
- Land uses include agriculture and grazing.

Private

- 14.8% of the land is private.
- Land uses include agriculture, domestic and commercial.

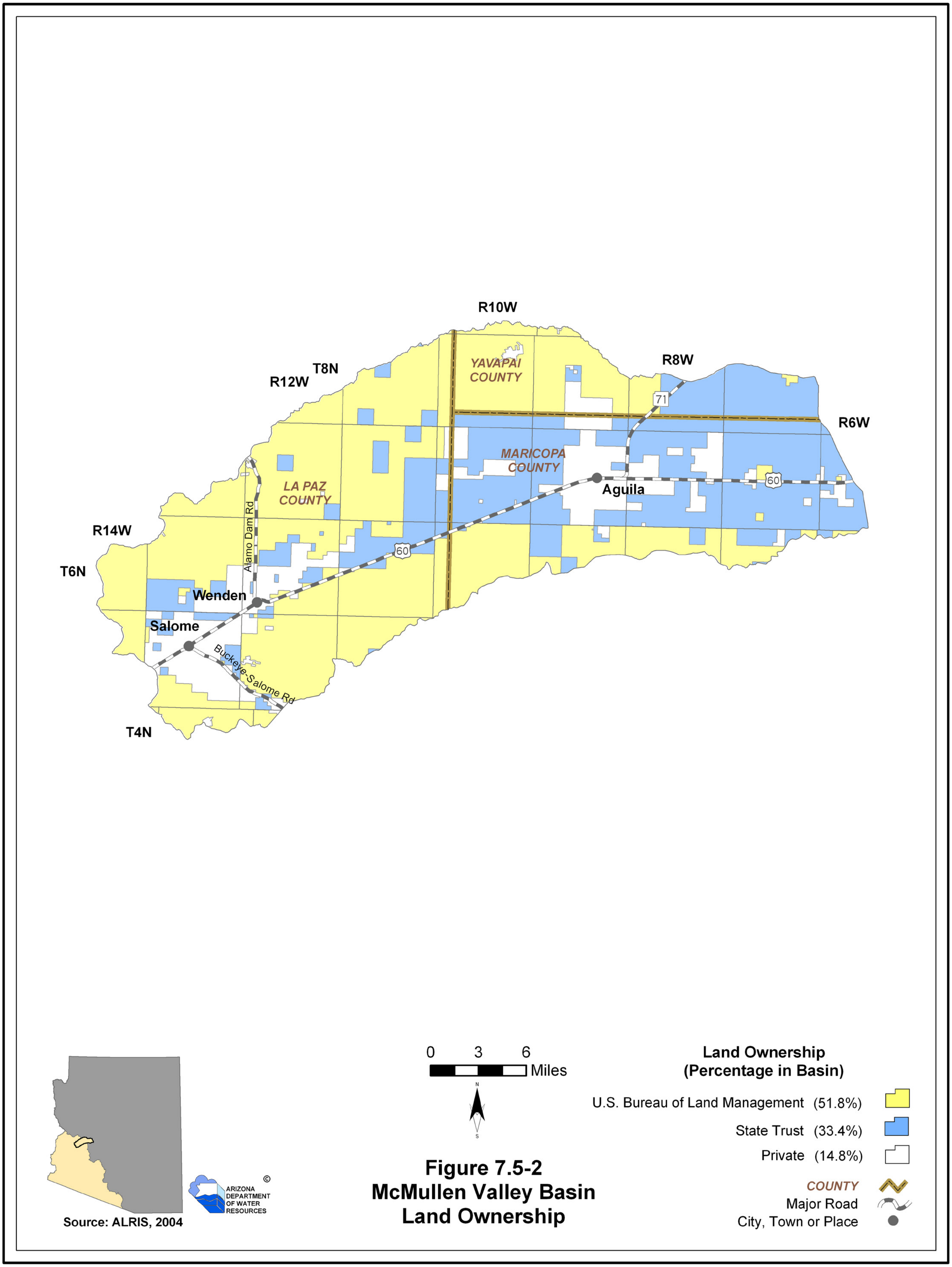


Figure 7.5-2
McMullen Valley Basin
Land Ownership

7.5.3 Climate of the McMullen Valley Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.5-1 and the locations are shown on Figure 7.5-3. Figure 7.5-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The McMullen Valley Basin does not contain Evaporation Pan or SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.5-1A
- Temperatures at the two NOAA/NWS Co-op Network stations in the basin range from an average high of 88.1°F in July at Salome 6 SE to an average low of 47.6°F at Aguila in December.
- Average seasonal rainfall follows a bi-modal pattern with approximately one-third of the average seasonal rainfall occurring in the winter (January-March) season and one-third in the summer (July-September) season. The highest average annual rainfall in the basin is 8.30 inches at the Aguila station.

AZMET

- Refer to Table 7.5-1C
- There is one AZMET station in the basin, Aguila. This station is at 2,149 feet and has an annual evaporation rate of 83.44 inches.

SCAS Precipitation Data

- See Figure 7.5-3
- Additional precipitation data shows average annual rainfall as high as 18 inches in the Harcuvar Mountains along the northern basin boundary and as low as eight inches in the middle of the basin.

Table 7.5-1 Climate Data for the McMullen 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 Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Aguila	2,170	1971-2000	85.3/Jul	47.6/Dec	3.20	0.42	2.81	1.87	8.30
Salome 6 SE	1,700	1908-1957	88.1/Jul	48.5/Jan	2.53	0.52	3.09	1.75	7.87

Source: WRCC, 2005

B. Evaporation Pan:

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

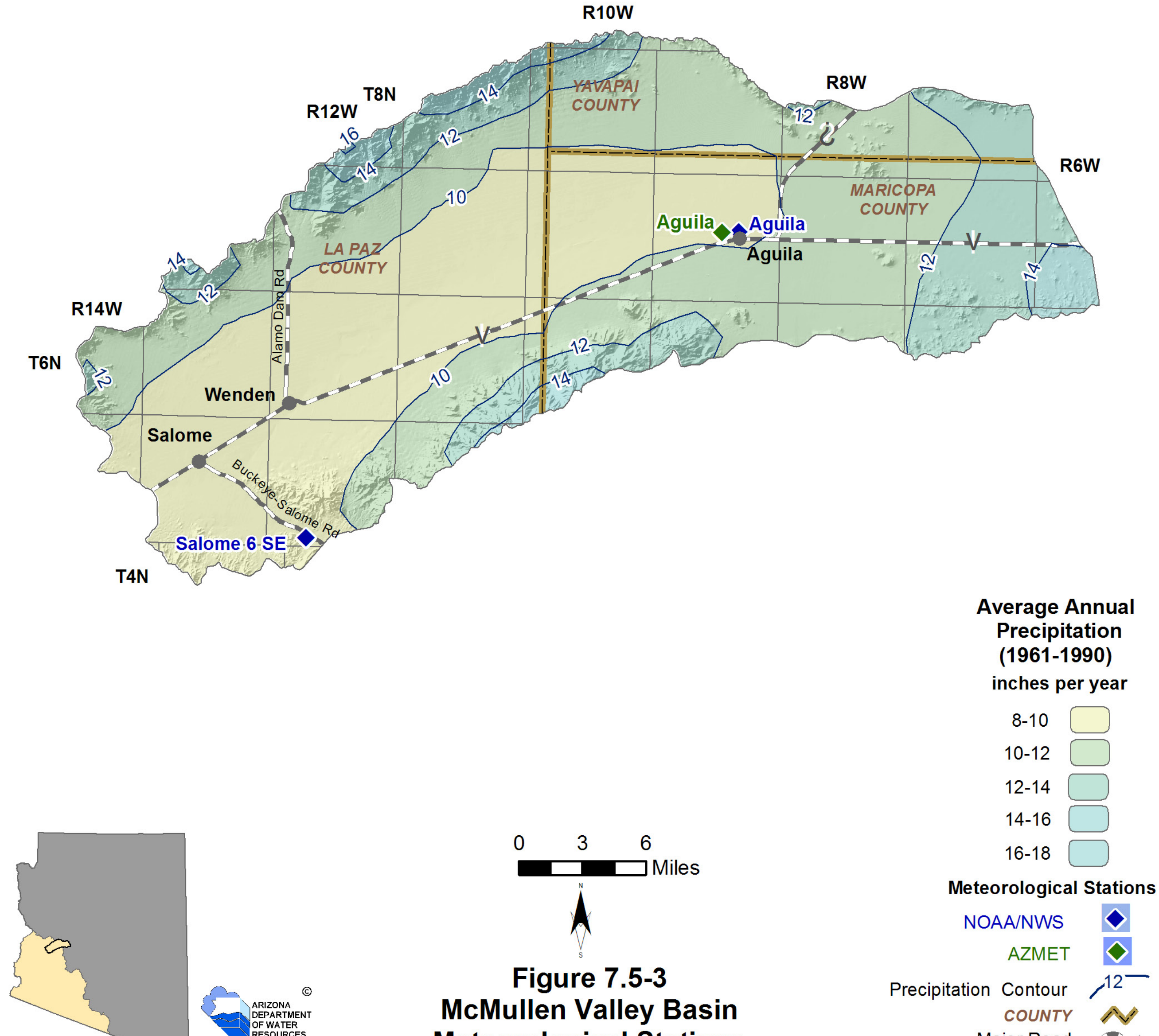
C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Aguila	2,149	1999 - current	83.44 *(6)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

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



Precipitation Data Source: Oregon State University, 1998

Figure 7.5-3
McMullen Valley Basin
Meteorological Stations and Annual Precipitation

7.5.4 Surface Water Conditions in the McMullen Valley Basin

Flood ALERT equipment in the basin is shown in Table 7.5-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.5-3. Flood ALERT equipment and USGS runoff contours are shown on Figure 7.5-4. There are no USGS streamflow gages in this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Flood ALERT Equipment

- Refer to Table 7.5-2.
- As of October 2005 there were eight stations in this basin.

Reservoirs and Stockponds

- Refer to Table 7.5-3.
- There are no large reservoirs in this basin.
- Surface water is stored or could be stored in two small reservoirs.
- There are 146 registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.5-4.
- Average annual runoff is highest, 0.2 inches per year or 10.66 acre-feet per square mile, in the easternmost portion of the basin and decreases to 0.1 inches, or 5.33 acre-feet per square mile, in the remainder of the basin.

Table 7.5-2 Flood ALERT Equipment in the McMullen Valley Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5090	Centennial @ Wenden	Precipitation/Stage	9/2/1998	Maricopa Country FCD
5155	Grass Wash @ US 60	Precipitation	9/19/2001	Maricopa County FCD
5165	Outlaw Hill	Precipitation	5/13/2002	Maricopa County FCD
5170	Gladden	Precipitation	8/27/2002	Maricopa County FCD
5175	Centennial near Aguila	Precipitation/Stage	6/5/2001	Maricopa County FCD
5180	Centennial Wash	Precipitation	11/19/1981	Maricopa County FCD
5190	Smith Peak	Precipitation	5/1/1980	Maricopa County FCD
7140	Ritter Dam	Precipitation	11/21/2002	Maricopa County FCD

Source: ADWR 2005a

Notes:
FCD = Flood Control District

Table 7.5-3 Reservoirs and Stockponds in the McMullen 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)

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

Source: Compilation of databases from ADWR & others

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

Total number: 1
Total maximum storage: 374 acre-feet

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

Total number: 1
Total surface area: 7 acres

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

Total number: 146

[1]Capacity data is not available to ADWR

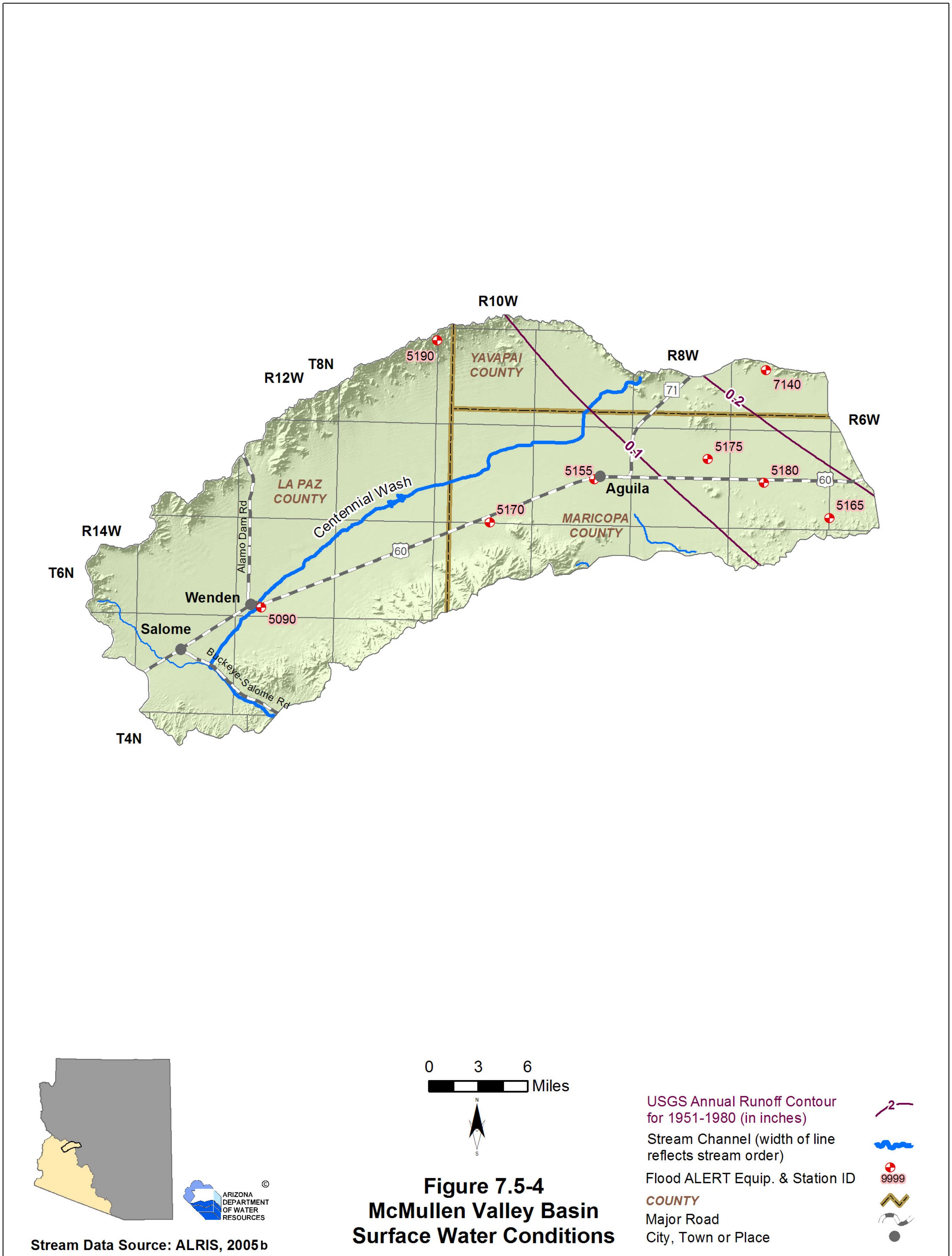


Figure 7.5-4
McMullen Valley Basin
Surface Water Conditions

7.5.5 Perennial/Intermittent Streams and Major Springs in the McMullen Valley Basin

The total number of springs in the basin are shown in Table 7.5-4. There are no perennial or intermittent streams and no major or minor springs in the McMullen Valley Basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- The total number of springs, regardless of discharge, identified by the USGS is two.

Table 7.5-4 Springs in the McMullen 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)	Date Discharge Measured
	Latitude	Longitude		
None identified by ADWR at this time				

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 2

7.5.6 Groundwater Conditions of the McMullen Valley Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.5-5. Figure 7.5-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.5-6 contains hydrographs for selected wells shown on Figure 7.5-5. Figure 7.5-7 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers
- Refer to Table 7.5-5 and Figure 7.5-5.
- The major aquifer in this basin is basin fill.
- Groundwater flows toward two cones of depression, one in the Wenden/Salome area and the other in the Aguila area.

Well Yields
- Refer to Table 7.5-5 and Figure 7.5-7.
- As shown on Figure 7.5-7, well yields in this basin are generally between 1,000 and 2,000 gallons per minute (gpm).
- One source of well yield information, based on 167 reported wells, indicates that the median well yield is 1,500 gpm.

Natural Recharge
- Refer to Table 7.5-5.
- The natural recharge estimate for this basin is 1,000 acre-feet per year (AFA).
- The only source of natural recharge is rainfall (ADWR 1994b).

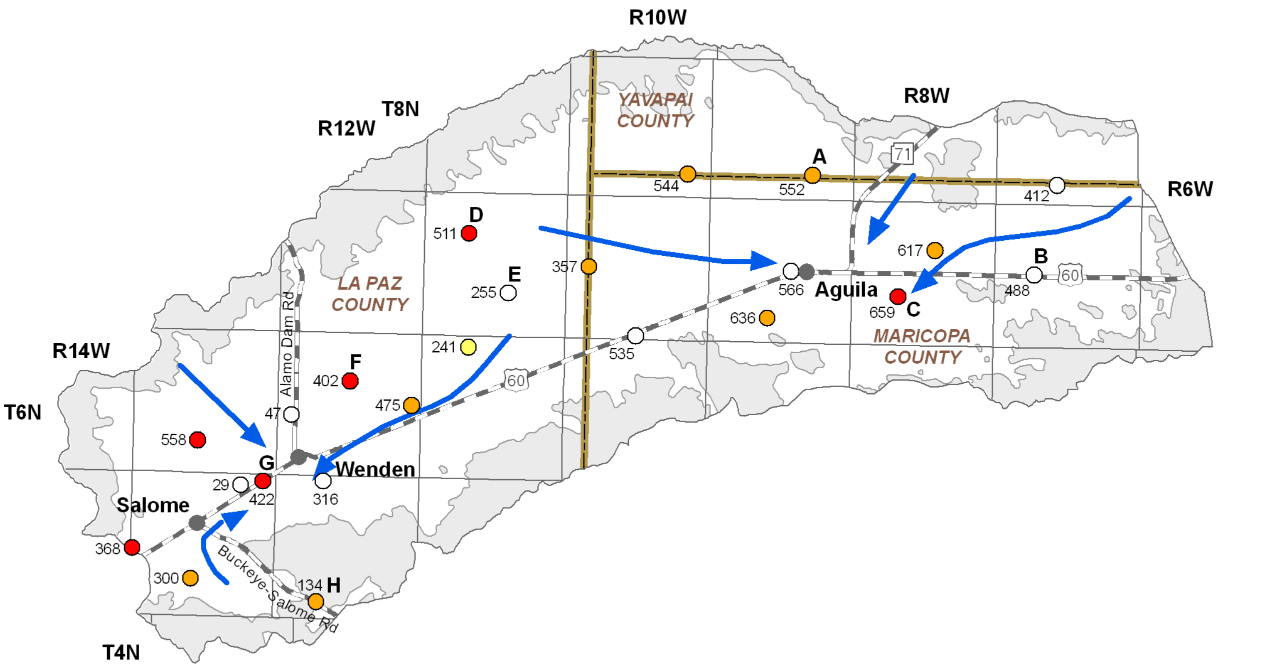
Water in Storage
- Refer to Table 7.5-5.
- Estimates of water in storage for this basin range from 14 million acre-feet (maf) to 15.1 maf to a depth of 1,200 feet.

Water Level
- Refer to Figure 7.5-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 25 index wells in this basin. Hydrographs for eight index wells are shown on Figure 7.5-6.
- The deepest water level shown on the map is 636 feet in the vicinity of Aguila and the shallowest is 29 feet west of Wenden.

Table 7.5-5 Groundwater Data for the McMullen Valley Basin

Basin Area, in square miles:	649	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 150-2,558 Median 1,132 (90 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 9-3,500 Median 1,500 (167 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 150-3,500	ADWR (1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	1,000	Freethey and Anderson (1986)
	1,000	Arizona Water Commission (1975)
Estimated Water Currently in Storage, in acre-feet:	15,100,000 (to 1,200 ft)	ADWR (1994b)
	14,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	14,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	25	
Date of Last Water-level Sweep:	2004 (118 wells measured)	

[1]Prevelopment Estimate



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.5-5
McMullen Valley Basin
Groundwater Conditions

Figure 7.5-6
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells

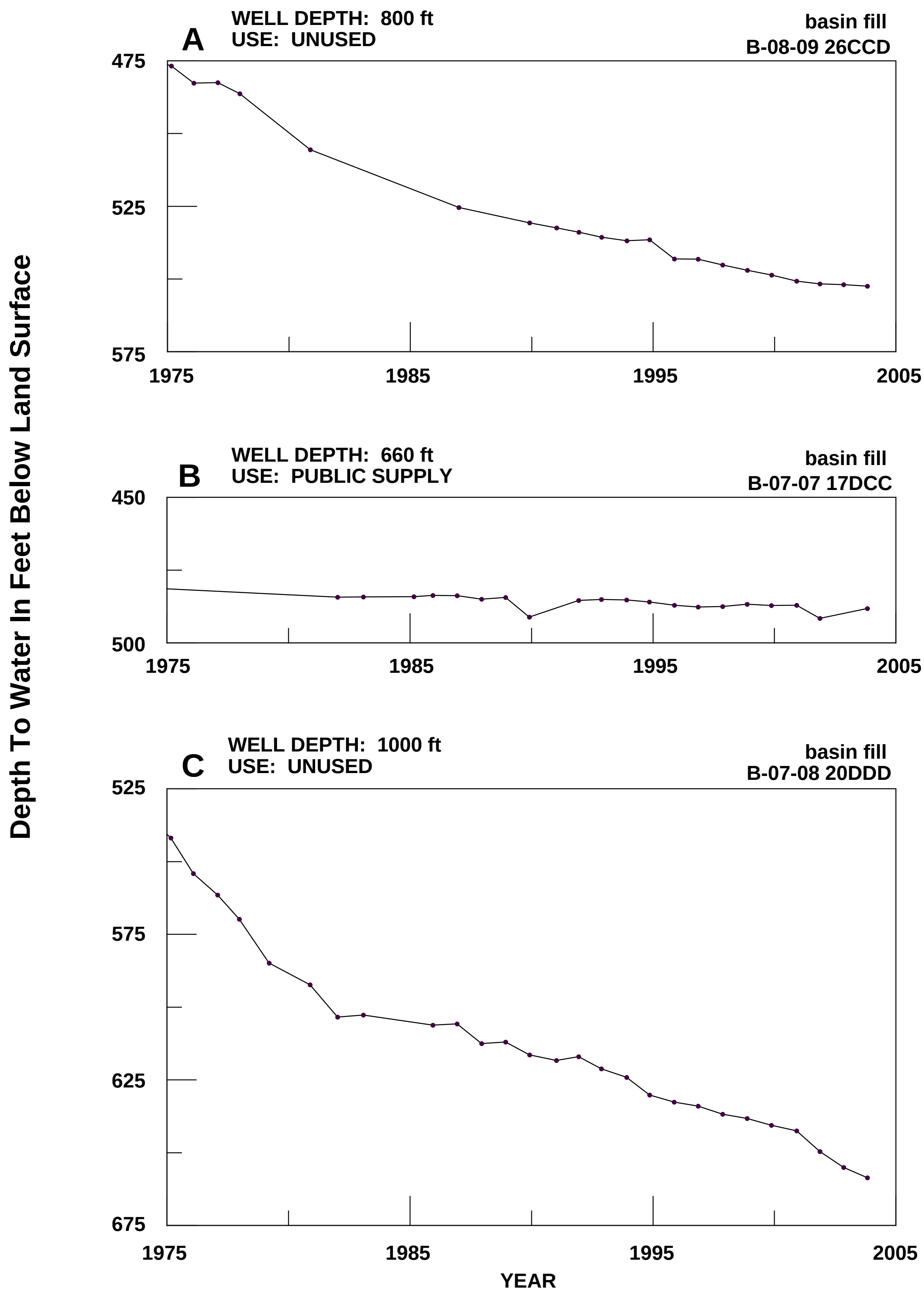


Figure 7.5-6 (cont'd)
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells

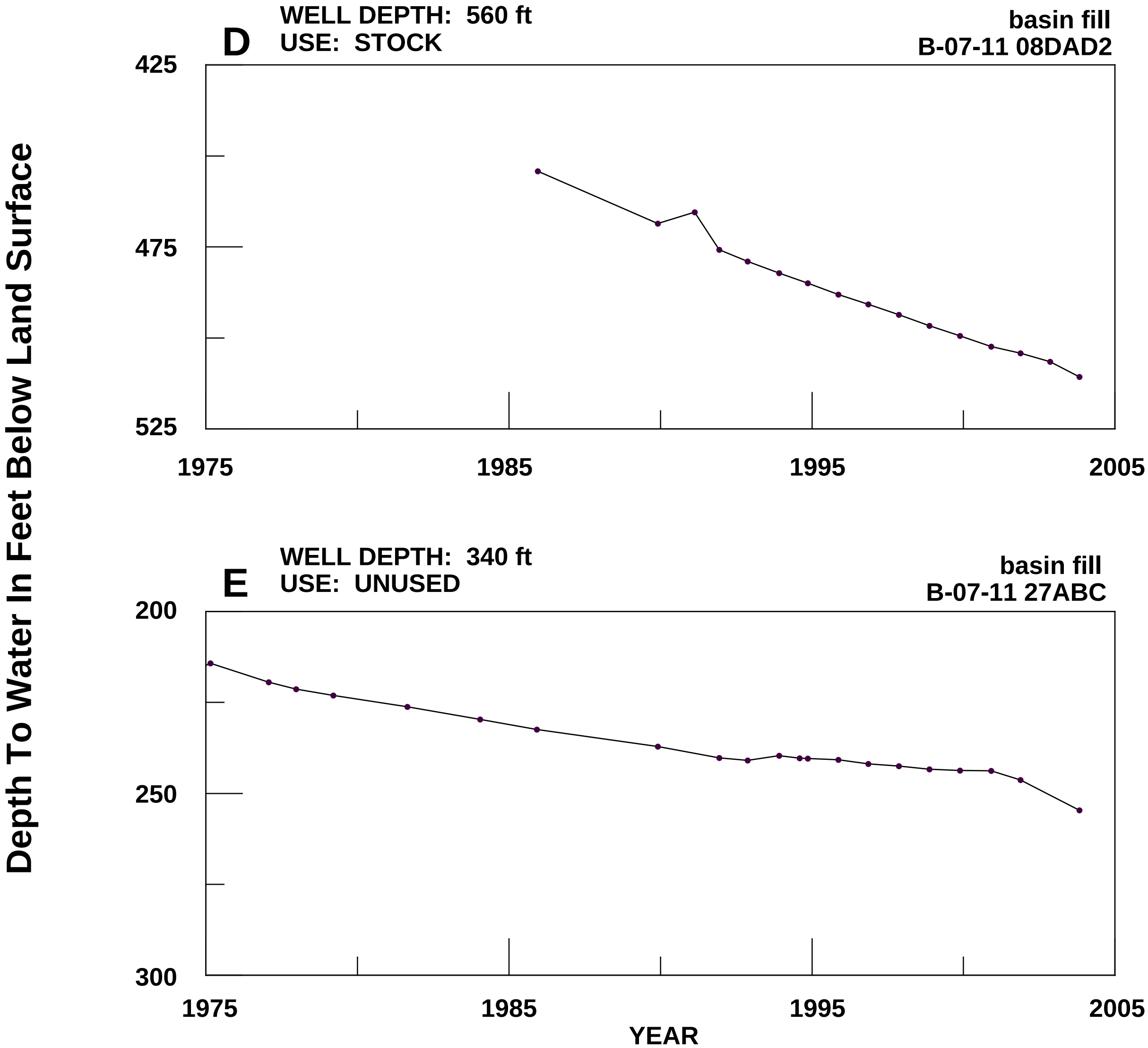


Figure 7.5-6 (cont'd)
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells

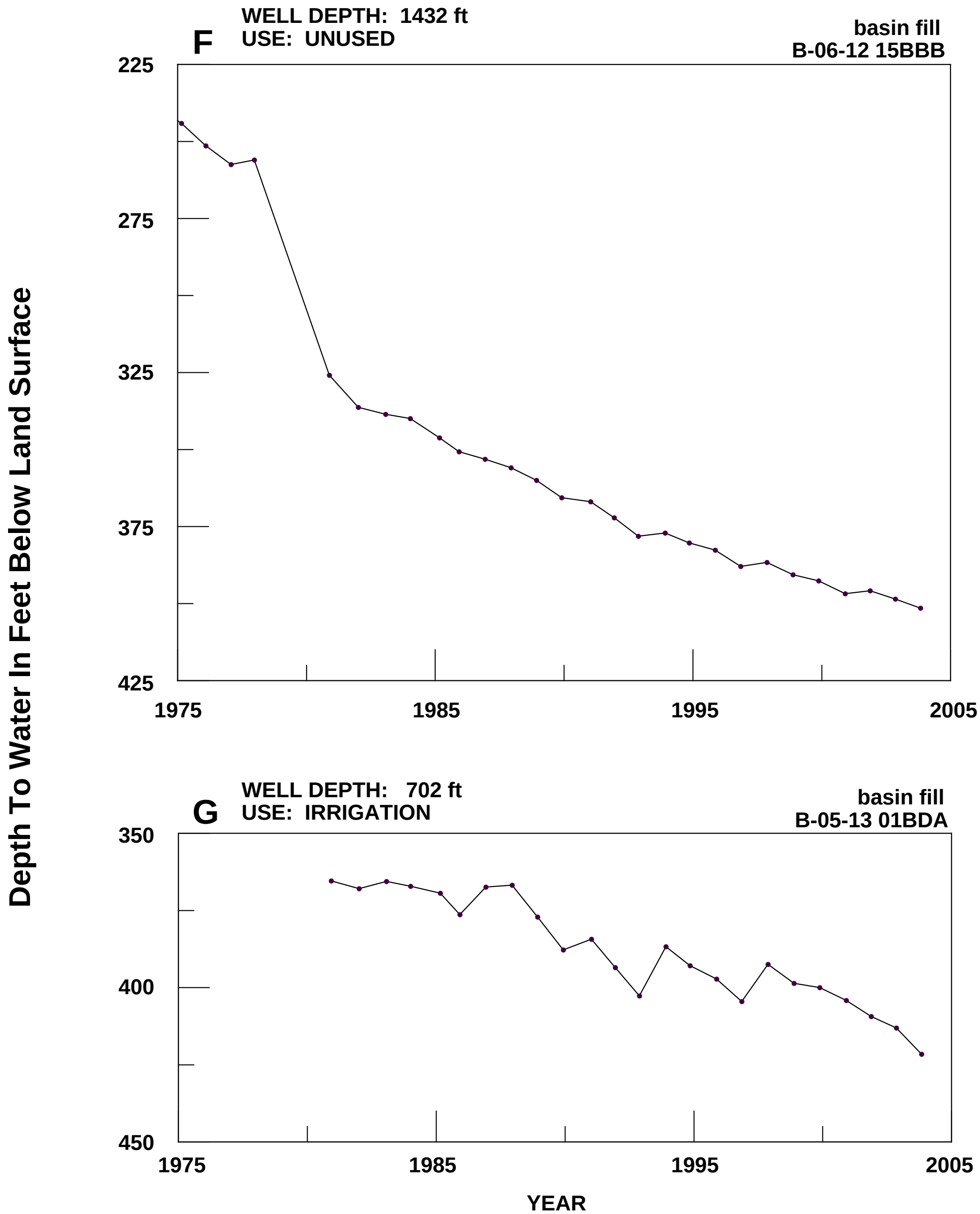
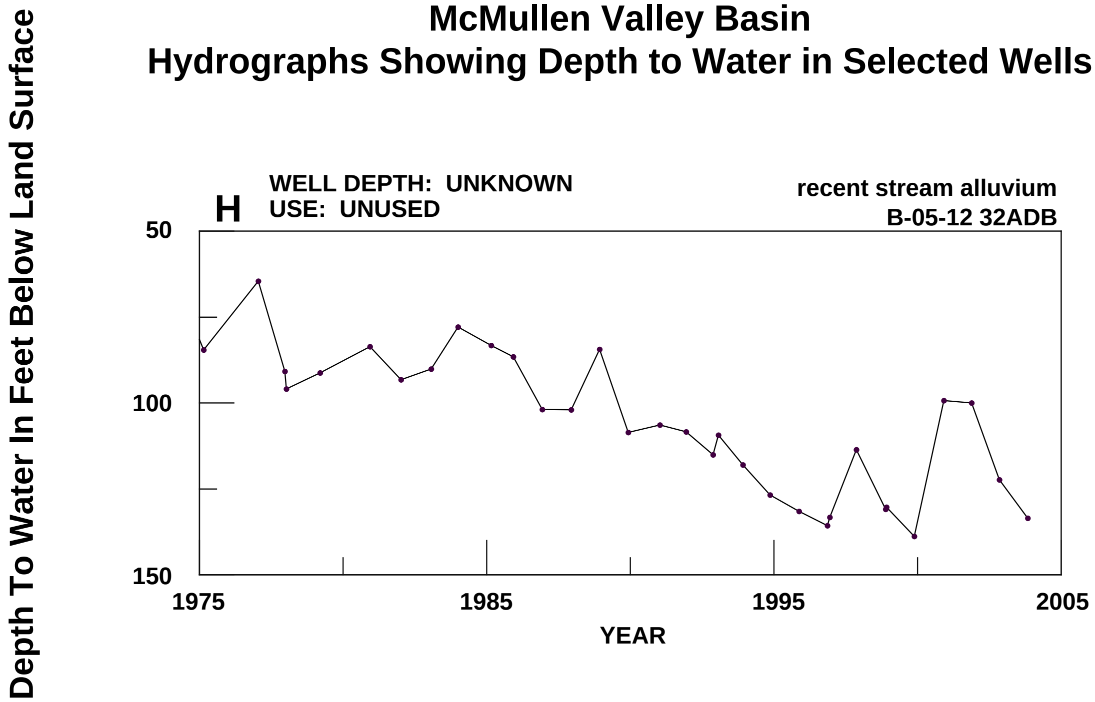


Figure 7.5-6 (cont'd)
McMullen Valley Basin
Hydrographs Showing Depth to Water in Selected Wells



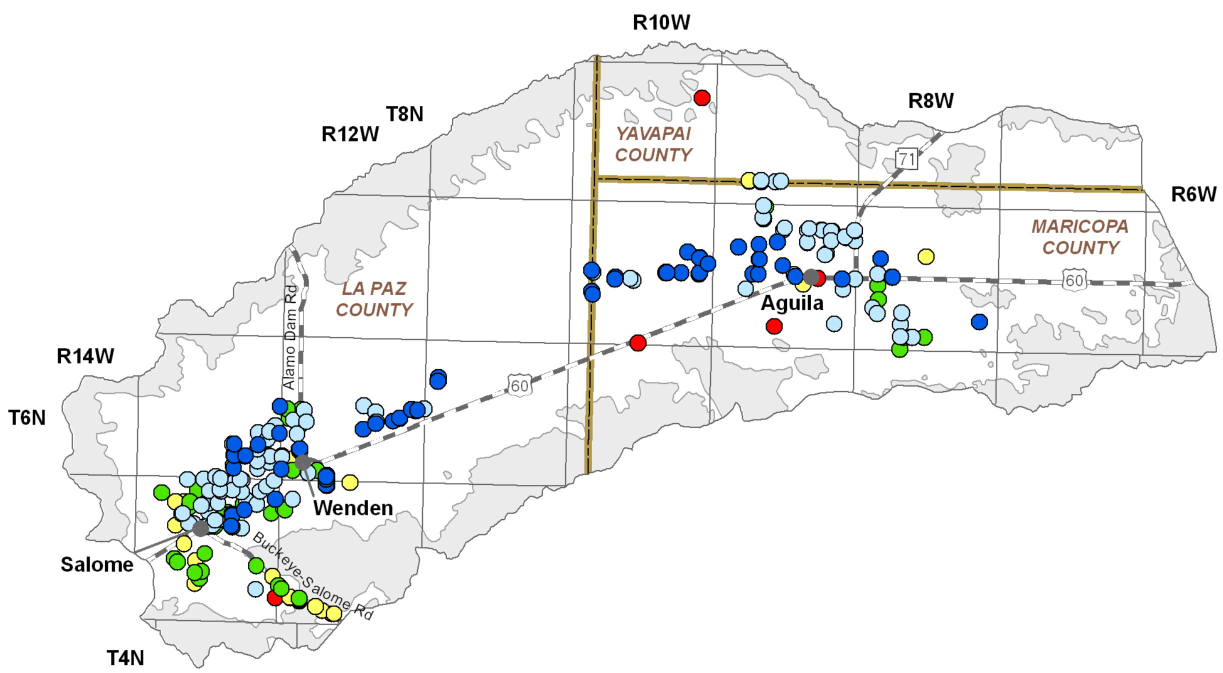


Figure 7.5-7
McMullen Valley Basin
Well Yields

7.5.7 Water Quality of the McMullen Valley Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.5-6A. There are no impaired lakes or streams in this basin. Figure 7.5-8 shows the location of water quality occurrences keyed to Table 7.5-6. A description of water quality data sources and methods is found in Volume 1, Appendix A. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

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

- Refer to Table 7.5-6A.
- Fifty-eight wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The most frequently equaled or exceeded parameter was fluoride. Other parameters equaled or exceeded include arsenic, chromium, lead and nitrates.

Table 7.5-6 Water Quality Exceedences in the McMullen Valley Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	8 North	9 West	32	As, F, Pb
2	Well	8 North	10 West	35	F
3	Well	7 North	7 West	17	F
4	Well	7 North	8 West	16	F
5	Well	7 North	8 West	17	F
6	Well	7 North	8 West	17	F
7	Well	7 North	8 West	17	F
8	Well	7 North	8 West	18	F
9	Well	7 North	8 West	30	As, F, Pb
10	Well	7 North	9 West	4	As, F, Pb
11	Well	7 North	9 West	11	NO3
12	Well	7 North	9 West	11	F
13	Well	7 North	9 West	12	F
14	Well	7 North	9 West	15	F
15	Well	7 North	9 West	25	F
16	Well	6 North	11 West	5	Cr
17	Well	6 North	11 West	7	F
18	Well	6 North	12 West	13	F
19	Well	6 North	12 West	13	F
20	Well	6 North	12 West	13	As, F
21	Well	6 North	12 West	19	F
22	Well	6 North	12 West	19	F
23	Well	6 North	12 West	20	F
24	Well	6 North	12 West	22	F
25	Well	6 North	12 West	22	F
26	Well	6 North	12 West	23	As, F
27	Well	6 North	12 West	23	As, F
28	Well	6 North	12 West	30	F
29	Well	6 North	12 West	30	F
30	Well	6 North	12 West	31	As, F
31	Well	6 North	12 West	31	F
32	Well	6 North	12 West	31	F
33	Well	6 North	12 West	31	As, F
34	Well	6 North	12 West	32	F
35	Well	6 North	12 West	32	F
36	Well	6 North	13 West	35	F
37	Well	6 North	13 West	36	F
38	Well	6 North	13 West	36	F
39	Well	6 North	13 West	36	F
40	Well	5 North	12 West	5	F
41	Well	5 North	12 West	35	F
42	Well	5 North	13 West	1	F
43	Well	5 North	13 West	1	F
44	Well	5 North	13 West	2	F
45	Well	5 North	13 West	2	F
46	Well	5 North	13 West	2	As, F, NO3
47	Well	5 North	13 West	10	NO3

Table 7.5-6 Water Quality Exceedences in the McMullen Valley Basin (Cont)[1]

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
48	Well	5 North	13 West	10	As, F, NO3
49	Well	5 North	13 West	10	NO3
50	Well	5 North	13 West	10	NO3
51	Well	5 North	13 West	11	NO3
52	Well	5 North	13 West	11	NO3
53	Well	5 North	13 West	11	F, NO3
54	Well	5 North	13 West	12	F
55	Well	5 North	13 West	12	NO3
56	Well	5 North	13 West	12	F, TDS
57	Well	5 North	13 West	14	As, NO3
58	Well	5 North	13 West	14	NO3

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1976 and 2001.
[2] As = Arsenic
Cr = Chromium
NO3 = Nitrate
F = Fluoride
Pb = Lead

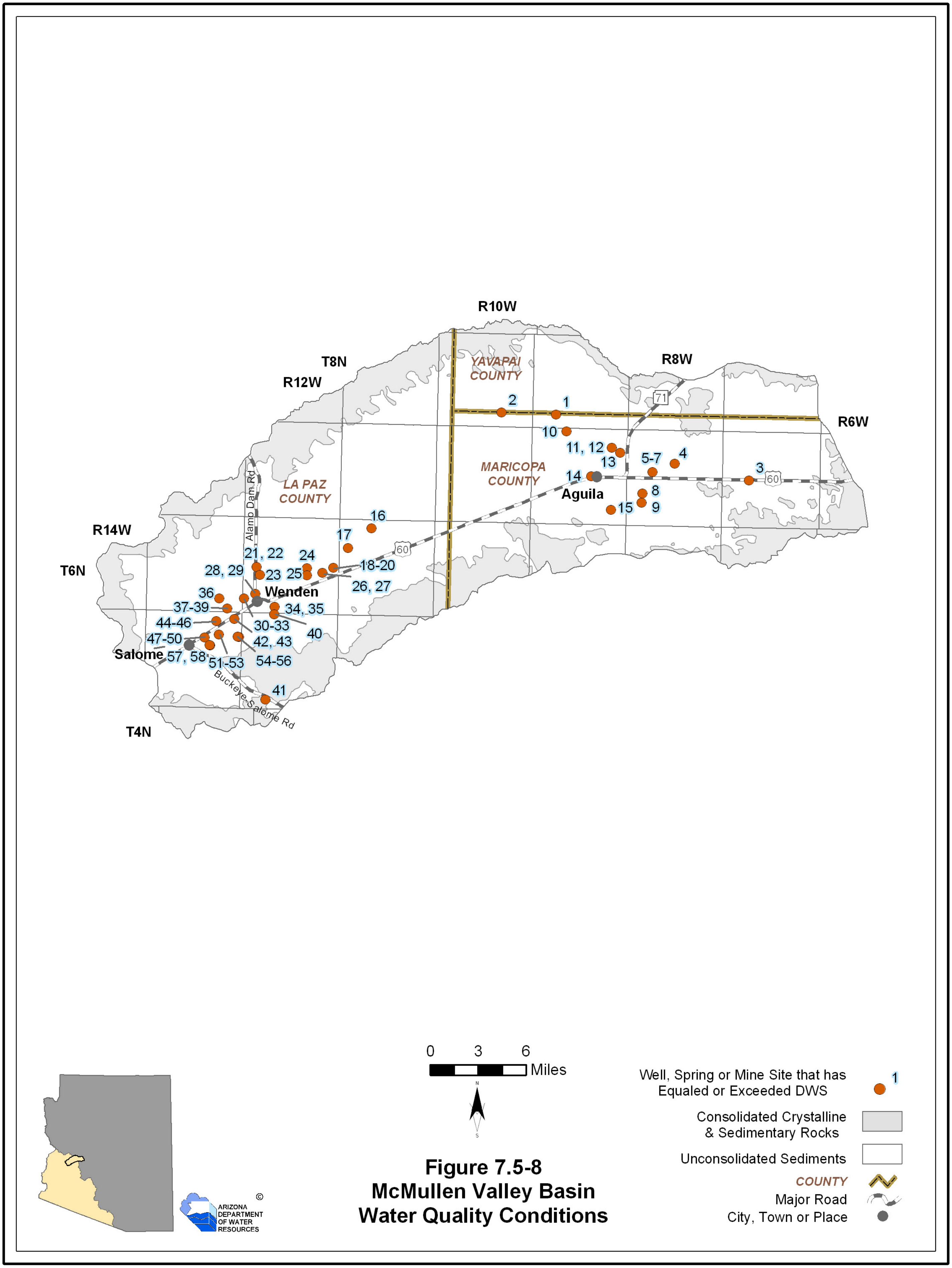


Figure 7.5-8
McMullen Valley Basin
Water Quality Conditions

7.5.8 Cultural Water Demands in the McMullen 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 7.5-7. Figure 7.5-9 shows the location of demand centers. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.5-8. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.5-7 and Figure 7.5-9.
- Population in this basin increased from 280 in 1980 to 3,426 in 2000.
- Most cultural water use is for irrigation located near Wenden/Salome and in the Aguila area.
- There is no reported surface water demand in this basin.
- Groundwater use for agriculture increased from 77,000 AFA in 1991-1995 to 89,100 AFA in 2001-2005.
- Both municipal and industrial groundwater demands are minimal in this basin, less than 800 AFA combined between 1991 and 2005.
- As of 2005 there were 339 registered wells with a pumping capacity of less than or equal to 35 gpm and 240 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 7.5-8.
- There is one wastewater treatment plant in this basin, Forepaugh WWTP, but no information was available on this facility.

Table 7.5-7 Cultural Water Demand in the McMullen Valley Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971		62[2]	203[2]	120,000			NR			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				123,000			NR			
1977										
1978										
1979										
1980	280									
1981	395	16	11	94,000			NR			
1982	509									
1983	624									
1984	739									
1985	853									
1986	968	36	13	60,000			NR			
1987	1,083									
1988	1,197									
1989	1,312									
1990	1,427									
1991	1,626	37	5	450	<300	77,000	NR			USGS (2007)
1992	1,826									
1993	2,026									
1994	2,226									
1995	2,426									
1996	2,626	75	3	500	<300	79,500	NR			
1997	2,826									
1998	3,026									
1999	3,226									
2000	3,426									
2001	3,539	113	5	500	<300	89,100	NR			
2002	3,652									
2003	3,765									
2004	3,878									
2005	3,991									
2010	4,555									
2020	5,696									
2030	6,945									
WELL TOTALS:		**339**	**240**							

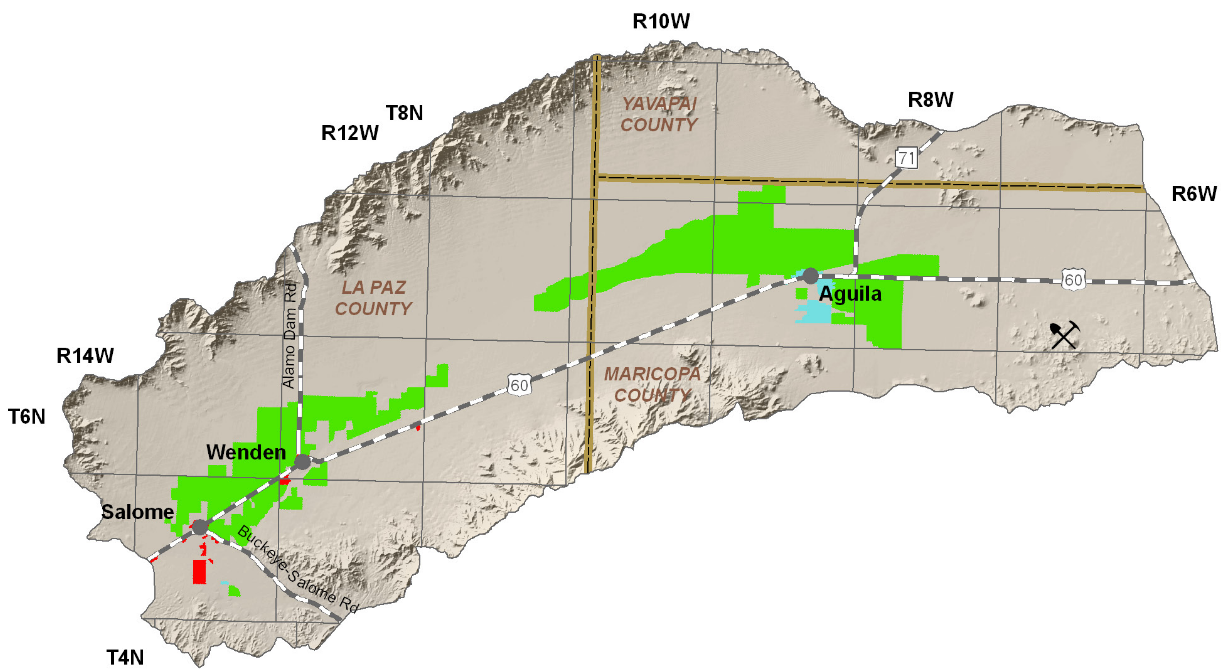
[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
NR - Not reported

Table 7.5-8 Effluent Generation in the McMullen Valley Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet)	Disposal Method									Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course	Wildlife Area	Discharged to another facility	Other	Infiltration Basins				
Forepaugh WWTP	NA	Forepaugh	NA													

Source: Compilation of databases from ADWR & others

NA: Data not currently available to ADWR
WWTP: Waste Water Treatment Plant



0 3 6 Miles

Demand Centers

- Agriculture
- M&I - High Intensity
- M&I - Low Intensity
- Small Mine / Quarry
- COUNTY
- Major Road
- City, Town or Place

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 7.5-9
McMullen Valley Basin
Cultural Water Demand

7.5.9 Water Adequacy Determinations in the McMullen Valley Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.5-9. Figure 7.5-10 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in La Paz County. Ten water adequacy determinations for 1,716 lots have been made in this basin through December 2008. Fourteen hundred and eighty-three lots in eight subdivisions, or 86% of lots, were determined to be adequate.
- Reasons for inadequacy include water quality and insufficient data.
- There is one Analysis of Adequate Water Supply application for 53,484 lots.

Table 7.5-9 Adequacy Determinations in the McMullen Valley Basin[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section						
1	Desert Links	La Paz	5 North	13 West	21	430	53-401492	Adequate		1/12/2005	Keaton Dev. Co.
2	Indian Hills Airpark II	La Paz	5 North	13 West	21	126	53-400953	Inadequate	C	7/14/2003	Keaton Dev. Co.
3	Indian Hills Estates	La Paz	5 North	13 West	21	95	53-500814	Adequate		8/17/1987	Keaton Dev. Co.
4	Keller Retirement Community	La Paz	5 North	13 West	28	31	53-500839	Adequate		2/28/1974	Keaton Water Company
5	Keller Retirement Community Unit 6	La Paz	5 North	13 West	28	233	53-500840	Adequate		8/7/1975	Keaton Water Company
7	Monroe Heights	La Paz	5 North	13 West	26	236	53-400388	Adequate		2/26/2001	Salome Heights Development, LLC
8	Outback Acres	La Paz	5 North	13 West	27	55	53-400391	Adequate		10/17/2000	Salome Heights Development, LLC
9	Salome Heights	La Paz	5 North	13 West	27	118	53-400390	Adequate		3/15/2001	Dry Lot Subdivision
10	Sunshine Acres	La Paz	5 North	13 West	27	107	53-500100	Inadequate	A1	3/12/2007	Keaton Dev. Co.
11	Western Sky Airpark	La Paz	5 North	13 West	17	285	53-401248	Adequate		3/31/2004	Western Sky Airpark Water Improvement District

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
6	Martori Farms - Aguila	Maricopa	7 North	8 West	8, 17, 18, 19, 20, 21	53,484	43-500070	9/26/2007	NA
			7 North	10 West	13, 14, 15, 16, 17, 19, 20, 21, 25, 28				
			7 North	9 West	3, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 24, 25				
			8 North	9 West	27, 28, 33, 34, 35				

Source: ADWR 2008a

Notes:

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

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

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

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

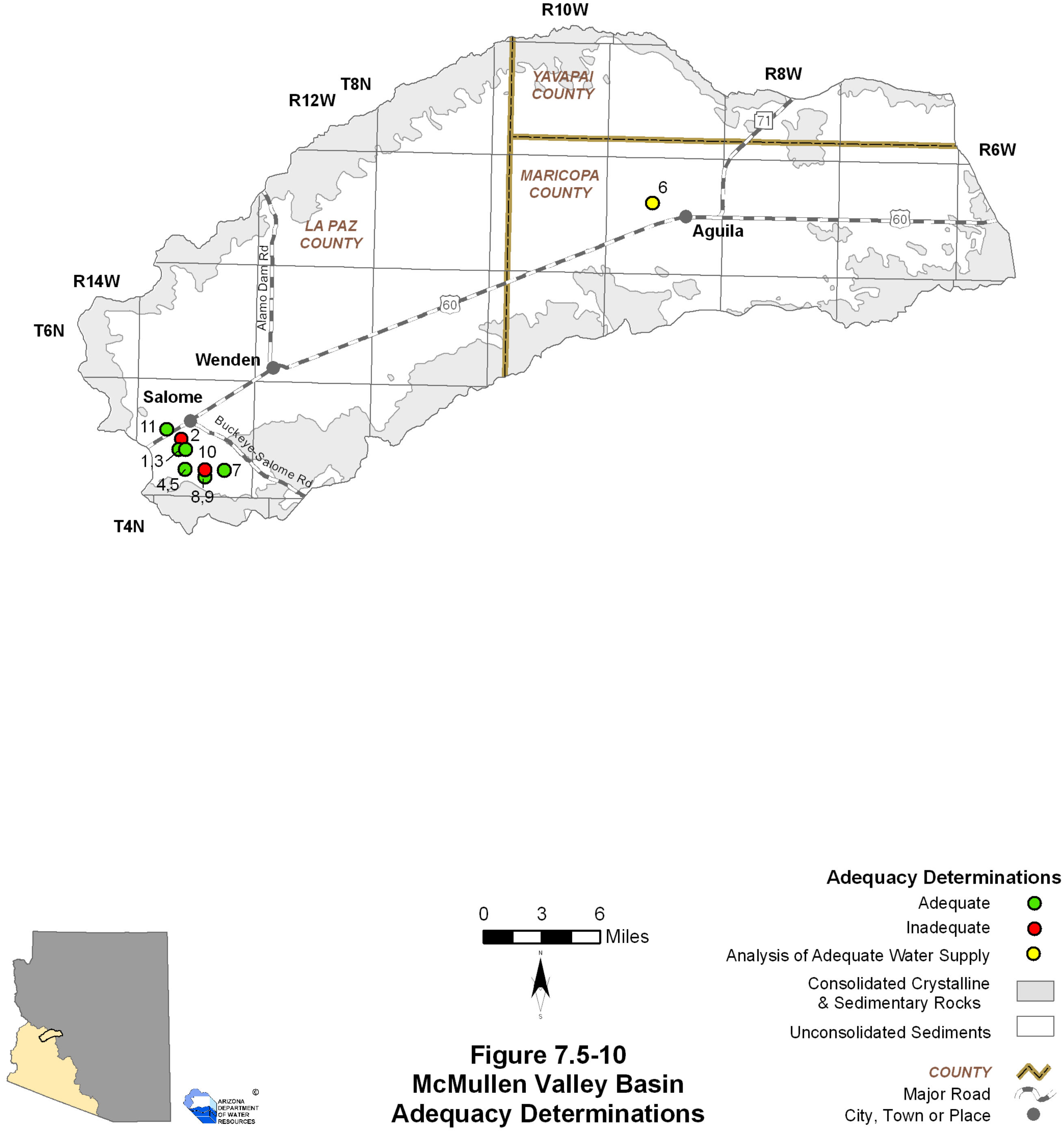


Figure 7.5-10
McMullen Valley Basin
Adequacy Determinations

McMullen Valley Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2005, WWTP and permit files: Miscellaneous working files, received July 2005. (Effluent Generation Table)

_____, 2004, Water quality exceedences for drinking water providers in Arizona: Data file, received September 2004. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005d, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Game and Fish Department (AZGF), 2005, Arizona Waterways: Data file, received April 2005. (Reservoirs and Stockponds Table)

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005b Streams: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html

_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

G

Gebert, W.A., D.J. Graczyk and W.R. Krug, 1987, Average annual runoff in the United States, 1951-1980: GIS Cover, accessed March 2006 at http://aa179.cr.usgs.gov/metadata/wrdmeta/runoff.htm. (Surface Water Conditions Map)

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Precipitation and temperature stations: Data file, accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Pool, D.R., 1987, Geohydrology of McMullen Valley, west central Arizona: USGS Water Resources Investigations Report 87-4041, 51 p.

Remick, W.H., 1981, Maps showing groundwater conditions in the McMullen Valley Area, Maricopa, Yavapai and Yuma Counties, Arizona: Arizona Department of Water Resources Hydrologic Map Series #6.

Robertson, F.N., 1991, Geochemistry of groundwater in alluvial basins of Arizona, and adjacent parts of Nevada, New Mexico and California: USGS Professional Paper 1406-C.

Santec Consulting, 1999, Small and minor watercourses analysis for La Paz County, Arizona,

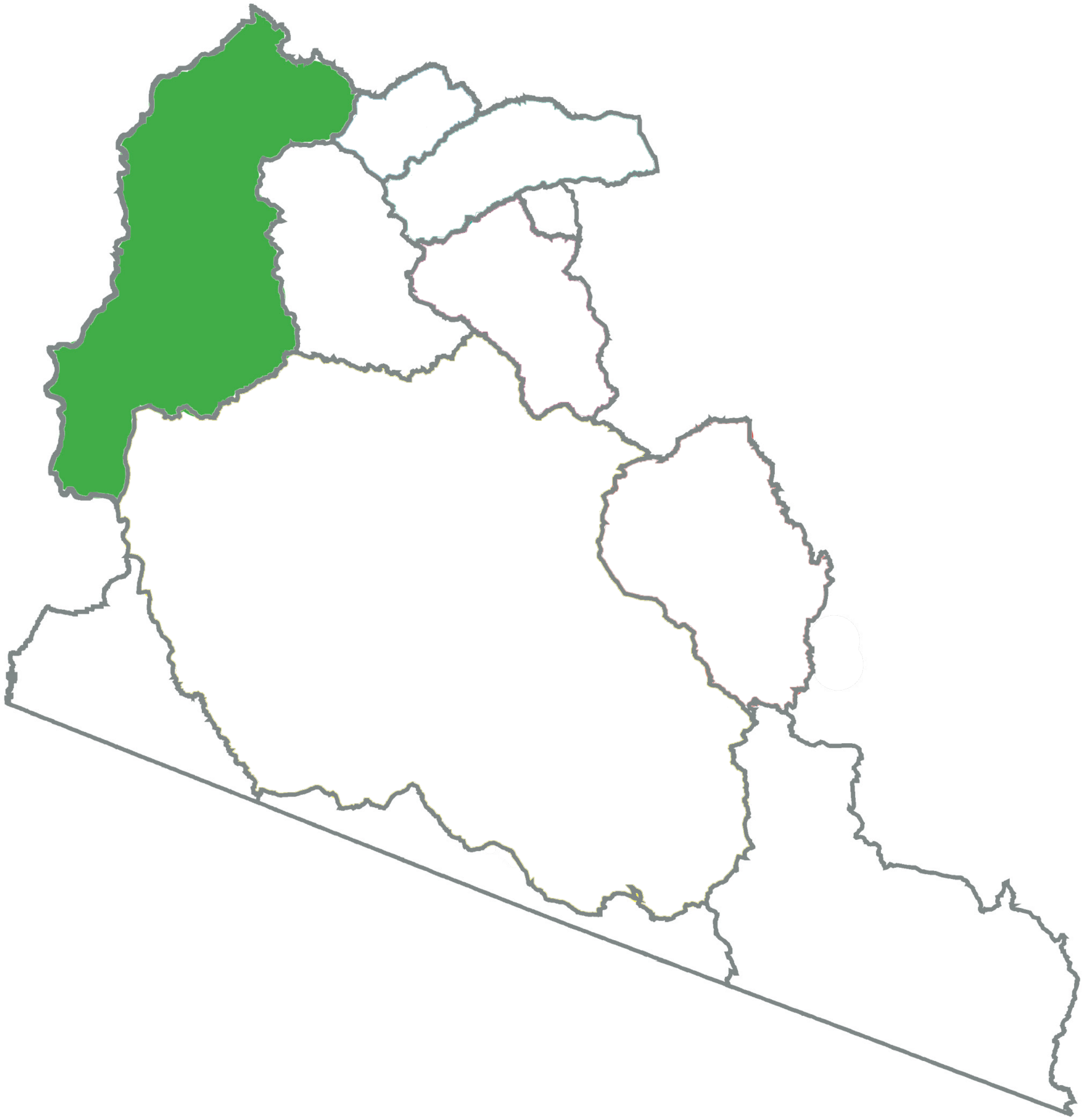
Arizona State Land Department, Final Report.

Southwest Water and Mineral Resources, 2000, Hydrologic Study Report for the Harrisburg Valley Consortium Subdivisions: Indian Hills Airpark and Indian Hills Airpark II, Indian Hills Estates, Salome Heights, Salome Heights RVS, Outback Acres, Monroe Heights. Prepared for Arizona Department of Water Resources.

______, 2002, Hydrologic Study Report for the Western Sky Airpark Development, La Paz County, Arizona. Prepared for Arizona Department of Water Resources.

______, 2004, Hydrologic Study Report for the Proposed Sunset Links Subdivision, La Paz County, Arizona. Prepared for Arizona Department of Water Resources.

Section 7.6
Parker Basin



7.6.1 Geography of the Parker Basin

The Parker Basin, located in the western part of the planning area is 2,229 square miles in area. Geographic features and principal communities are shown on Figure 7.6-1. The basin is characterized by plains and valleys and low elevation mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona Uplands Sonoran desertscrub. (See Figure 7.0-9) Riparian vegetation includes tamarisk, marsh and mesquite along the Colorado River.

- Principal geographic features shown on Figure 7.6-1 are:
    - Plains and valleys including La Posa Plain in the center of the basin, Parker Valley on the northwestern basin boundary and Cactus Plain in the northern portion of the basin
    - Mountain ranges including the Trigo and Dome Rock Mountains in the center of the basin
    - The highest point in the basin, Cunningham Mountain, at 3,314 feet in the Dome Rock Mountains east of Ehrenberg and the Kofa Mountains on the eastern basin boundary
    - The lowest point at 150 feet where the Colorado River exits the basin.

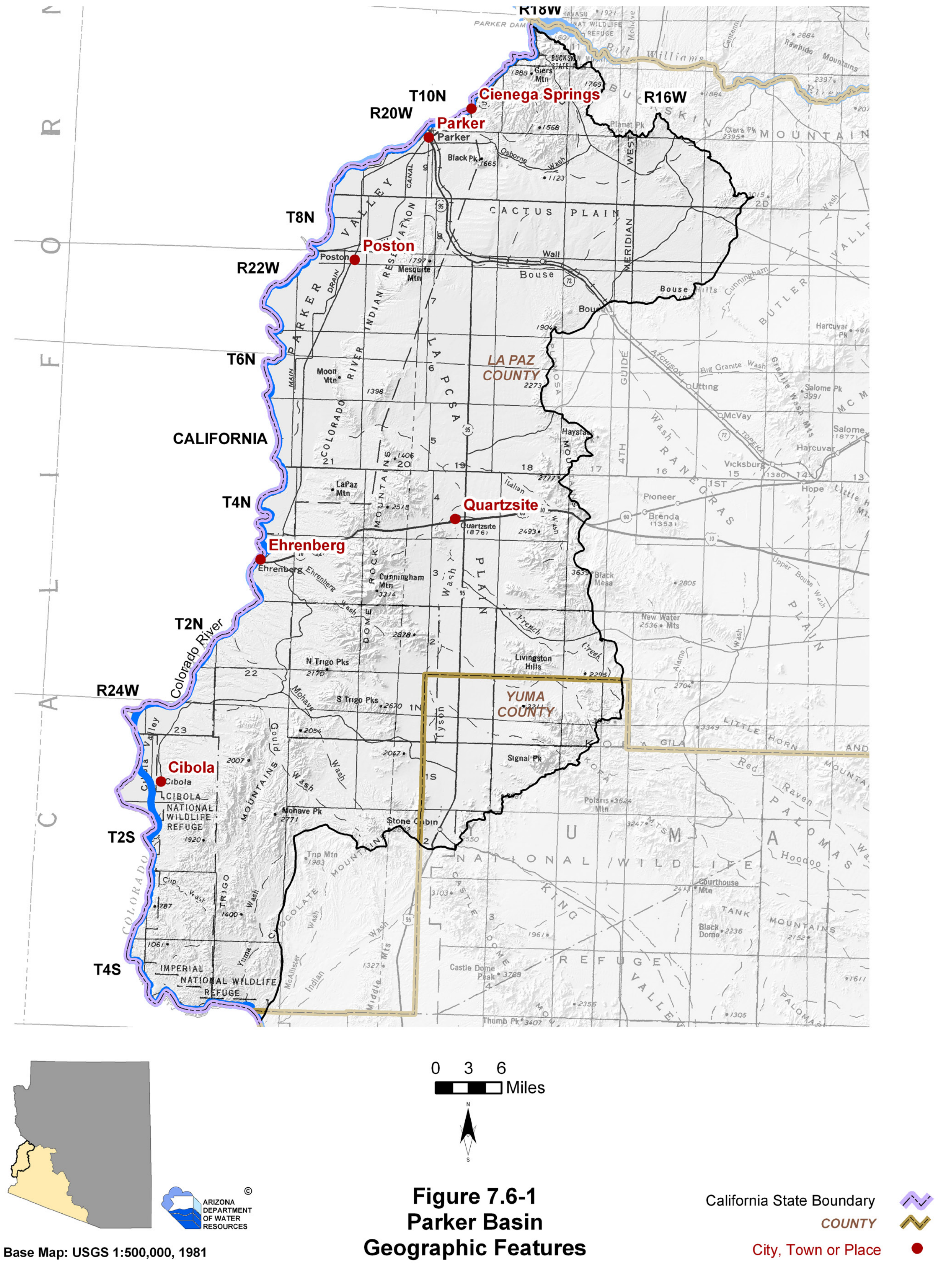


Figure 7.6-1
Parker Basin
Geographic Features

7.6.2 Land Ownership in the Parker Basin

Land ownership, including the percentage of ownership by category, for the Parker Basin is shown in Figure 7.6-2. The principal feature of land ownership in this basin is the very small proportion of private land. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 49.7% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- This basin includes the 30,000 acre Trigo Mountains Wilderness, the 19,000 acre Gibraltar Mountain Wilderness and the 15,000 acre East Cactus Plain Wilderness. (see Figure 7.0-12)
- Land uses include grazing, resource conservation and recreation.

U.S. Military

- 19.5% of the land is federally owned and managed by the U.S. Military as the Yuma Proving Ground.
- Primary land use is military activity.

Indian Reservation

- 16.4% of the land is under tribal ownership as the Colorado River Indian Tribes Reservation.
- Land uses include domestic, commercial and agriculture.

Wildlife Refuge

- 9.3% of the land is federally owned and managed by the U.S. Fish and Wildlife Service as the Kofa National Wildlife Refuge (NWR), Cibola NWR and the Imperial NWR
- Land uses include resource conservation, wildlife protection and recreation.

State Trust Land

- 3.7% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is agriculture.

Private

- 1.3% of the land is private.
- Small parcels of private land are located in the vicinity of Highway 95, north of Cibola, and at Parker and Cienega Springs
- Land uses include domestic, commercial and agriculture.

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

- 0.1% of the land is federally owned and managed by the U.S. Bureau of Reclamation (USBOR)

- USBOR lands are located north of Cibola along the Colorado River.
- Primary land use is unknown.

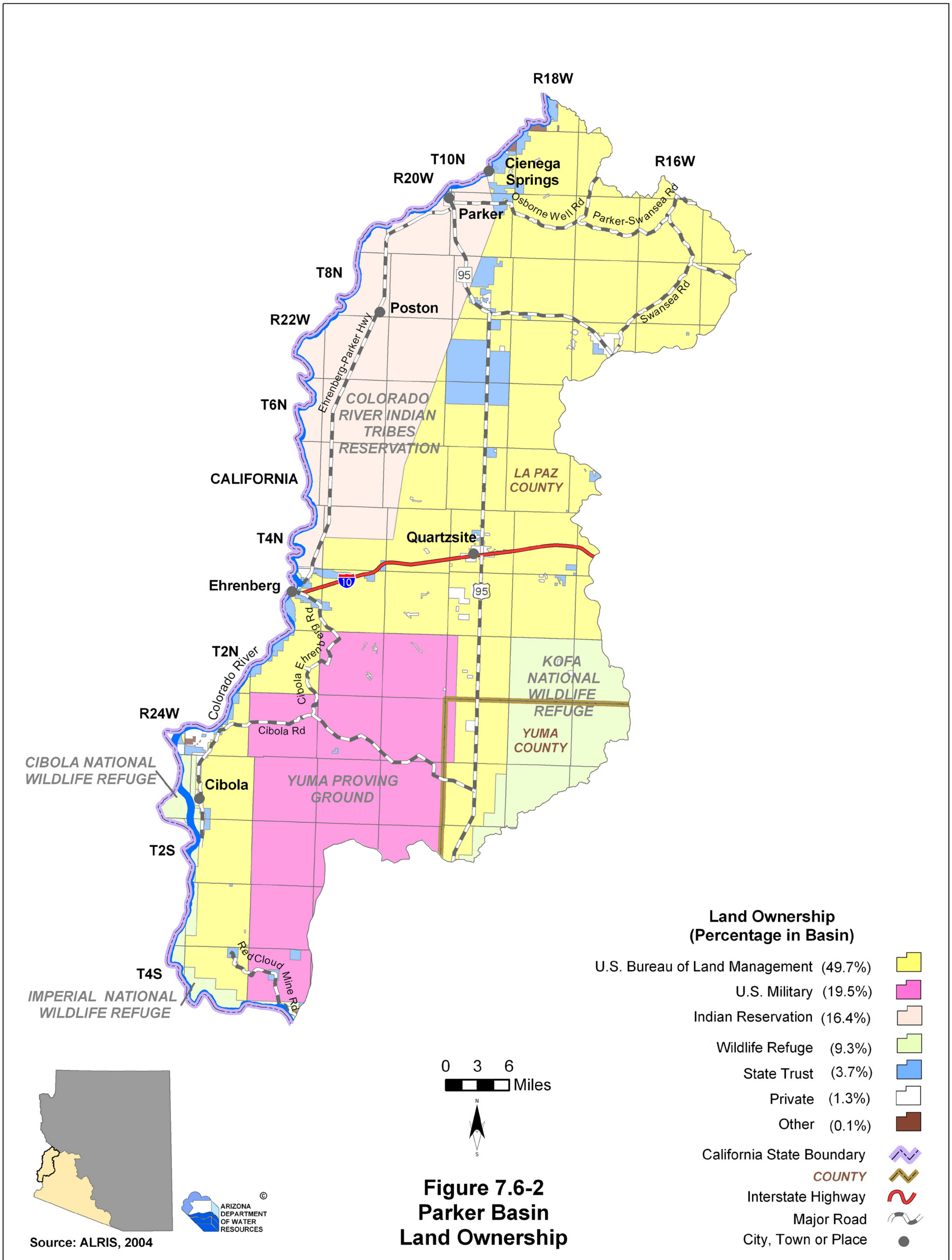


**Figure 7.6-2
Parker Basin
Land Ownership**

7.6.3 Climate of the Parker Basin

Climate data from NOAA/NWS Co-op Network and AZMET stations are complied in Table 7.6-1 and the locations are shown on Figure 7.6-3. Figure 7.6-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Parker Basin does not contain Evaporation Pan or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.6-1A
- There are five NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 94.8°F at Quartzite and 92.2°F at Bouse. The average monthly minimum temperature occurs in January or December and ranges between 49.8°F at Bouse and 54.5°F at Ehrenburg 2E.
- Average seasonal rainfall follows a bi-modal pattern with approximately one-third of the average seasonal rainfall occurring in the winter (January-March) season and one-third in the summer (July-September) season. For the period of record used, the highest annual rainfall is is 5.89 inches at the Bouse and the lowest is 3.50 inches at Ehrenburg.

AZMET

- Refer to Table 7.6-1C
- There is one AZMET station in the basin, Parker. This station is at 308 feet and has an annual reference evaportranspiration of 82.91inches.

SCAS Precipitation Data

- See Figure 7.6-3
- Additional precipitation data shows average annual rainfall as high as 10 inches along the eastern basin boundary and as low as four inches or less along the Colorado River on the western basin boundary.

Table 7.6-1 Climate Data for the Parker 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
Bouse	930	1971 - 2000	92.2/Jul	49.8/Dec	2.14	0.38	2.12	1.25	5.89
Ehrenberg	320	1948 - 1977[1]	93.1/Jul	52.8/Jan	0.94	0.28	1.41	0.90	3.50
Ehrenberg 2E	460	1971 - 2000	94.4/Jul	54.5/Dec	1.42	0.21	1.69	1.05	4.37
Parker 6 NE	41	1971 - 2000	93.2/Jul	53.9/Dec	2.22	0.28	1.45	1.22	5.17
Quartzsite	870	1971 - 2000	94.8/Jul	51.8/Dec	1.36	0.23	1.18	0.74	3.51

Source: WRCC, 2005

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

B. Evaporation Pan:

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

C. AZMet:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches *(Number of years to calculate averages)*
Parker	308	1987 - current	82.91 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

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

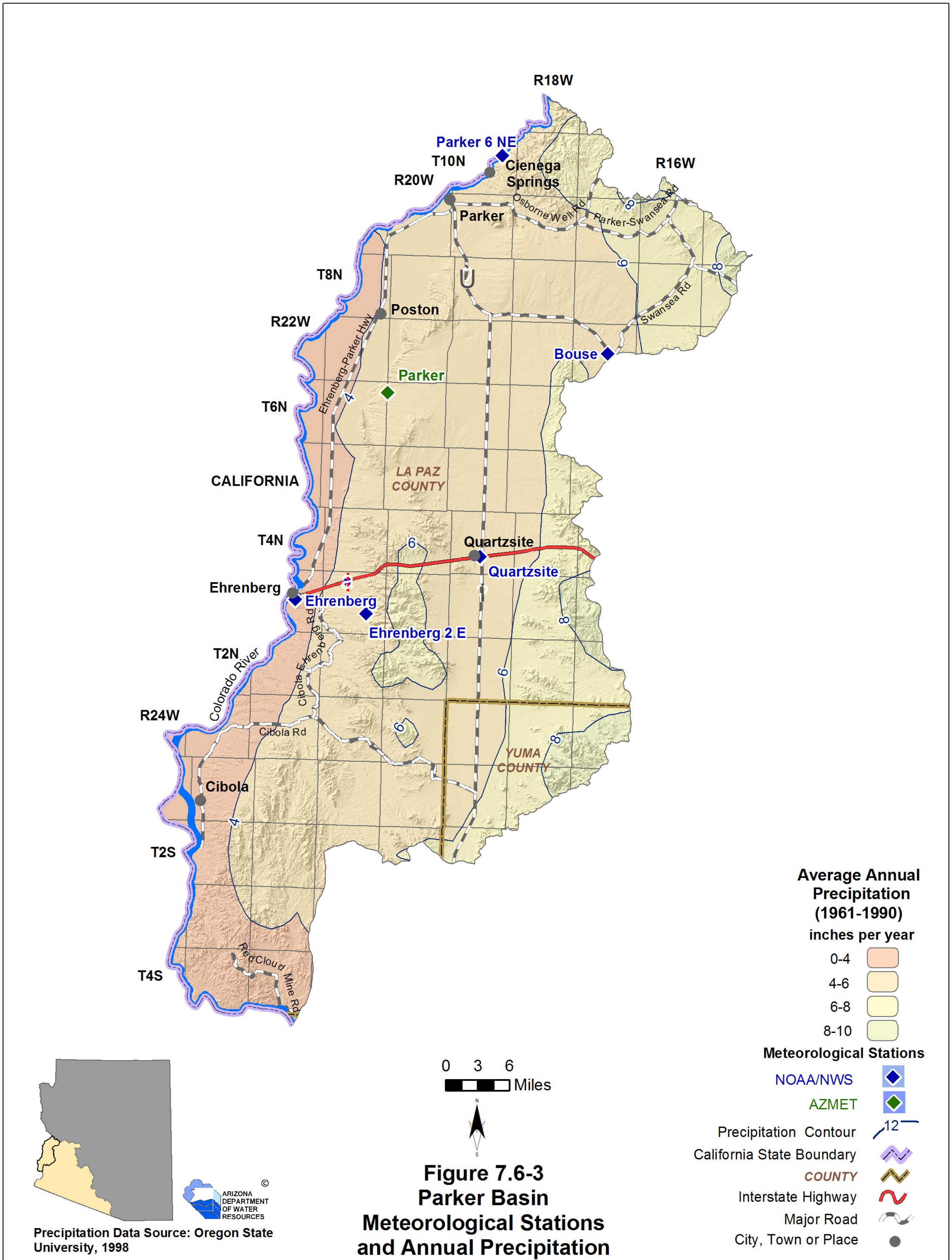


Figure 7.6-3
Parker Basin
Meteorological Stations
and Annual Precipitation

7.6.4 Surface Water Conditions in the Parker Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.6-2. Flood ALERT equipment in the basin is shown in Table 7.6-3. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.6-4. The location of streamflow gages identified by USGS number, flood ALERT equipment and large reservoirs are shown on Figure 7.6-4. There are no USGS runoff contour data available for this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 7.6-2.
- Data from three stations, two real-time and one discontinued, located on the Colorado River are shown in the table and on Figure 7.6-4.
- Average seasonal flow is highest in spring and summer at the three stations and is regulated by scheduled releases from dams.
- The largest annual flow recorded in the basin is more than 20 million acre feet (maf) in 1984 at the Colorado River below Parker Dam station with a contributing drainage area of 182,700 square miles.

Flood ALERT Equipment

- Refer to Table 7.6-3.
- As of October 2005 there was one precipitation station in the basin located at Tyson Wash.

Reservoirs and Stockponds

- Refer to Table 7.6-4.
- The basin contains five large reservoirs or dams. The largest, Lake Havasu, with a maximum storage of 651,000 acre-feet, is located in the Upper Colorado River Planning Area but Parker Dam is located at the basin boundary.
- Reservoirs in this basin are used for water supply, irrigation, hydroelectric power, recreation and fish and wildlife.
- Surface water is stored or could be stored in five small reservoirs in the basin.
- There are five registered stockponds in this basin.

Table 7.6-2 Streamflow Data for the Parker Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9427520	Colorado River below Parker Dam[1]	182,700	350	11/1934-current (real time)	23	28	28	20	5,534,256 (1993)	7,229,140	8,918,956	20,409,560 (1984)	61
9429100	Colorado River below Palo Verde Dam[1]	182,200	260	3/1956-curent (real time)	22	31	30	17	4,369,340 (1993)	5,507,468	5,831,096	9,860,880 (1958)	39
9429300	Colorado River below Cibola Valley	187,800	200	4/1956-9/1988 (discontinued)	22	28	30	19	5,365,301 (1982)	6,187,223	7,801,072	19,016,442 (1984)	31

Source: USGS (NWIS) 2005 & 2008

Notes:
[1]Station in California
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Annual Flow/Year statistics were only completed for those gages that had at least 3 years of 12 month records
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retrieved in 2005

Table 7.6-3 Flood ALERT Equipment in the Parker Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
7203	Quartzite	Precipitation	12/5/2001	ADWR

Source: ADWR 2005a

Notes:
ADWR = Arizona Department of Water Resources

Table 7.6-4 Reservoirs and Stockponds in the Parker 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	Lake Havasu *(Parker)*[2]	Bureau of Reclamation	651,000	S, I, H	Federal
2	Moovalya Lake *(Headgate Rock)*	Bureau of Reclamation	20,000	I, H, R	Federal

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
3	Cibola	Bureau of Reclamation/ USFWS	400	R,F	Federal
4	Island	Bureau of Reclamation/ USFWS	220	F	Federal
5	Adobe	Bureau of Reclamation/ USFWS	209	F	Federal

Source: Compilation of databases from ADWR & others

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

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

D. Other Small Reservoirs (between 5 and 50 acres surface area)[3]

Total number: 5
Total surface area: 188 acres

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

Total number: 5

Notes:
[1] S = Supply; I = Irrigation; H = Hydroelectric power; F=Fish & wildlife pond; R=Recreation
[2] Dam is located in the Parker Basin and lake storage is in the Lake Havasu Basin in the Upper Colorado River Planning Area.
[3] Capacity data not available to ADWR
USFWS = United States Fish and Wildlife Service

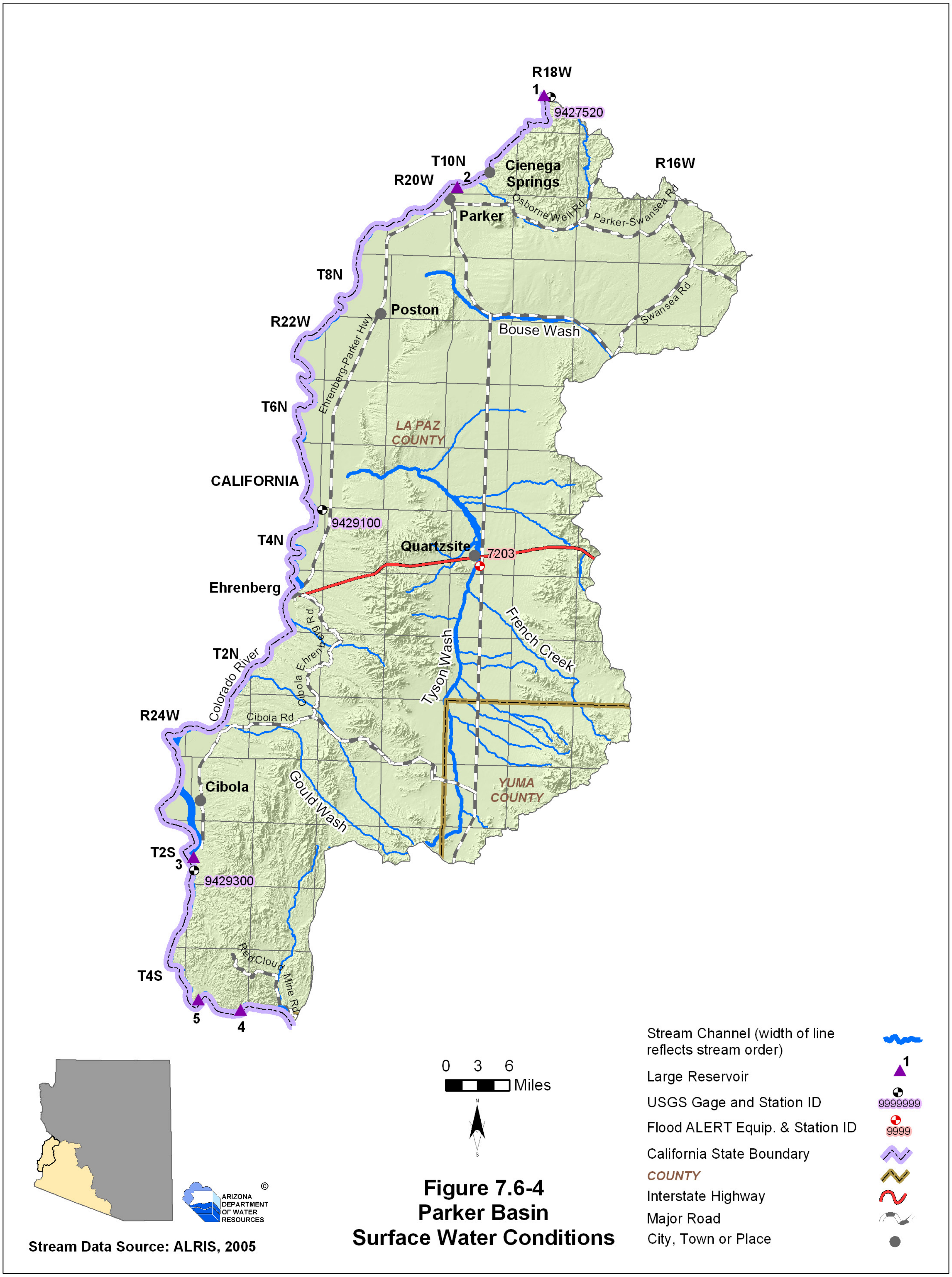


Figure 7.6-4
Parker Basin
Surface Water Conditions

7.6.5 Perennial/Intermittent Streams and Major Springs in the Parker Basin

The total number of springs in the basin are shown in Table 7.6-5. The location of a perennial stream is shown on Figure 7.6-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are no intermittent streams and one perennial stream, the Colorado River.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS varies from 11 to 12, depending on the database reference.

Table 7.6-5 Springs in the Parker Basin

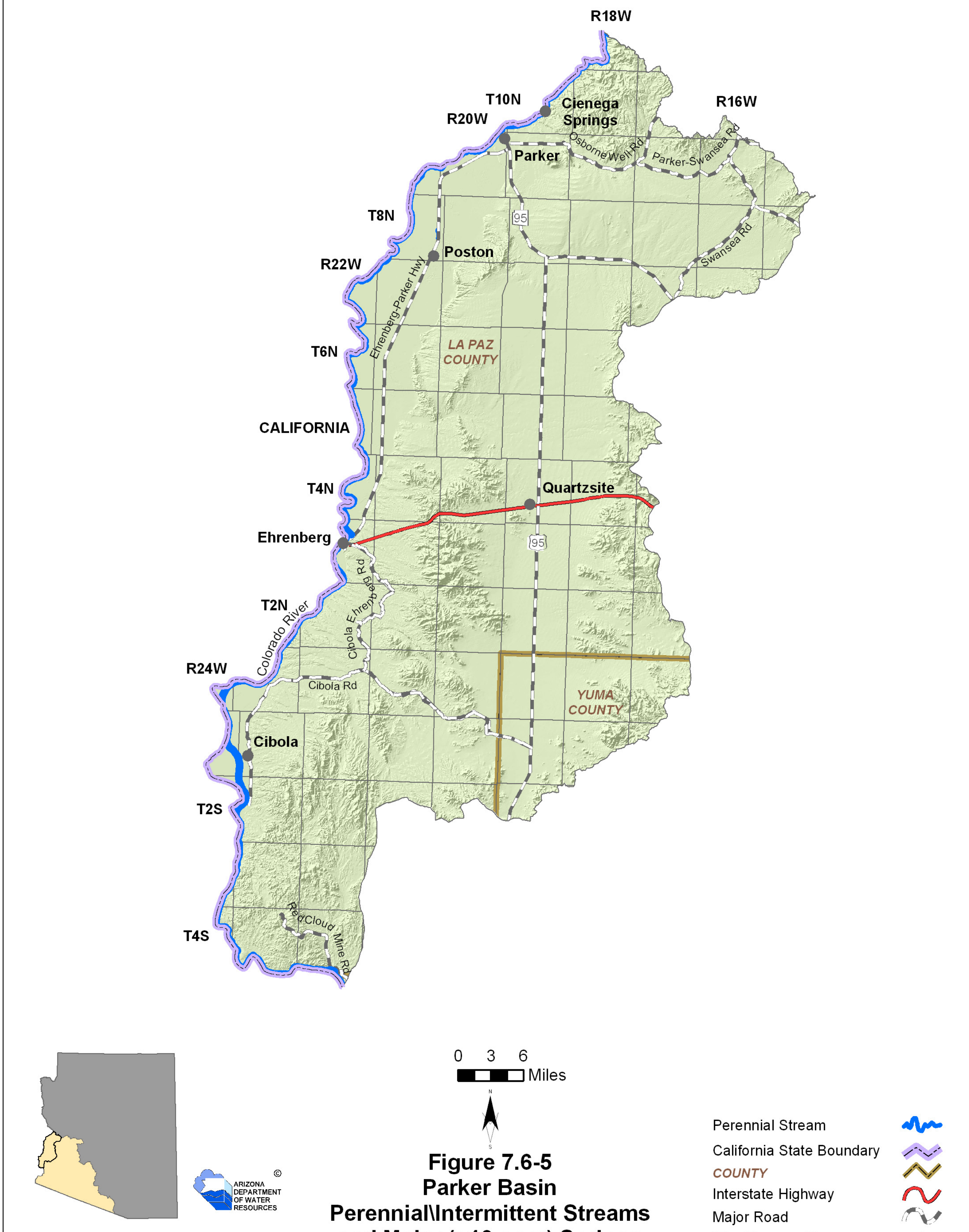
A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 11 to 12



Stream Data Source: AGFD, 1993 & 1997

Figure 7.6-5
Parker Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.6.6 Groundwater Conditions of the Parker Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.6-6. Figure 7.6-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.6-7 contains hydrographs for selected wells shown on Figure 7.6-6. Figure 7.6-8 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.6-6 and Figure 7.6-6.
- The major aquifer is recent stream alluvium and sedimentary rock (Bouse Formation).
- The basin contains three sub-basins: Cibola Valley, Colorado River Indian Reservation and La Posa Plains.
- Groundwater flow is from the south and east toward the Colorado River.

Well Yields

- Refer to Table 7.6-6 and Figure 7.6-8.
- As shown on Figure 7.6-8, well yields are generally less than 100 gallons per minute (gpm) although higher well yields are found near the Colorado River.
- One source of well yield information, based on 75 reported wells, indicates that the median well yield is 100 gpm.

Natural Recharge

- Refer to Table 7.6-6.
- The natural recharge estimate for this basin is 241,000 acre-feet per year (AFA).
- The largest source of natural recharge is the Colorado River (ADWR 1994).

Water in Storage

- Refer to Table 7.6-6.
- Storage estimates for this basin range from 14 maf to 24 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.6-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures six index wells in this basin. Hydrographs for five these wells and two additional wells (B and G) are shown on Figure 7.6-7.
- The deepest water level shown on the map is 553 feet north of Quartzsite and the shallowest is 10 feet west of the Cibola Ehrenberg Road near the Colorado River.

Table 7.6-6 Groundwater Data for the Parker Basin

Basin Area, in square miles:	2,229	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Recent Stream Alluvium	
	Sedimentary Rock (Bouse Formation)	
Well Yields, in gal/min:	N/A	Measured by ADWR (GWSI) and/or USGS
	Range 2-6,000 Median 100 (75 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 30-900	ADWR (1990 and 1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	241,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	14,000,000 (to 1,200 ft)	ADWR (1994b)
	24,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	21,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	6	
Date of Last Water-level Sweep:	1995-97 (348 wells measured)	

[1]Predevelopment Estimate

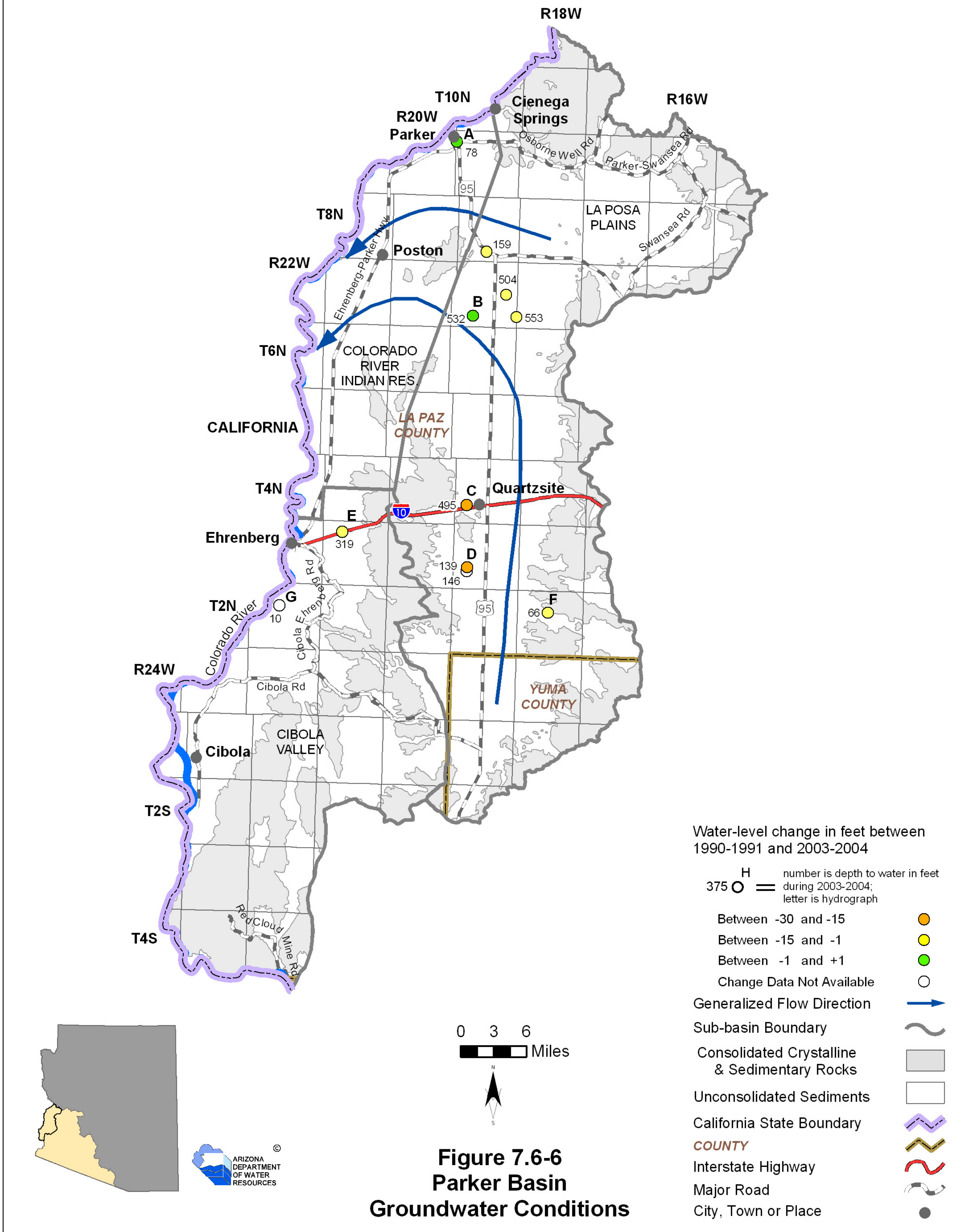


Figure 7.6-6
Parker Basin
Groundwater Conditions

Figure 7.6-7
Parker Basin
Hydrographs Showing Depth to Water in Selected Wells

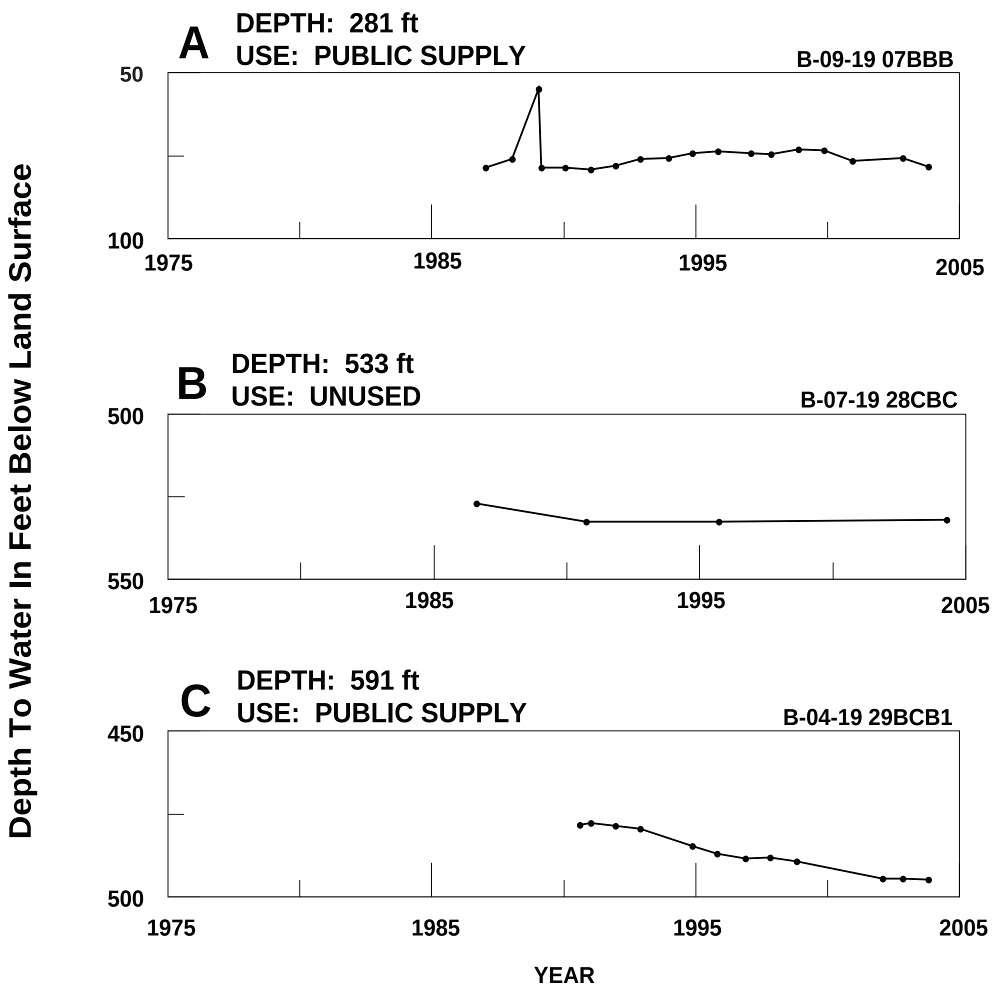
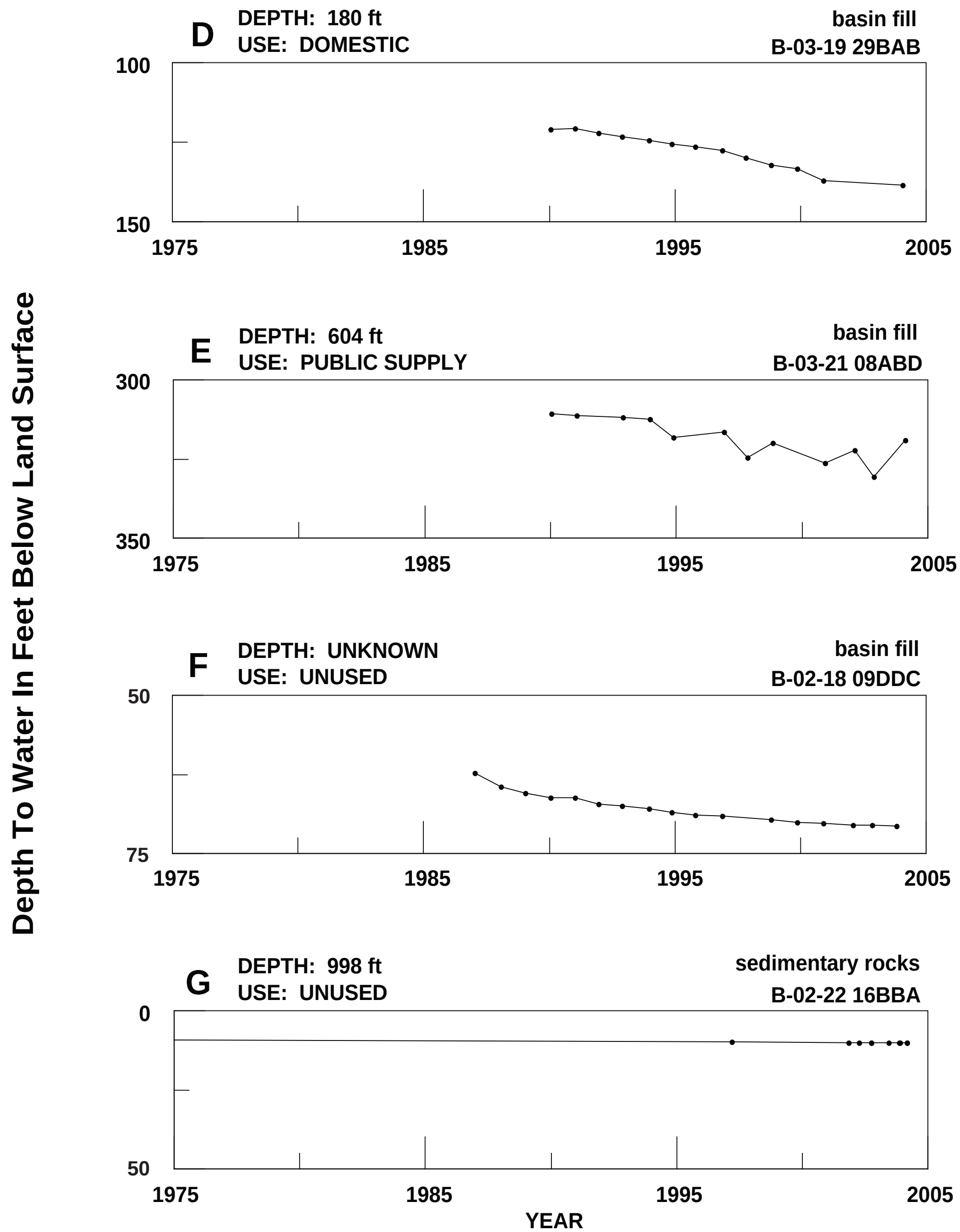


Figure 7.6-7 (cont'd)
Parker Basin
Hydrographs Showing Depth to Water in Selected Wells



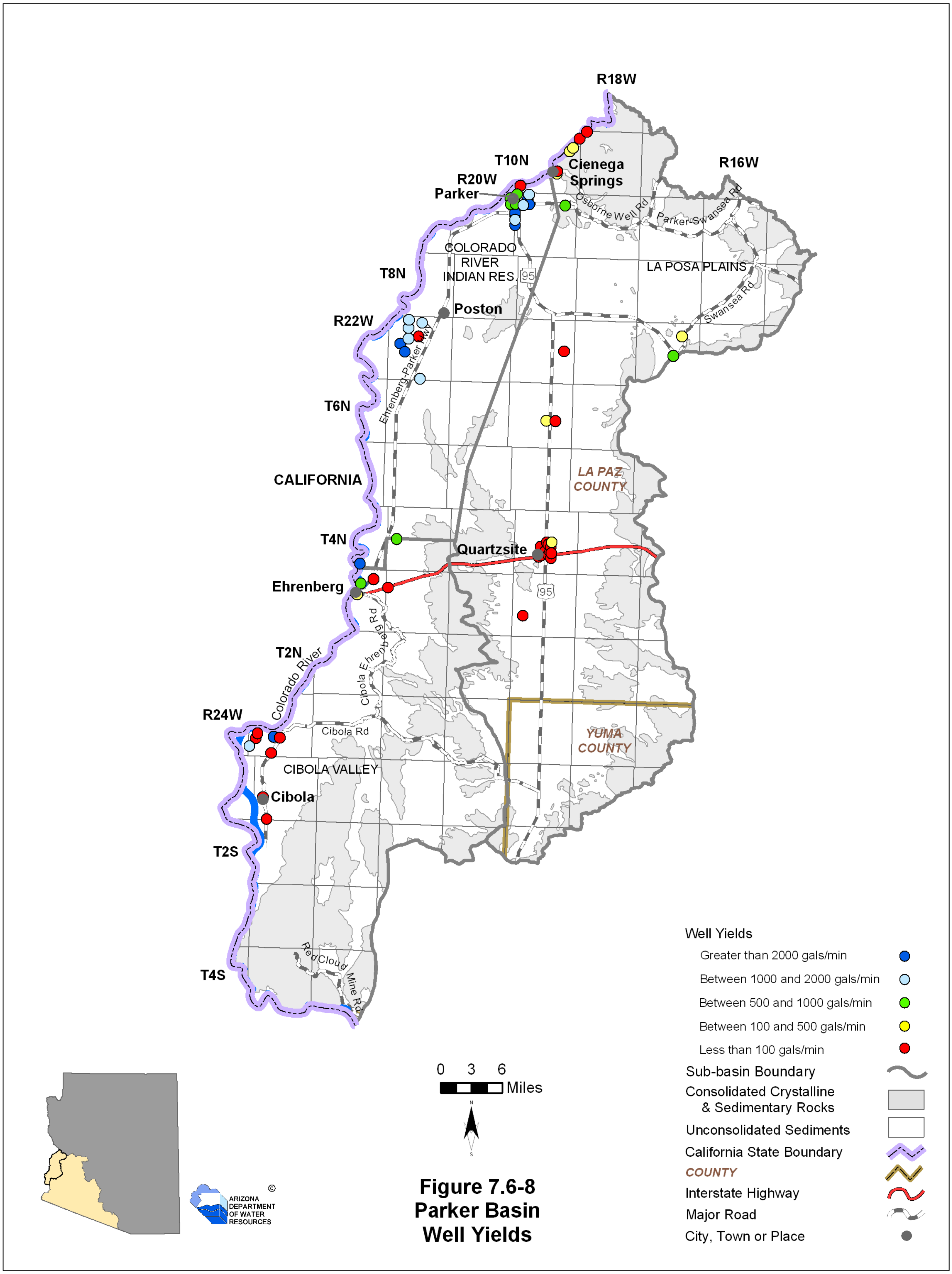


Figure 7.6-8
Parker Basin
Well Yields

7.6.7 Water Quality of the Parker Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.6-7A. There are no impaired lakes or streams in this basin. Figure 7.6-9 shows the location of water quality occurrences keyed to Table 7.6-7. All community water systems are regulated under the Safe Drinking Water Act and treat water supplies to meet drinking water standards. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.6-7A.
- Fifty-two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter most frequently equaled or exceeded was nitrate. Other parameters equaled or exceeded include arsenic, chromium, lead, fluoride and organics.

Table 7.6-7 Water Quality Exceedences in the Parker Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	10 North	19 West	27	F
2	Well	10 North	19 West	27	F
3	Well	10 North	19 West	27	F
4	Well	9 North	19 West	7	As
5	Well	9 North	10 West	1	As
6	Well	6 North	20 West	13	F
7	Well	4 North	19 West	16	NO3
8	Well	4 North	19 West	21	As
9	Well	4 North	19 West	21	As, NO3
10	Well	4 North	19 West	21	NO3
11	Well	4 North	19 West	21	NO3
12	Well	4 North	19 West	21	NO3
13	Well	4 North	19 West	21	NO3
14	Well	4 North	19 West	21	NO3
15	Well	4 North	19 West	21	NO3
16	Well	4 North	19 West	21	NO3
17	Well	4 North	19 West	21	NO3
18	Well	4 North	19 West	21	Organics
19	Well	4 North	19 West	21	Organics
20	Well	4 North	19 West	21	Organics
21	Well	4 North	19 West	21	Organics
22	Well	4 North	19 West	21	Organics
23	Well	4 North	19 West	21	NO3
24	Well	4 North	19 West	21	Organics
25	Well	4 North	19 West	21	Organics
26	Well	4 North	19 West	21	Organics
27	Well	4 North	19 West	21	Organics
28	Well	4 North	19 West	21	Organics
29	Well	4 North	19 West	21	Organics
30	Well	4 North	19 West	21	Organics
31	Well	4 North	19 West	21	Organics
32	Well	4 North	19 West	21	Organics
33	Well	4 North	19 West	22	NO3
34	Well	4 North	19 West	22	As
35	Well	4 North	19 West	26	As
36	Well	4 North	19 West	27	As
37	Well	4 North	19 West	27	NO3
38	Well	4 North	19 West	27	F
39	Well	4 North	19 West	27	NO3
40	Well	4 North	19 West	27	NO3
41	Well	4 North	19 West	27	NO3
42	Well	4 North	19 West	28	NO3
43	Well	4 North	19 West	28	NO3
44	Well	4 North	19 West	28	NO3

Table 7.6-7 Water Quality Exceedences in the Parker Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
45	Well	4 North	19 West	28	NO3
46	Well	4 North	19 West	28	NO3
47	Well	4 North	19 West	28	NO3
48	Well	4 North	19 West	29	NO3
49	Well	4 North	19 West	31	Pb
50	Well	3 North	19 West	7	As
51	Well	1 North	23 West	33	TDS
52	Well	1 South	23 West	32	TDS

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.

[2] As = Arsenic
F = Fluoride
Pb = Lead
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
NO3 = Nitrate/ Nitrite
TDS = Total Dissolved Solids

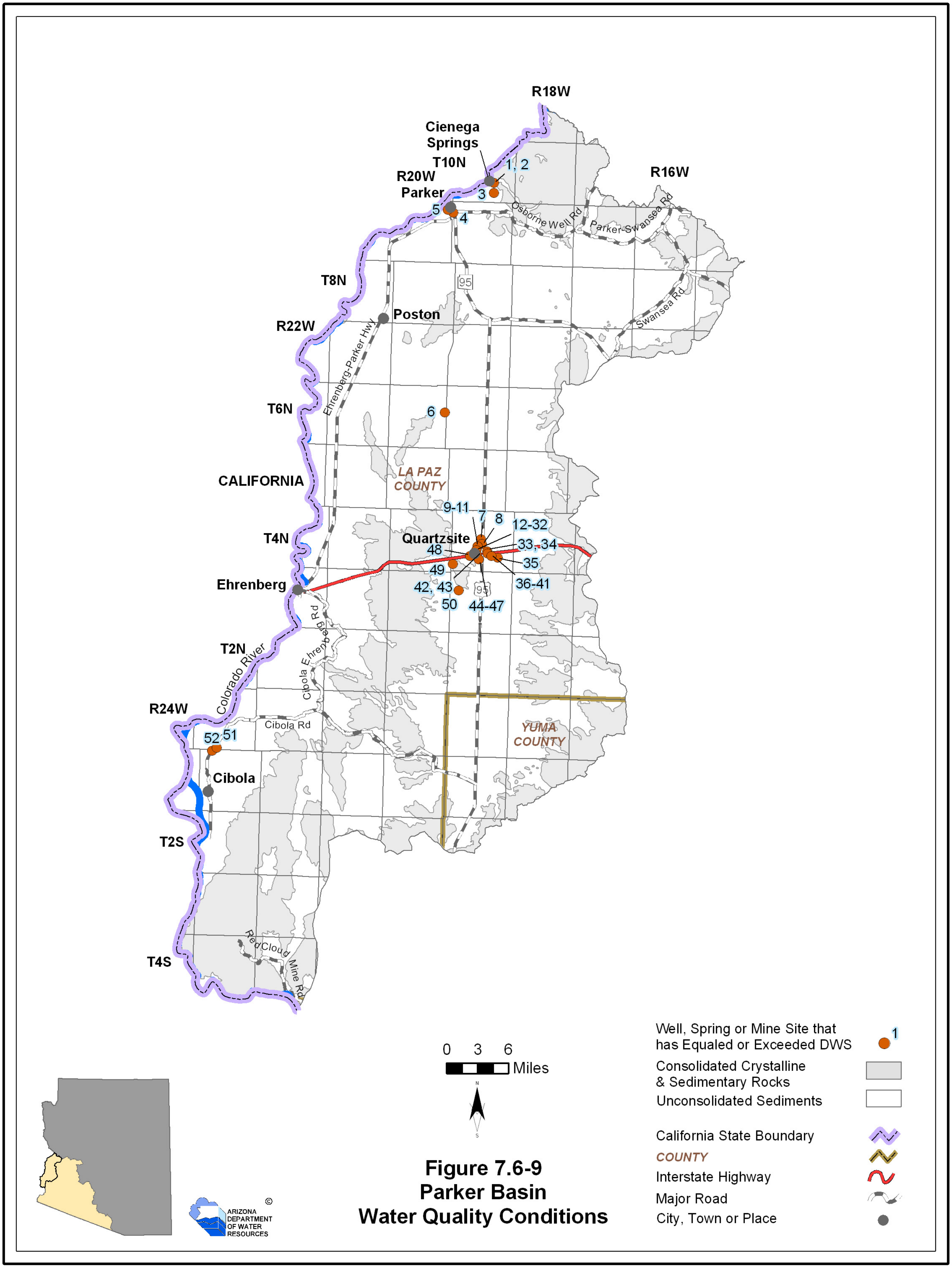


Figure 7.6-9
Parker Basin
Water Quality Conditions

7.6.8 Cultural Water Demands in the Parker 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 7.6-8. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.6-9. Figure 7.6-10 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.6-8 and Figure 7.6-10.
- Population in this basin increased from 11,339 in 1980 to 16,155 in 2000.
- Most cultural water use is for irrigation on the Colorado River Indian Tribe's land in the northwestern portion of the basin.
- Agricultural surface water demand declined from 1991 to 2005 with 630,600 acre-feet diverted per year on average in 2001-2005. Agricultural groundwater demand decreased slightly between 1991 and 2005.
- Municipal demand is relatively small. Groundwater demand increased from 2,900 AFA in 1991-1995 to 3,800 AFA in 2001-2005. Surface water increased from 400 AFA in 1991-1995 to 500 AFA in 2001-2005.
- There is minimal industrial demand in this basin associated with sand and gravel operations.
- As of 2005 there were 1,749 registered wells with a pumping capacity of less than or equal to 35 gpm and 191 wells with a pumping capacity of more than 35 gpm.

Effluent Generation

- Refer to Table 7.6-9.
- There are 12 wastewater treatment facilities in this basin.
- Information on population served was available for 10 facilities and information on the volume of effluent generated was available for all 12 facilities. These facilities serve almost 12,000 people and generate almost 2,200 acre-feet of effluent per year.
- Two facilities discharge to a watercourse, two facilities discharge for irrigation, one facility discharges to a golf course and five discharge to unlined impoundments that recharge the aquifer.

Table 7.6-8 Cultural Water Demand in the Parker Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971										
1972										
1973				9,000			1,251,000[4]			
1974										
1975										
1976		850[2]	105[2]							
1977										
1978				21,000			1,102,000[4]			
1979										
1980	11,339									ADWR (1994a)
1981	11,398									
1982	11,457									
1983	11,516	181	26	25,000			1,130,000[4]			
1984	11,575									
1985	11,634									
1986	11,693									
1987	11,752									
1988	11,810	203	26	18,000			1,229,000[4]			
1989	11,869									
1990	11,928									
1991	12,351									
1992	12,774									
1993	13,196	130	7	2,900	NR	1,300	400	NR	662,000	
1994	13,619									
1995	14,042									
1996	14,464									USGS (2007) ADWR (2008b) ADWR (2008c)
1997	14,887									
1998	15,310	118	8	3,200	NR	<1,000	400	NR	667,000	
1999	15,732									
2000	16,155									
2001	16,351									
2002	16,548									
2003	16,744	267	19	3,800	<300	<1,000	500	NR	630,600	
2004	16,941									
2005	17,137									
2010	18,119									
2020	20,037									
2030	21,775									
	WELL TOTALS:	**1,749**	**191**							

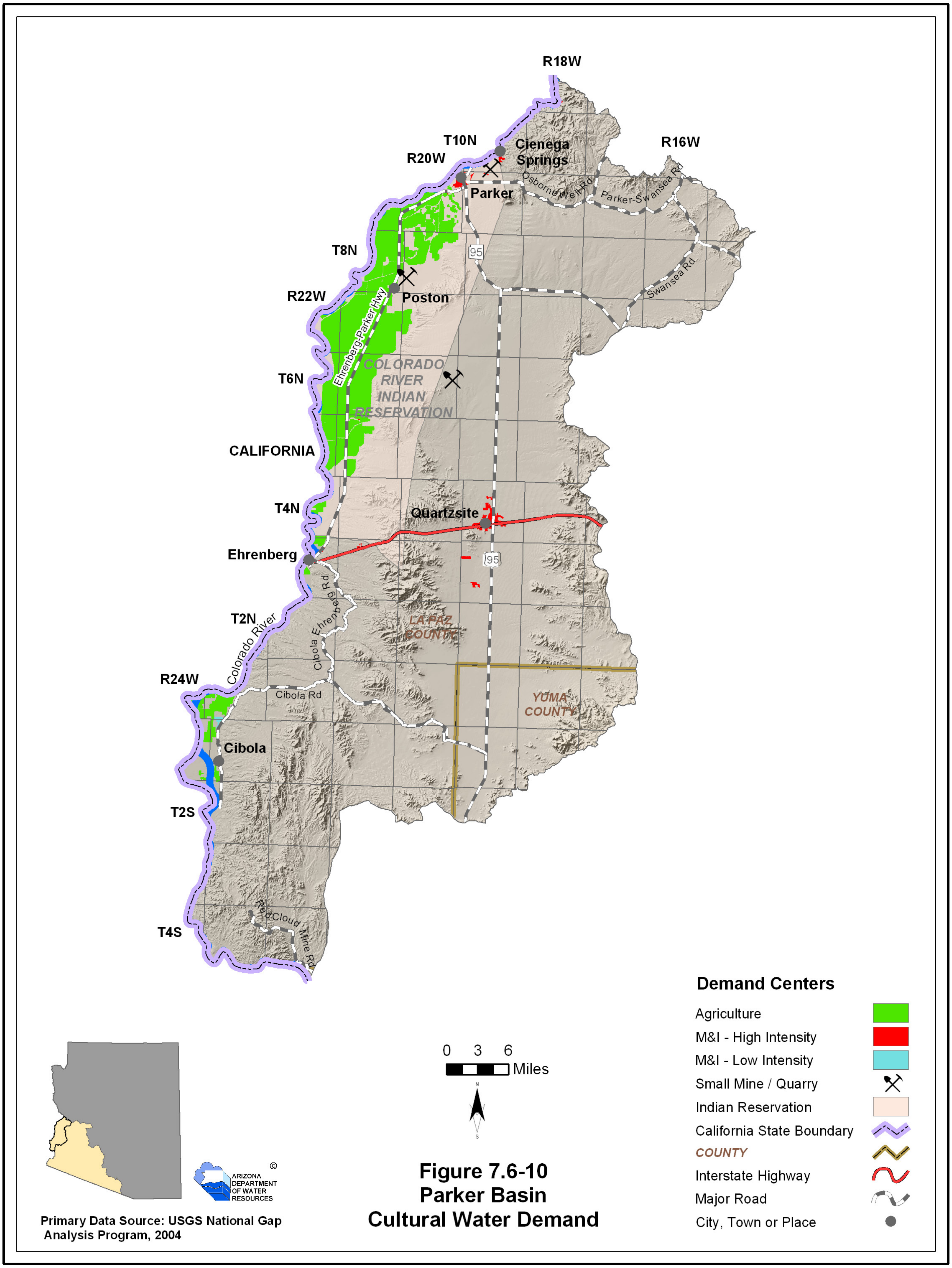
[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Includes pumpage and diversion of Colorado River Contract Water.
[4] Includes surface-water diversions in the Lower Gila and Yuma basins.
NR - Not reported

Table 7.6-9 Effluent Generation in the Parker Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method								Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course/Turf/ Landscape	Wildlife Area	Discharged to Another Facility	Infiltration Basins	Other			
Bouse WWTP	Arizona Department of Transportation	Rest Area	NA	301	NA										1996
Buckskin Mtn. WWTF	State of Arizona	State Park	240	11	X								Secondary	1,400	2001
Buckskin/Sandpiper WWTP	Buckskin SD	Parker	50	6			X	Emerald Canyon					Adv. Trt. I	NA	1996
Colorado River Joint Venture	Municipal	Parker	5,000	840	X		X						Secondary	NA	2005
Headstart Sewer System	Colorado River Tribes	School	90	10							X		Secondary	90	2000
Mochem Sewer System	Colorado River Tribes	Reservation	1,000	112							X		Secondary	125	1999
Parker WWTP	Colorado River Tribes	Parker	3,045	336							X		Secondary	NA	2000
Poston	Colorado River Tribes	Poston	600	67							X		Secondary	NA	2000
Poston BIA WWTF	Bureau of Indian Affairs	Poston	489	11	NA								Secondary	NA	2001
Poston CRHA	Colorado River Housing Authority	Poston	244	11	NA								Secondary	37	2001
Quartzsite WWTP	Quartzsite	Quartzsite	1,000	371							X		Adv.Trt. I	NA	2000
Thompson Enterprises	Private	RV Park	NA	29	NA										
Total			**11,758**	**2,106**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
SD: Sanitation District



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 7.6-10
Parker Basin
Cultural Water Demand

7.6.9 Water Adequacy Determinations in the Parker Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.6-10A. Designated water provider information is shown in Table 7.6-10B with date of application, date the designation was issued and projected or annual estimated demand. Figure 7.6-11 shows the general locations of subdivisions (to the section level) and designated providers keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in La Paz County. Twenty-eight water adequacy determinations have been made in this basin through December 2008. Of the 25 subdivisions for which lot information is available, 1,145 lots in 15 subdivisions, or 73% or lots, were determined to be adequate.
- The most common reason for a determination of inadequacy was because the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination.
- There are two designated providers, Town of Parker and Town of Quartzsite. The total projected or annual estimated demand for the Town of Quartzsite is 602 acre-feet. The Town of Parker does not have a projected or annual estimated demand.

Table 7.6-10 Adequacy Determinations in the Parker Basin[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	Brandy Hills West	Yuma	7 North	17 West	16	92	53-500357	Inadequate	C	2/21/1974	Dry Lot Subdivision
2	College Acres	Yuma	3 South	22 East	30	16	53-500481	Adequate		9/18/1974	Dry Lot Subdivision
3	Emerald Springs Unit I	La Paz	3 North	22 West	3, 10	53	53-300299	Adequate		5/7/1997	Ehrenberg Water Company
4	Highland Estates Amended	La Paz	10 North	19 West	27	17	53-500791	Inadequate	B	12/5/1994	Dry Lot Subdivision
5	La Paz Estates	Yuma	3 South	22 East	2	159	53-500859	Adequate		5/28/1976	La Paz Water Company
6	La Paz Estates #1	La Paz	3 North	22 West	2	23	53-500860	Adequate		5/9/1988	Ehrenberg Water Company
7	La Paz Valley Acres	La Paz	3 North	19 West	29	20	53-500861	Adequate		6/10/1984	Dry Lot Subdivision
8	Lake Moovalya Keys amended	La Paz	10 North	19 West	22	NA	53-500889	Inadequate		1/14/1992	Consolidated Water Utility
9	Miraleste Shores Estates	La Paz	10 North	19 West	15	46	53-500987	Inadequate	B	4/4/1994	Consolidated Water Utility
10	Moon Mountain Estates	La Paz	4 North	19 West	21	36	53-501009	Inadequate	A1	4/10/1980	Dry Lot Subdivision
11	Moon Mountain Estates #2	La Paz	4 North	19 West	21	24	53-501010	Inadequate	A1	6/24/1985	Dry Lot Subdivision
12	Mountain View Estates	La Paz	10 North	19 West	27	114	53-402249	Adequate		2/22/2007	Brooke Water Co.
13	Mountain View Resort	La Paz	4 North	19 West	21	54	53-300548	Inadequate	A1	10/15/1998	Town of Quartzsite
14	Mountain View Subdivision	La Paz	4 North	19 West	21	10	53-300549	Inadequate	A1	10/15/1998	Town of Quartzsite
15	Palo Fiero	La Paz	4 North	19 West	28	11	53-700435	Inadequate	A1	10/30/2007	Town of Quartzsite
16	Q Mountain Mobile Home & RV	La Paz	4 North	19 West	28	248	53-501232	Adequate		1/11/1991	Q Mountain Water Company
17	Rainbow Acres Unit 1, Phase 2	La Paz	3 North	19 West	7	63	53-300333	Adequate		9/22/1997	Q Mountain Water Company
18	Rainbow Acres Unit 3, Phase I	La Paz	3 North	19 West	7	123	53-400086	Adequate		8/2/1999	Q Mountain Water Company
19	Rainbow Acres Unit 3, Phase II	La Paz	3 North	19 West	7	137	53-400247	Adequate		5/8/2000	Q Mountain Water Company
20	Rainbow Acres Unit No. 2	La Paz	3 North	19 West	7	113	53-300429	Adequate		9/15/1998	Q Mountain Water Company
21	Rainbow Acres, Unit I, Phases 1,2	La Paz	3 North	19 West	7	63	53-501244	Adequate		3/29/1995	Q Mountain Water Company
22	Ranchero Estates #1,2	La Paz	11 North	18 West	27	NA	53-501248	Adequate		6/30/1976	Holiday Harbor Utilities Co.
23	Ranchero Estates Unit One at Holiday Harbour	La Paz	11 North	18 West	27	5	53-700342	Adequate		6/5/2007	Brooke Water LLC. - Holiday Harbour
24	Rivers Edge Estates Subdivision, Tract 0331	La Paz	10 North	19 West	11	8	53-700552	Adequate		9/5/2008	Marina Village
25	Riverview	La Paz	10 North	19 West	27	NA	53-501330	Inadequate	D	10/22/1974	Consolidated Water Utility
26	Sunrise Village	La Paz	4 North	19 West	21	32	53-700457	Inadequate	A1	12/31/2007	Town of Quartzsite
27	The Arroyos Quartzsite	La Paz	4 North	19 West	23	103	53-402067	Inadequate	A1	4/19/2006	Town of Quartzsite
28	Vinnedge	La Paz	4 North	19 West	16	5	53-501640	Inadequate	D	12/8/1975	Dry Lot Subdivision

Table 7.6-10 Adequacy Determinations in the Parker Basin (Cont)[1]

B. Designated Adequate Water Supply

Map Key	Provider Name	County	Designation No.	Projected or Annual Estimated Demand *(af/yr)*	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	Town of Parker	La Paz	40-900010.0000	No amount designated	NA	5/17/1973	No data, hydrologic study needed
b	Town of Quartzsite	La Paz	40-500041.0000	602	10/26/2006	3/14/2008	2012

Source: ADWR 2008a

Notes:

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

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

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

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

NA = Information not available to ADWR

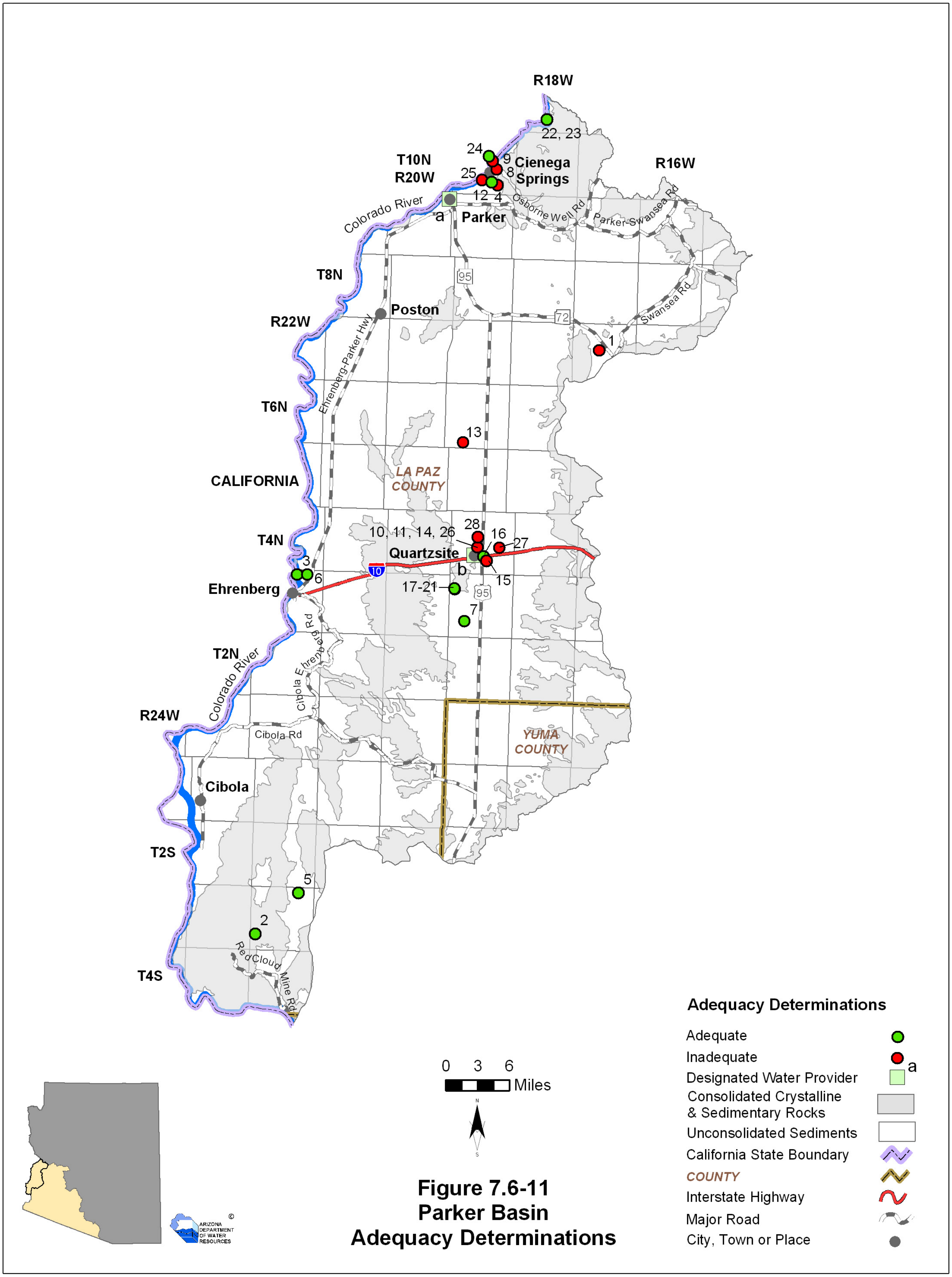


Figure 7.6-11
Parker Basin
Adequacy Determinations

Parker Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2005a, ADEQSWI: Data file, received September 2005. (Effluent Generation Table)

_____, 2005b, ADEQWWTP: Data file, received August 2005. (Effluent Generation Table)

_____, 2005c, Azurite: Data file, received September 2005. (Effluent Generation Table)

_____, 2005d, WWTP and permit files: Miscellaneous working files, received July 2005. (Effluent Generation Table)

_____, 2004, Water quality exceedences by watershed: Data file, received June 2004. (Water Quality Map and Table)

_____, 2004, Water quality exceedences for drinking water providers in Arizona: Data file, received September 2004. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2008c, Municipal surface water demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

_____, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005d, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Game and Fish Department (AZGF), 2005, Arizona Waterways: Data file, received April 2005. (Reservoirs and Stockponds Table)

_____, 1997, Remote Sensing Mapping of Arizona Intermittent Stream Riparian Areas: GIS cover.

_____, 1993, Arizona Riparian Inventory and Mapping Project: GIS cover.

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005b Streams: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html
_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.
Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.
Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

E

Environmental Protection Agency (EPA), 2005, Surf Your Watershed: Facility reports, accessed April 2005 at http://oaspub.epa.gov/enviro/ef_home2.water. (Effluent Generation Table)
_____, 2005, 2000 and 1996, Clean Watershed Needs Survey: datasets, accessed March 2005 at http://www.epa.gov/owm/mtb/cwns/index.htm. (Effluent Generation Table)

F

Freethey, G.W. and T.W. Anderson, 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.
_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.
_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.
_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.
_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.
_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Precipitation and temperature stations: Data file, accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Anning, D.W., 2002, Estimation and analysis of the uncertainty in stream flow and change in reservoir-content data at selected stream flow-gaging stations in the Lower Colorado River network, 1995-99: University of Arizona, M.S. thesis.

Benemelis, P., 2003, Lower Colorado River Multi Species Program: in Sustainability Issues of Arizona's Regional Watersheds: Proceedings from the 16th annual Arizona Hydrological Society Symposium, September 2003, Mesa, Arizona.

Bureau of Reclamation, 2000, Colorado River Interim Surplus Criteria: Final Environmental Impact Statement.

Clean Colorado River Alliance, 2006, Recommendations to Address Colorado River Water Quality.

Colorado River Basin Salinity Control Forum, 2005, Water Quality Standards for Salinity: Colorado River System.

Gonzalez, J.L., 1990, An evaluation of the d15N values of nitrate in ground water at Quartzsite, Arizona: University of Arizona, M.S. thesis, 20 p.

Hart, R., 1999, Water quality of the Colorado River monitored by the USGS national stream accounting network: in Water Issues and Partnerships for Rural Arizona: Proceedings from the 12th annual Arizona Hydrological Society Symposium, September 1999, White Mountains Arizona.

MacNish, R.D., 1992, Scientific challenges in managing the Colorado River: in Interdisciplinary Approaches to Hydrology and Hydrogeology: American Institute of Hydrology, October 1992, p.323-337.

Owen-Joyce, S.J., and Kimsey, S.L., 1996, An accounting system for water and consumptive use along the Colorado River, Hoover Dam to Mexico: USGS Water Supply Paper 2407, 94 p.

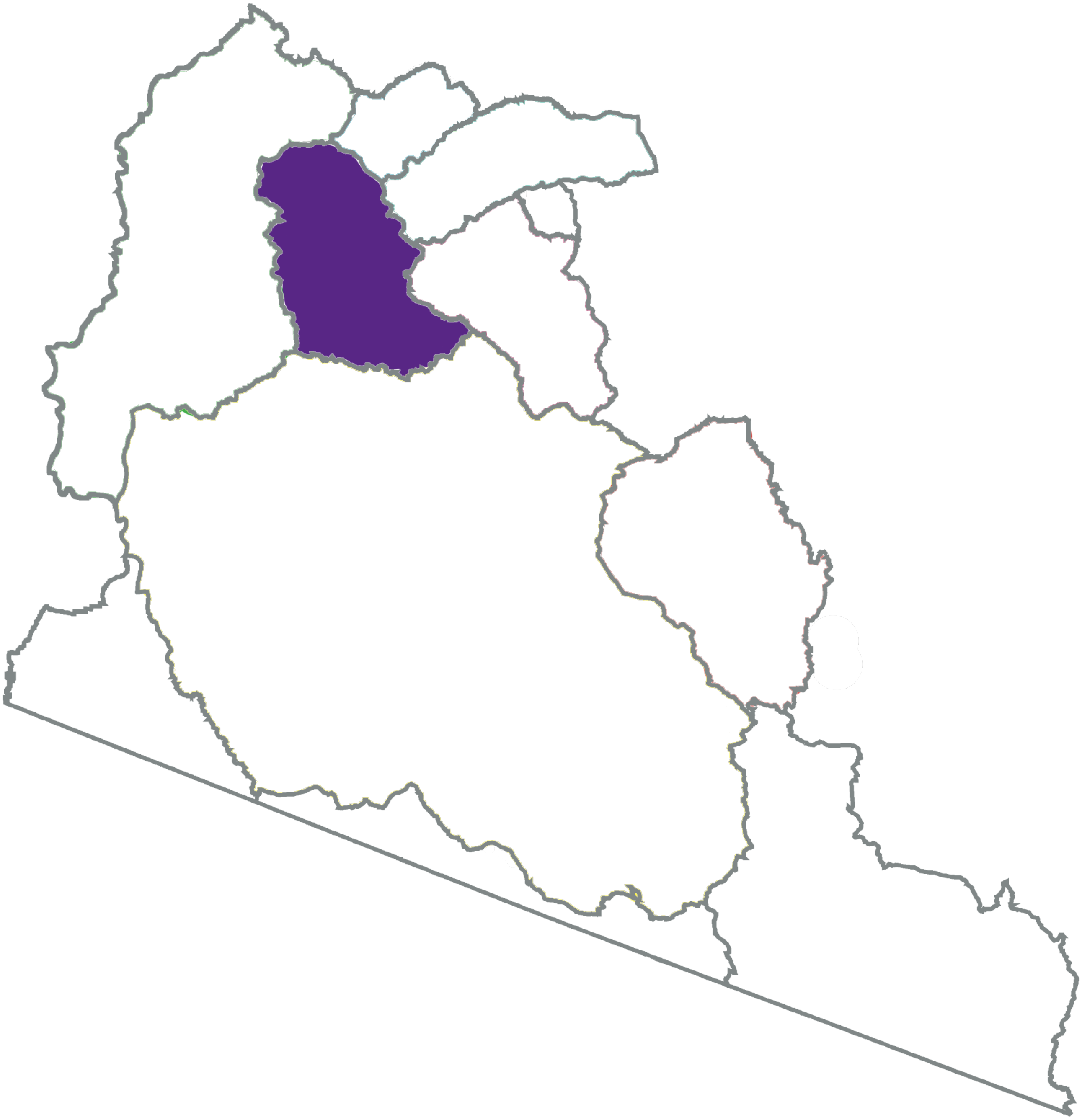
Radtke, D.B., 1990, Environmental contaminants in the lower Colorado River Valley, Arizona, California and Nevada: in Water Quality and Quantity Issues into the 1990's-Adaptations to Current Realities: Phoenix Arizona: Proceedings from the 2nd annual Arizona Hydrological Society symposium, September 1990, Casa Grande, Arizona, part R, p.1-21.

R.B. Williams and Associates, 1973, Water Report for La Paz Water Company, Ehrenberg, Arizona. Prepared for Arizona Department of Water Resources.

Robertson, F.N., 1991, Geochemistry of groundwater in alluvial basins of Arizona and adjacent parts of Nevada, New Mexico and California: USGS Professional Paper 1406-C, 87 p

Santec Consulting, 1999, Small and minor watercourses analysis for La Paz County, Arizona, Arizona State Land Department, Final Report.

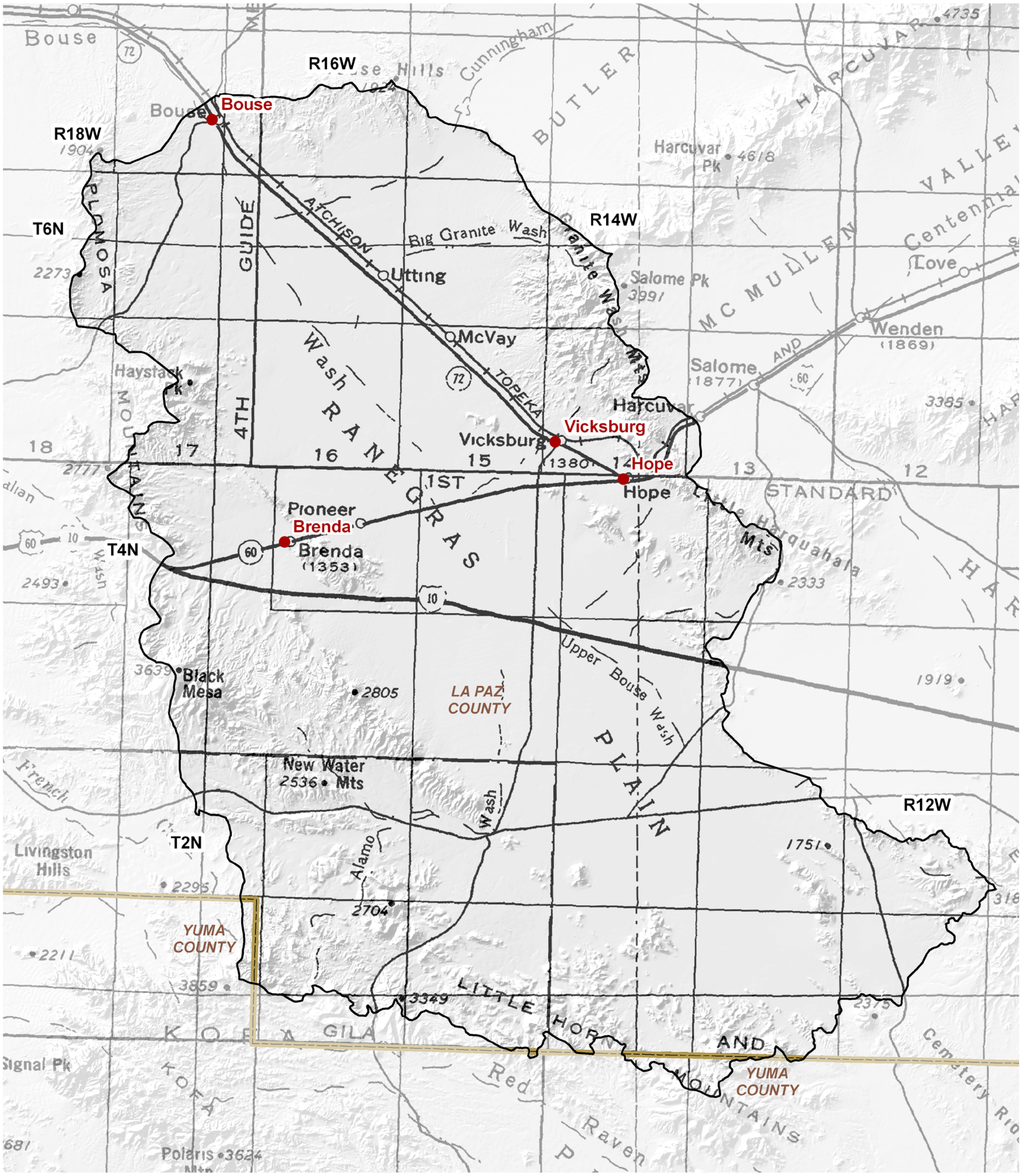
Section 7.7
Ranegras Plain Basin



7.7.1 Geography of the Ranegras Plain Basin

The Ranegras Plain Basin, located in the northern part of the planning area is 912 square miles in area. Geographic features and principal communities are shown on Figure 7.7-1. The basin is characterized by a plain bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.7-1 are:
  - Bouse Wash in the northern portion of the basin
  - Ranegras Plain in the center of the basin bordered by the Plomosa, New Water and Little Horn Mountains in the west and the Granite Wash and Little Harquahala Mountains in the east
  - The highest point in the basin at 2,805 feet in the New Water Mountains
  - The lowest point in the basin at 930 feet near the Town of Bouse.



0 3 6
Miles

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Base Map: USGS 1:500,000, 1981

Figure 7.7-1
Ranegras Plain Basin
Geographic Features

COUNTY
City, Town or Place

7.7.2 Land Ownership in the Ranegras Plain Basin

Land ownership, including the percentage of ownership by category, for the Ranegras Plain Basin is shown in Figure 7.7-2. The principal feature of land ownership in this basin is the large proportion of U.S. Bureau of Land Management land. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management (BLM)

- 66.3% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- This basin includes the 25,000 acre New Water Mountains Wilderness and 12,000 acres of the 100,000 acre Eagletail Mountains Wilderness. (See Figure 7.0-12)
- Land uses include grazing, resource conservation and recreation.

Wildlife Refuge

- 15.5% of the land is federally owned and managed by the U.S. Fish and Wildlife Service as the Kofa National Wildlife Refuge (NWR).
- Land uses include resource conservation, wildlife protection and recreation.

Private

- 11.1% of the land is private.
- Land uses include domestic, commercial and agriculture.

State Trust Land

- 7.1% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing and agriculture.

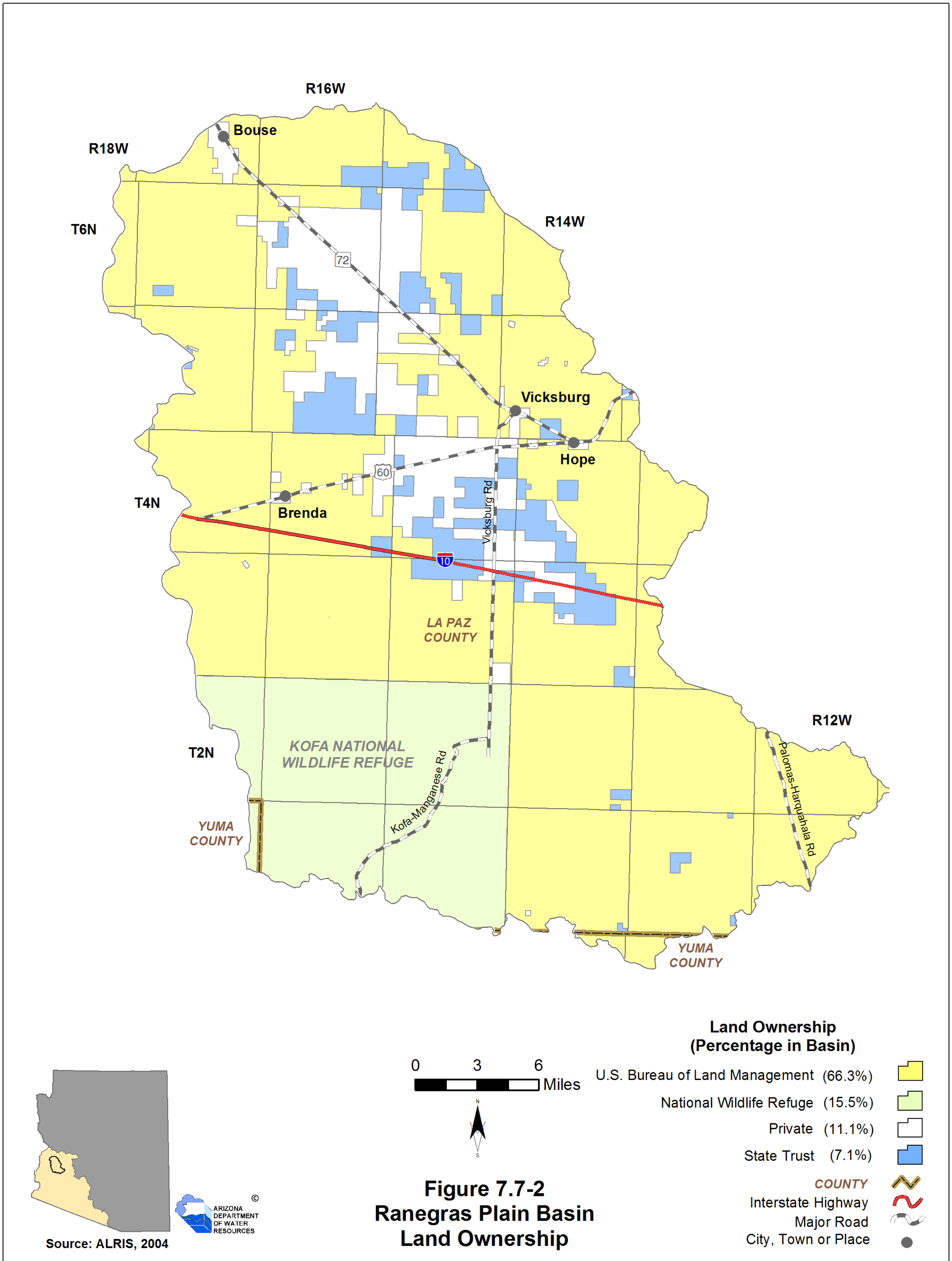


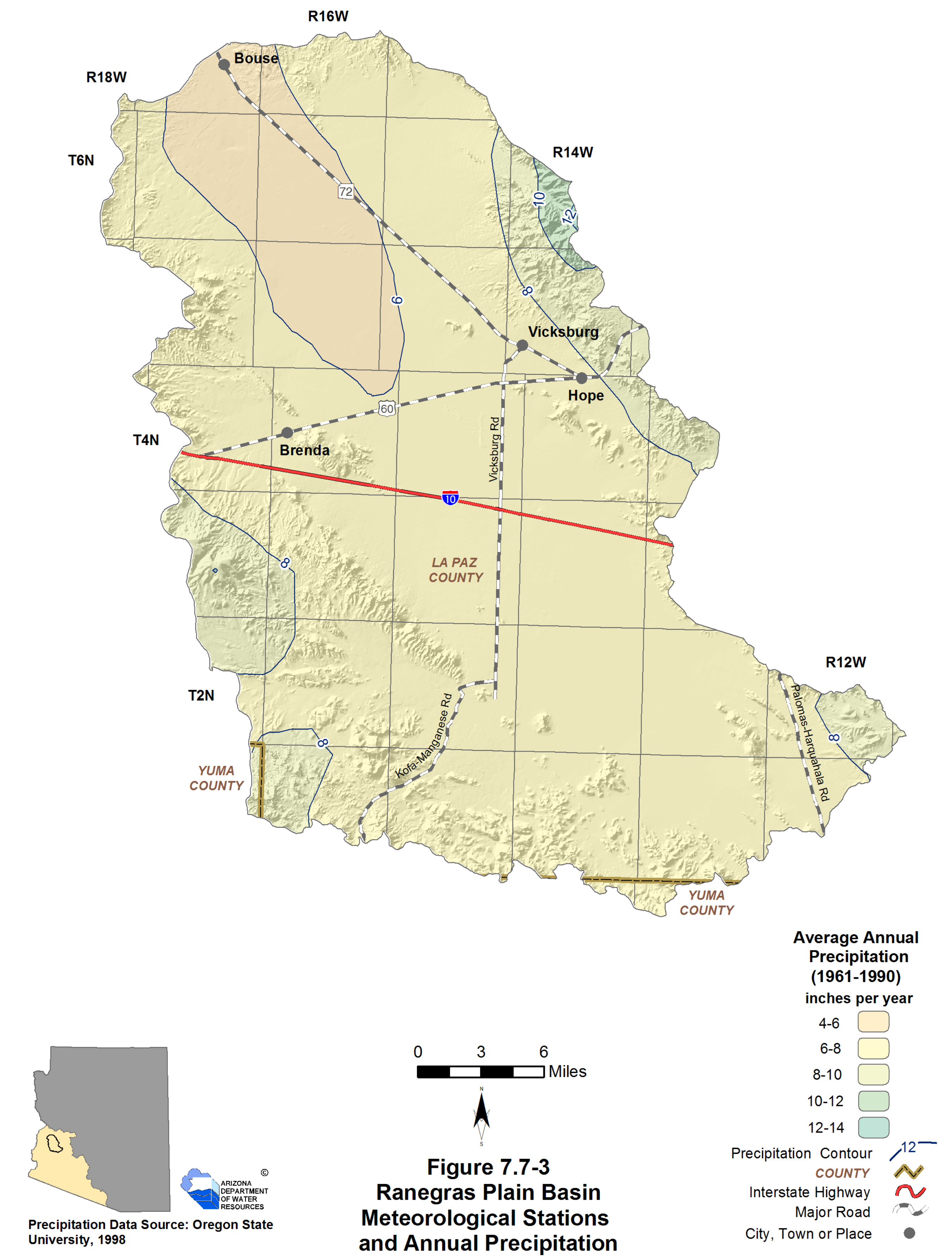
Figure 7.7-2
Ranegras Plain Basin
Land Ownership

7.7.3 Climate of the Ranegras Plain Basin

The Ranegras Plain Basin does not contain NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 7.7-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 7.0.3. A description of the climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 7.7-3
- Average annual rainfall is as high as 14 inches along the eastern basin boundary north of Vicksburg and as low as four inches in the north central portion of the basin.



Precipitation Data Source: Oregon State University, 1998

Figure 7.7-3
Ranegras Plain Basin
Meteorological Stations
and Annual Precipitation

7.7.4 Surface Water Conditions in the Ranegras Plain Basin

There are no streamflow data, flood ALERT equipment or USGS runoff contour data available for this basin. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.7-1. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Reservoirs and Stockponds

- Refer to Table 7.7-1.
- There are no large or small reservoirs and 16 registered stockponds in this basin.

Table 7.7-1 Reservoirs and Stockponds in the Ranegras Plain Basin

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

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

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

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

Source: Compilation of databases from ADWR & others

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

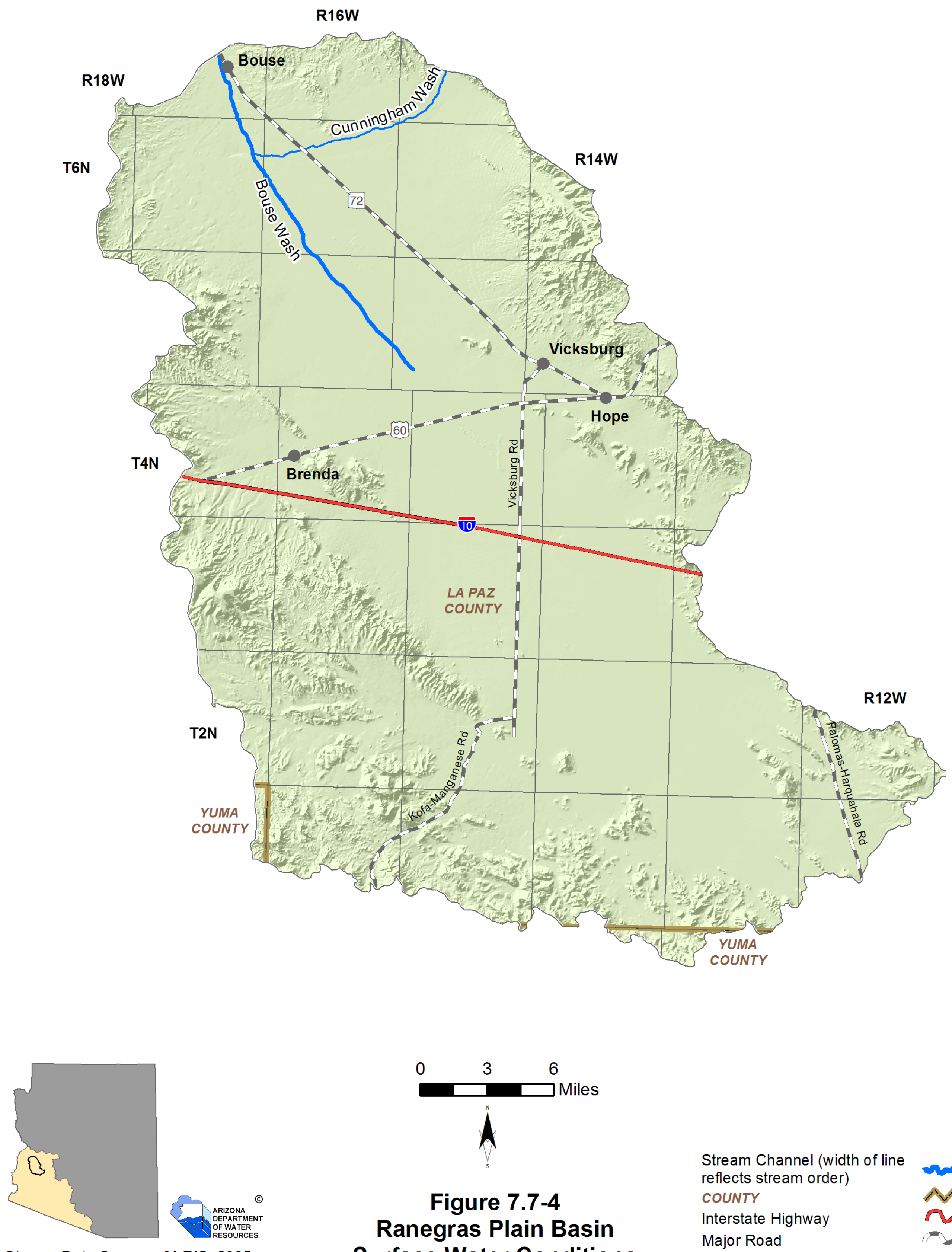
Total number: 0
Total maximum storage: 0 acre-feet

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

Total number: 0
Total surface area: 0 acres

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

Total number: 16



Stream Data Source: ALRIS, 2005b

Figure 7.7-4
Ranegras Plain Basin
Surface Water Conditions

7.7.5 Perennial/Intermittent Streams and Major Springs in the Ranegras Plain Basin

The total number of springs in the basin are shown in Table 7.7-2. There are no perennial or intermittent streams and no major or minor springs in the Ranegras Plain Basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- The total number of springs, regardless of discharge, identified by the USGS is two.

Table 7.7-2 Springs in the Ranegras Plain Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 2

7.7.6 Groundwater Conditions of the Ranegras Plain Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.7-3. Figure 7.7-5 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.7-6 contains hydrographs for selected wells shown on Figure 7.7-5. Figure 7.7-7 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.7-3 and Figure 7.7-5.
- The major aquifer is basin fill.
- Groundwater flow is generally from south to north, and to a cone of depression caused by irrigation pumping west of Hope.

Well Yields

- Refer to Table 7.7-3 and Figure 7.7-7.
- As shown on Figure 7.7-7, well yields in this basin are generally greater than 1,000 gallons per minute (gpm).
- One source of well yield information, based on 68 reported wells, indicates that the median well yield is 1,150 gpm.

Natural Recharge

- Refer to Table 7.7-3.
- Natural recharge estimates range from less than 1,000 acre-feet per year (AFA) to between 4,550 acre-feet and 6,050 AFA.
- The largest source of natural recharge is infiltration of runoff from the Bouse Wash and its tributaries (ADWR 1994b).

Water in Storage

- Refer to Table 7.7-3.
- Storage estimates for this basin range from 9.0 million acre-feet (maf) to 27 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.7-5. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 19 index wells in this basin. Hydrographs for six index wells are shown on Figure 7.7-6.
- The deepest water level shown on the map is 363 feet south of Vicksburg and the shallowest is 75 feet at Bouse.

Table 7.7-3 Groundwater Data for the Ranegras Plain Basin

Basin Area, in square miles:	912	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 812-3,310 Median 1,993.5 (14 wells measured)	Measured by ADWR (GWSI) and/or USGS
	Range 12-4,000 Median 1,150 (68 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 85-3,310	ADWR (1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	5,000	ADWR (1994b)
	5,500	ADWR (1990) (HMS 18)
	<1,000	Freethey and Anderson (1986)
	1,000	Arizona Water Commission (1975)
	4,550 - 6,050	Briggs (1969)
Estimated Water Currently in Storage, in acre-feet:	21,700,000 (to 1,200 ft)	ADWR (1994b)
	9,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	27,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
	15,400,000 - 22,200,000	Johnson (1990)
Current Number of Index Wells:	19	
Date of Last Water-level Sweep:	2004 (124 wells measured)	

[1]Predevelopment Estimate

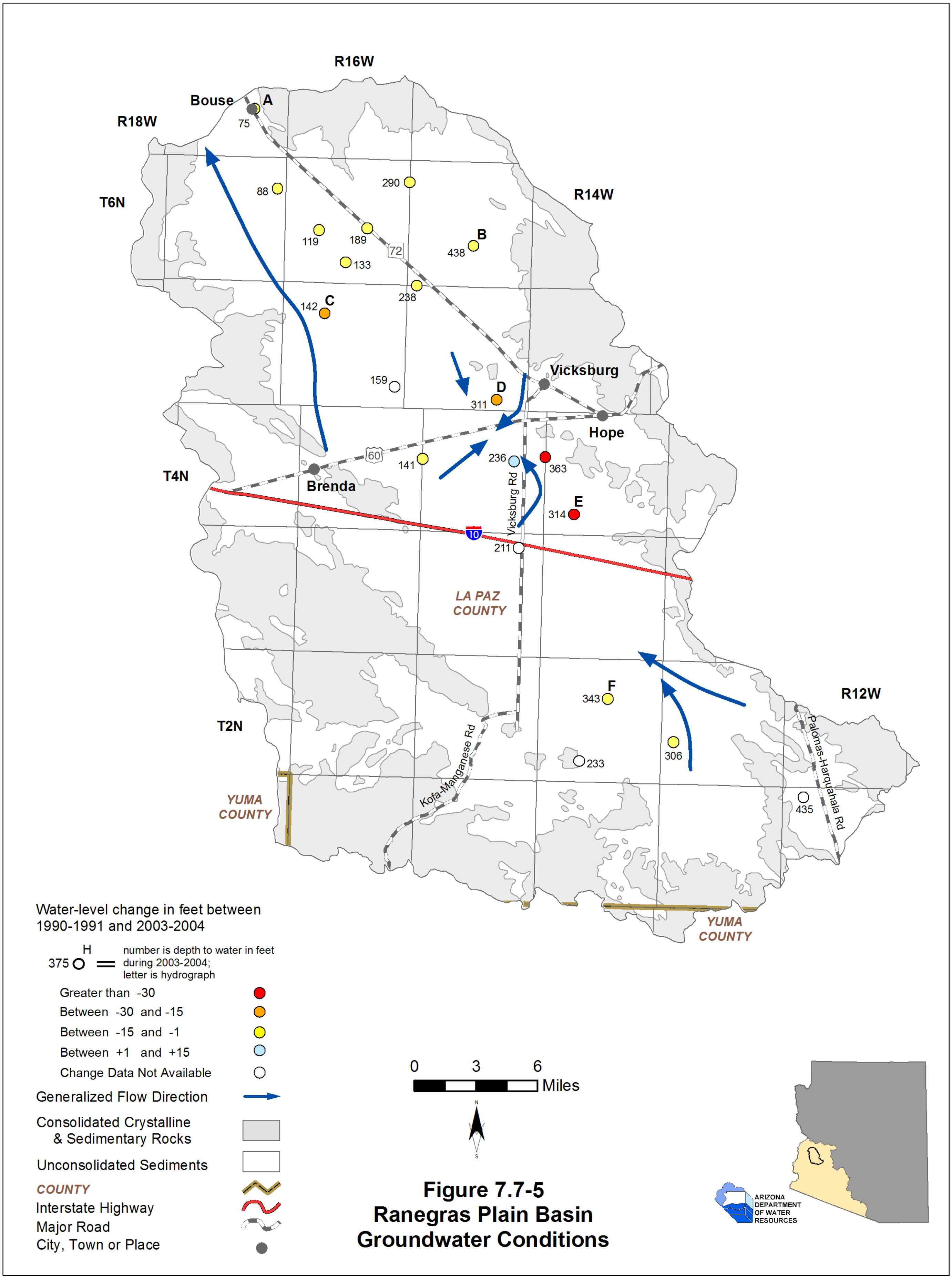


Figure 7.7-5
Ranegras Plain Basin
Groundwater Conditions

Figure 7.7-6
Ranegras Plain Basin
Hydrographs Showing Depth to Water in Selected Wells

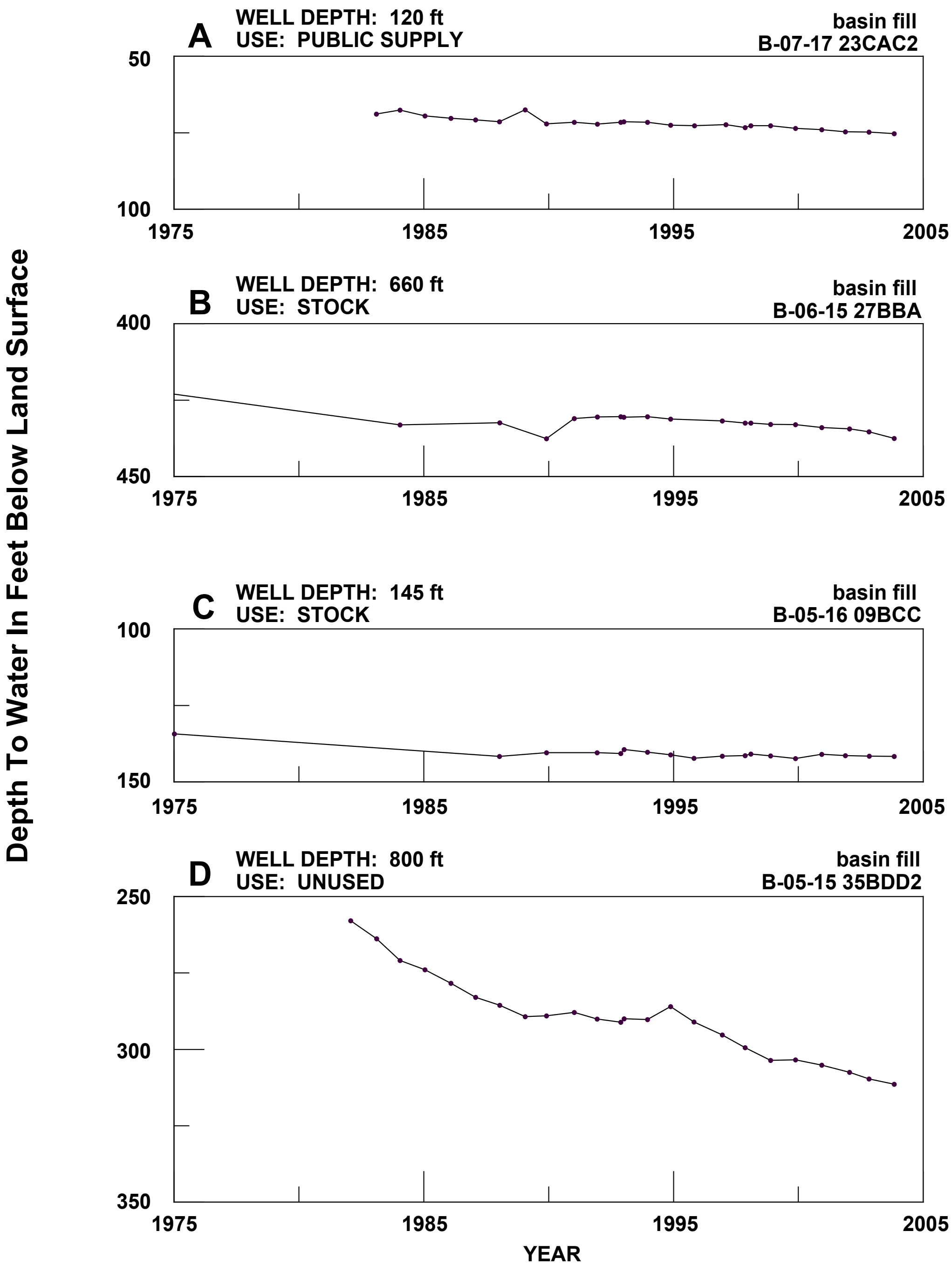
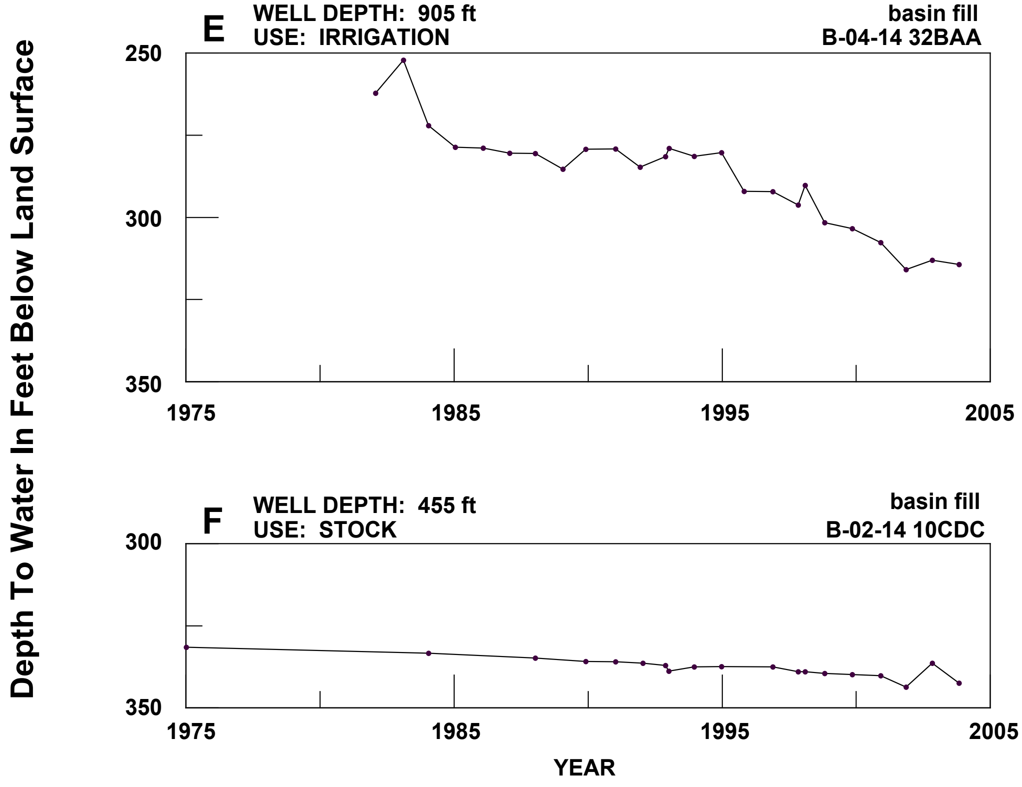


Figure 7.7-6 (cont'd)
Ranegras Plain Basin
Hydrographs Showing Depth to Water in Selected Wells



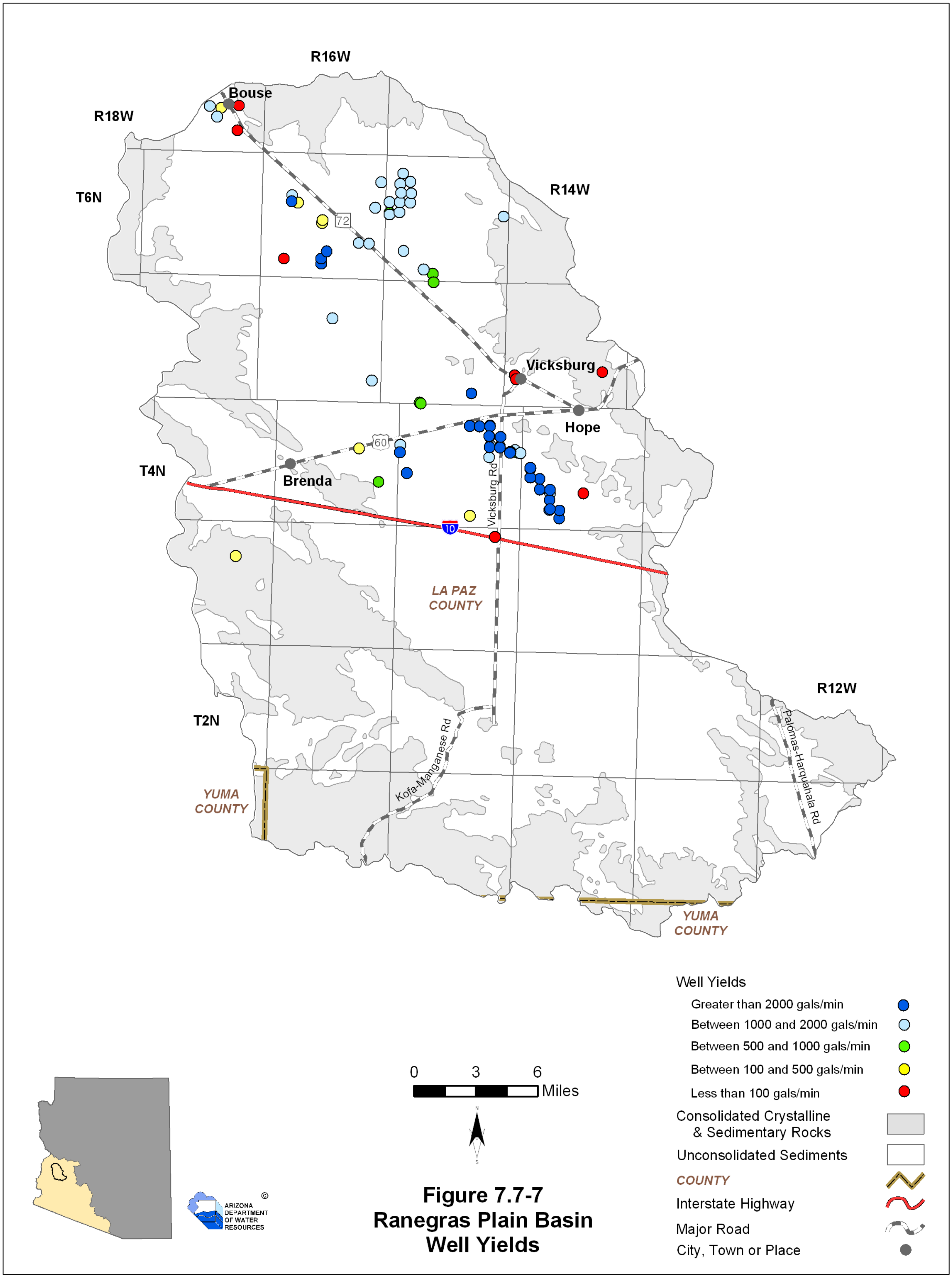


Figure 7.7-7
Ranegras Plain Basin
Well Yields

7.7.7 Water Quality of the Ranegras Plain Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.7-4A. There are no impaired lakes or streams in this basin. Figure 7.7-8 shows the location of water quality occurrences keyed to Table 7.7-4. A description of water quality data sources and methods is found in Volume 1, Appendix A. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

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

- Refer to Table 7.7-4A.
- Ninety-one wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The most frequently equaled or exceeded the parameter was fluoride. Other parameters equaled or exceeded include arsenic, barium, chromium, lead, nitrate and total dissolved solids.

Table 7.7-4 Water Quality Exceedences in the Ranegras Plain Basin[1]

A. Wells, Springs and Mines

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

Table 7.7-4 Water Quality Exceedences in the Ranegras Plain Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
59	Well	4 North	15 West	10	F
60	Well	4 North	15 West	10	F
61	Well	4 North	15 West	11	F
62	Well	4 North	15 West	11	As, Cr, F, NO3
63	Well	4 North	15 West	11	F
64	Well	4 North	15 West	13	As, Cr, F
65	Well	4 North	15 West	13	F
66	Well	4 North	15 West	13	As, F
67	Well	4 North	15 West	13	F
68	Well	4 North	15 West	14	As, F, NO3
69	Well	4 North	15 West	14	As, F, NO3, TDS
70	Well	4 North	15 West	14	As
71	Well	4 North	15 West	18	As
72	Well	4 North	15 West	18	As, F
73	Well	4 North	15 West	23	F
74	Well	4 North	15 West	28	As, NO3
75	Well	4 North	16 West	9	As, F
76	Well	4 North	16 West	13	As
77	Well	4 North	16 West	13	As, F
78	Well	4 North	16 West	13	As
79	Well	4 North	16 West	15	As, F
80	Well	4 North	16 West	18	As
81	Well	4 North	16 West	18	As
82	Well	4 North	16 West	19	As
83	Well	4 North	16 West	19	As
84	Well	3 North	14 West	11	F
85	Well	3 North	15 West	2	As, F, NO3
86	Well	3 North	15 West	2	As, F
87	Well	3 North	15 West	2	As, Cr, F
88	Well	3 North	15 West	23	As, F
89	Well	2 North	13 West	19	As
90	Well	2 North	14 West	10	As
91	Well	2 North	14 West	28	NO3

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.

[2] As = Arsenic
Ba = Barium
Cr = Chromium
F = Fluoride
Pb = Lead
NO3 = Nitrate
TDS = Total Dissolved Solids

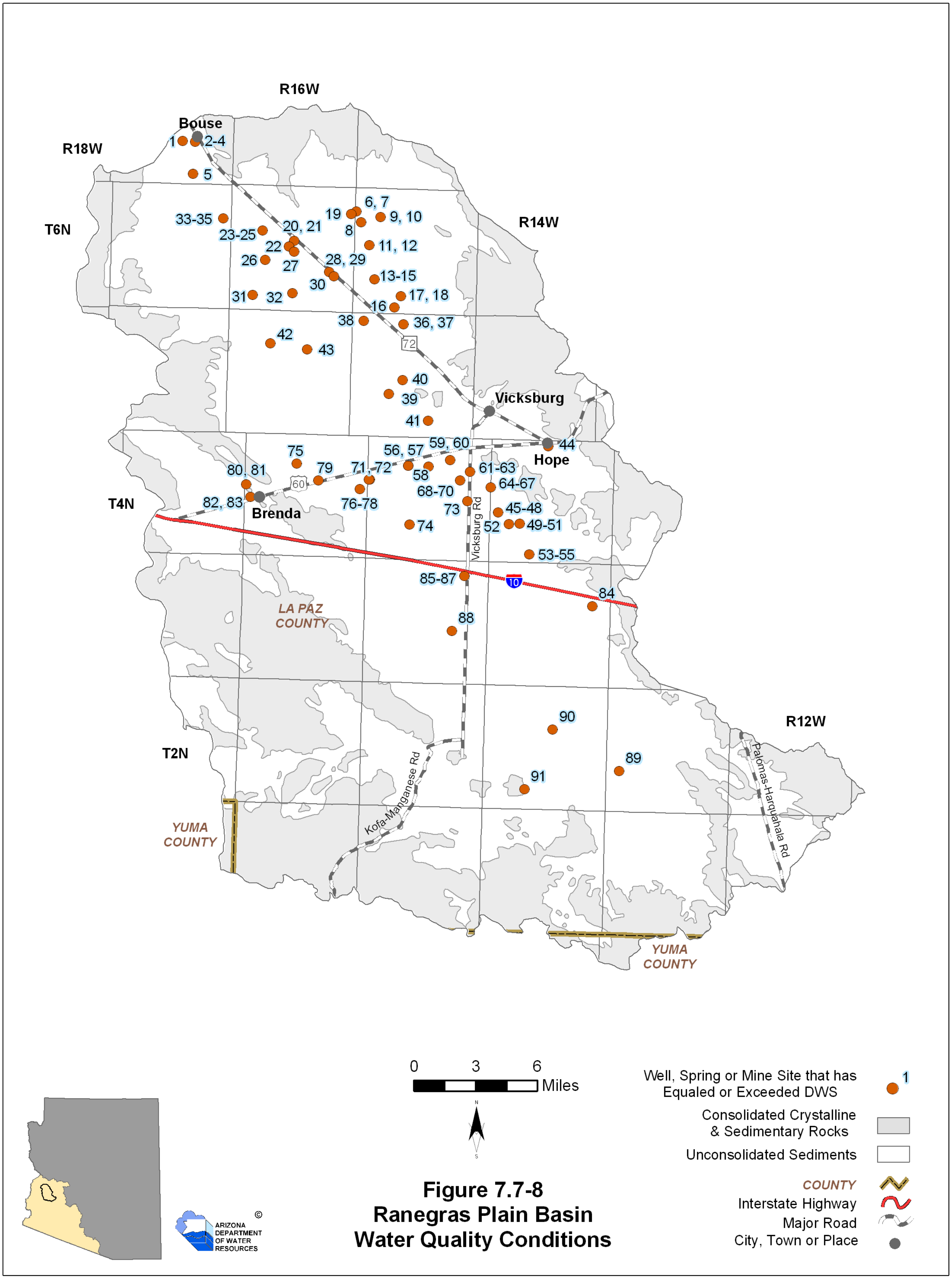


Figure 7.7-8
Ranegras Plain Basin
Water Quality Conditions

7.7.8 Cultural Water Demands in the Ranegras Plain 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 7.7-5. Figure 7.7-9 shows the location of demand centers. There is no recorded effluent generation in this basin. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

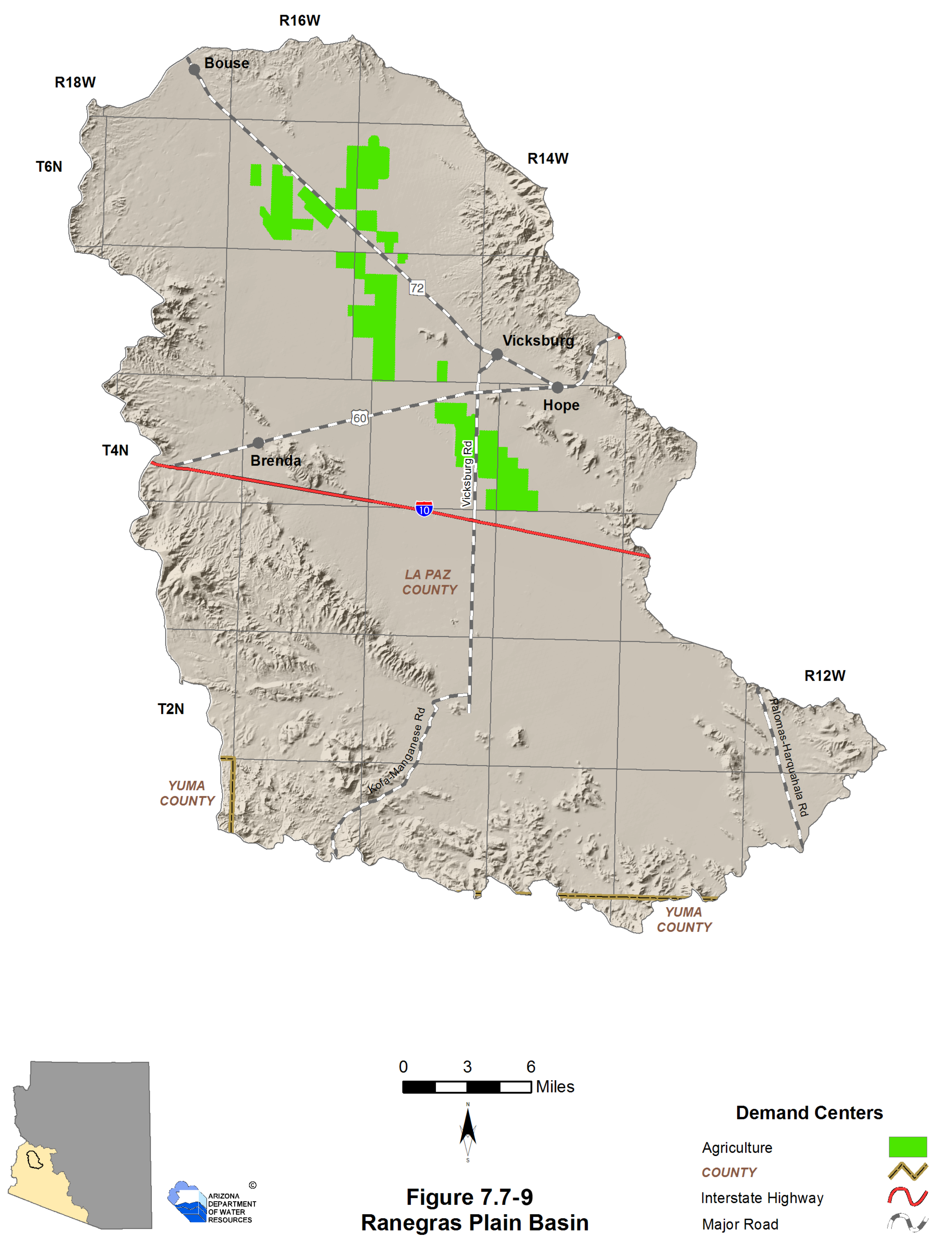
Cultural Water Demands

- Refer to Table 7.7-5 and Figure 7.7-9.
- Population in this basin declined from 1,024 in 1980 to 581 in 1990 but is slowly increasing. The 2000 basin population was 905.
- There are no reported surface water diversions in this basin.
- Most cultural water use is for irrigation in the northern half of the basin.
- Groundwater use for agriculture decreased from 1991 to 2005 with 28,800 AFA on average between 2001 and 2005.
- Municipal groundwater demand is relatively small and increased from less than 300 AFA in 1991-1995 to 400 AFA in 2001-2005.
- There was no reported industrial groundwater demand from 1991 to 2005. Another dairy began operating in December 2006.
- As of 2005 there were 522 registered wells with a pumping capacity of less than or equal to 35 gpm and 138 wells with a pumping capacity of more than 35 gpm.

Table 7.7-5 Cultural Water Demand in the Ranegras Plain Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971		155[2]	91[2]	18,000			NR			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				11,000			NR			
1977										
1978										
1979										
1980	1,024									
1981	980	43	17	35,000			NR			
1982	935									
1983	891									
1984	847									
1985	802									
1986	758	61	12	31,000			NR			
1987	714									
1988	669									
1989	625									
1990	581									
1991	613	62	3	<300	NR	29,500	NR			USGS (2007)
1992	646									
1993	678									
1994	710									
1995	743									
1996	775	96	5	300	NR	32,000	NR			
1997	808									
1998	840									
1999	873									
2000	905									
2001	920	105	10	400	NR	28,800	NR			
2002	934									
2003	949									
2004	963									
2005	978									
2010	1,050									
2020	1,128									
2030	1,198									
WELL TOTALS:		**522**	**138**							

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



Primary Data Source: USGS National Gap Analysis Program, 2004

Figure 7.7-9
Ranegras Plain Basin
Cultural Water Demand

7.7.9 Water Adequacy Determinations in the Ranegras Plain Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.7-6. Figure 7.7-10 shows the general locations of subdivisions (to the section level) keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in La Paz County. Eight water adequacy determinations for 280 lots have been made in this basin through December 2008. Twenty-six lots in one subdivision, or 9% or lots, were determined to be adequate.
- The most common reason for a determination of inadequacy is water quality.

Table 7.7-6 Adequacy Determinations in the Ranegras Plain 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	Bucksaw	La Paz	6 North	16 West	17	54	53-700293	Inadequate	A1,C	4/9/2007	Dry Lot Subdivision
2	Desert Rose Acres (Tract No. 0135)	La Paz	6 North	16 West	22	64	53-400809	Inadequate	C	10/22/2002	Dry Lot Subdivision
3	Desert Shadows	La Paz	4 North	16 West	19	26	53-500579	Adequate		1/10/1994	Desert Shadows Water District
4	Eden Park Phase 3	La Paz	4 North	15 West	1	67	53-700557	Inadequate	A1	8/20/2008	Eden Park HOA
5	Eden Park RV Subdivision	La Paz	4 North	15 West	1	16	53-400701	Inadequate	D	5/8/2002	Eden Park HOA
6	Eden Park RV Subdivision Phase 2	La Paz	4 North	15 West	1	12	53-700294	Inadequate	A1	4/12/2007	Eden Park HOA
7	Faybol Subdivision	La Paz	6 North	16 West	34	29	53-300247	Inadequate	A1,C	1/28/1997	Dry Lot Subdivision
8	Sunnyside, Unit 1	La Paz	7 North	17 West	35	12	53-402075	Inadequate	A1	7/26/2006	Undetermined Provider

Source: ADWR 2008a

Notes:

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

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

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

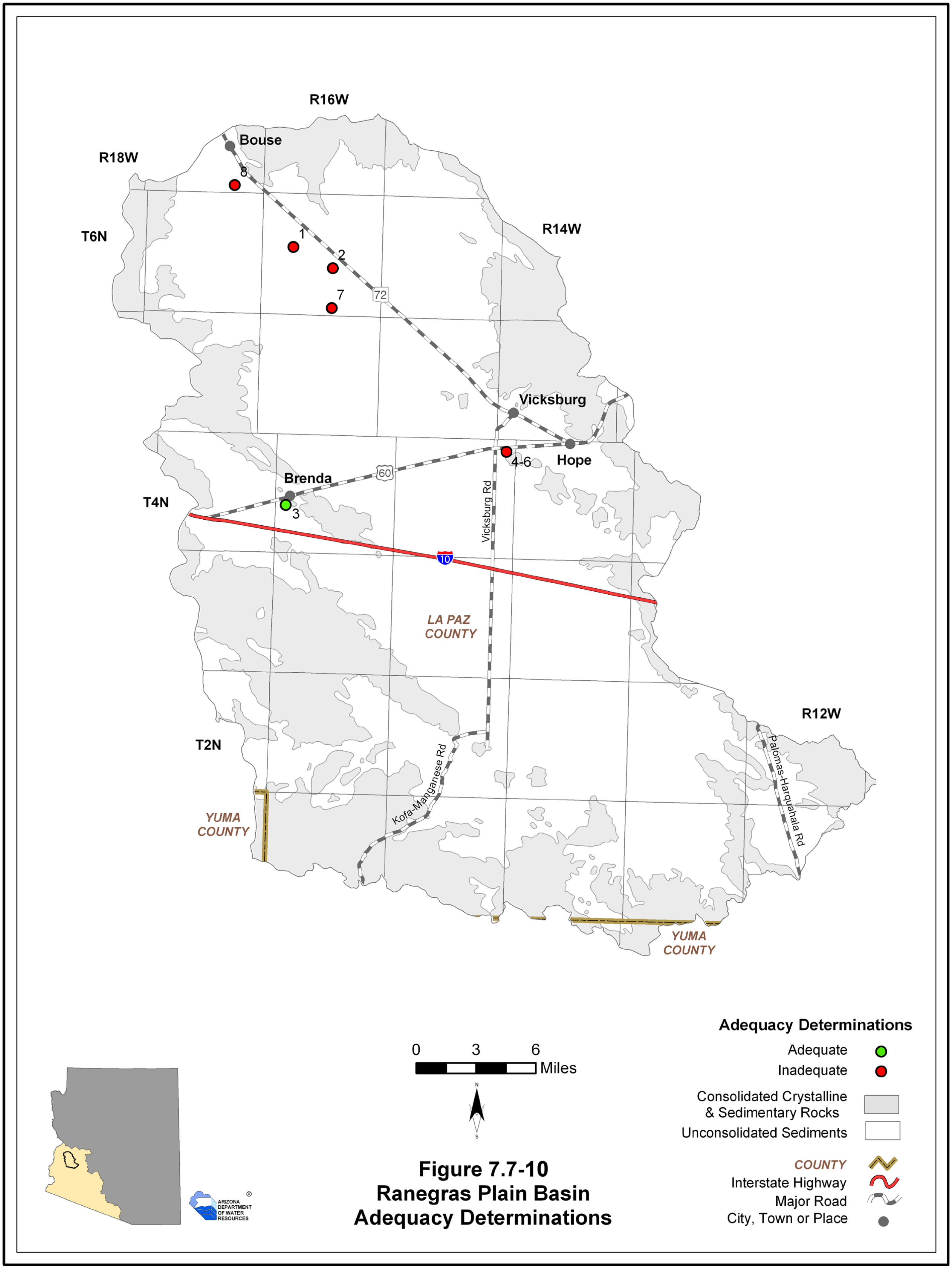


Figure 7.7-10
Ranegras Plain Basin
Adequacy Determinations

Ranegras Plain Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2004, Water quality exceedences for drinking water providers in Arizona: Data file, received September 2004. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

_____, 2005a, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005b, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Land Resource Information System (ALRIS), 2005, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005b Streams: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html

_____, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

F

Freethey, G.W. and Anderson, T.W. 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

J

Johnson, B.J., 1990, Maps showing groundwater conditions in the Ranegras Plain Basin: La Paz and Yuma Counties, Arizona: Arizona Department of Water Resources Hydrologic Map Series #18.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

______, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

______, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

______, 2004, Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu/swgap.

______, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Associated Engineers, Inc., 1975, Water Production Report, Caballo Farms, Yuma County, Arizona. Prepared for Arizona Department of Water Resources.

Gregor Engineering, Inc., 2002, Hydrology Study for Arizona Department of Water Resources Application for a Water Adequacy Report for Desert Rose Acres, Tract 0135, La Paz County, Arizona. Prepared for Arizona Department of Water Resources.

Robertson, F.N., 1991, Geochemistry of groundwater in alluvial basins of Arizona, and adjacent parts of Nevada, New Mexico and California: USGS Professional Paper 1406-C.

Santec Consulting, 1999, Small and minor watercourses analysis for La Paz County, Arizona, Arizona State Land Department, Final Report.

Section 7.8
San Simon Wash Basin

7.8.1 Geography of the San Simon Wash Basin

The San Simon Wash Basin, located in the southeastern part of the planning area is 2,284 square miles in area. Geographic features and principal communities are shown on Figure 7.8-1. The basin is characterized by plains and valleys bordered by mountain ranges including the highest elevation mountain range in the planning area. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub, semi-desert grassland and madrean evergreen woodland along the eastern basin boundary. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.8-1 are:
    - San Simon Wash running north-south through the center of the basin
    - Valleys and plains including the Quijotoa Valley in the northern portion of the basin, the Gu Oidak Valley in the center of the basin and the Baboquivari Valley in the southeastern portion of the basin
    - Mountain ranges including the Ajo Range on the southwestern basin boundary and the Baboquivari Mountains on the southeastern basin boundary
    - The highest point in the basin at 7,730 feet in the Baboquivari Mountains
    - The lowest point at about 1,650 feet where San Simon Wash enters Mexico.

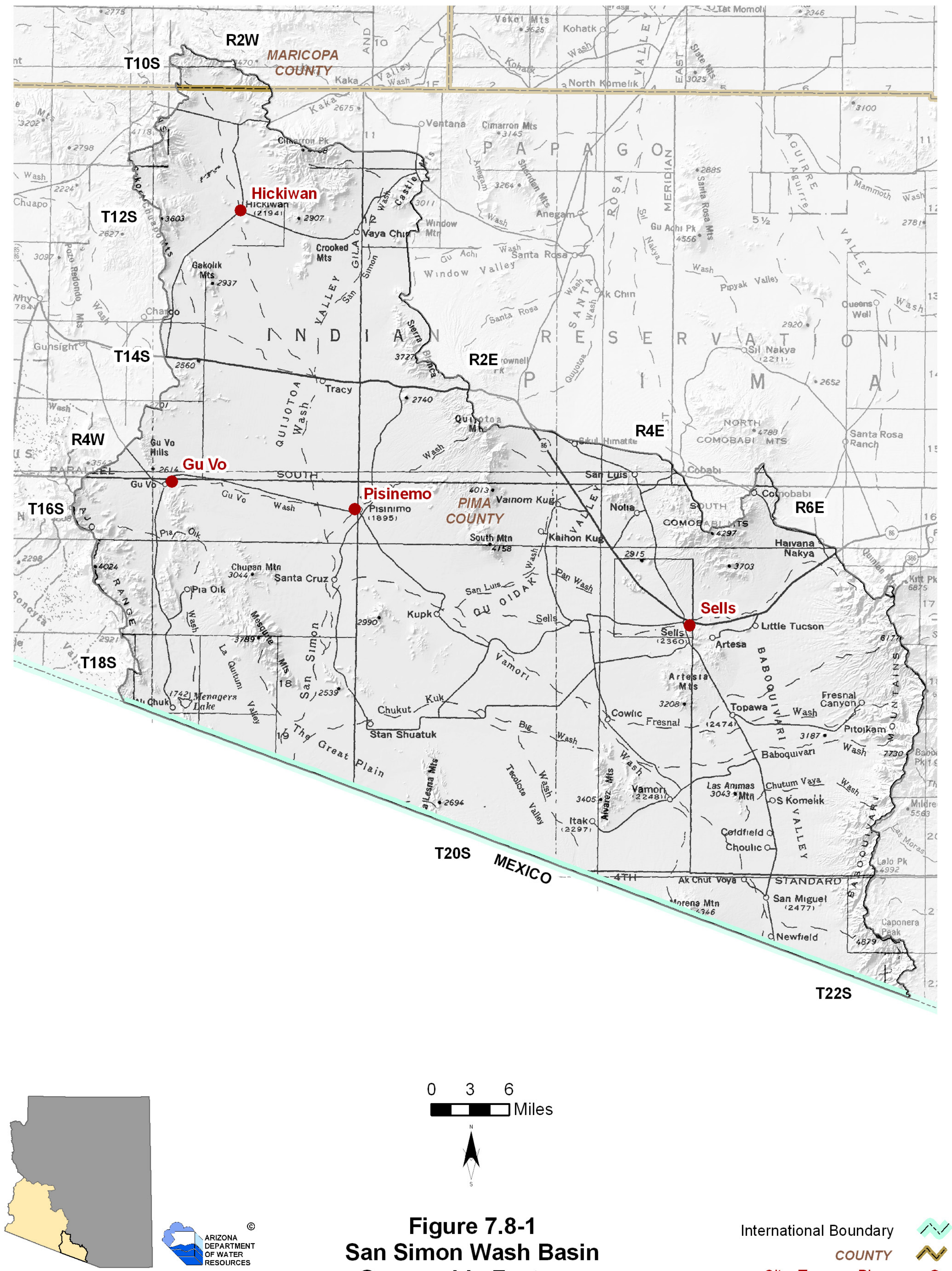


Figure 7.8-1
San Simon Wash Basin
Geographic Features

7.8.2 Land Ownership in the San Simon Wash Basin

Land ownership, including the percentage of ownership by category, for the San Simon Wash Basin is shown in Figure 7.8-2. The principal feature of land ownership in this basin is the large proportion of tribal lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

Indian Reservation

- 99.2% under tribal ownership as the Tohono O'odham Indian Reservation.
- Land uses include domestic, commercial, grazing and farming.

Private

- 0.3% of the land is private.
- Small parcels of private land are found in the southern portion of the basin and in the vicinity of Sells.
- Land uses include domestic, commercial and grazing.

U.S. Bureau of Land Management

- 0.2% of the land is federally owned and managed by the Lower Sonoran Field Office of the U.S. Bureau of Land Management.
- Primary land use is grazing.

State Trust Land

- 0.2% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing.

National Park Service (NPS)

- 0.1% of the land is federally owned and managed by the National Park Service as the Organ Pipe Cactus National Monument.
- Land uses include resource conservation and recreation.

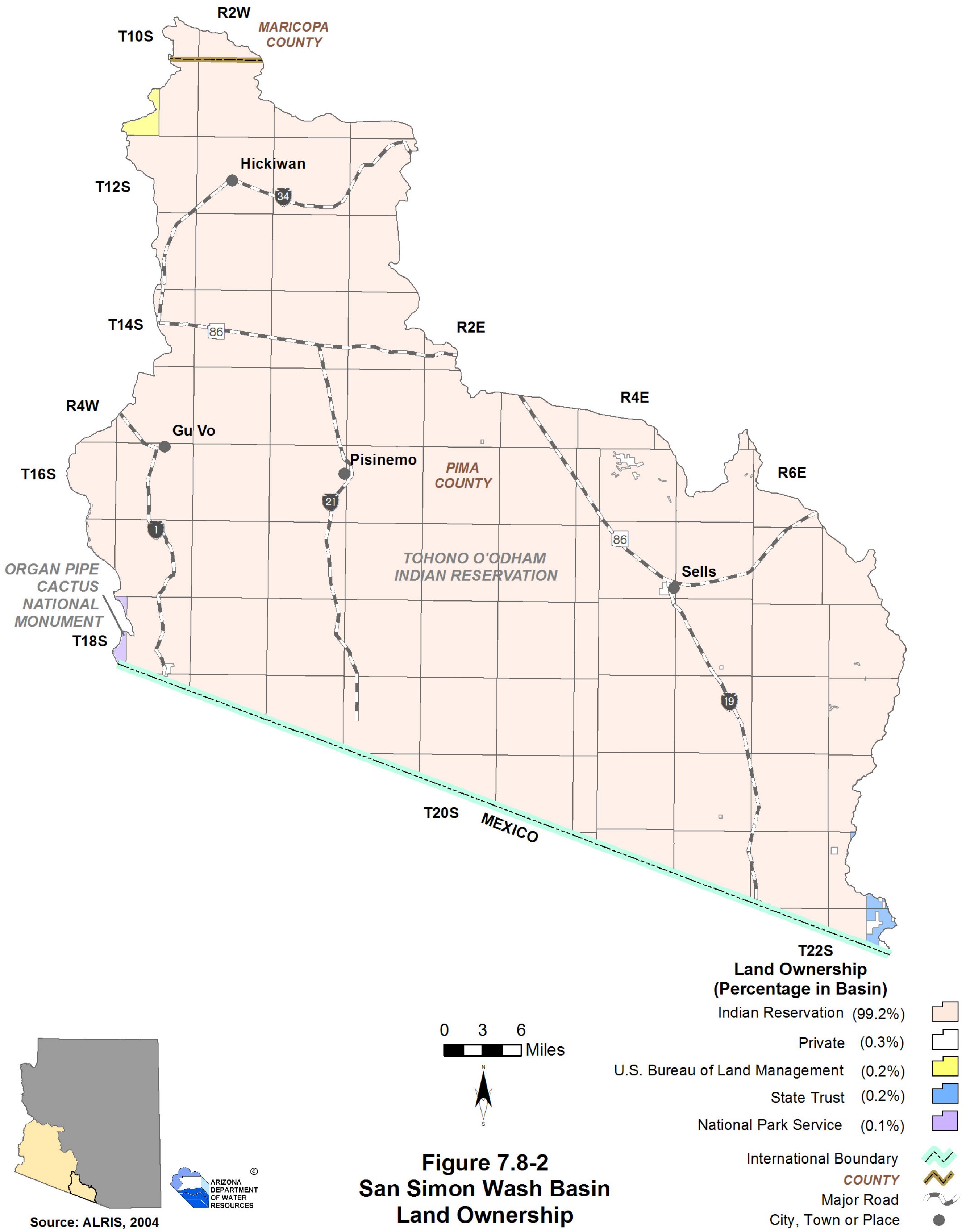


Figure 7.8-2
San Simon Wash Basin
Land Ownership

7.8.3 Climate of the San Simon Wash Basin

Climate data from NOAA/NWS Co-op Network stations are complied in Table 7.8-1 and the locations are shown on Figure 7.8-3. Figure 7.8-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The San Simon Wash Basin does not contain Evaporation Pan, AZMET or SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.8-1A
- There is one NOAA/NWS Co-op Network station in the basin, Sells, with an average high of 86.4°F and an average low of 51.2°F.
- Highest average seasonal rainfall, 6.66 inches, occurs in the summer season (July-September) when 55% of the annual average precipitation occurs.

SCAS Precipitation Data

- See Figure 7.8-3
- Additional precipitation data shows average annual rainfall as high as 32 inches along the eastern basin boundary in the Baboquivari Mountains and as low as eight inches along the border with Mexico and west and south of Hickiwan.

Table 7.8-1 Climate Data for the San Simon 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 Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Sells	2380	1948 - 2004[1]	86.4/Jul	51.2/Jan	1.46	0.65	6.66	3.31	12.07

Source: WRCC, 2005

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

B. Evaporation Pan:

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

C. AZMET:

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

D. SNOTEL/Snowcourse:

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

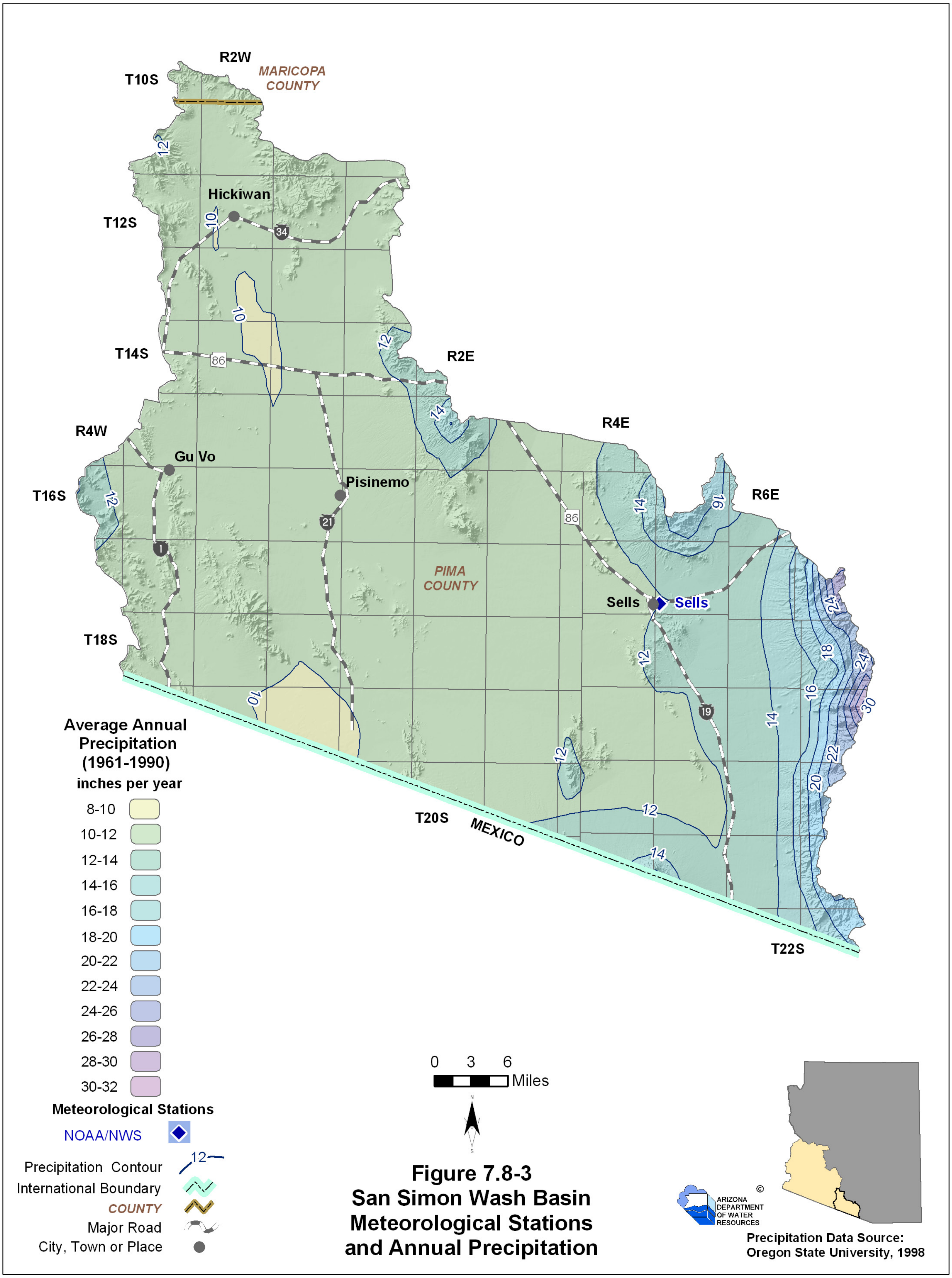


Figure 7.8-3
San Simon Wash Basin Meteorological Stations and Annual Precipitation

7.8.4 Surface Water Conditions in the San Simon Wash Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.8-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.8-3. The location of streamflow gages identified by USGS number, USGS runoff contours and large reservoirs are shown on Figure 7.8-4. There are no flood ALERT stations in this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 7.8-2.
- Data from three stations located at two watercourses are shown in the table and on Figure 7.8-4. One station has been discontinued.
- Average seasonal flow at all three stations is highest in the summer season (July-September). All three stations report zero average seasonal flow in the spring season (April-June).
- The largest annual flow recorded in the basin is 39,684 acre-feet in 1983 at the Vamori Wash at Kom Vo station.

Reservoirs and Stockponds

- Refer to Table 7.8-3.
- The basin contains one large reservoir, Menegers Lake, with a maximum storage of 15,000 acre-feet. This reservoir is used for irrigation.
- Surface water is stored or could be stored in 12 small reservoirs.
- There are three registered stockponds in this basin.

Runoff Contour

- Refer to Figure 7.8-4.
- Average annual runoff is highest, 0.5 inches per year or 26.65 acre-feet per square mile, in the eastern portion of the basin around Sells and decreases to 0.1 inches, or 5.33 acre-feet per square mile, in the southwest corner of the basin.

Table 7.8-2 Streamflow Data for the San Simon Wash Basin

Station Number	USGS Station Name	Drainage Area (in mi^2)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9535100	San Simon Wash near Pisinimo	569	1,830	2/1972-current	12	0	70	17	94 (1980)	1,340	2,372	11,007 (1976)	30
9535295	Vamori Wash at International Boundary near Sells	NA	NA	7/1995-4/2001 (discontinued)	10	0	72	17	4,452 (1996)	8,905	8,274	11,801 (1998)	5
9535300	Vamori Wash at Kom Vo	1,250	1,770	2/1972-current	11	0	57	32	941 (1973)	4,334	6,625	39,684 (1983)	28

Source: USGS (NWIS) 2005 & 2008

Notes:
NA = Not available
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Annual Flow/Year statistics were only completed for those gages that had at least 3 years of 12 month records
Summation of Average Annual Flows may not equal 100 due to rounding
Period of record may not equal Year of Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retrieved in 2005

Table 7.8-3 Reservoirs and Stockponds in the San Simon 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[1]	JURISDICTION
1	Menegers Lake	Tohono O'odham	15,000	I	Tribal

Source: US Army Corps of Engineers 2005

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

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

Source: Compilation of databases from ADWR & others

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

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

D. Other Small Reservoirs (between 5 and 50 acres surface area)[2]

Total number: 12
Total surface area: 144 acres

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

Total number: 3

Notes:
[1]I = Irrigation
[2]Capacity data not available to ADWR

Figure 7.8-4
San Simon Wash Basin
Surface Water Conditions

7.8.5 Perennial/Intermittent Streams and Major Springs in the San Simon Wash Basin

The total number of springs in the basin are shown in Table 7.8-4. There are no perennial or intermittent streams and no major or minor springs in the San Simon Wash Basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- The total number of springs, regardless of discharge, identified by the USGS varies from 11 to 17, depending on the database reference.

Table 7.8-4 Springs in the San Simon Wash Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 11 to 17

7.8.6 Groundwater Conditions of the San Simon Wash Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.8-5. Figure 7.8-5 shows aquifer flow direction, data on water-level change between 1990-1991 and 2003-2004 was not available for this basin. Figure 7.8-6 shows well yields in two yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers
- Refer to Table 7.8-5 and Figure 7.8-5
- The major aquifer in this basin is basin fill.
- Groundwater flow is generally from east and north to south.

Well Yields
- Refer to Table 7.8-5 and Figure 7.8-6
- Well yield data are only available for two wells located in the vicinity of the international boundary.

Natural Recharge
- Refer to Table 7.8-5
- The natural recharge estimate is 11,000 acre-feet per year (AFA).

Water in Storage
- Refer to Table 7.8-5
- Storage estimates range from 6.7 million acre-feet (maf) to 45 maf to a depth of 1,200 feet.

Table 7.8-5 Groundwater Data for the San Simon Wash Basin

Basin Area, in square miles:	2,284	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	2,000 (1 well measured)	Measured by ADWR (GWSI) and/or USGS
	34 (1 well reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 50-3,000	ADWR (1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	11,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	6,700,000 (to 1,200 ft)	ADWR (1990)
	21,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	45,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	0	
Date of Last Water-level Sweep:	1979 (148 wells measured)	

[1]Predevelopment Estimate

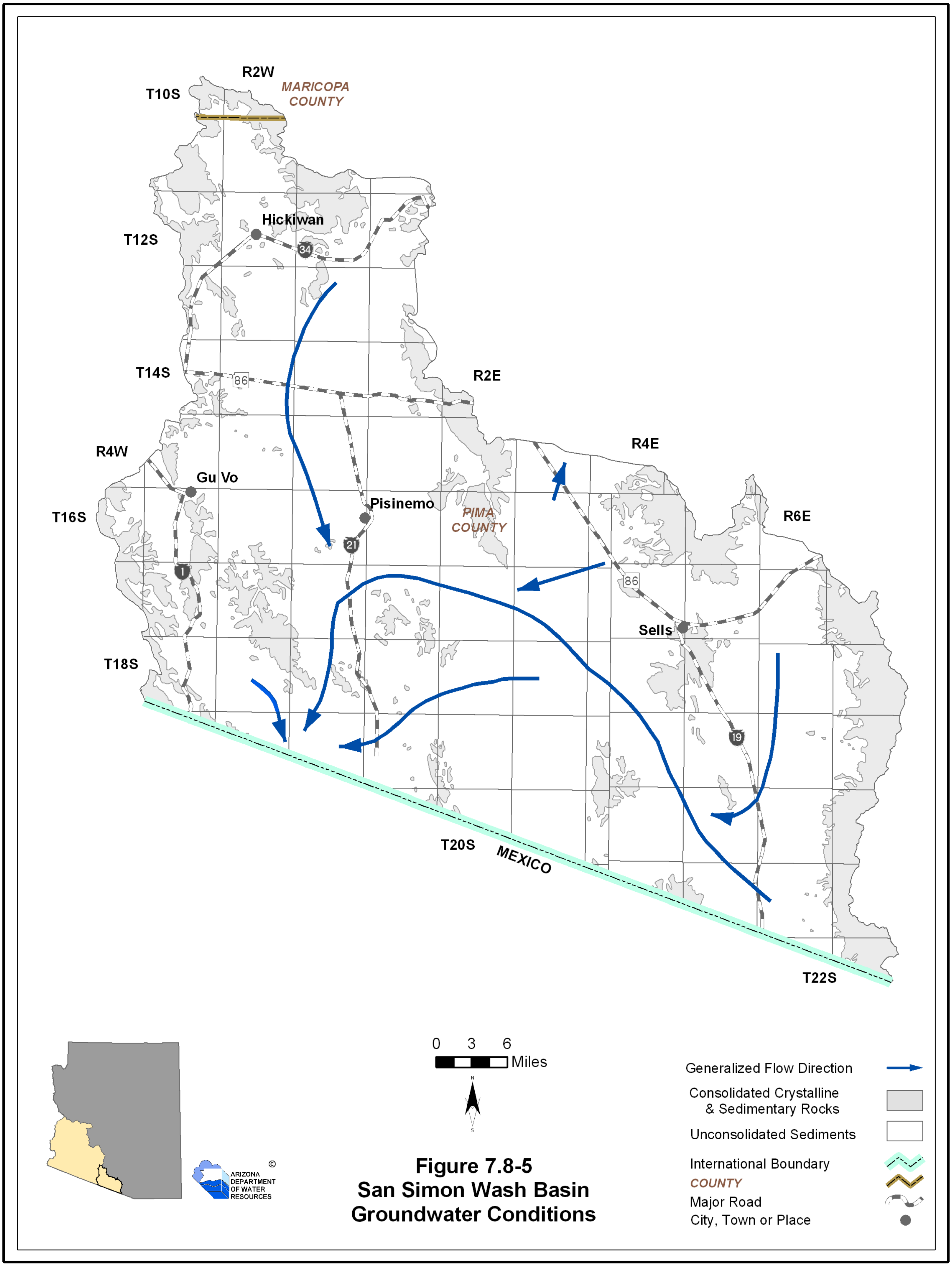


Figure 7.8-5
San Simon Wash Basin
Groundwater Conditions

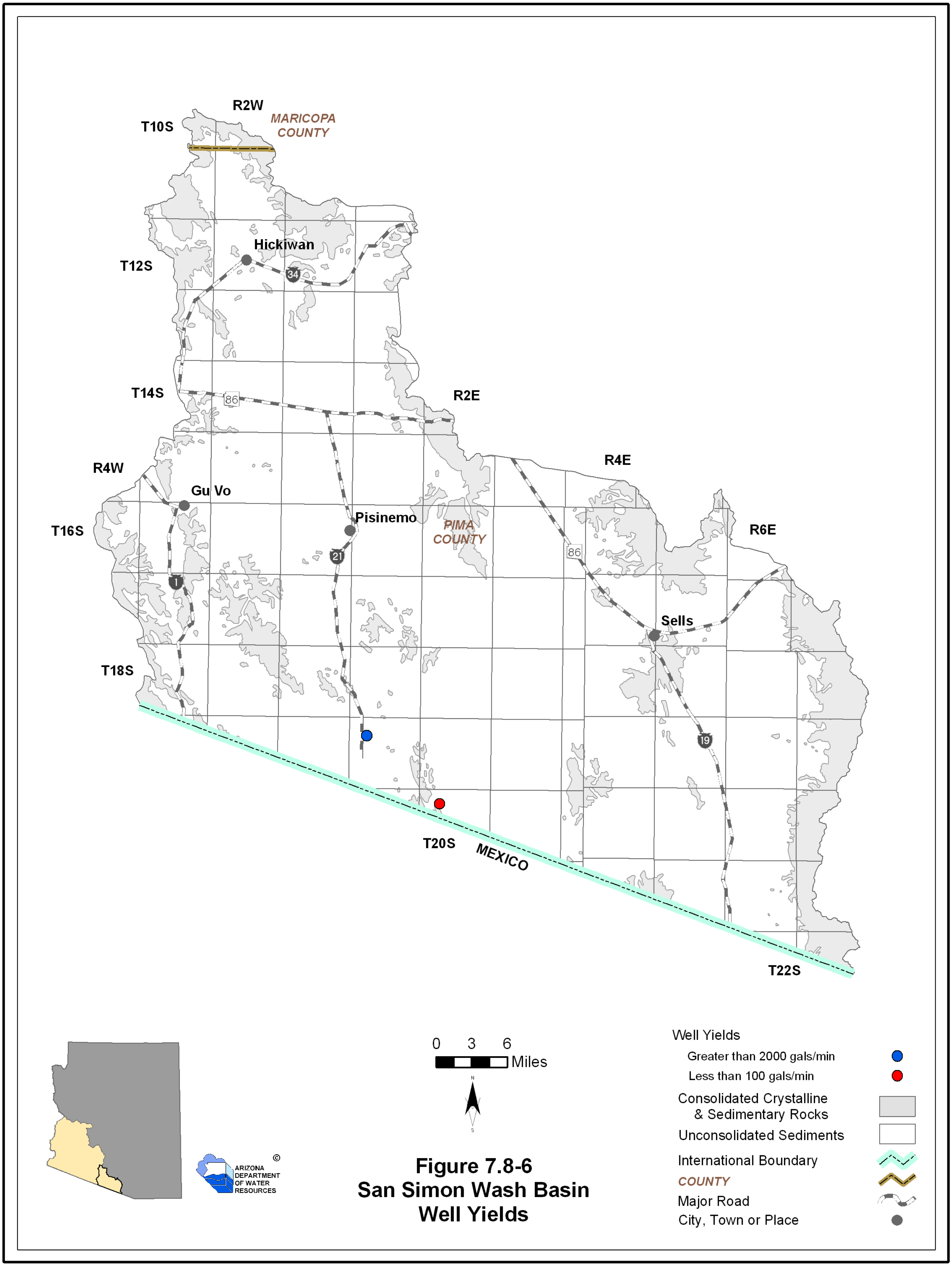


Figure 7.8-6
San Simon Wash Basin
Well Yields

7.8.7 Water Quality of the San Simon Wash Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.8-6A. There are no impaired lakes or streams in this basin. Figure 7.8-7 shows the location of water quality occurrences keyed to Table 7.8-6. A description of water quality data sources and methods is found in Volume 1, Appendix A. Not all parameters were measured at all sites; selective sampling for particular constituents is common.

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

- Refer to Table 7.8-6A.
- Fifty-three wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter for arsenic was equaled or exceeded in eighty-one percent of the wells.
- Other parameters equaled or exceeded include chromium, fluoride, mercury, lead, nitrate and total dissolved solids.

Table 7.8-6 Water Quality Exceedences in the San Simon Wash Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	12 North	1 West	25	Cd
2	Well	14 North	1 West	20	As, Pb
3	Well	15 South	1 West	15	As, Pb, NO3
4	Well	16 South	1 West	10	As, Pb
5	Well	17 South	1 West	11	As, Hg
6	Well	17 South	1 West	11	As, Pb
7	Well	17 South	3 West	35	F
8	Well	17 South	3 West	36	As, F
9	Well	18 South	1 West	35	As, F
10	Well	18 South	3 West	34	As
11	Well	19 South	1 West	14	As, F
12	Well	19 South	1 West	28	As, F
13	Well	19 South	1 West	36	As, F
14	Well	19 South	2 West	3	TDS
15	Well	15 South	4 East	34	As
16	Well	15 South	4 East	36	As
17	Well	16 South	1 East	18	As
18	Well	16 South	1 East	18	As
19	Well	16 South	1 East	18	As, F
20	Well	16 South	2 East	15	As
21	Well	16 South	3 East	10	As
22	Well	17 South	1 East	3	As
23	Well	17 South	2 East	33	As, Pb
24	Well	17 South	3 East	24	As
25	Well	17 South	4 East	30	As
26	Well	17 South	5 East	20	As
27	Well	17 South	6 East	8	Hg
28	Well	18 South	5 East	5	As
29	Well	18 South	5 East	7	As
30	Well	18 South	7 East	29	As
31	Well	19 South	1 East	5	F
32	Well	19 South	1 East	7	As, F, Pb
33	Well	19 South	1 East	7	F
34	Well	19 South	1 East	8	As, F
35	Well	19 South	1 East	8	As, F
36	Well	19 South	1 East	8	F
37	Well	19 South	1 East	8	F
38	Well	19 South	1 East	8	F
39	Well	19 South	1 East	11	As
40	Well	19 South	1 East	17	As, F
41	Well	19 South	1 East	18	As, F
42	Well	19 South	1 East	18	F
43	Well	19 South	1 East	28	As, F
44	Well	19 South	2 East	22	As
45	Well	19 South	3 East	29	As
46	Well	19 South	3.5 East	1	As
47	Well	19 South	5 East	3	As

Table 7.8-6 Water Quality Exceedences in the San Simon Wash Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
48	Well	20 South	2 East	2	As
49	Well	20 South	3 East	2	As, F
50	Well	20 South	4 East	2	As
51	Well	20 South	5 East	24	As
52	Well	20 South	7 East	32	As
53	Well	21 South	7 East	7	As

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.

[1] Water quality samples collected between 1977 and 1980.

[2] As = Arsenic
Cd = Cadmium
F = Fluoride
Hg = Mercury
Pb = Lead
NO3 = Nitrate
TDS = Total Dissolved Solids

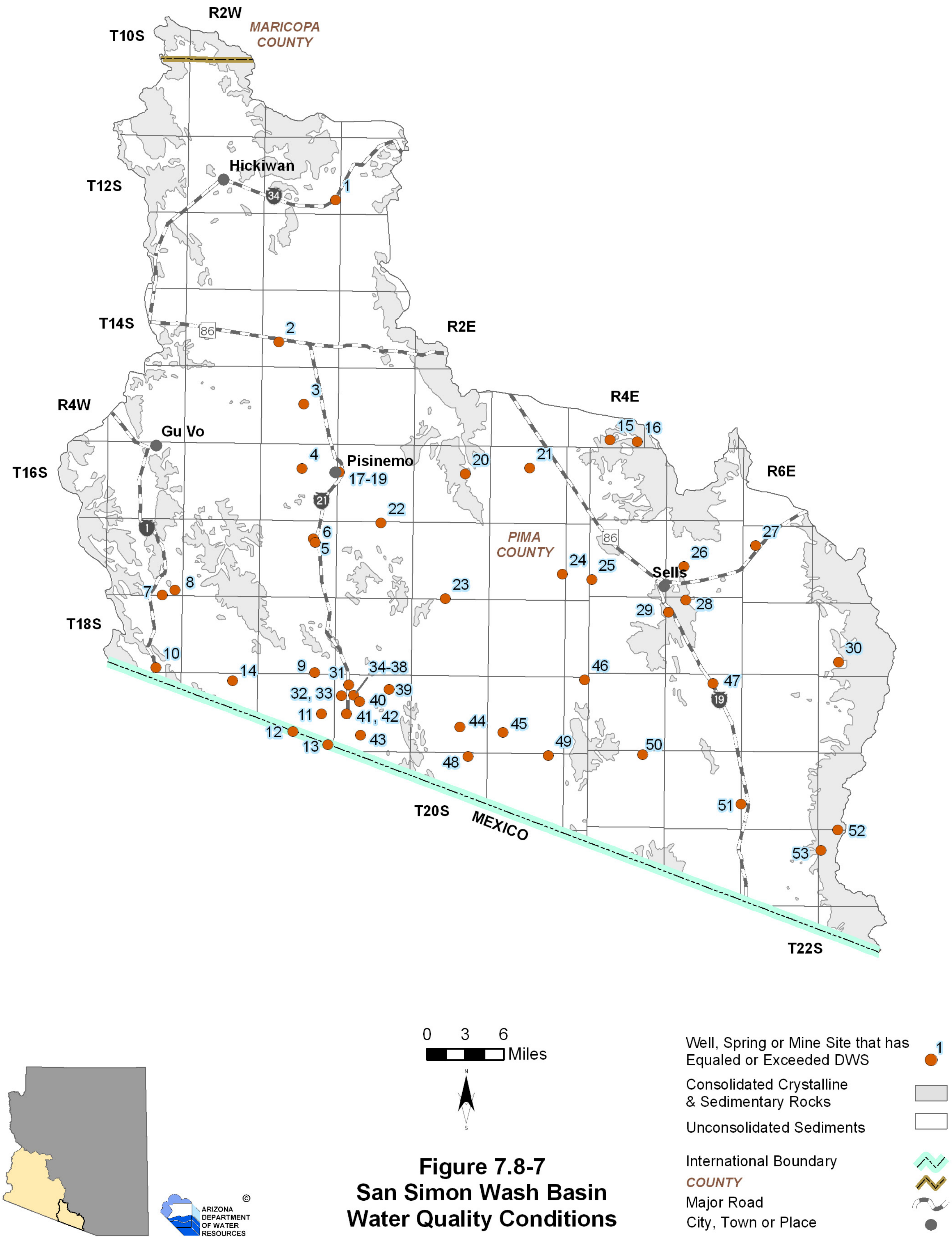


Figure 7.8-7
San Simon Wash Basin
Water Quality Conditions

7.8.8 Cultural Water Demands in the San Simon 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 7.8-7. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.8-8. Figure 7.8-8 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.8-7 and Figure 7.8-8.
- Population in this basin increased from 4,852 in 1980 to 5,837 in 2000.
- Most cultural water demand is for irrigation south of Pisinemo.
- Agricultural groundwater demand remained relatively constant from 1991 to 2005.
- Municipal groundwater demand was about 1,000 AFA between 1991 and 2005.
- There are no surface water diversions in this basin.
- As of 2005 there were seven registered wells with a pumping capacity of less than or equal to 35 gpm and one well with a pumping capacity of more than 35 gpm.
- Tribes are not required to register wells with the Department; therefore, Table 7.8-7 does not reflect all of the wells in the basin.

Effluent Generation

- Refer to Table 7.8-8.
- There are two wastewater treatment facilities in this basin.
- These facilities serve over 4,600 people and generate over 420 acre-feet of effluent per year.
- Both facilities discharge to evaporation ponds.

Table 7.8-7 Cultural Water Demand in the San Simon Wash Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="6">Average Annual Demand (in acre-feet)</th><th rowspan="3">Data Source</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">5[2]</td><td rowspan="10">1[2]</td><td colspan="3" rowspan="5">3,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5">4,000</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>4,852</td></tr>
<tr><td>1981</td><td>4,979</td><td rowspan="5">0</td><td rowspan="5">0</td><td colspan="3" rowspan="5">6,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1982</td><td>5,106</td></tr>
<tr><td>1983</td><td>5,234</td></tr>
<tr><td>1984</td><td>5,361</td></tr>
<tr><td>1985</td><td>5,488</td></tr>
<tr><td>1986</td><td>5,615</td><td rowspan="5">0</td><td rowspan="5">0</td><td colspan="3" rowspan="5">7,000</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1987</td><td>5,742</td></tr>
<tr><td>1988</td><td>5,870</td></tr>
<tr><td>1989</td><td>5,997</td></tr>
<tr><td>1990</td><td>6,124</td></tr>
<tr><td>1991</td><td>6,095</td><td rowspan="5">1</td><td rowspan="5">0</td><td rowspan="5">900</td><td rowspan="5">NR</td><td rowspan="5">4,000</td><td colspan="3" rowspan="5">NR</td><td rowspan="15">USGS (2007)</td></tr>
<tr><td>1992</td><td>6,067</td></tr>
<tr><td>1993</td><td>6,038</td></tr>
<tr><td>1994</td><td>6,009</td></tr>
<tr><td>1995</td><td>5,980</td></tr>
<tr><td>1996</td><td>5,952</td><td rowspan="5">1</td><td rowspan="5">0</td><td rowspan="5">950</td><td rowspan="5">NR</td><td rowspan="5">3,800</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1997</td><td>5,923</td></tr>
<tr><td>1998</td><td>5,894</td></tr>
<tr><td>1999</td><td>5,866</td></tr>
<tr><td>2000</td><td>5,837</td></tr>
<tr><td>2001</td><td>6,093</td><td rowspan="5">0</td><td rowspan="5">0</td><td rowspan="5">1,000</td><td rowspan="5">NR</td><td rowspan="5">3,900</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>6,350</td></tr>
<tr><td>2003</td><td>6,606</td></tr>
<tr><td>2004</td><td>6,862</td></tr>
<tr><td>2005</td><td>7,119</td></tr>
<tr><td>2010</td><td>8,400</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>10,622</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>13,646</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>WELL TOTALS</td><td>7</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

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

Table 7.8-8 Effluent Generation in the San Simon 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/ Landscape	Wildlife Area	Discharged to Another Facility	Infiltration Basins	Other			
Santa Lucia Sewer System	Tohono O'odham Nation	Santa Lucia	810	90		X							Secondary	NA	2000
Sells WWTF	Tohono O'odham Nation	Sells	3,858	336		X							Secondary	NA	2001
Total			**4,668**	**426**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility

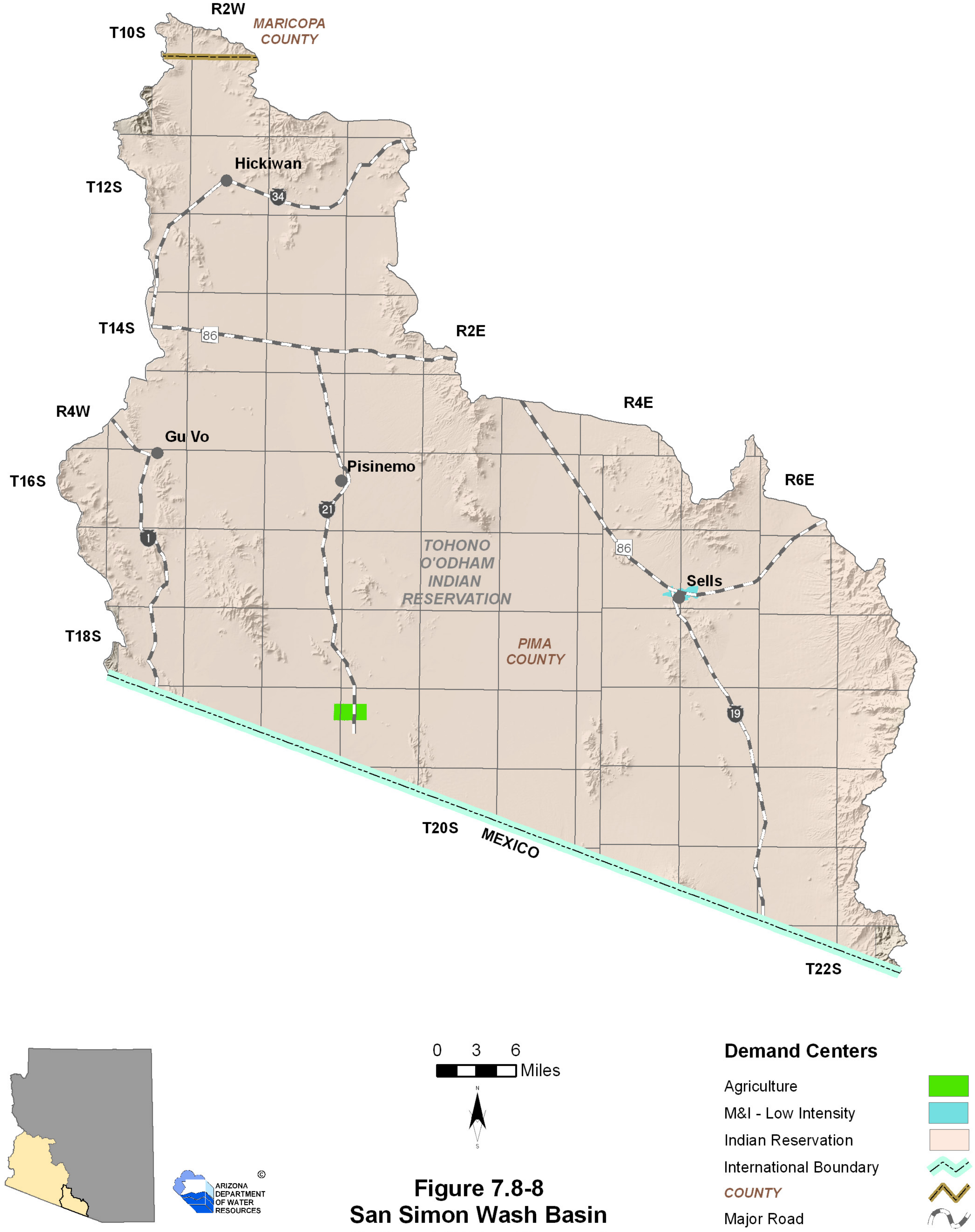


Figure 7.8-8
San Simon Wash Basin
Cultural Water Demand

Primary Data Source: USGS National Gap Analysis Program, 2004

7.8.9 Water Adequacy Determinations in the San Simon Wash Basin

No water adequacy applications for the San Simon Wash Basin were filed with the Department as of December 2008. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

San Simon Wash Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2004, Water quality exceedences by watershed: Data file, received June 2004. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2005, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005a, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005b, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning.(Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Land Resource Information System (ALRIS), 2005a, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____, 2005b Streams: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html

_____ (ALRIS), 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.*

C

Carruth, R.L., Hydrogeology of the Quitobonito Springs and the La Abra Plain area, Organ Pipe National Monument, Arizona and Sonora Mexico:USGS Open File Report 95-4295. (Water Quality Map and Table)

E

Environmental Protection Agency (EPA), 2005, Surf Your Watershed: Facility reports, accessed April 2005 at http://oaspub.epa.gov/enviro/ef_home2.water. (Effluent Generation Table)

_____, 2005, 2000 and 1996, Clean Watershed Needs Survey: datasets, accessed March 2005 at http://www.epa.gov/owm/mtb/cwns/index.htm. (Effluent Generation Table)

F

Freethey, G.W. and Anderson, T.W. 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

G

Gebert, W.A., D.J. Graczyk and W.R. Krug, 1987, Average annual runoff in the United States, 1951-1980: GIS Cover, accessed March 2006 at http://aa179.cr.usgs.gov/metadata/wrdmeta/runoff.htm. (Surface Water Conditions Map)

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.

_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Precipitation and temperature stations: Data file, accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Andersen ,M. 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Brown, B.T., Hendrickson, L.P., Johnson, R., and Werrell, W., 1983, An inventory of surface water resources at Organ Pipe National Monument, Arizona: National Park Service and University of Arizona Technical Report # 10.

Fisher, S. G., 1989, Hydrologic and limonlogic features of the Quitobaquito pond and springs, Organ Pipe Cactus National Monument: US Park Service Report.

Goodman, B.S., 1992, Hydrogeology of the Quitobaquito Springs Area, La Abra Plain, and the Rio Sonoita Valley, Organ Pipe Cactus National Monument, Arizona and Sonora, Mexico: University of Arizona, M.S. thesis.

Heindl, L.A., 1976, Availability of groundwater in the Molenitus area, Papago Indian Reservation, Arizona, 1958: USGS Open – File Report 76-716 9 p.

Hollett, K.J., 1985, Geohydrology and water resources of the Papago Farms - Great Plain area, Papago Indian Reservation, Arizona, and the upper Rio Sonyota area, Sonora, Arizona: USGS Water Survey Paper 2258

Hollett, K.J., and Garrett, J. M., 1984, Geohydrology of the Papago, San Xavier, and Gila Bend Indian Reservations, Arizona - 1978-81: USGS Hydrologic Investigations Atlas HA-660, scale 1: 250,000.

Thomsen, B.W., and Eychaner, J.H., 1991, Predevelopment hydrology of the Gila River Indian Reservation, south central Arizona: USGS Water Resources Investigations Report 85-4073, 2 sheets.

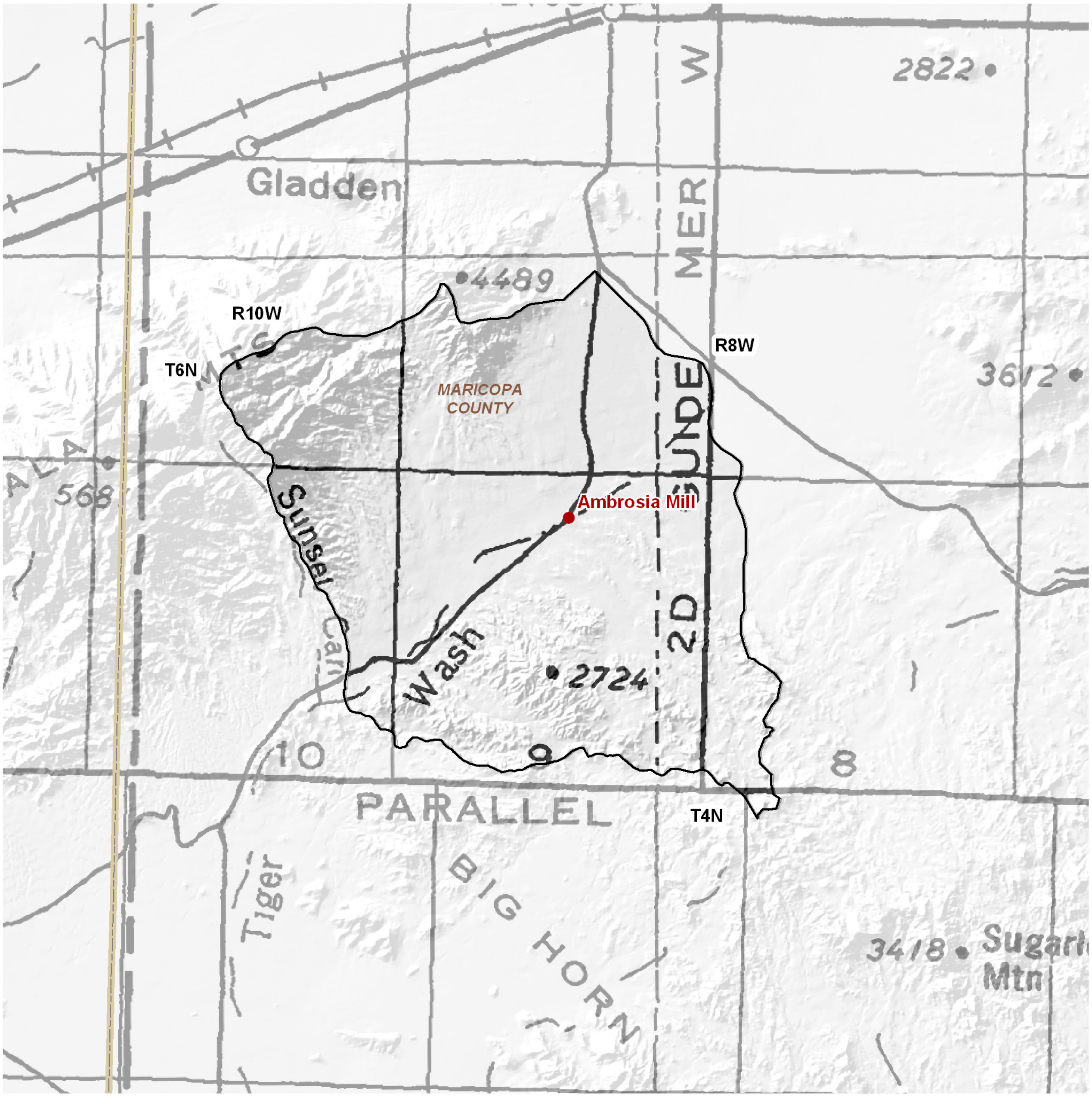
Thomsen, B.W., and Baldys, S., 1985, Groundwater conditions in and near the Gila River Indian Reservation, south central Arizona: USGS Water Resources Investigations Report 85-4073, 2 sheets.

Section 7.9
Tiger Wash Basin

7.9.1 Geography of the Tiger Wash Basin

The Tiger Wash Basin, located in the northeastern part of the planning area is 74 square miles in area, the smallest basin in the planning area and the state. Geographic features and principal places are shown on Figure 7.9-1. The basin is characterized by a valley bordered by mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub and a small amount of southwestern interior chaparral near the northwestern basin boundary. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.9-1 are:
    - Tiger Wash in the center of the basin
    - Harquahala Mountains in the northern portion of the basin and the Big Horn Mountains in the southern portion of the basin with the highest point at 2,724 feet.
    - The lowest point is approximately 1,950 feet where Tiger Wash exits the basin southeast of Ambrosia Mill.



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Base Map: USGS 1:500,000, 1981

Figure 7.9-1
Tiger Wash Basin
Geographic Features

City, Town or Place ●

7.9.2 Land Ownership in the Tiger Wash Basin

Land ownership, including the percentage of ownership by category, for the Tiger Wash Basin is shown in Figure 7.9-2. The principal feature of land ownership in this basin is the large proportion of U.S Bureau of Land Management lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Bureau of Land Management

- 97.4% of the land is federally owned and managed by the Lower Sonoran Field Office of the U.S. Bureau of Land Management.
- This basin contains 8,700 acres of the 23,000 acre Harquahala Mountains Wilderness. (see Figure 7.0-12)
- Land use includes grazing, resource conservation and recreation.

State Trust Land

- 2.3% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is grazing.

Private

- 0.3% of the land is private.
- Land uses include domestic and grazing.

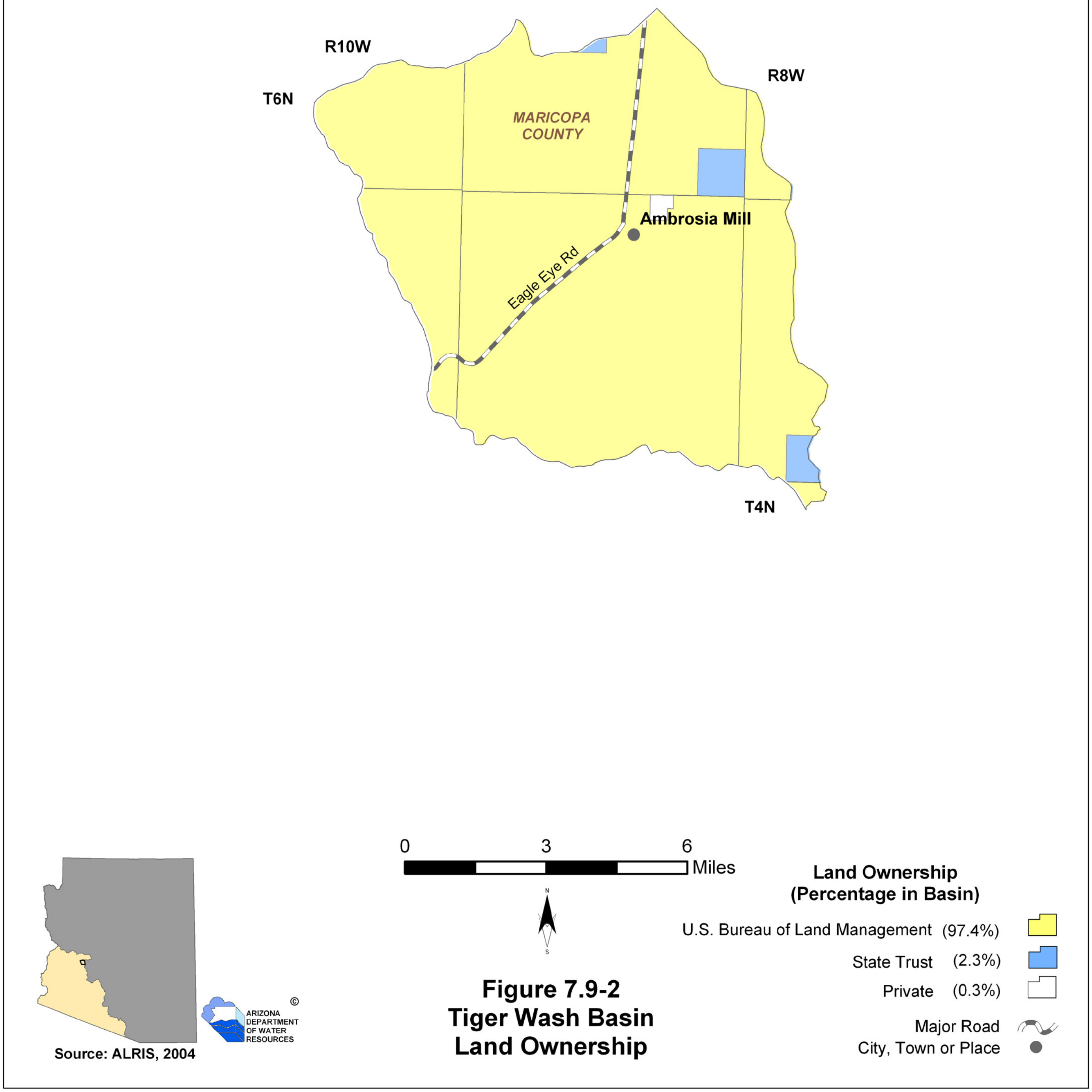


Figure 7.9-2
Tiger Wash Basin
Land Ownership

7.9.3 Climate of the Tiger Wash Basin

The Tiger Wash Basin does not contain NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. Figure 7.9-3 shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate in the planning area is found in Section 7.0.3. A description of the climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 7.9-3
- Average annual rainfall is as high as 18 inches along the northwestern tip of the basin and as low as eight inches in the southwestern portion of the basin.

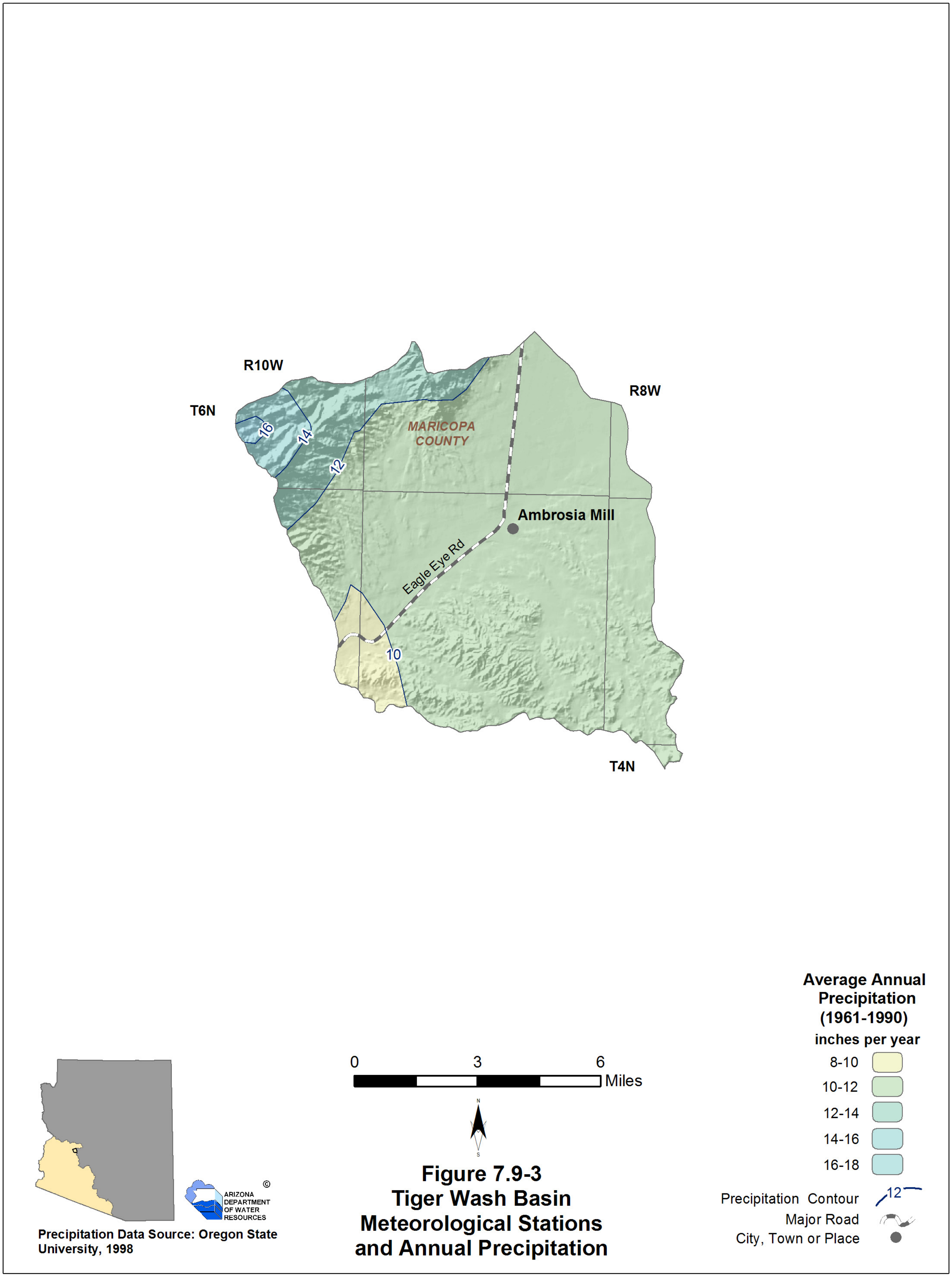


Figure 7.9-3
Tiger Wash Basin
Meteorological Stations
and Annual Precipitation

7.9.4 Surface Water Conditions in the Tiger Wash Basin

Flood ALERT equipment in the basin is shown in Table 7.9-1 and Figure 7.9-4. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.9-2. There are no streamflow data or USGS runoff contour data available for this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Flood ALERT Equipment

- Refer to Table 7.9-1
- As of October 2005 there was one station in this basin.

Reservoirs and Stockponds

- Refer to Table 7.9-2.
- There are no large or small reservoirs and nine registered stockponds in this basin.

Table 7.9-1 Flood ALERT Equipment in the Tiger Wash Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
5130	Upper Tiger Wash	Precipitation	11/1/1981	Maricopa County FCD

Notes:
FCD = Flood Control District

Table 7.9-2 Reservoirs and Stockponds in the Tiger Wash Basin

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

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

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

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

Source: Compilation of databases from ADWR & others

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

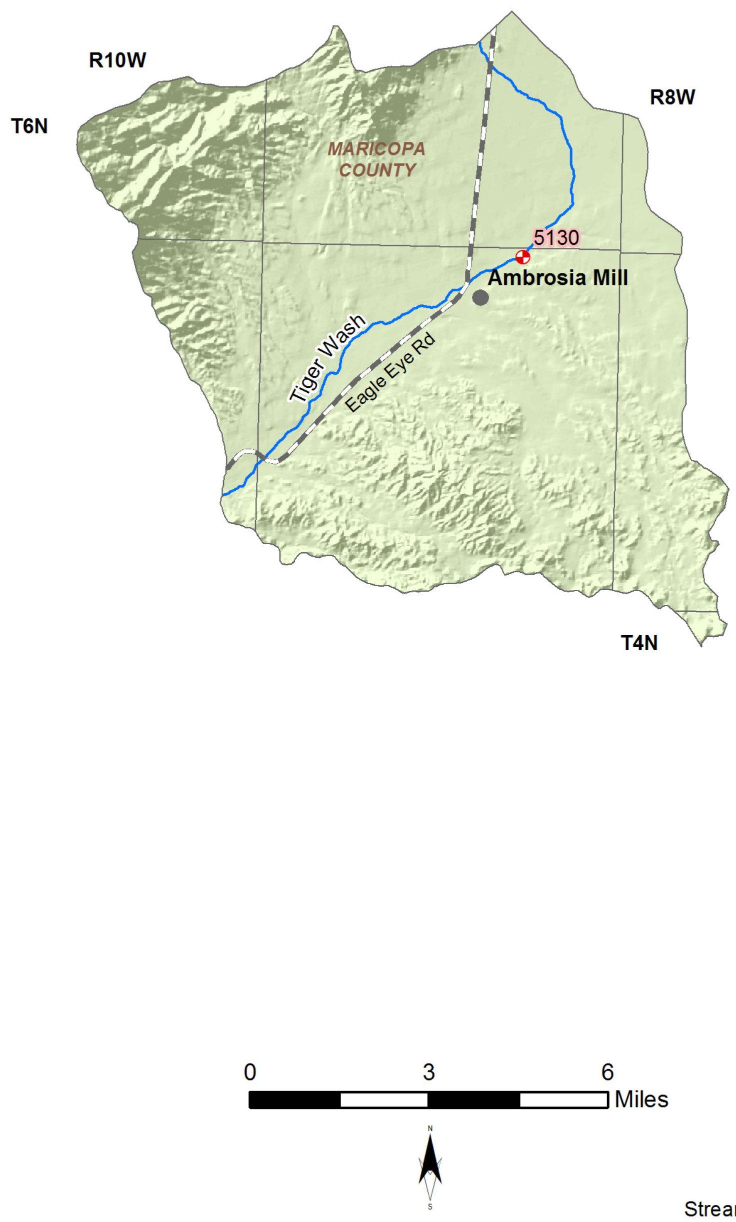
Total number: 0
Total maximum storage: 0 acre-feet

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

Total number: 0
Total surface area: 0 acres

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

Total number: 9



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Stream Data Source: ALRIS, 2005b

Figure 7.9-4
Tiger Wash Basin
Surface Water Conditions

7.9.5 Perennial/Intermittent Streams and Major Springs in the Tiger Wash Basin

The total number of springs in the basin are shown in Table 7.9-3. The location of an intermittent stream is shown on Figure 7.9-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are no perennial streams and one intermittent stream, Browns Canyon Wash.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS is three.

Table 7.9-3 Springs in the Tiger Wash Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005a and USGS, 2006a): 3

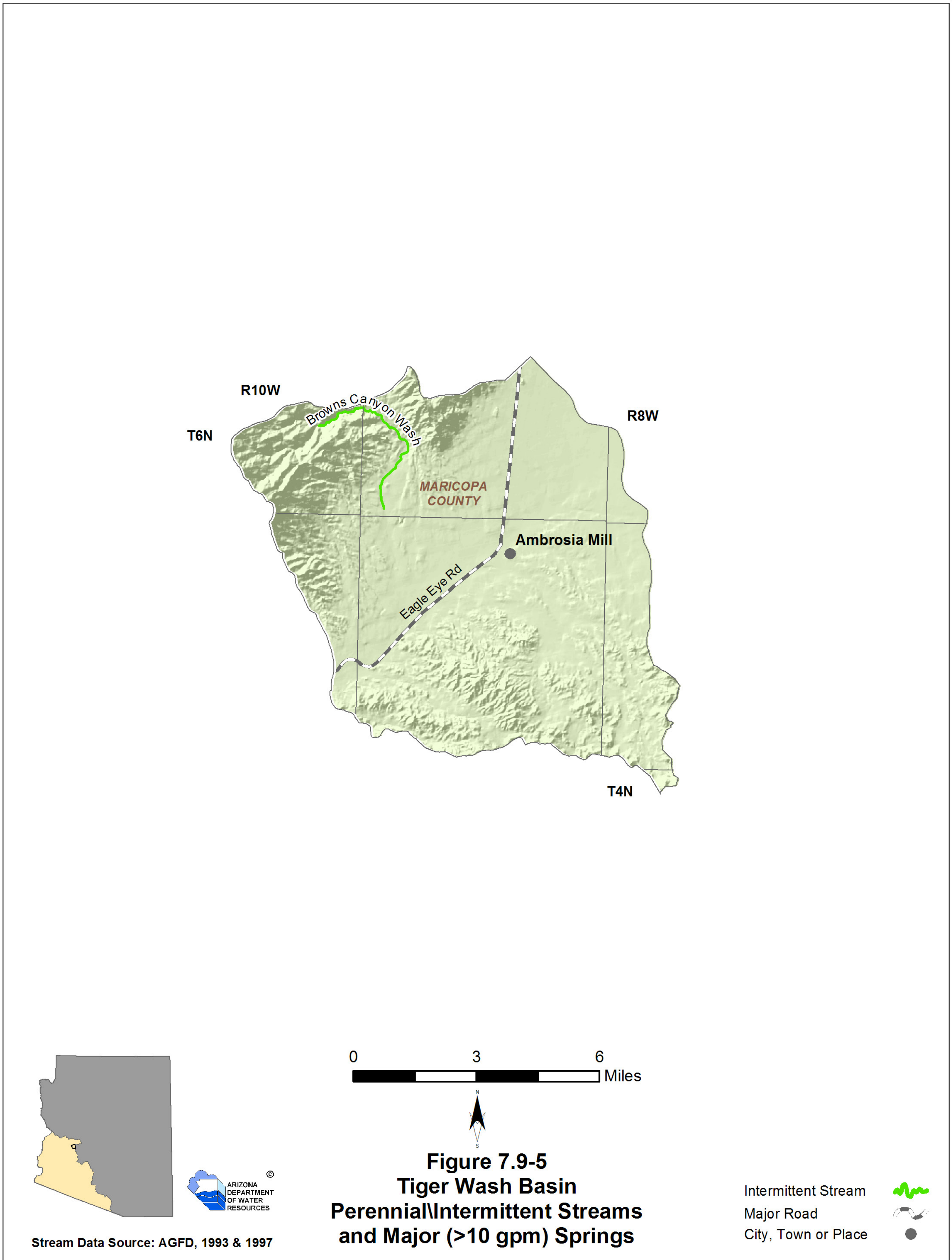


Figure 7.9-5
Tiger Wash Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.9.6 Groundwater Conditions of the Tiger Wash Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.9-4. Figure 7.9-6 shows aquifer flow direction. Data on water-level change between 1990-1991 and 2003-2004 was not available for this basin. Figure 7.9-7 contains hydrographs for selected wells shown on Figure 7.9-6. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.9-4 and Figure 7.9-6.
- The major aquifer in this basin is basin fill.
- Groundwater flow is to the northeast and southwest away from the center of the basin.

Well Yields

- Refer to Table 7.9-4.
- The only well yield data available within the basin indicates a well yield range from dry to 500 gallons per minute (gpm).

Natural Recharge

- Refer to Table 7.9-4.
- The natural recharge estimate for this basin is less than 1,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 7.9-4.
- Storage estimates range from 700,000 acre-feet to 2.0 million acre-feet to a depth of 1,200 feet.

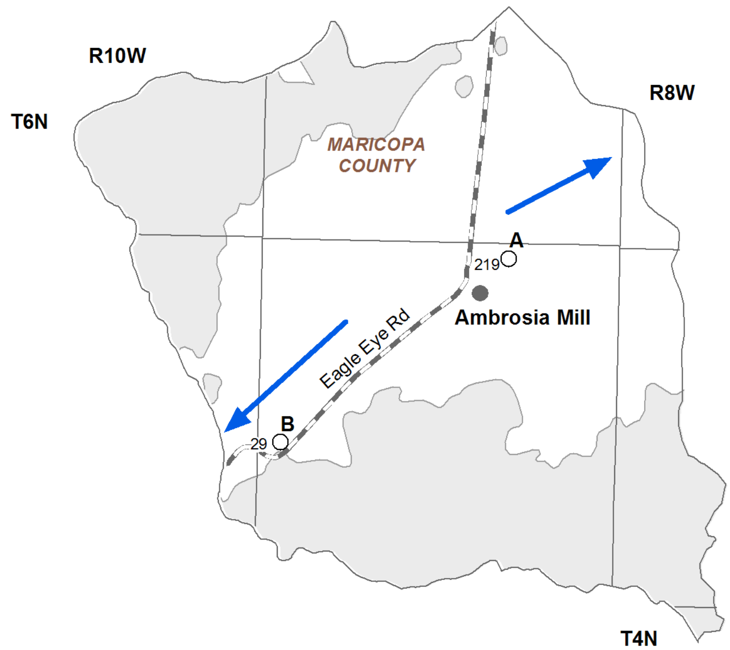
Water Level

- Refer to Figure 7.9-6.
- The Department annually measures two index wells in this basin. Hydrographs for these index wells are shown on Figure 7.9-7.

Table 7.9-4 Groundwater Data for the Tiger Wash Basin

Basin Area, in square miles:	74	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	769** (1 well measured)	Measured by ADWR (GWSI) and/or USGS
	N/A	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	N/A	ADWR (1994b)
	Range 0-500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	<1,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	700,000 (to 1,200 ft)	ADWR (1990)
	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:	2	
Date of Last Water-level Sweep:	2004 (5 wells measured)	

** well located just outside basin boundary in Phoenix AMA
[1]Predevelopment Estimate



0 3 6 Miles

ARIZONA DEPARTMENT OF WATER RESOURCES ©

Figure 7.9-6
Tiger Wash Basin
Groundwater Conditions

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

375 H = number is depth to water in feet during 2003-2004; letter is hydrograph

Change Data Not Available

Generalized Flow Direction

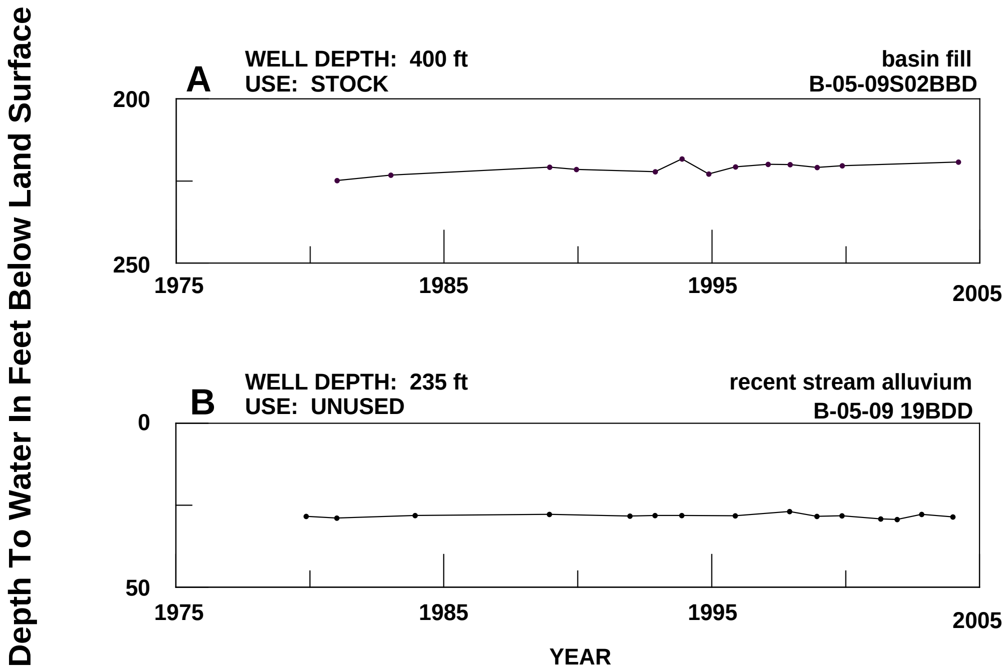
Consolidated Crystalline & Sedimentary Rocks

Unconsolidated Sediments

Major Road

City, Town or Place

Figure 7.9-7
Tiger Wash Basin
Hydrographs Showing Depth to Water in Selected Wells



7.9.7 Water Quality of the Tiger Wash Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.9-5A. There are no impaired lakes or streams in this basin. Figure 7.9-8 shows the location of water quality occurrences keyed to Table 7.9-5. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.9-5A.
- Two wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameters exceeded were nitrate and arsenic.

Table 7.9-5 Water Quality Exceedences in the Tiger Wash Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]	
		Township	Range	Section		
1	Well	5 North	9 West	2	NO3	
2	Well	5 North	9 West	19	As	

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1984 and 2001.
[2] As = Arsenic
NO3 = Nitrate

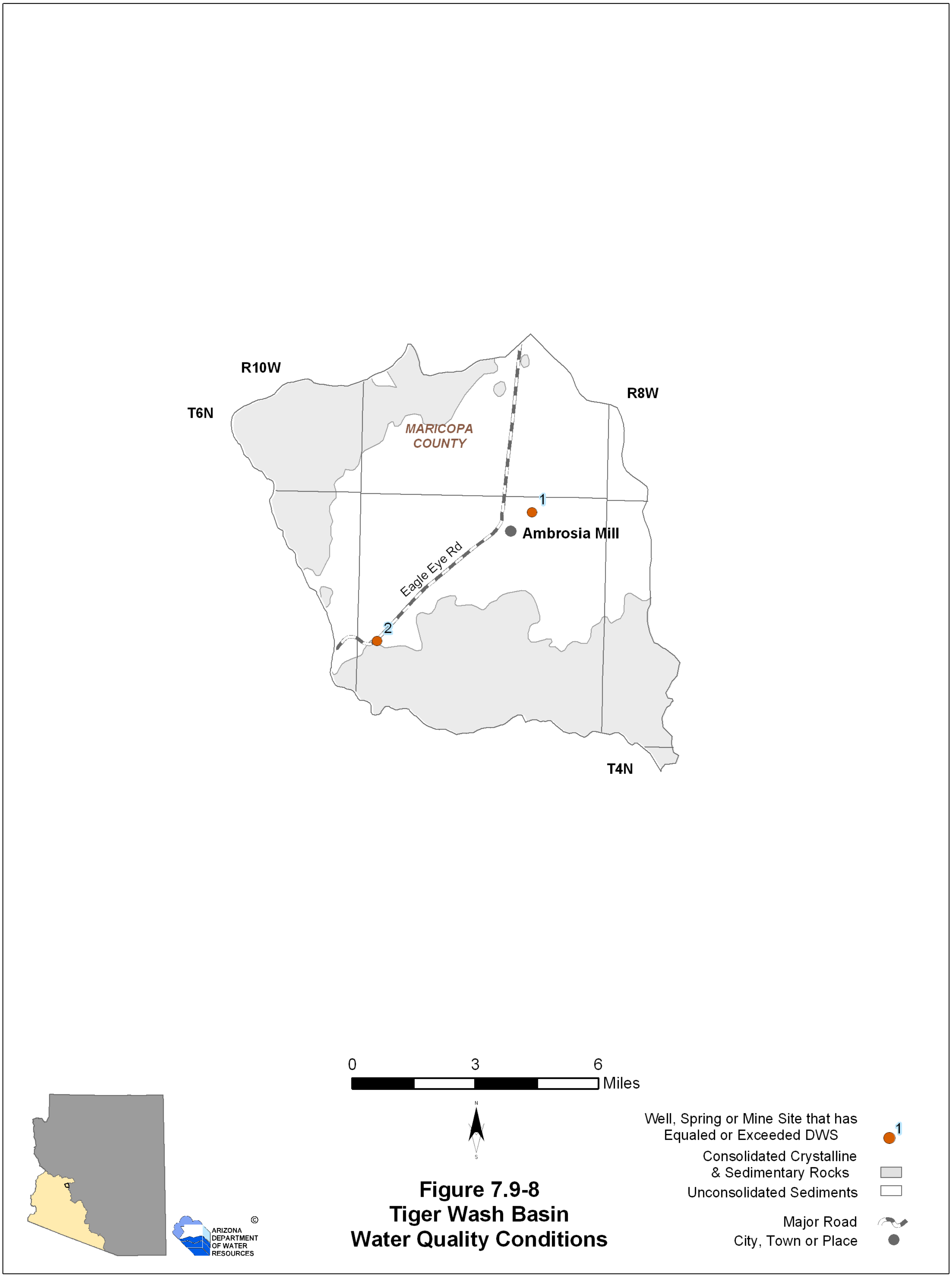


Figure 7.9-8
Tiger Wash Basin
Water Quality Conditions

7.9.8 Cultural Water Demands in the Tiger 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 7.9-6. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the primary source of cultural demand map data, showed no demand centers for this basin. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.9-6
- Population in this basin is very small, with less than ten residents in 2000.
- There are no recorded surface water uses. All groundwater use is for municipal (domestic) demand and has remained relatively constant since 1971.
- As of 2005 there were seven registered wells with a pumping capacity of less than or equal to 35 gpm and one well with a pumping capacity of more than 35 gpm.

Table 7.9-6 Cultural Water Demand in the Tiger Wash Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						
				Well Pumpage			Surface-Water Diversions			Data Source
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971										
1972										
1973				<500			NR			
1974										
1975										
1976		6[2]	1[2]							
1977										
1978				<500			NR			
1979										
1980	<10									ADWR
1981	<10									(1994a)
1982	<10									
1983	<10	1	0	<500			NR			
1984	<10									
1985	<10									
1986	<10									
1987	<10									
1988	<10	0	0	<500			NR			
1989	<10									
1990	<10									
1991	<10									
1992	<10									
1993	<10	0	0	<300	NR	NR	NR			
1994	<10									
1995	<10									
1996	<10									
1997	<10									USGS
1998	<10	0	0	<300	NR	NR	NR			(2007)
1999	<10									
2000	<10									
2001	<10									
2002	<10									
2003	<10	0	0	<300	NR	NR	NR			
2004	<10									
2005	<10									
2010	<10									
2020	<10									
2030	<10									
WELL TOTALS:		**7**	**1**							

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

7.9.9 Water Adequacy Determinations in the Tiger Wash Basin

No water adequacy applications for the Tiger Wash Basin were filed with the Department as of December 2008. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

Tiger Wash Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Water Resources (ADWR), 2005, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005, Registry of surface water rights: ADWR Office of Water Management. (Reservoirs and Stockponds Table)

_____, 2005, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

_____, 1990, Draft outline of basin profiles for the state water assessment: ADWR Statewide Planning Division, Memorandum to L. Linser, D.W., January, 16, 1990.

Arizona Game and Fish Department (AZGF), 1997 & 1993, Statewide riparian inventory and mapping project: GIS cover.

Arizona Land Resource Information System (ALRIS), 2005, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____ (ALRIS), 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

F

Freethey, G.W. and Anderson, T.W. 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 1998, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006. Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

Supplemental Reading

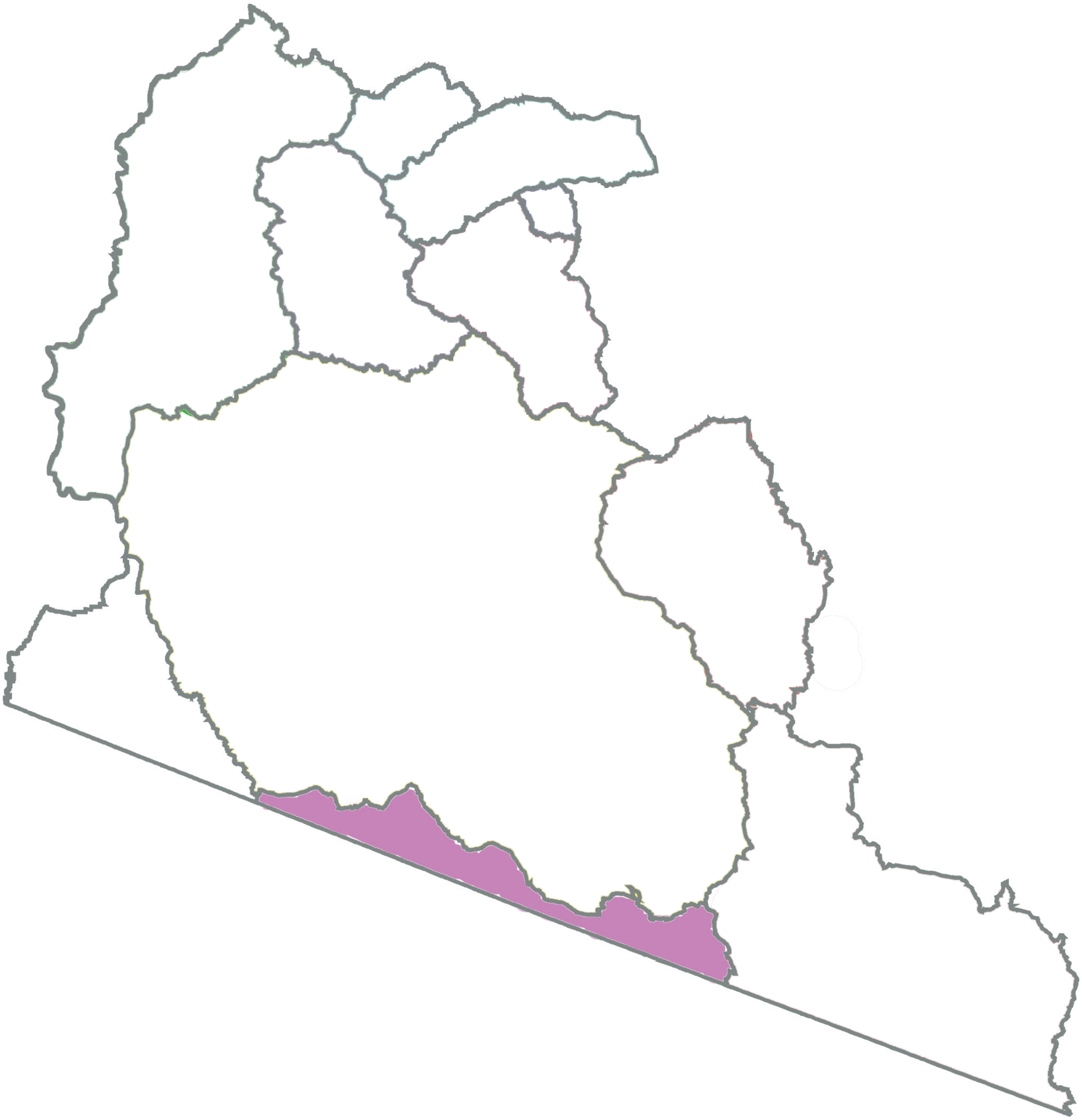
Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Headly, J.D., 1990, Groundwater conditions in the Harquahala Irrigation Non-Expansion area and Tiger Wash Basin, Arizona Department of Water Resources Hydrologic Map Series No. 17

Klawon, J.E. and P.A. Pearthree, 2000, Field Guide to a dynamic distributary drainage system: Tiger Wash, western Arizona: AZGS Open File Report 00-01, 34 p.

Pearthree, P.A., J.E. Klawon and T.W. Lehman, 2004, Geomorphology and hydrology of an alluvial fan flood on Tiger Wash, Maricopa and La Paz Counties, West-Central Arizona: AZGS Open File Report 04-02, 40 p., 2 sheets.

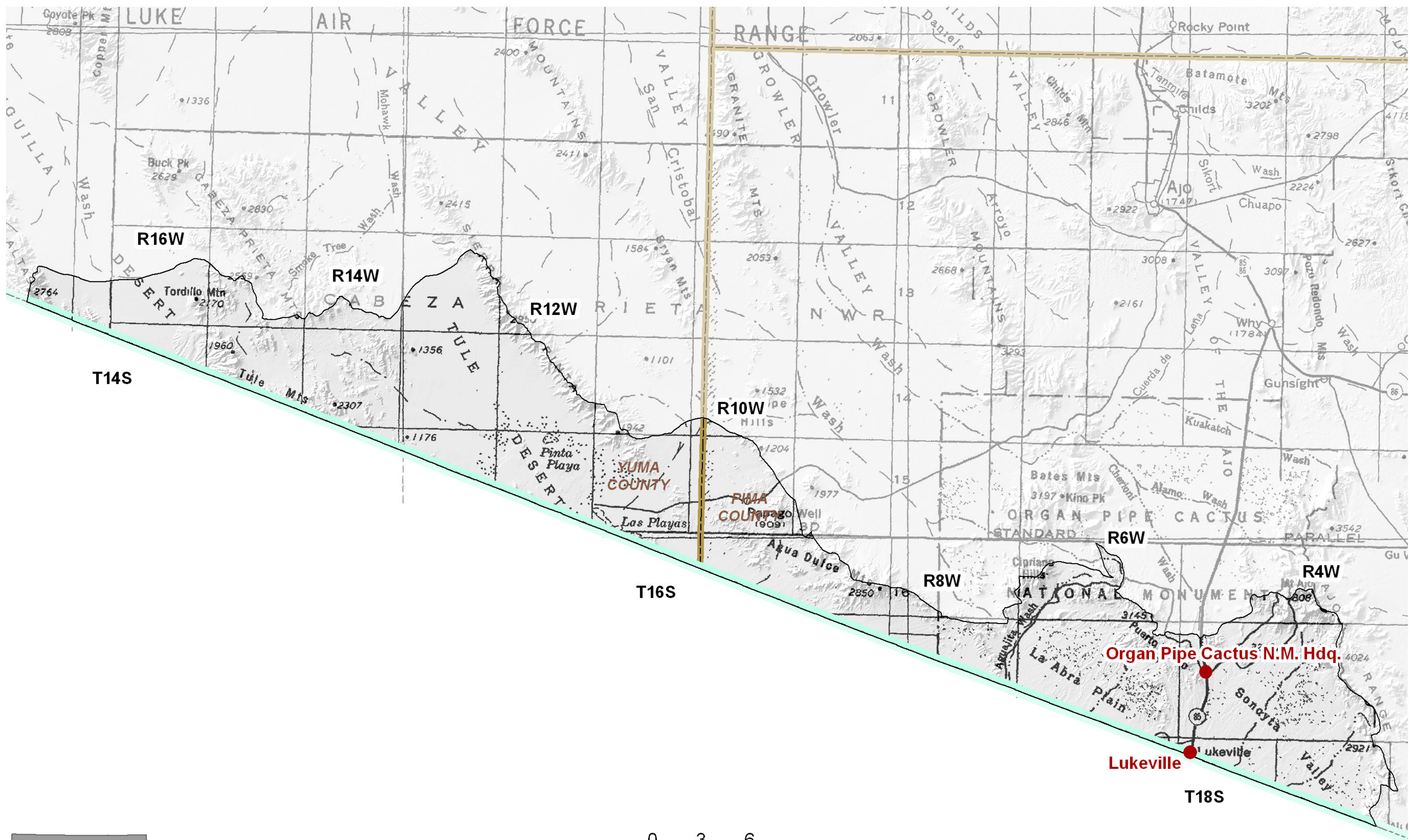
Section 7.10
Western Mexican Drainage Basin



7.10.1 Geography of the Western Mexican Drainage Basin

The Western Mexican Drainage Basin, located in the south central part of the planning area is 610 square miles in area. Geographic features and principal communities are shown on Figure 7.10-1. The basin is characterized by desert valleys and low elevation mountain ranges. Vegetation types include Lower Colorado River Valley and Arizona uplands Sonoran desertscrub. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.10-1 are:
  - Aguajita Wash west of Lukeville
  - Tule Desert in the western portion of the basin
  - Ajo Range on the eastern basin boundary and the highest point in the basin at 4,024 feet.
  - The lowest point in the basin at 680 feet at Las Playas at the international boundary



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Base Map: USGS 1:500,000, 1981

Figure 7.10-1
Western Mexican Drainage Basin
Geographic Features

International Boundary
COUNTY
City, Town or Place

7.10.2 Land Ownership in the Western Mexican Drainage Basin

Land ownership, including the percentage of ownership by category, for the Western Mexican Drainage Basin is shown in Figure 7.10-2. The principal feature of land ownership in this basin is the large proportion of National Wildlife Refuge lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

Wildlife Refuge

- 61.1% of the land is federally owned and managed by the U.S. Fish and Wildlife Service as the Cabeza Prieta National Wildlife Refuge.
- Land uses include resource protection and recreation.

National Park Service (NPS)

- 36.3% of the land is federally owned and managed by the National Park Service as the Organ Pipe Cactus National Monument.
- Land uses include resource conservation and recreation.

U.S. Military

- 2.2% of the land is federally owned and managed by the U.S. Military as the Barry Goldwater Air Force Range.
- Primary land use is military activity.

Indian Reservation

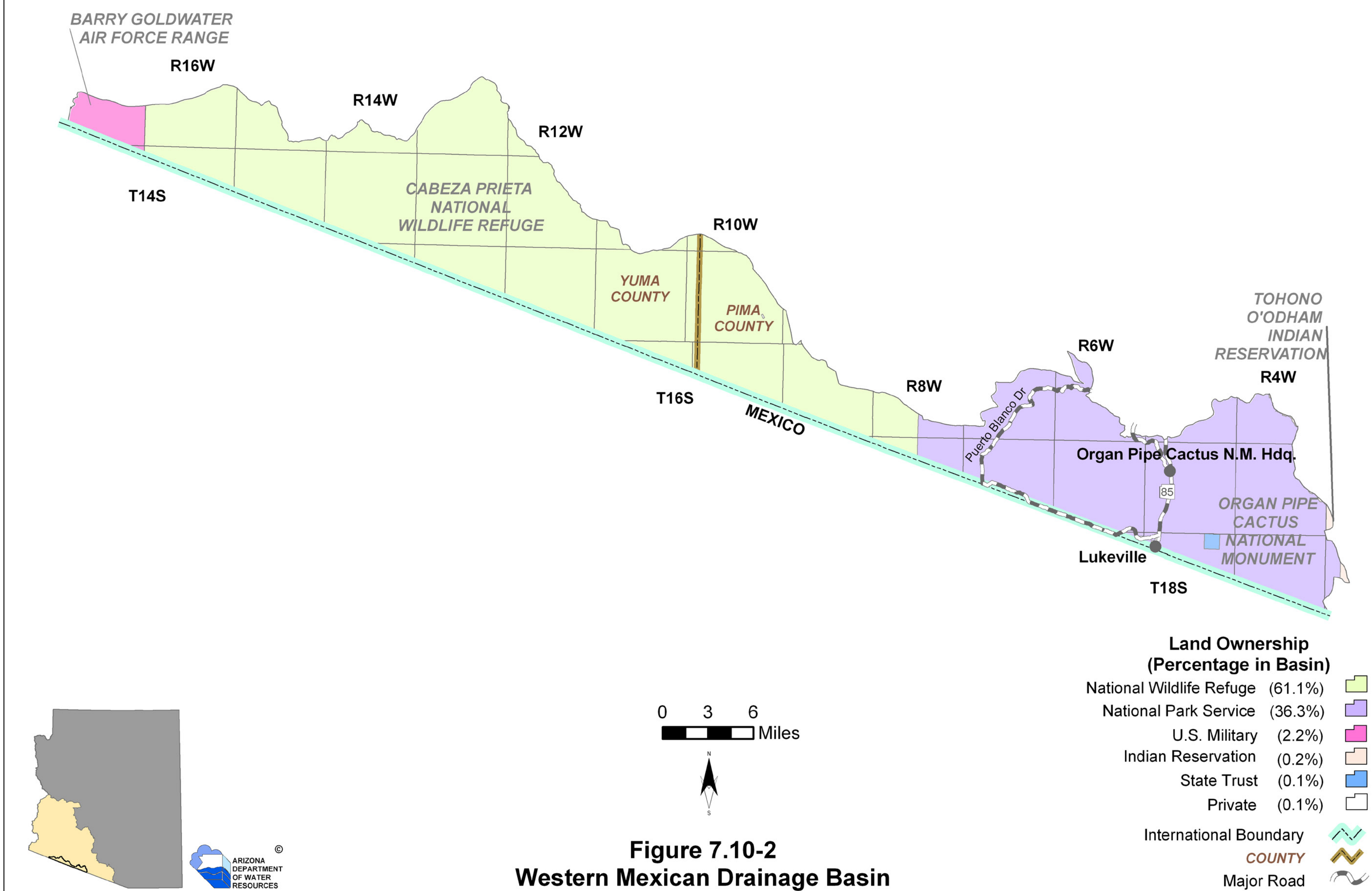
- 0.2% of the land is under tribal ownership as the Tohono O'odham Indian Reservation.
- Tribal lands are located along the eastern basin boundary
- Primary land use is grazing.

State Trust Land

- 0.1% of the land is held in trust for the public schools under the State Trust Land system.
- State trust land is found in the eastern portion of the basin surrounded by the Organ Pipe Cactus National Monument.
- Primary land use is resource conservation.

Private

- 0.1% of the land is private.
- All private land is in the vicinity of Lukeville, however, it cannot be seen at the map scale shown.
- Land uses include domestic and commercial.



Source: ALRIS, 2004

Figure 7.10-2
Western Mexican Drainage Basin
Land Ownership

7.10.3 Climate of the Western Mexican Drainage Basin

Climate data from NOAA/NWS Co-op Network stations are complied in Table 7.10-1 and the locations are shown on Figure 7.10-3. Figure 7.10-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Western Mexican Drainage Basin does not contain Evaporation Pan, AZMET or SNOTEL/Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.10-1A
- There is one NOAA/NWS Co-op Network station in the basin, Organ Pipe Cactus N.M., with an average monthly maximum temperature of 89.2°F and an average minimum temperature of 54.7°F.
- Highest average seasonal rainfall, 4.38 inches, occurs in the summer season (July-September) when 44% of the annual average precipitation occurs.

SCAS Precipitation Data

- See Figure 7.10-3
- Additional precipitation data shows average annual rainfall as high as 14 inches along the northeastern basin boundary and as low as four inches in the western portion of the basin.

Table 7.10-1 Climate Data for the Western Mexican Drainage Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Organ Pipe Cactus N.M.	1,680	1971 - 2000	89.2/Jul	54.7/Jan	2.66	0.32	4.38	2.52	9.88

Source: WRCC, 2005

B. Evaporation Pan:

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

C. AZMET:

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

D. SNOTEL/Snowcourse:

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

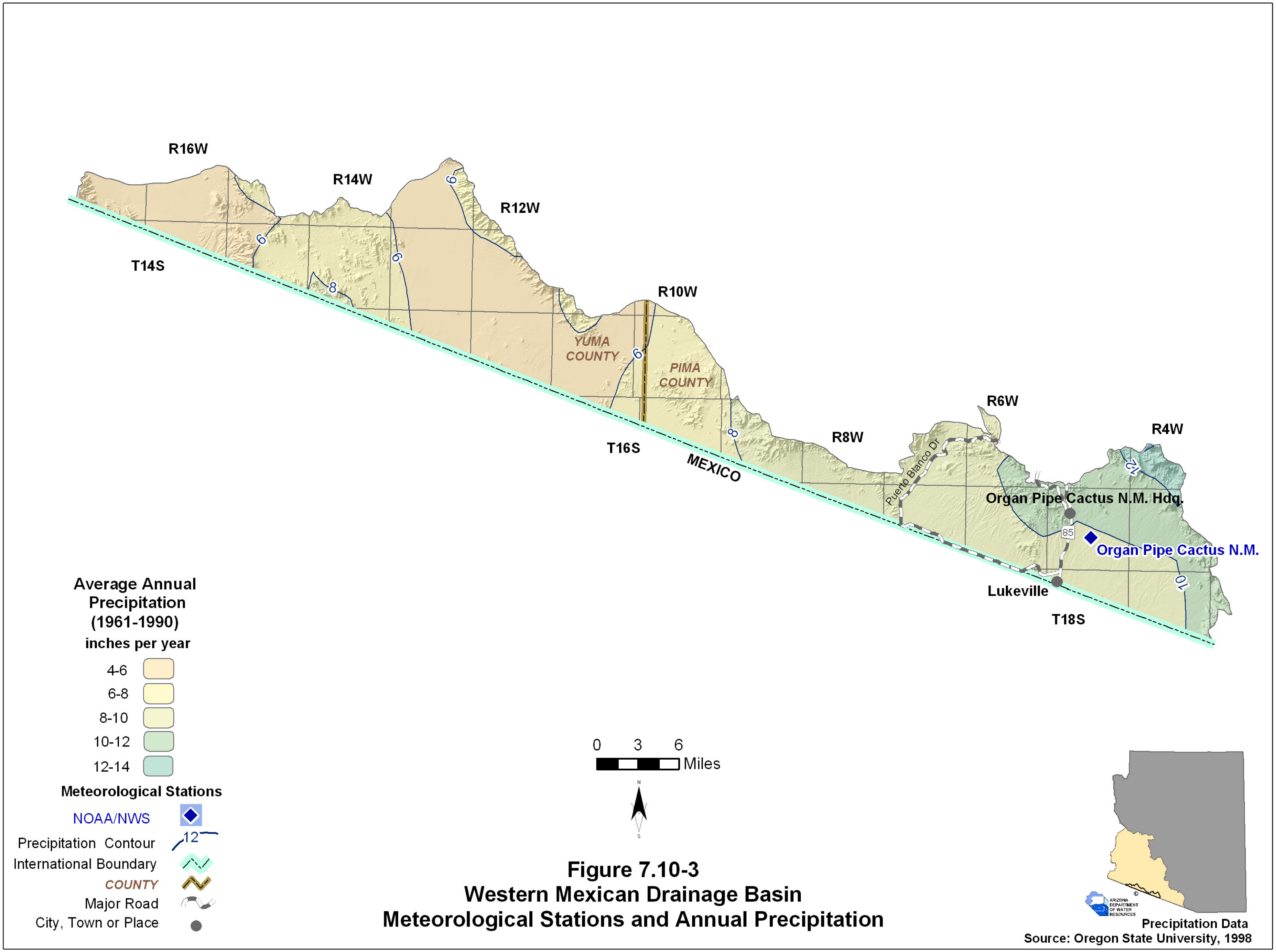


Figure 7.10-3
Western Mexican Drainage Basin
Meteorological Stations and Annual Precipitation

7.10.4 Surface Water Conditions in the Western Mexican Drainage Basin

Flood ALERT equipment in the basin is shown in Table 7.10-2 and Figure 7.10-4. There are no streamflow data, reservoirs, stockponds or USGS runoff contour data available for this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Flood ALERT Equipment

- Refer to Table 7.10-2
- As of October 2005 there was one station in this basin.

Table 7.10-2 Flood ALERT Equipment in the Western Mexican Drainage Basin

Station ID	Station Name	Station Type	Install Date	Responsibility
Organ Pipe Weather Station	7230	Weather Station	7/31/2004	ADWR

Source: ADWR 2005a

Notes:
ADWR = Arizona Department of Water Resources

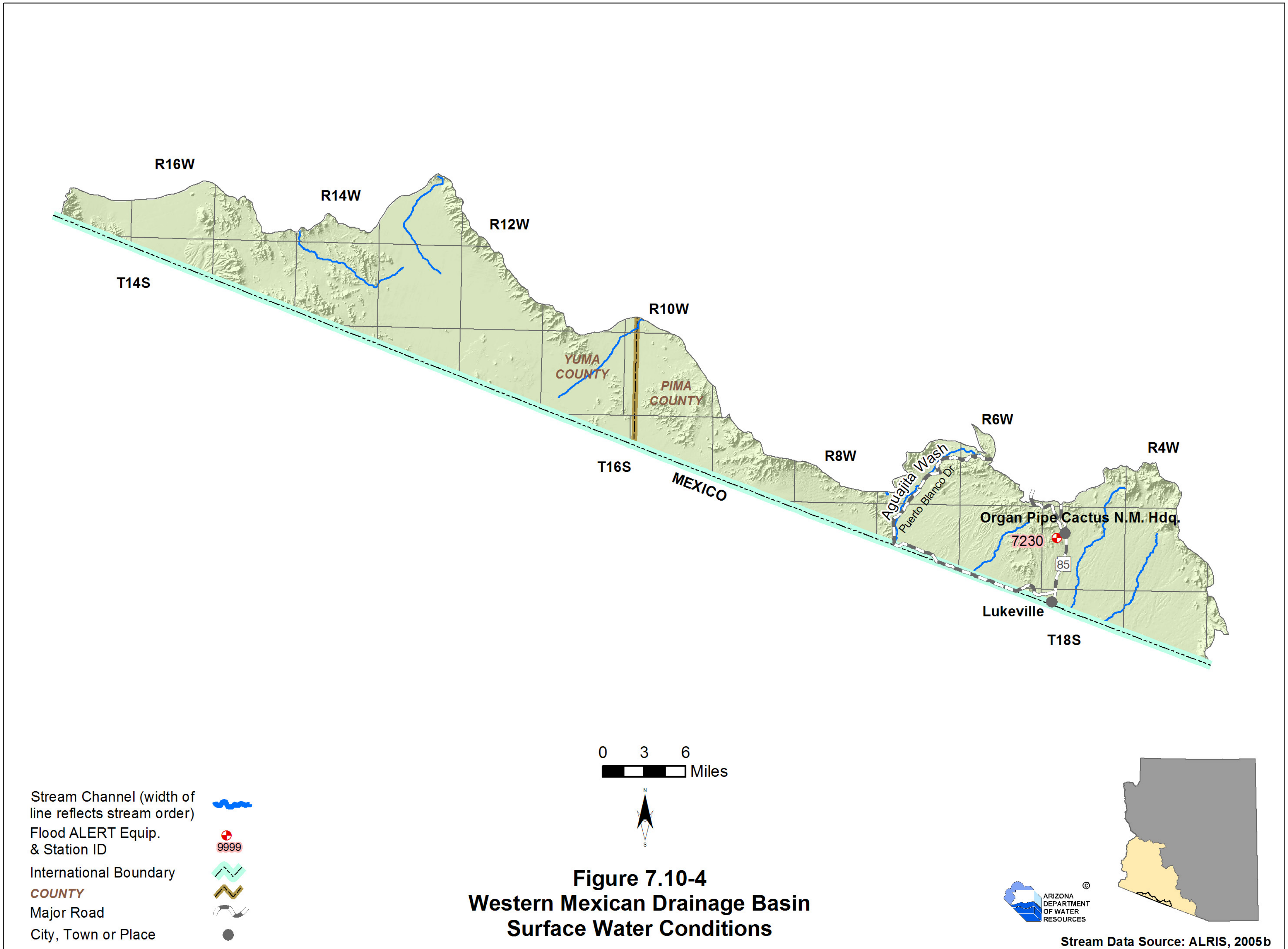


Figure 7.10-4
Western Mexican Drainage Basin
Surface Water Conditions

7.10.5 Perennial/Intermittent Streams and Major Springs in the Western Mexican Drainage 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 7.10-3. The location of a major spring is shown on Figure 7.10-5. There are no perennial or intermittent streams in the Western Mexican Drainage Basin. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There is one major spring with a measured discharge rate of 28 gallons per minute (gpm). This discharge rate may not be indicative of current conditions; the spring was last measured during or prior to 1992. This is the only major spring in the planning area.
- There are two minor springs in this basin.
- The total number of springs, regardless of discharge, identified by the USGS varies from four to six, depending on the database reference.

Table 7.10-3 Springs in the Western Mexican Drainage Basin

A. Major Springs (10 gpm or greater):

Map Key	Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
		Latitude	Longitude		
1	Quitobaquito (multiple)	315640	1130103	28	During or prior to 1992

B. Minor Springs (1 to 10 gpm):

Name	Location		Discharge (in gpm)[1]	Date Discharge Measured
	Latitude	Longitude		
Aguajita	315623	1130037	4	12/13/1976
Unnamed	315700	1130116	1	12/14/1976

Source: Compilation of databases from ADWR & others

C. Total number of springs, regardless of discharge, identified by USGS (see ALRIS, 2005 and USGS, 2006): 4 to 6

Notes:
[1] Most recent measurement identified by ADWR

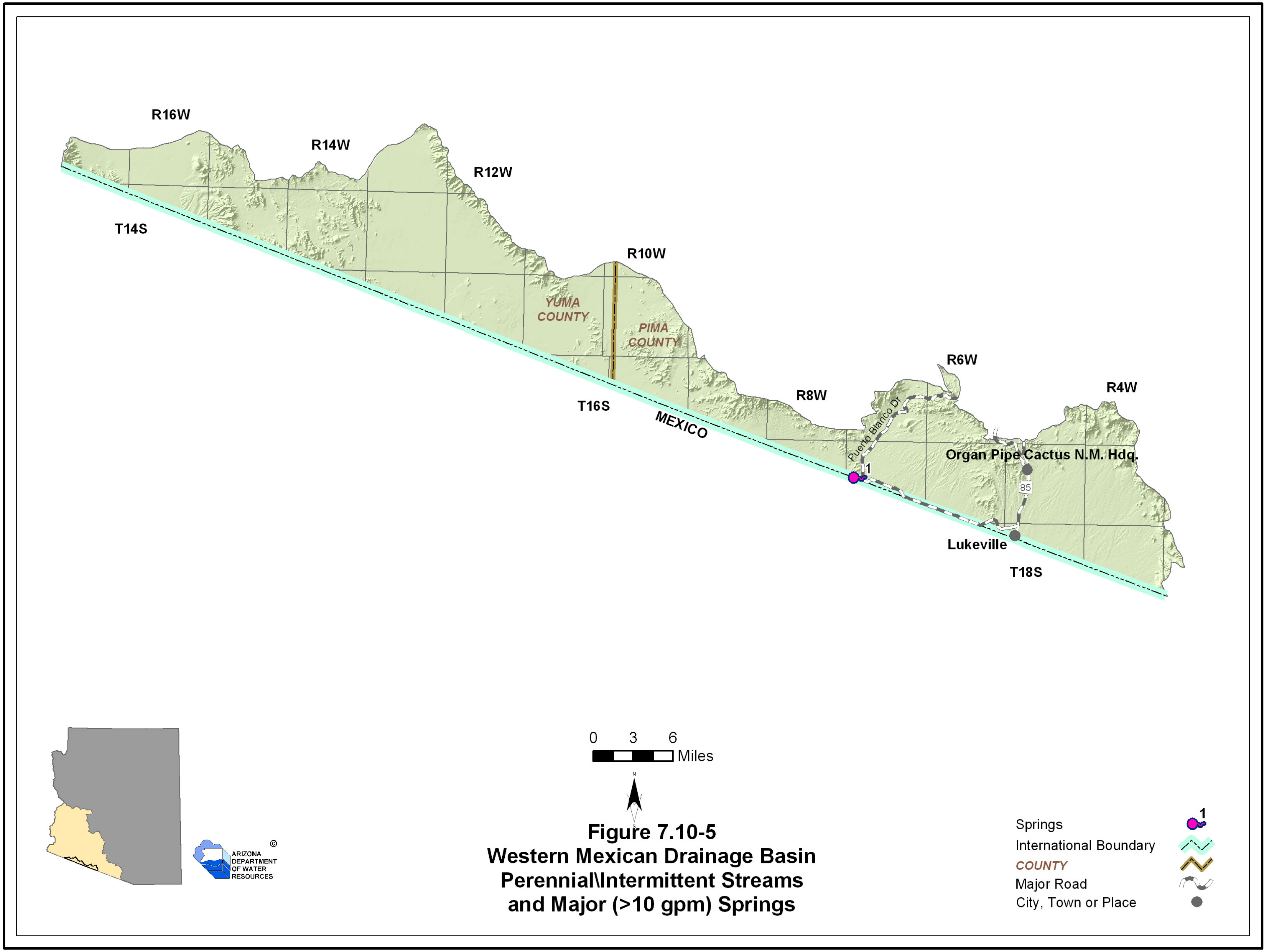


Figure 7.10-5
Western Mexican Drainage Basin
Perennial\Intermittent Streams
and Major (>10 gpm) Springs

7.10.6 Groundwater Conditions of the Western Mexican Drainage Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.10-4. Figure 7.10-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.10-7 contains hydrographs for selected wells shown on Figure 7.10-6. Figure 7.10-8 shows well yields in one category. A description of aquifer data sources and methods is found in Volume 1, Appendix A. A description of well data sources and methods, including water-level changes and well yields, is found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.10-4 and Figure 7.10-6.
- The major aquifer is basin fill.
- Groundwater flow is from north to south.

Well Yields

- Refer to Table 7.10-4 and Figure 7.10-8.
- As shown on Figure 7.10-8, all recorded well yields are less than 100 gpm.
- One source of well yield information, based on three reported wells, indicates that the median well yield is 50 gpm.

Natural Recharge

- Refer to Table 7.10-4.
- The natural recharge estimate for this basin is 1,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 7.10-4.
- Storage estimates range from 3.0 million acre-feet (maf) to 4.1 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.10-6. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures one index well in this basin. Hydrographs for this well (B) and four other wells are shown on Figure 7.10-7.
- The deepest water level shown on the map is 337 feet at the Organ Pipe Cactus National Monument Headquarters and the shallowest is 27 feet near Puerto Blanco Drive.

Table 7.10-4 Groundwater Data for the Western Mexican Drainage Basin

Basin Area, in square miles:	610	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	1.9 (1 well measured)	Measured by ADWR (GWSI) and/or USGS
	Range 30-50 Median 50 (3 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 0-500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	1,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	4,100,000 (to 1,200 ft)	ADWR (1994b)
	3,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
Current Number of Index Wells:	1	
Date of Last Water-level Sweep:	2004 (6 wells measured)	

[1]Predevelopment Estimate

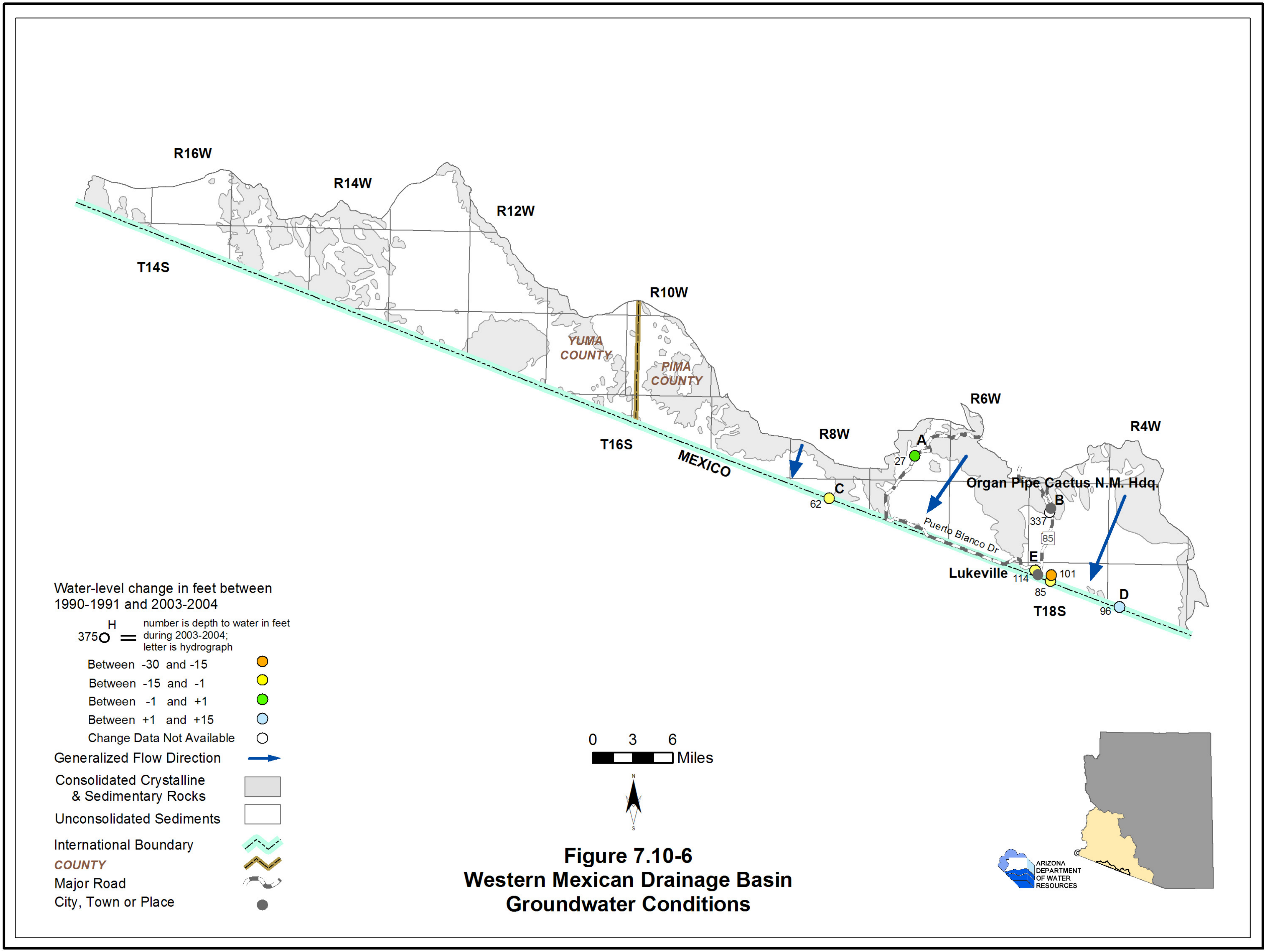
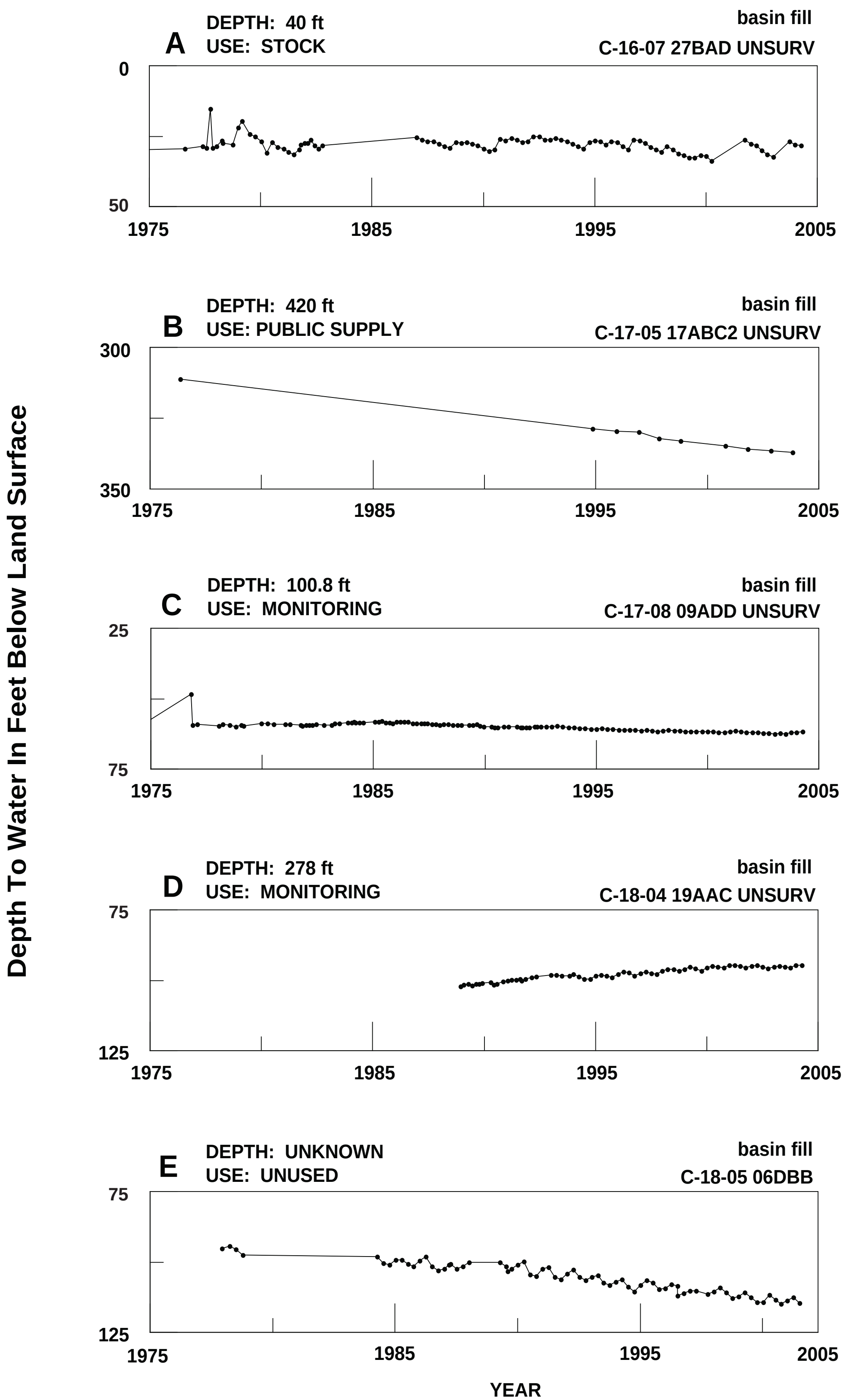


Figure 7.10-6
Western Mexican Drainage Basin
Groundwater Conditions

Figure 7.10-7
Western Mexican Drainage Basin
Hydrographs Showing Depth to Water in Selected Wells



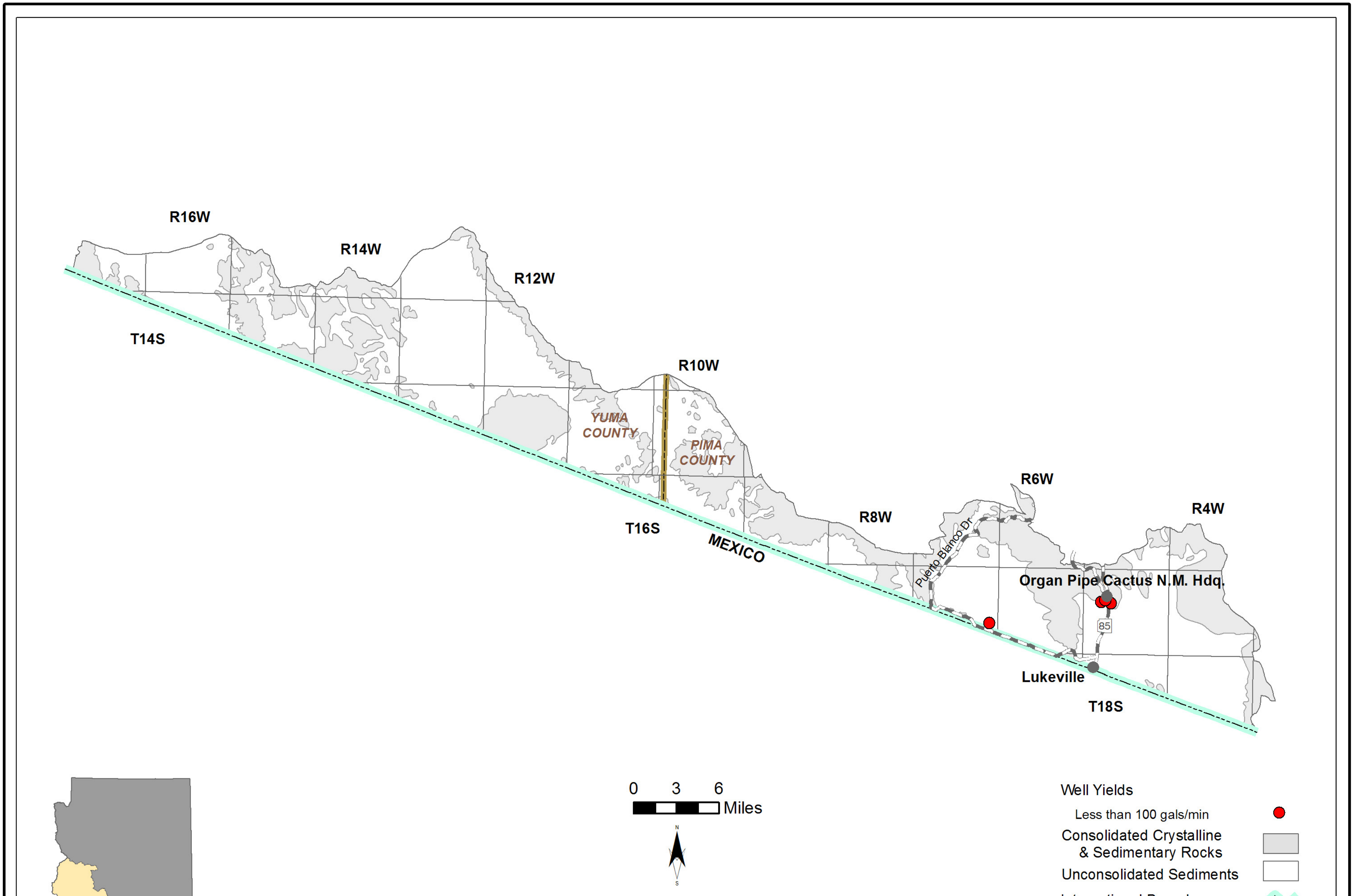


Figure 7.10-8
Western Mexican Drainage Basin
Well Yields

7.10.7 Water Quality of the Western Mexican Drainage Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.10-5A. There are no impaired lakes or streams in this basin. Figure 7.10-9 shows the location of water quality occurrences keyed to Table 7.10-5. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.10-5A.
- Six wells have parameter concentrations that have equaled or exceeded drinking water standards.
- The parameter for fluoride was equaled or exceeded in all wells. Other parameters equaled or exceeded include arsenic and lead.

Table 7.10-5 Water Quality Exceedences in the Western Mexican Drainage Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	17 South	7 West	17	F
2	Well	17 South	7 West	17	As, F
3	Well	17 South	7 West	18	As, F, Pb
4	Well	17 South	7 West	24	F
5	Well	17 South	8 West	9	F
6	Well	17 South	8 West	11	As, F

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard	Parameter(s) Exceeding Use Standard
None identified by ADWR at this time						

Notes:

[1] Water quality samples collected between 1976 and 1988.

[2] As = Arsenic
F = Fluoride
Pb = Lead

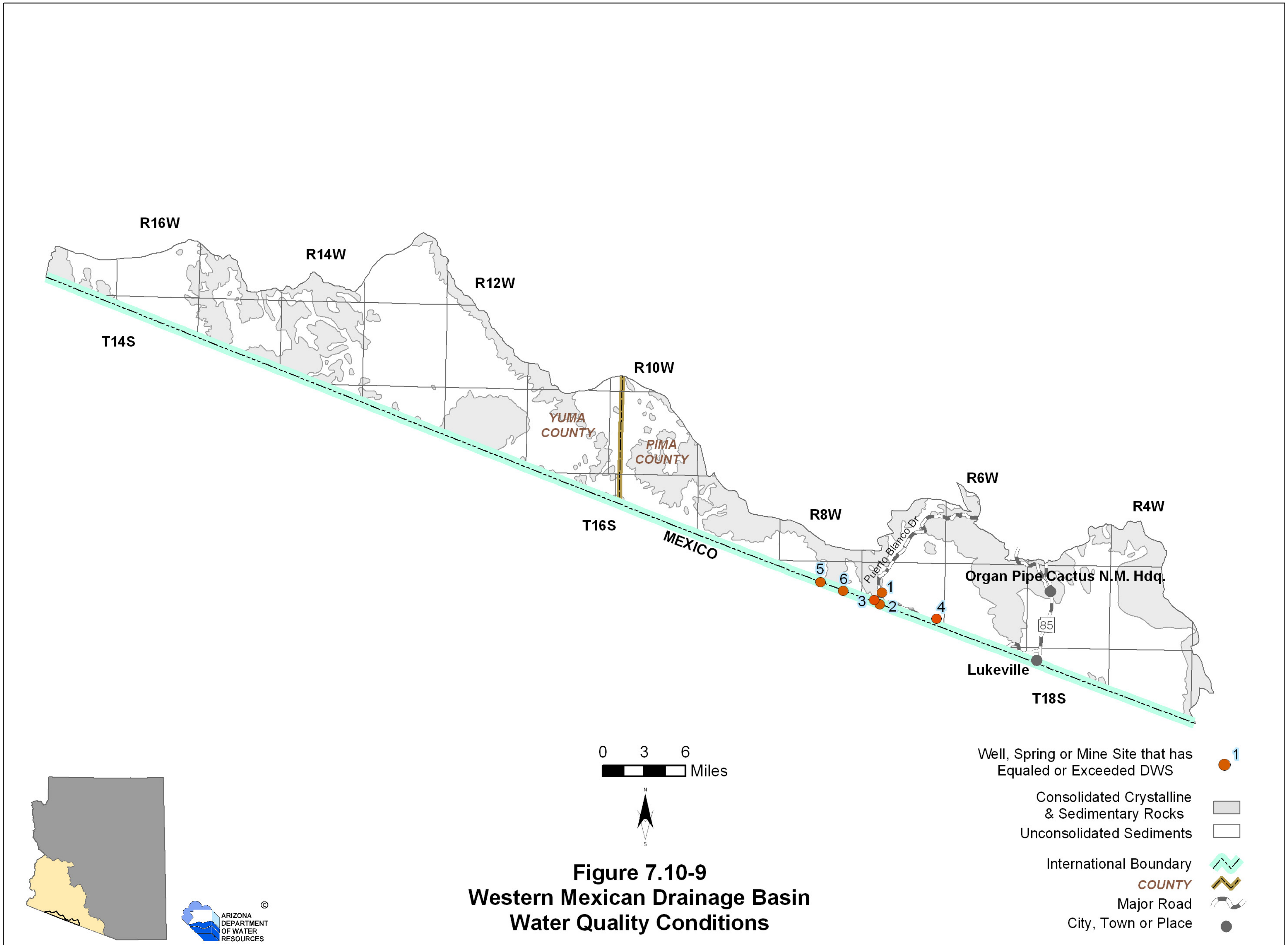


Figure 7.10-9
Western Mexican Drainage Basin
Water Quality Conditions

7.10.8 Cultural Water Demands in the Western Mexican Drainage 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 7.10-6. There is no recorded effluent generation in this basin. The USGS National Gap Analysis Program, the primary source of cultural demand map data, showed no demand centers for this basin. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 7.0.7.

Cultural Water Demands

- Refer to Table 7.10-6
- Population in this basin is very small, with 33 residents in 2000.
- There are no recorded surface water uses. All groundwater use is for municipal demand and has remained relatively constant since 1971.
- As of 2005 there were 20 registered wells with a pumping capacity of less than or equal to 35 gpm and five wells with a pumping capacity of more than 35 gpm.

Table 7.10-6 Cultural Water Demand in the Western Mexican Drainage Basin[1]

<table>
<tr><th rowspan="3">Year</th><th rowspan="3">Estimated and Projected Population</th><th colspan="2" rowspan="2">Number of Registered Water Supply Wells Drilled</th><th colspan="6">Average Annual Demand (in acre-feet)</th><th rowspan="3">Data Source</th></tr>
<tr><th colspan="3">Well Pumpage</th><th colspan="3">Surface-Water Diversions</th></tr>
<tr><th>Q ≤ 35 gpm</th><th>Q > 35 gpm</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th><th>Municipal</th><th>Industrial</th><th>Agricultural</th></tr>
<tr><td>1971</td><td></td><td rowspan="10">18[2]</td><td rowspan="10">5[2]</td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td><td rowspan="20">ADWR (1994a)</td></tr>
<tr><td>1972</td><td></td></tr>
<tr><td>1973</td><td></td></tr>
<tr><td>1974</td><td></td></tr>
<tr><td>1975</td><td></td></tr>
<tr><td>1976</td><td></td><td colspan="3" rowspan="5"><500</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>1977</td><td></td></tr>
<tr><td>1978</td><td></td></tr>
<tr><td>1979</td><td></td></tr>
<tr><td>1980</td><td>10</td></tr>
<tr><td>1981</td><td>11</td><td rowspan="5">0</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>12</td></tr>
<tr><td>1983</td><td>13</td></tr>
<tr><td>1984</td><td>14</td></tr>
<tr><td>1985</td><td>15</td></tr>
<tr><td>1986</td><td>16</td><td rowspan="5">0</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>17</td></tr>
<tr><td>1988</td><td>18</td></tr>
<tr><td>1989</td><td>19</td></tr>
<tr><td>1990</td><td>20</td></tr>
<tr><td>1991</td><td>21</td><td rowspan="5">0</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td><td rowspan="15">USGS (2007)</td></tr>
<tr><td>1992</td><td>23</td></tr>
<tr><td>1993</td><td>24</td></tr>
<tr><td>1994</td><td>25</td></tr>
<tr><td>1995</td><td>27</td></tr>
<tr><td>1996</td><td>28</td><td rowspan="5">2</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>29</td></tr>
<tr><td>1998</td><td>30</td></tr>
<tr><td>1999</td><td>32</td></tr>
<tr><td>2000</td><td>33</td></tr>
<tr><td>2001</td><td>34</td><td rowspan="5">0</td><td rowspan="5">0</td><td rowspan="5"><300</td><td rowspan="5">NR</td><td rowspan="5">NR</td><td colspan="3" rowspan="5">NR</td></tr>
<tr><td>2002</td><td>35</td></tr>
<tr><td>2003</td><td>36</td></tr>
<tr><td>2004</td><td>37</td></tr>
<tr><td>2005</td><td>38</td></tr>
<tr><td>2010</td><td>42</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>51</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>59</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>WELL TOTALS:</td><td>20</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

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

7.10.9 Water Adequacy Determinations in the Western Mexican Drainage Basin

No water adequacy applications for the Western Mexican Drainage Basin were filed with the Department as of December 2008. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

Western Mexican Drainage Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Water Resources (ADWR), 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

_____, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

_____, 2005c, Wells55: Database.

_____, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

_____, 1994a, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

_____, 1994b, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

Arizona Land Resource Information System (ALRIS), 2005, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

_____ (ALRIS), 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

F

Freethey, G.W. and Anderson, T.W. 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 2006, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

U

United States Geological Survey (USGS), 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Precipitation and temperature stations: Data file, accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Carruth, R.L., 1996, Hydrogeology of the Quitobaquito Springs and La Abra Plain Area, Organ Pipe Cactus National Monument, Arizona and Sonora, Mexico: USGS Water-Resources Investigations Report 95-4295.

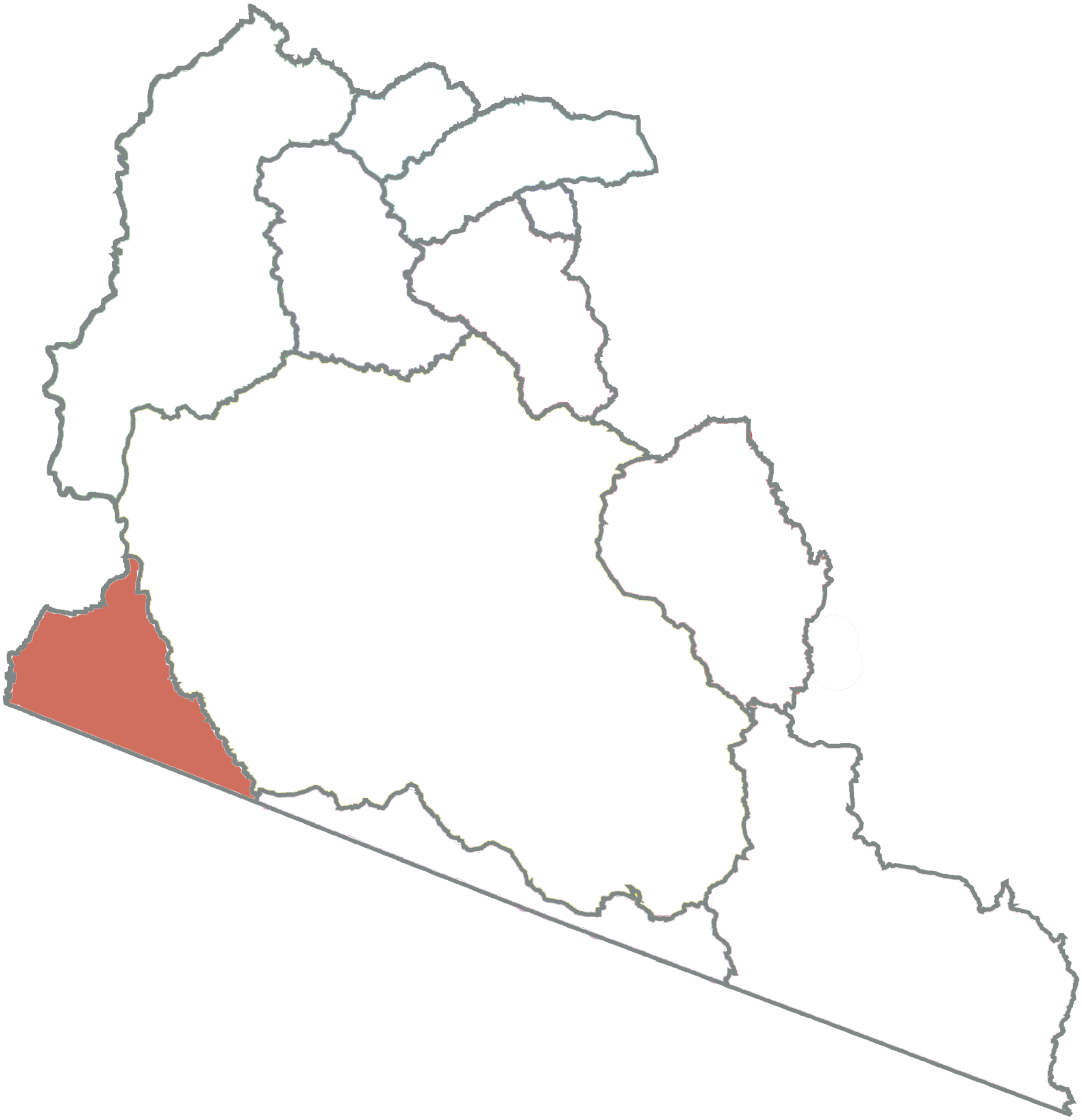
______, 1994, Hydrology of the Quitobaquito Springs area, Arizona and Sonora, Mexico: in the Approaching Millennium -Evolving Perspectives in Water Resources: Proceedings from the 7th annual Arizona Hydrological Society Symposium, September 1994, Scottsdale, Arizona, p. 261-262.

Fisher, S. G., 1989, Hydrologic and limonlogic features of the Quitobaquito pond and springs, Organ Pipe Cactus National Monument: US Park Service Report.

Goodman, B.S., 1992, Hydrogeology of the Quitobaquito Springs Area, La Abra Plain, and the Rio Sonoita Valley, Organ Pipe Cactus National Monument, Arizona and Sonora, Mexico: University of Arizona, M.S. thesis.

Santec Consulting, 1999, Small and minor watercourses analysis for Yuma County, Arizona, Arizona State Land Department, Final Report.

Section 7.11
Yuma Basin



7.11.1 Geography of the Yuma Basin

The Yuma Basin, located in the northeastern part of the planning area is 792 square miles in area. Geographic features and principal communities are shown on Figure 7.11-1. The basin is characterized by desert valleys and mountain ranges. Vegetation type is Lower Colorado River Valley Sonoran desertscrub. (See Figure 7.0-9)

- Principal geographic features shown on Figure 7.11-1 are:
    - The Colorado River on the western basin boundary
    - Yuma Desert in the southern portion of the basin
    - Tinajas Altas Mountains and the Gila Mountains on the eastern basin boundary with the highest point in the basin at 2,694 feet.
    - The lowest point in the basin at 70 feet where the Colorado River enters Mexico at the southern international boundary.

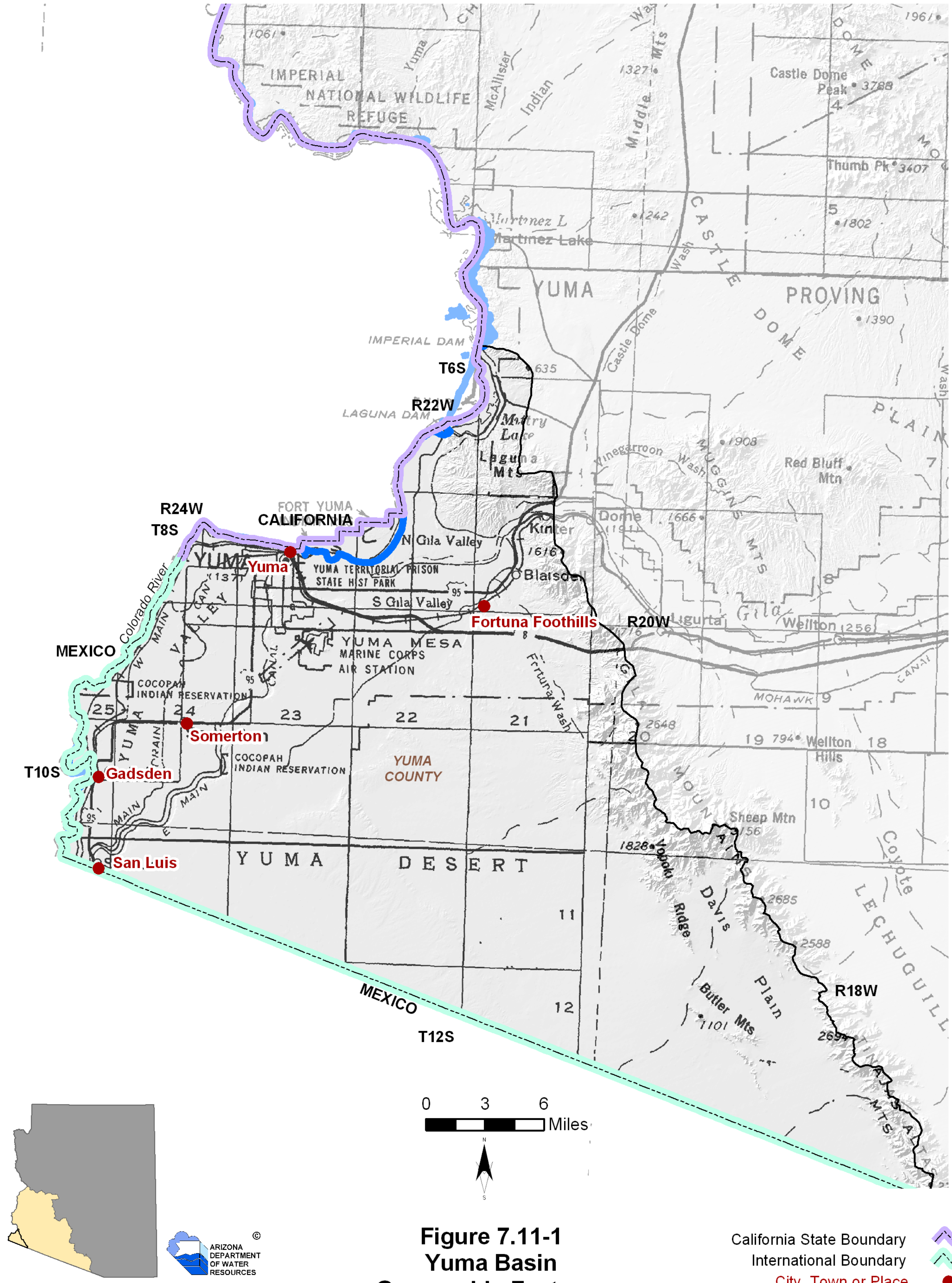


Figure 7.11-1
Yuma Basin
Geographic Features

7.11.2 Land Ownership in the Yuma Basin

Land ownership, including the percentage of ownership by category, for the Yuma Basin is shown in Figure 7.11-2. The principal feature of land ownership in this basin is the relatively large portion of military and private lands. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on protected areas is found in Section 7.0.4. Land ownership categories are discussed below in the order of largest to smallest percentage in the basin.

U.S. Military

- 51.7% of the land is federally owned and managed by the U.S. Military
- U.S. Military lands include the Barry Goldwater Air Force Range, the Yuma Marine Corps Air Station (MCAS) and the Yuma Proving Grounds.
- Primary land use is military activity.

Private

- 27.8% of the land is private.
- Land uses include agriculture, domestic and commercial.

U.S. Bureau of Land Management (BLM)

- 8.2% of the land is federally owned and managed by the Yuma Field Office of the Bureau of Land Management.
- Primary land use is unknown.

State Trust Land

- 5.9% of the land is held in trust for the public schools under the State Trust Land system.
- Primary land use is agriculture.

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

- 4.9% of the land is federally owned and managed by the U.S. Bureau of Reclamation.
- Land use is unknown.

Indian Reservation

- 1.5% of the land is under tribal ownership.
- Tribal lands include the Cocopah Indian Reservation in three separate areas in the western portion of the basin and the Fort Yuma-Quechan Indian Reservation west of Laguna Dam Road.
- Land uses include domestic, commercial and agriculture.

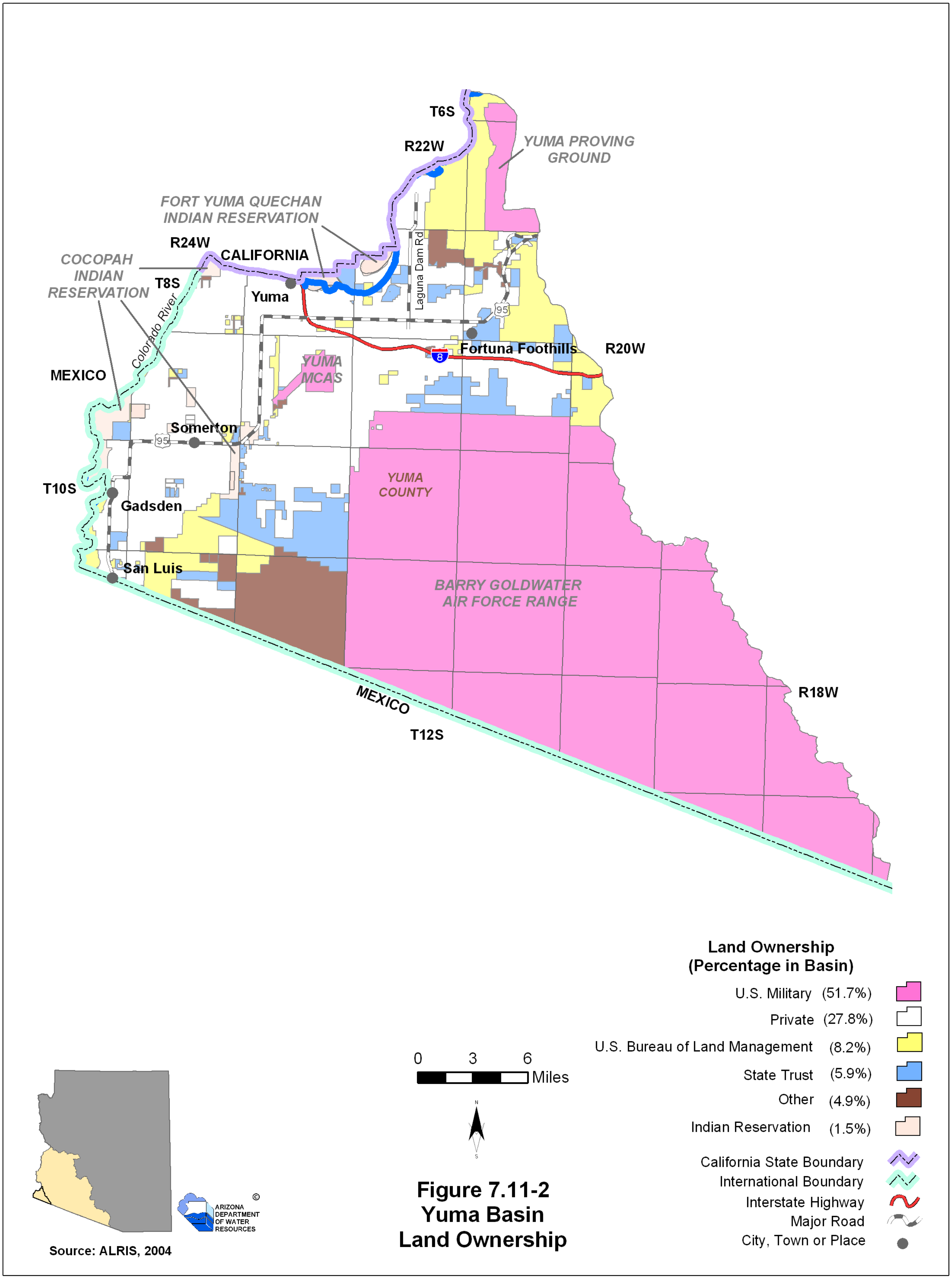


Figure 7.11-2
Yuma Basin
Land Ownership

7.11.3 Climate of the Yuma Basin

Climate data from NOAA/NWS Co-op Network, Evaporation Pan and AZMET stations are complied in Table 7.11-1 and the locations are shown on Figure 7.11-3. Figure 7.11-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. The Yuma Basin does not contain SNOTEL/ Snowcourse stations. More detailed information on climate in the planning area is found in Section 7.0.3. A description of climate data sources and methods is found in Volume 1, Appendix A.

NOAA/NWS Co-op Network

- Refer to Table 7.11-1A
- There are three NOAA/NWS Co-op network climate stations in the basin. The average monthly maximum temperature occurs in July at all stations and ranges between 94.1°F at Yuma WSO AP and 89.6°F at Yuma Valley. The average monthly minimum temperature occurs in December and ranges between 54.1°F at Yuma Citrus Station and 57.4°F at Yuma WSO AP.
- Highest average seasonal rainfall occurs at most stations in the summer (July-September). For the period of record used, the highest annual rainfall is 3.89 inches at the Yuma Citrus Station and the lowest is 2.63 inches at Yuma Valley.
- This is the most arid basin in the state.

Evaporation Pan

- Refer to Table 7.11-1B
- There are two evaporation pan stations in the basin at elevations of 210 feet and 190 feet with an average annual evaporation of 122.5 inches and 99.21 inches respectively.

AZMET

- Refer to Table 7.11-1C
- There are three AZMET stations in the basin at elevations ranging from 105 feet to 190 feet with average annual reference evaportranspiration of between 80.54 inches and 83.75 inches.

SCAS Precipitation Data

- See Figure 7.11-3
- Additional precipitation data shows average annual rainfall of four inches or less in most of the basin and an average annual rainfall as high as six inches along the eastern basin boundary.

Table 7.11-1 Climate Data for the Yuma Basin

A. NOAA/NWS Co-op Network:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Average Temperature Range (in F)		Average Precipitation (in inches)				
			Max/Month	Min/Month	Winter	Spring	Summer	Fall	Annual
Yuma Citrus Station	190	1971 - 2000	90.8/Jul	54.1/Dec	1.16	0.23	1.51	0.99	3.89
Yuma Valley	120	1971 - 2000	89.6/Jul	54.9/Dec	0.99	0.13	0.82	0.69	2.63
Yuma WSO AP	210	1971 - 2000	94.1/Jul	57.4/Dec	0.93	0.16	1.10	0.82	3.01

Source: WRCC, 2005

B. Evaporation Pan:

Station Name	Elevation (in feet)	Period of Record Used for Averages	Avg. Annual Evap (in inches)
Yuma AP	210	NA	122.5
Yuma Citrus Station	190	1920 - 2002	99.21

Source: WRCC, 2005

Notes:
NA = Not available

C. AZMET:

Station Name	Elevation (in feet)	Period of Record	Average Annual Reference Evaportranspiration, in inches (*Number of years to calculate averages*)
Yuma Mesa	190	1987 - current	81.05 *(8)*
Yuma North Gila	144	1988 - current	80.54 *(9)*
Yuma Valley	105	1987 - current	83.75 *(9)*

Source: Arizona Meteorological Network, 2007

D. SNOTEL/Snowcourse:

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

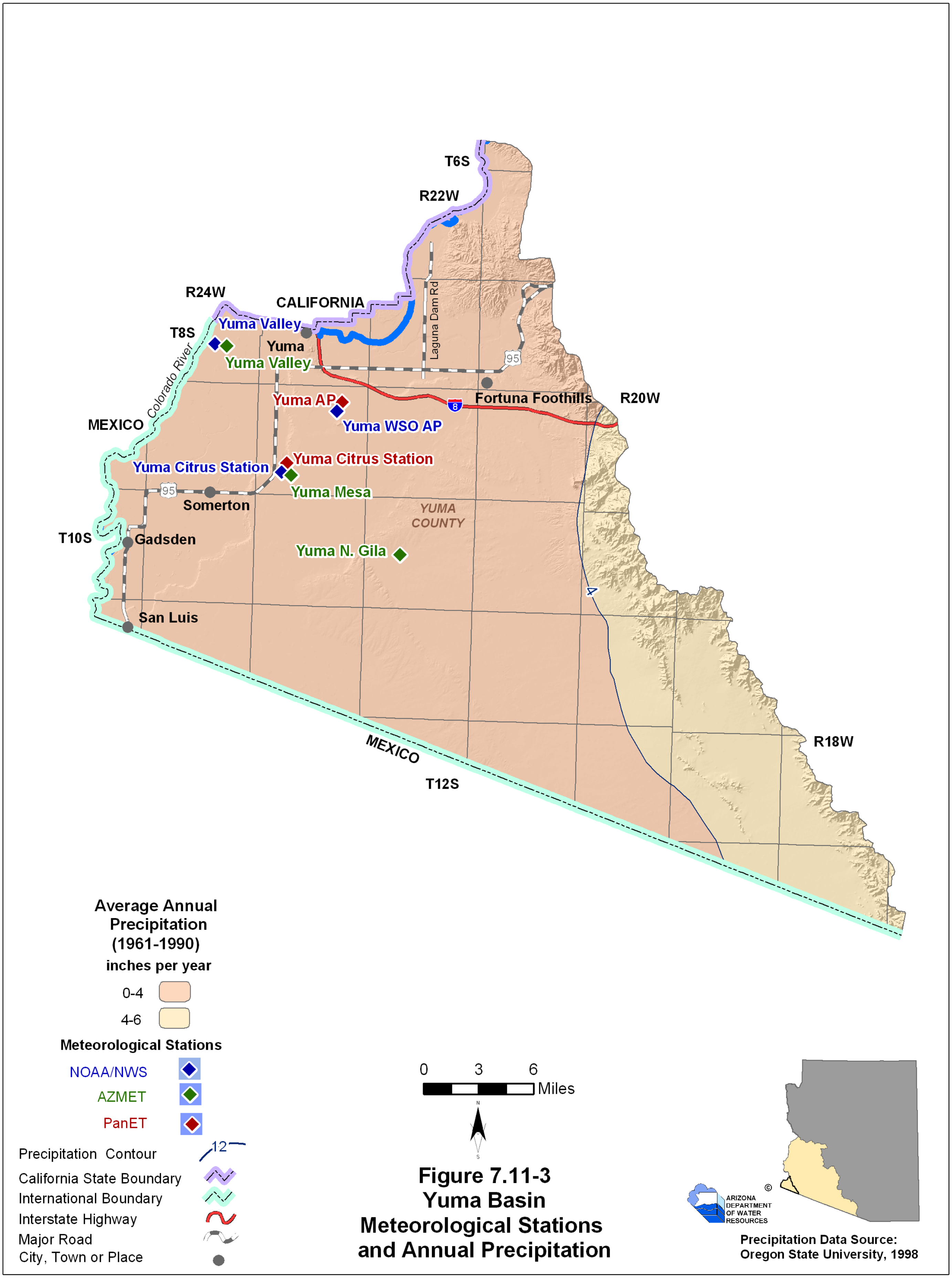


**Figure 7.11-3
Yuma Basin
Meteorological Stations
and Annual Precipitation**

7.11.4 Surface Water Conditions in the Yuma Basin

Streamflow data, including average seasonal flow, average annual flow and other information are shown in Table 7.11-2. Reservoir and stockpond data, including maximum storage or maximum surface area, are shown in Table 7.11-3. The location of streamflow gages identified by USGS number and large reservoirs are shown on Figure 7.11-5. There are no flood ALERT stations or USGS runoff contour data available for this basin. Descriptions of stream, reservoir and stockpond data sources and methods are found in Volume 1, Appendix A.

Streamflow Data

- Refer to Table 7.11-2.
- Data from seven stations located on two watercourses are shown in the table and on Figure 7.11-5. Four stations have been discontinued and two are real-time stations.
- Highest average seasonal flow varies from station to station. Flows are impacted by regulatory releases, diversions and return flow.
- The largest annual flow recorded in the basin is almost 26 million acre-feet (maf) in 1909 at the Colorado River at Yuma Station. Mean annual flow at this station is 10.1 maf. The hydrograph of annual flows at this station shows the dramatic drop in river flow during the construction of Hoover Dam from 1931-1935. (See Figure 7.11-4)

Reservoirs and Stockponds

- Refer to Table 7.11-3.
- The basin contains two large reservoirs. The largest, Mittry Lake has a maximum storage of 4,850 acre-feet. This reservoir is used as a fish and wildlife pond and for flood control.
- The other large reservoir, Morelos Diversion Dam was constructed by Mexico pursuant to the 1944 Treaty to provide Mexico a mechanism for the utilization of Colorado River water.
- Surface water is stored or could be stored in two small reservoirs in the basin.
- There are no registered stockponds in this basin.

Figure 7.11-4 Annual Flows (acre-feet) at Colorado River near Yuma, water years 1904-1964 (Station #9521000)

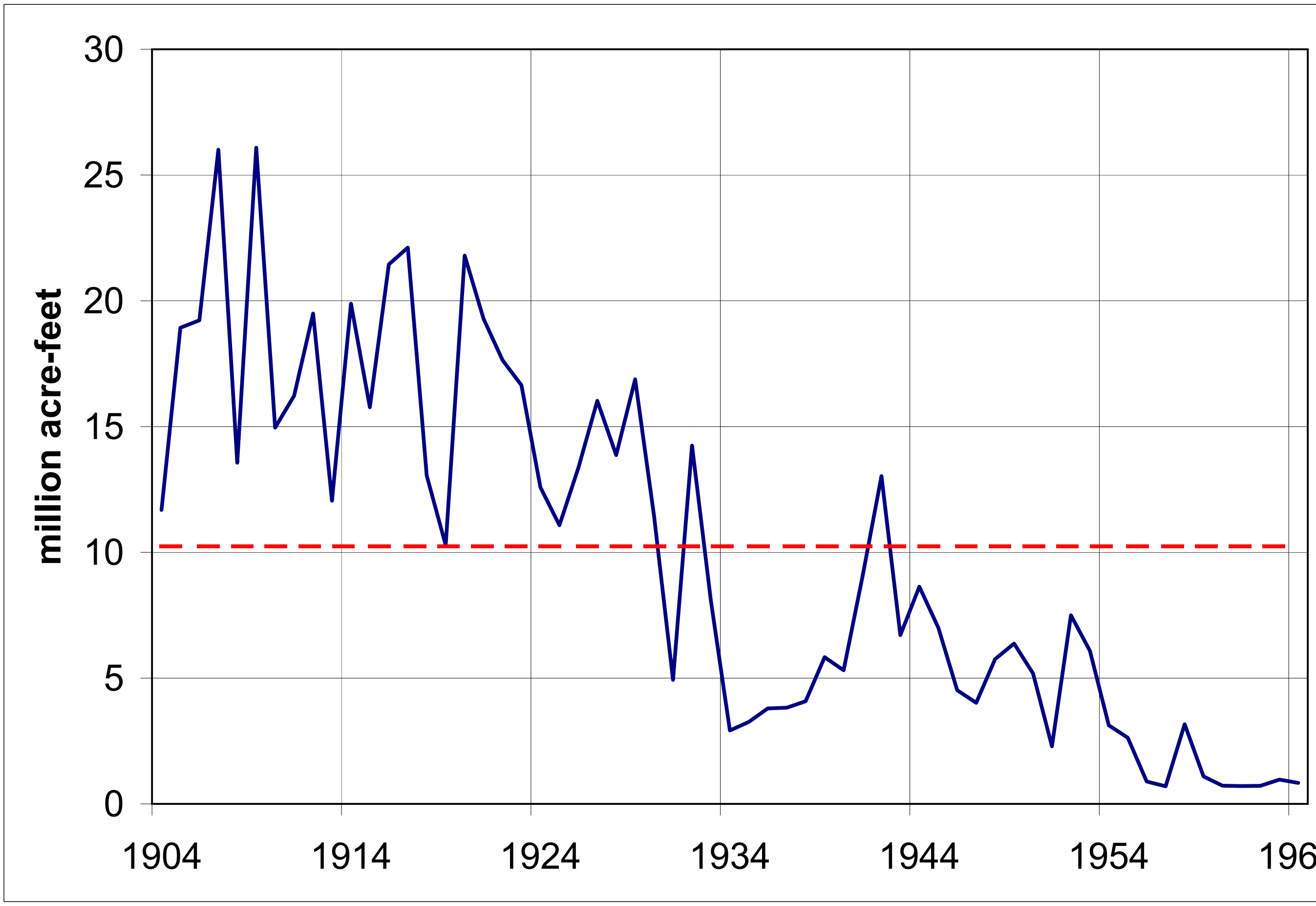


Table 7.11-2 Streamflow Data for the Yuma Basin

Station Number	USGS Station Name	Drainage Area (in mi²)	Gage Elevation (in feet)	Period of Record	Average Seasonal Flow (% of annual flow)				Annual Flow/Year (in acre-feet)				Years of Annual Flow Record
					Winter	Spring	Summer	Fall	Minimum	Median	Mean	Maximum	
9429600	Colorado River below Laguna Dam[1]	188,600	121	12/1971-current (real time)	24	21	31	24	251,952 (1973)	388,788	1,830,996	10,222,880 (1984)	19
9520500	Gila River near Dome	57,850	139	1/1905-current (real time)	41	35	10	14	0 (1993, 1936, 1940, 1942-1950)	4,772	237,245	4,733,110 (1993)	76
9520700	Gila River near mouth near Yuma	57,950	NA	5/1968-6/1983 (discontinued)	19	34	24	22	56,398 (1978)	6,700	484,103	1,742,614 (1981)	7
9520701	Gila River at mouth (flow past gage only)	NA	NA	10/1975-6/1983 (discontinued)	17	36	27	20	30,769 (1978)	38,371	458,381	1,720,895 (1980)	7
9521000	Colorado River at Yuma	242,900	103	1/1904-11/1983 (discontinued)	17	44	25	14	682,711 (1961)	9,628,539	10,090,123	25,969,073 (1909)	60
9522000	Colorado River @ NIB above Morelos Dam	246,700	0	1/1950-current	28	24	26	21	1,281,480 (1973)	1,671,716	3,496,196	15,392,240 (1984)	48
9522200	Colorado River @ SIB near San Luis	246,700	NA	10/1960-9/1986 (discontinued)	23	21	29	26	9,412 (1982)	149,144	1,880,952	12,655,520 (1984)	24

Source: USGS (NWIS) 2005 & 2008

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

Table 7.11-3 Reservoirs and Stockponds in the Yuma 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	Mittry Lake *(Laguna Diversion)*	Bureau of Reclamation	4,850	F, C	Federal
2	Morelos Diversion	IBWC	1,160	O	Federal

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

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

Source: Compilation of databases from ADWR & others

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

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

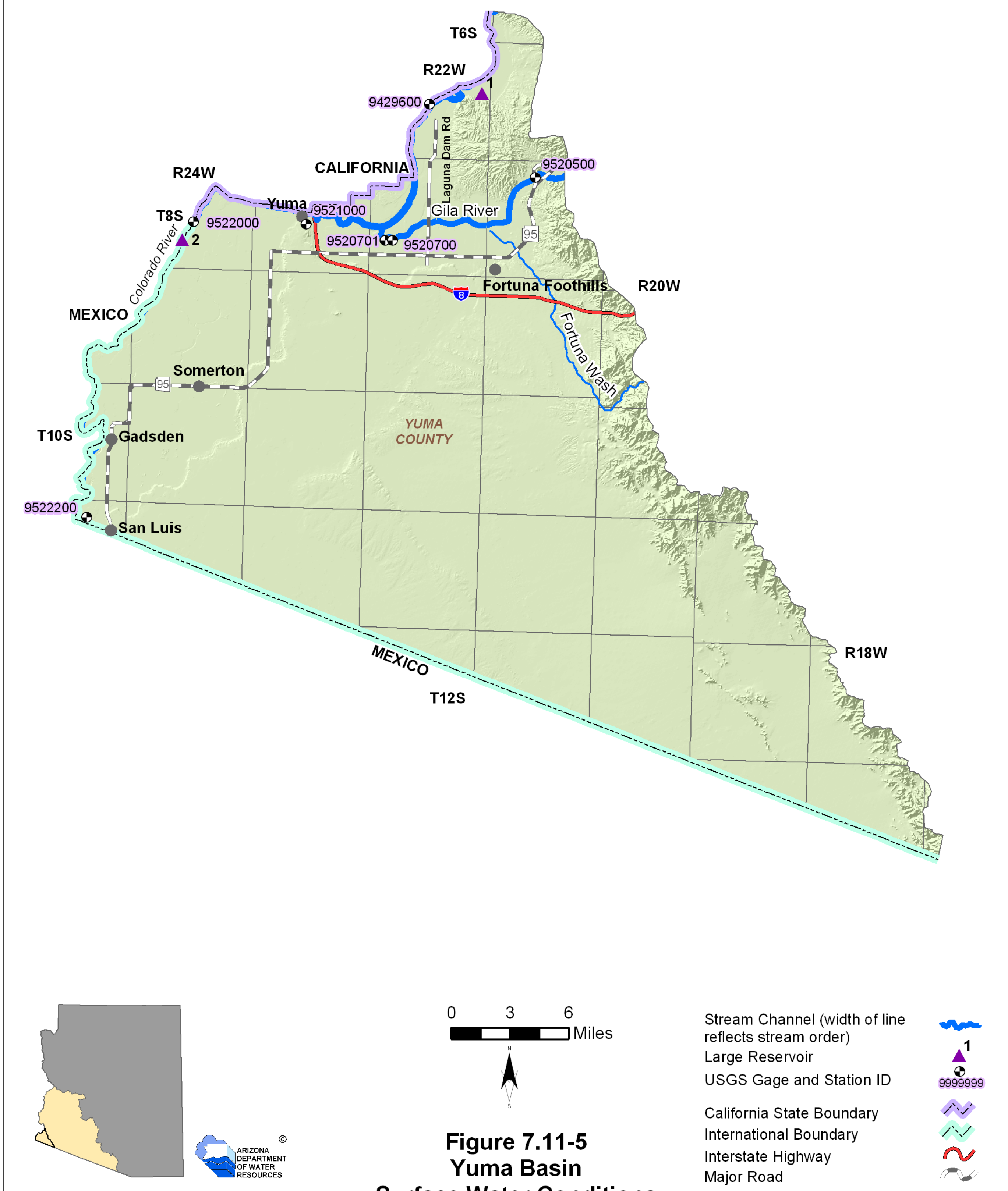
D. Other Small Reservoirs (between 5 and 50 acres surface area)[2]

Total number: 2
Total surface area: 25 acres

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

Total number: 0

Notes:
[1] F = fish & wildlife pond; C = Flood control; O = Other
[2] Capacity data is not available to ADWR
IBWC = International Boundary Water Commission



Stream Data Source: ALRIS, 2005

Figure 7.11-5
Yuma Basin
Surface Water Conditions

7.11.5 Perennial/Intermittent Streams and Major Springs in the Yuma Basin

The total number of springs in the basin are shown in Table 7.11-4. The locations of perennial streams are shown on Figure 7.11-6. A description of data sources and methods for intermittent and perennial reaches is found in Volume 1, Appendix A. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

- There are two perennial streams in this basin, the Colorado River and most of the Gila River. A small reach of the Gila River, located on the eastern basin boundary, is intermittent.
- There are no major or minor springs in the basin.
- The total number of springs, regardless of discharge, identified by the USGS is one.

Table 7.11-4 Springs in the Yuma Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

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

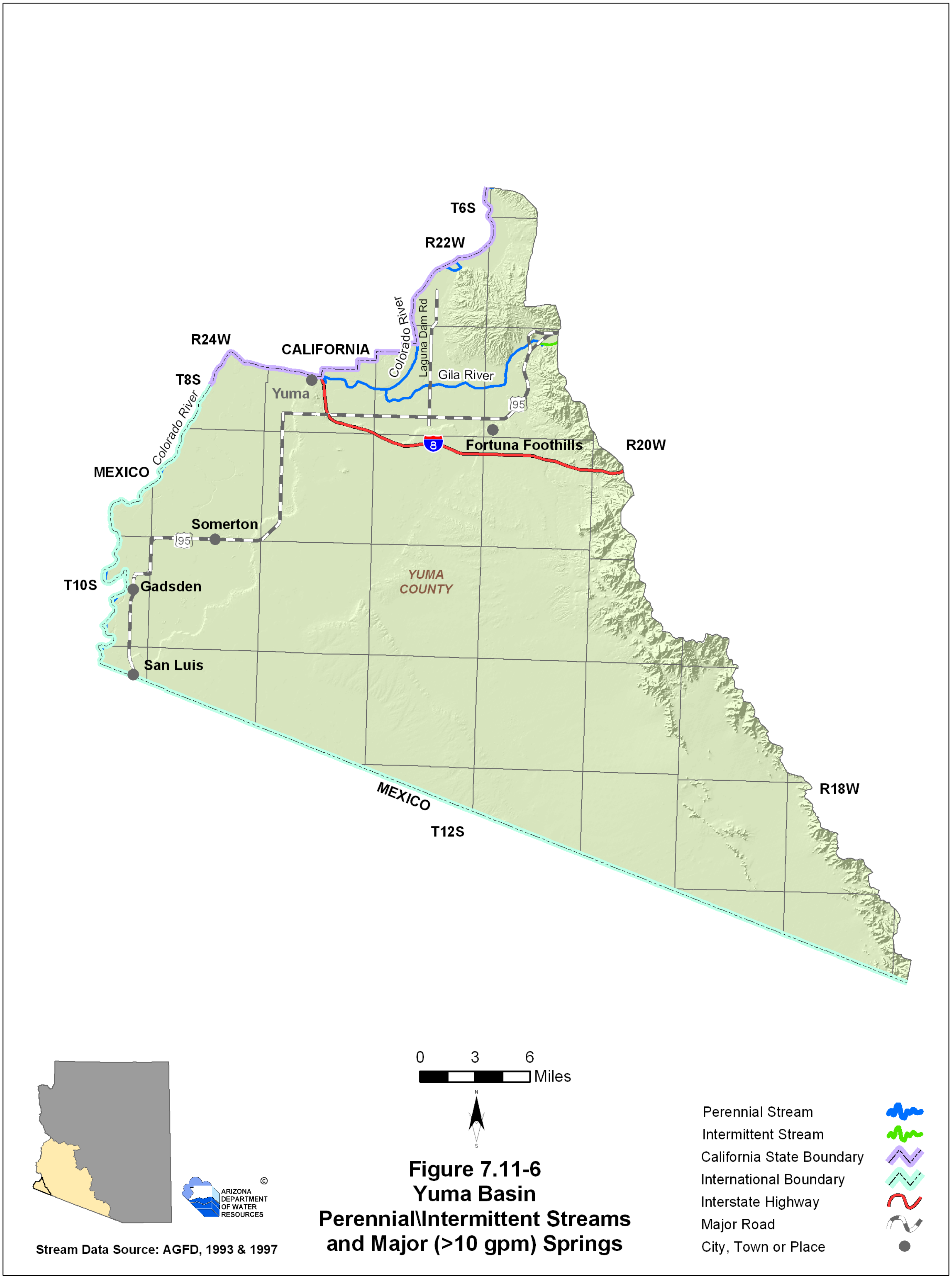


Figure 7.11-6
Yuma Basin
Perennial\Intermittent Streams and Major (>10 gpm) Springs

7.11.6 Groundwater Conditions of the Yuma Basin

Major aquifers, well yields, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 7.11-5. Figure 7.11-7 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 7.11-8 contains hydrographs for selected wells shown on Figure 7.11-7. Figure 7.11-9 shows well yields in five yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 7.11-5 and Figure 7.11-7.
- The major aquifer is basin fill.
- Flow direction is generally toward the Colorado River and south toward Mexico.

Well Yields

- Refer to Table 7.11-5 and Figure 7.11-9.
- As shown on Figure 7.11-9, well yields are generally greater than 2,000 gallons per minute (gpm).
- One source of well yield information, based on 327 reported wells, indicates that the median well yield is 2,456 gpm.
- The line of wells along the international boundary is the 242 Well Field. These wells collect groundwater and deliver it via the 242 Lateral to Mexico to meet a portion of the International treaty obligations (see Appendix D).

Natural Recharge

- Refer to Table 7.11-5.
- The natural recharge estimate is 213,000 acre-feet per year (AFA).

Water in Storage

- Refer to Table 7.11-5.
- Storage estimates range from 34 maf to 49 maf to a depth of 1,200 feet.

Water Level

- Refer to Figure 7.11-7. Water levels are shown for wells measured in 2003-2004.
- The Department annually measures 11 index wells in this basin. Hydrographs for 10 of these wells are shown on Figure 7.11-8.
- The deepest water level shown on the map is 152 feet on the Mexican border and the shallowest is nine feet east of Yuma.

Table 7.11-5 Groundwater Data for the Yuma Basin

Basin Area, in square miles:	792	
Major Aquifer(s):	**Name and/or Geologic Units**	
	Basin Fill	
Well Yields, in gal/min:	Range 3,186-5,271 Median 5,098 (3 well reported)	Measured by ADWR (GWSI) and/or USGS
	Range 10-7,000 Median 2,456 (327 wells reported)	Reported on registration forms for large (>10-inch) diameter wells (Wells55)
	Range 500-3,000	ADWR (1994b)
	Range 0-2,500	Anning and Duet (1994)
Estimated Natural Recharge, in acre-feet/year:	213,000	Freethey and Anderson (1986)
Estimated Water Currently in Storage, in acre-feet:	49,000,000 (to 1,200 ft)	ADWR (1994b)
	34,000,000[1] (to 1,200 ft)	Freethey and Anderson (1986)
	35,000,000 (to 1,200 ft)	Arizona Water Commission (1975)
Current Number of Index Wells:	11	
Date of Last Water-level Sweep:	1992 (587 wells measured)	

[1]Predevelopment Estimate

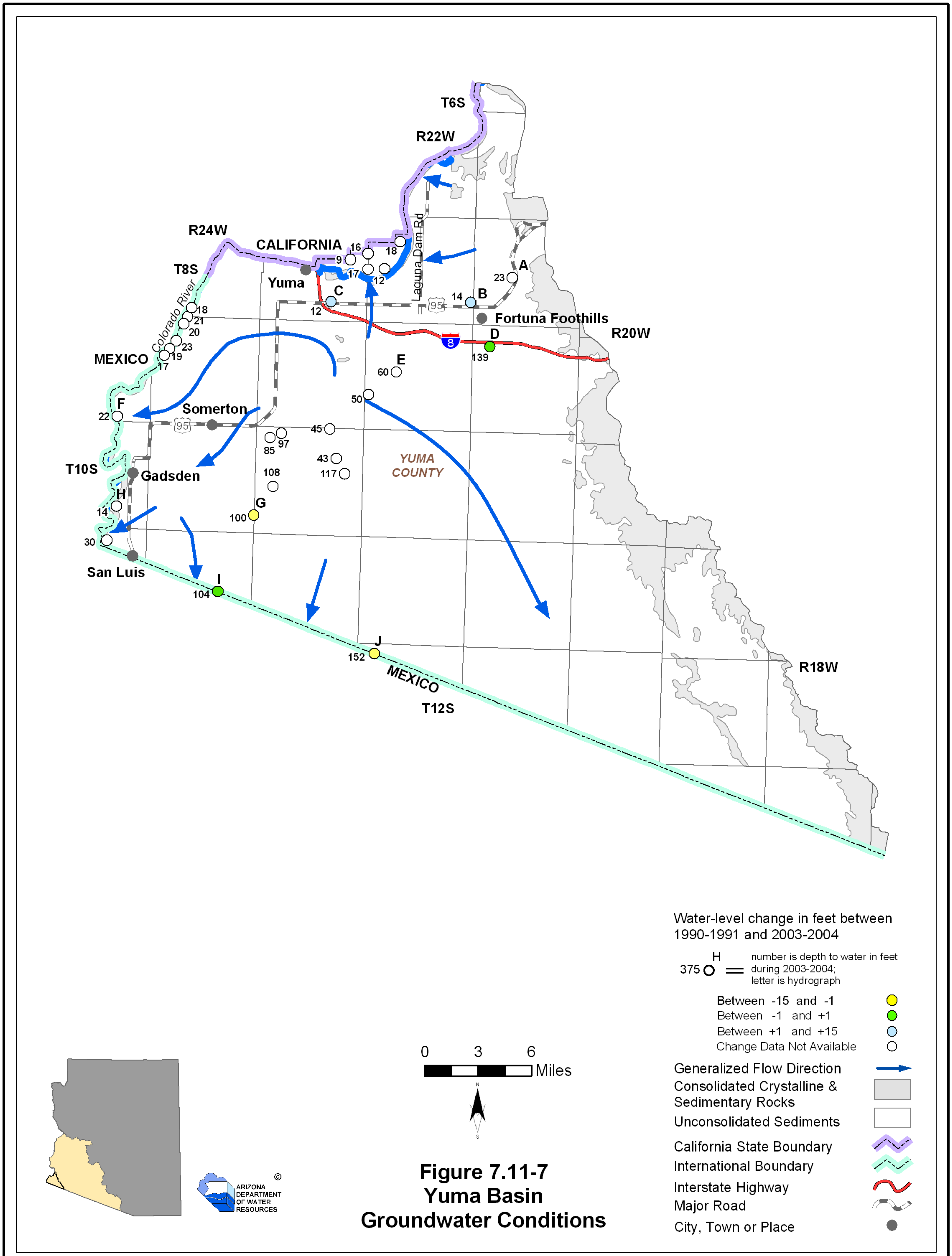


Figure 7.11-7
Yuma Basin
Groundwater Conditions

Figure 7.11-8
Yuma Basin
Hydrographs Showing Depth to Water in Selected Wells

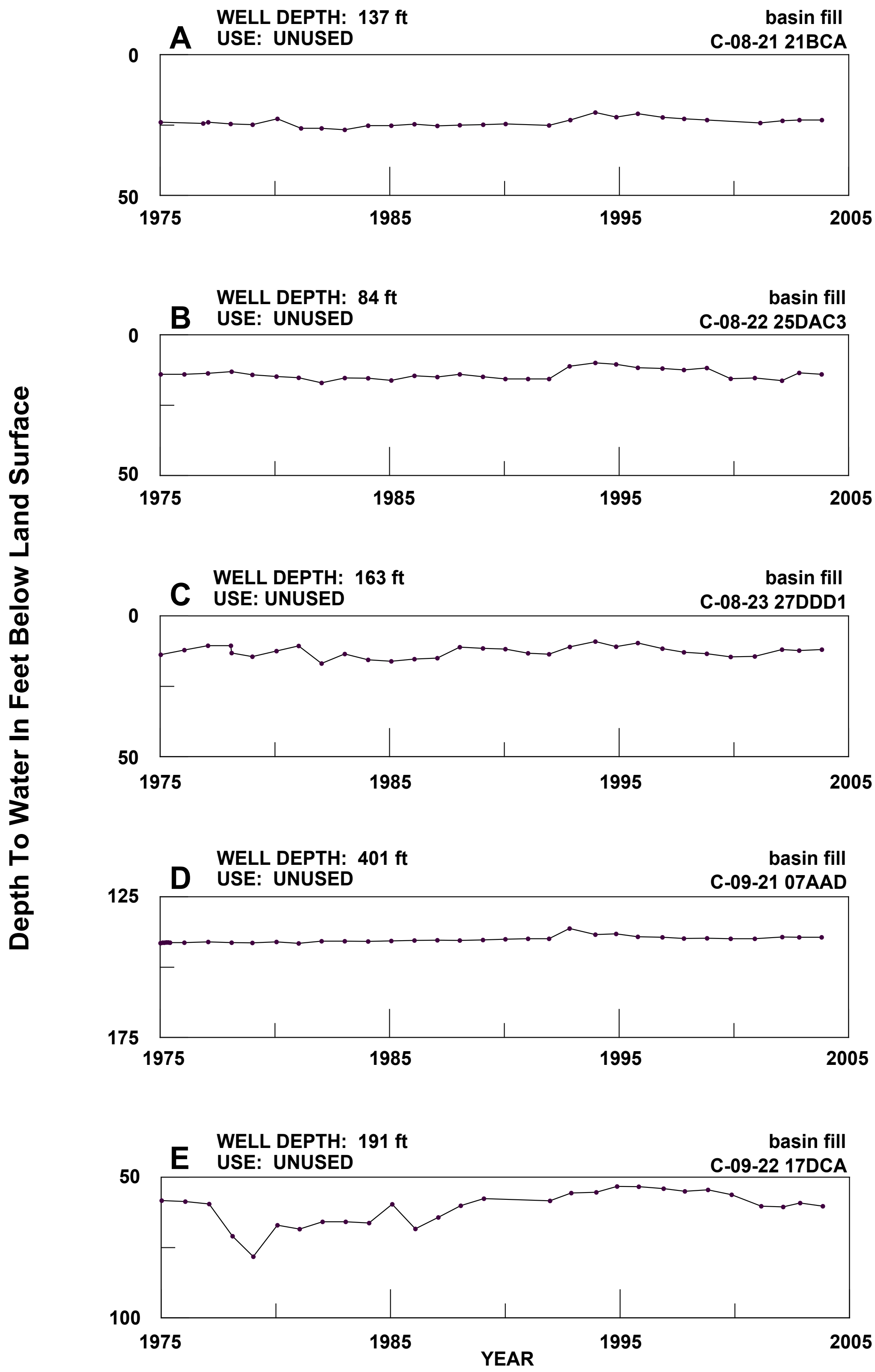
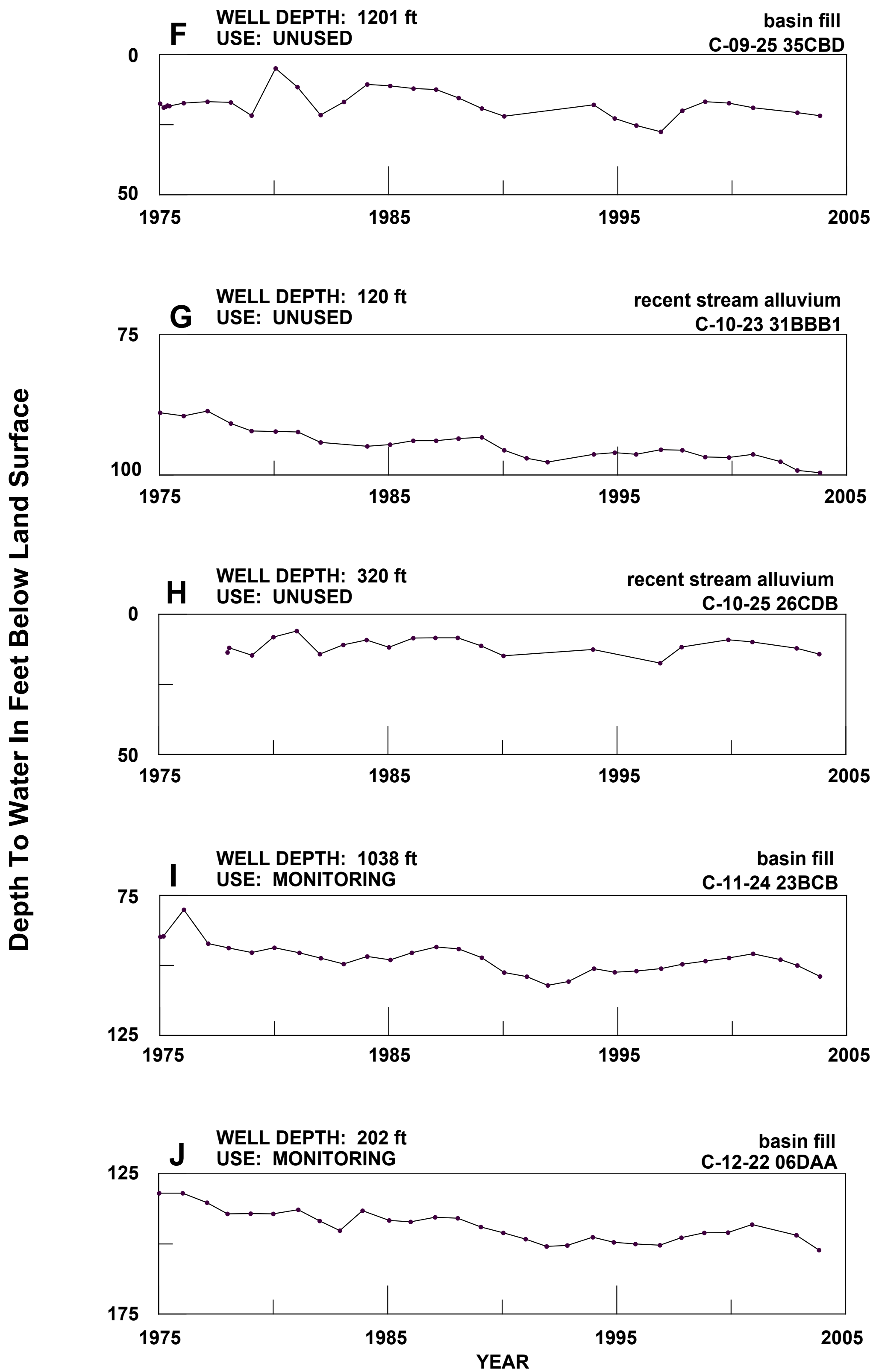


Figure 7.11-8 (cont'd)
Yuma Basin
Hydrographs Showing Depth to Water in Selected Wells



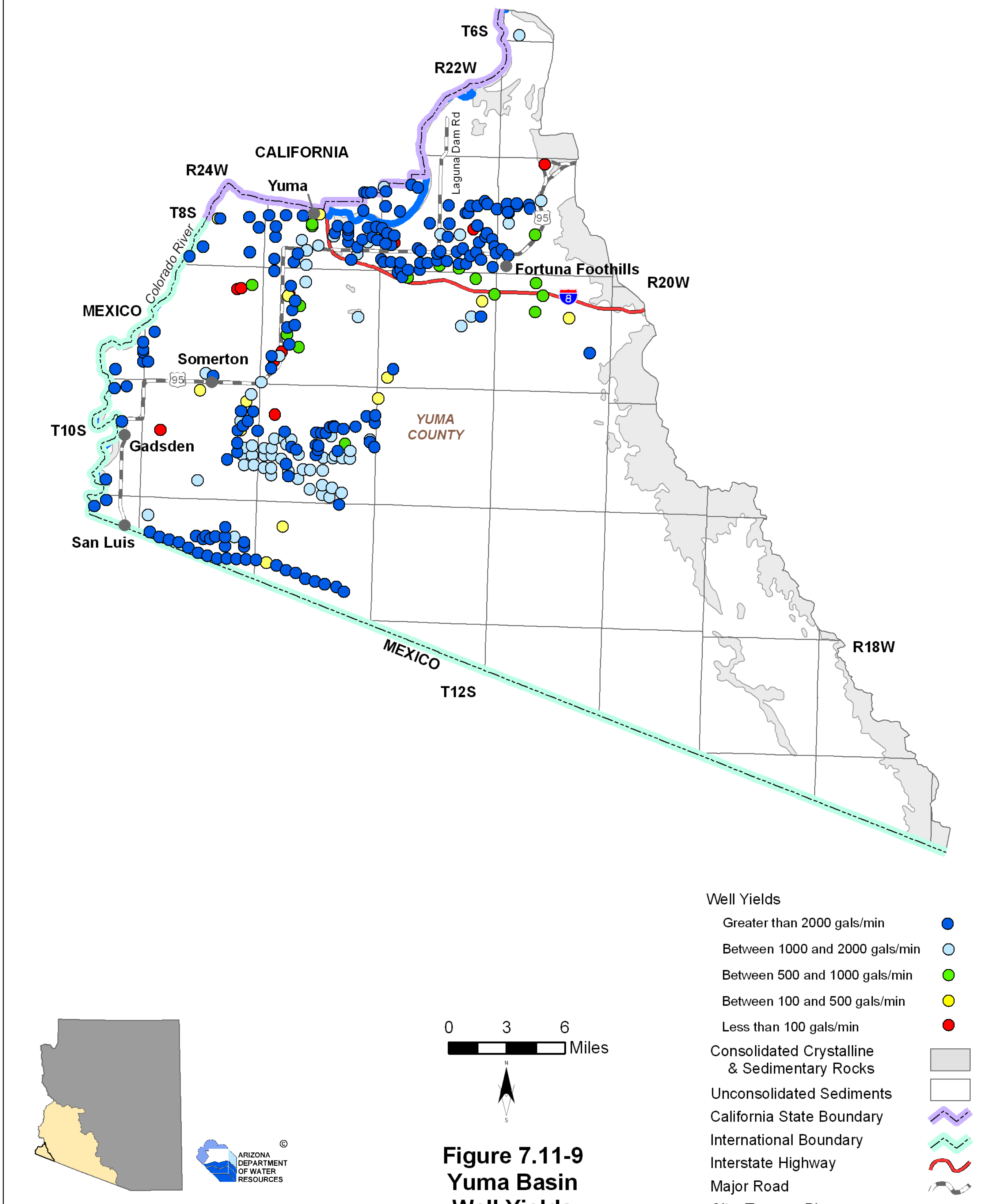


Figure 7.11-9
Yuma Basin
Well Yields

7.11.7 Water Quality of the Yuma Basin

Wells, springs and mine sites with parameter concentrations that have equaled or exceeded drinking water standard(s), including location and parameter(s) are shown in Table 7.11-6A. Impaired lakes and streams with site type, name, length of impaired reach, area of impaired lake, designated use standard and parameter(s) exceeded is shown in Table 7.11-6B. Figure 7.11-10 shows the location of water quality occurrences keyed to Table 7.11-6. All community water systems are regulated under the Safe Drinking Water Act and treat water supplies to meet drinking water standards. Not all parameters were measured at all sites; selective sampling for particular constituents is common. A description of water quality data sources and methods is found in Volume 1, Appendix A.

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

- Refer to Table 7.11-6A
- One hundred and three wells have parameter concentrations that have equaled or exceeded drinking water standards.
- Parameters frequently equaled or exceeded include arsenic, organics, lead and total dissolved solids. Other parameters equaled or exceeded include antimony, beryllium, cadmium, thallium and nitrate.

Lakes and Streams with impaired waters

- Refer to Table 7.11-6B
- The water quality standard for boron and selenium was equaled or exceeded in one 28 mile reach of the Gila River; a portion of this reach is also in the Lower Gila Basin.
- This reach of the Gila River is not part of the ADEQ water quality improvement effort, the Total Maximum Daily Load (TMDL) Program, at this time.

Table 7.11-6 Water Quality Exceedences in the Yuma Basin[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
1	Well	7 South	22 West	27	Organics
2	Well	8 South	21 West	4	TDS
3	Well	8 South	21 West	18	TDS
4	Well	8 South	21 West	18	TDS
5	Well	8 South	21 West	21	As, NO3, TDS
6	Well	8 South	21 West	21	TDS
7	Well	8 South	21 West	21	NO3
8	Well	8 South	21 West	21	NO3, Th
9	Well	8 South	21 West	29	NO3
10	Well	8 South	21 West	29	As, NO3
11	Well	8 South	21 West	29	NO3
12	Well	8 South	22 West	3	TDS
13	Well	8 South	22 West	10	NO3
14	Well	8 South	22 West	13	As, TDS
15	Well	8 South	22 West	13	TDS
16	Well	8 South	22 West	14	As
17	Well	8 South	22 West	21	As
18	Well	8 South	22 West	22	NO3, TDS
19	Well	8 South	22 West	25	As
20	Well	8 South	22 West	26	As
21	Well	8 South	22 West	27	As
22	Well	8 South	22 West	28	As
23	Well	8 South	22 West	28	As
24	Well	8 South	22 West	28	As, Organics
25	Well	8 South	22 West	30	TDS
26	Well	8 South	22 West	32	As
27	Well	8 South	22 West	32	As, Be, F, Pb, NO3, TDS
28	Well	8 South	22 West	33	As
29	Well	8 South	22 West	34	As, NO3, Organics, TDS
30	Well	8 South	23 West	25	Organics
31	Well	8 South	23 West	27	As, TDS
32	Well	8 South	23 West	27	Organics, TDS
33	Well	8 South	23 West	32	Organics
34	Well	8 South	24 West	22	Be, Cd
35	Well	8 South	24 West	24	Organics
36	Well	8 South	24 West	36	Organics
37	Well	8 South	24 West	27	Pb
38	Well	8 South	24 West	27	Organics
39	Well	9 South	21 West	3	Pb
40	Well	9 South	21 West	3	As, Pb
41	Well	9 South	21 West	3	Pb
42	Well	9 South	21 West	3	Pb
43	Well	9 South	21 West	3	Pb
44	Well	9 South	21 West	3	Pb
45	Well	9 South	21 West	4	As

Table 7.11-6 Water Quality Exceedences in the Yuma Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
46	Well	9 South	21 West	4	As
47	Well	9 South	21 West	4	As
48	Well	9 South	21 West	9	As
49	Well	9 South	21 West	9	Pb
50	Well	9 South	21 West	9	Pb
51	Well	9 South	21 West	9	Pb
52	Well	9 South	21 West	9	Pb
53	Well	9 South	21 West	9	Pb
54	Well	9 South	21 West	9	Pb
55	Well	9 South	21 West	9	Pb
56	Well	9 South	21 West	9	Pb
57	Well	9 South	21 West	9	Pb
58	Well	9 South	21 West	9	Pb
59	Well	9 South	21 West	9	As
60	Well	9 South	21 West	9	Pb
61	Well	9 South	21 West	9	Pb
62	Well	9 South	21 West	9	As, Pb
63	Well	9 South	21 West	17	As
64	Well	9 South	21 West	22	Pb
65	Well	9 South	22 West	7	NO3
66	Well	9 South	22 West	7	NO3
67	Well	9 South	22 West	31	Organics
68	Well	9 South	23 West	5	TDS
69	Well	9 South	23 West	24	Cd
70	Well	9 South	23 West	24	Cd
71	Well	9 South	23 West	28	Pb
72	Well	9 South	23 West	29	Organics
73	Well	9 South	23 West	33	NO3
74	Well	9 South	23 West	36	Organics
75	Well	9 South	24 West	1	TDS
76	Well	9 South	24 West	10	As
77	Well	9 South	24 West	11	TDS
78	Well	9 South	24 West	13	NO3, TDS
79	Well	9 South	24 West	15	Organics
80	Well	9 South	24 West	16	Organics
81	Well	9 South	24 West	17	Organics
82	Well	9 South	24 West	19	Pb
83	Well	9 South	24 West	21	NO3, Organics
84	Well	9 South	24 West	24	As, TDS
85	Well	9 South	24 West	36	Organics
86	Well	10 South	21 West	9	As, Pb
87	Well	10 South	23 West	5	F, TDS
88	Well	10 South	23 West	6	Organics
89	Well	10 South	23 West	10	Organics
90	Well	10 South	24 West	1	Organics

Table 7.11-6 Water Quality Exceedences in the Yuma Basin (Cont)[1]

A. Wells, Springs and Mines

Map Key	Site Type	Site Location			Parameter(s) Concentration has Equaled or Exceeded Drinking Water Standard (DWS)[2]
		Township	Range	Section	
91	Well	10 South	24 West	1	Sb
92	Well	10 South	24 West	1	Be
93	Well	10 South	24 West	1	Organics
94	Well	10 South	24 West	9	NO3
95	Well	10 South	24 West	9	Organics
96	Well	10 South	24 West	10	NO3, TDS
97	Well	10 South	24 West	10	NO3
98	Well	10 South	24 West	18	Organics
99	Well	10 South	24 West	31	Organics
100	Well	10 South	24 West	31	Organics
101	Well	10 South	25 West	2	Pb
102	Well	10 South	25 West	36	NO3
103	Well	11 South	23 West	20	Organics

Source: Compilation of databases from ADWR & others

B. Lakes and Streams

Map Key	Site Type	Site Name	Length of Impaired Stream Reach (in miles)	Area of Impaired Lake (in acres)	Designated Use Standard[3]	Parameter(s) Exceeding Use Standard[2]
a	Stream	Gila River (Coyote Wash to Fortuna Wash)	28	NA	A&W	B, Se

Source: ADEQ 2005c

Notes:

[1] Water quality samples collected between 1978 and 1991. Listed TDS exceedences indicate "mineralized water" that contains over 3000 milligrams per liter (mg/l) of TDS and would require special well construction procedures (A.A.C. R12-15-812(B)). The secondary drinking water standard for TDS is 500 mg/l.
[1] Water quality samples collected between 1975 and 2004.
[2] As = Arsenic
B = Boron
Be = Beryllium
Cd = Cadmium
F = Fluoride
NO3 = Nitrate
Organics = One or more of several volatile and semi-volatile organic compounds and pesticides
Sb = Antimony
Se = Selenium
TDS = Total Dissolved Solids
Th = Thallium
[3]A&W = Aquatic and Wildlife

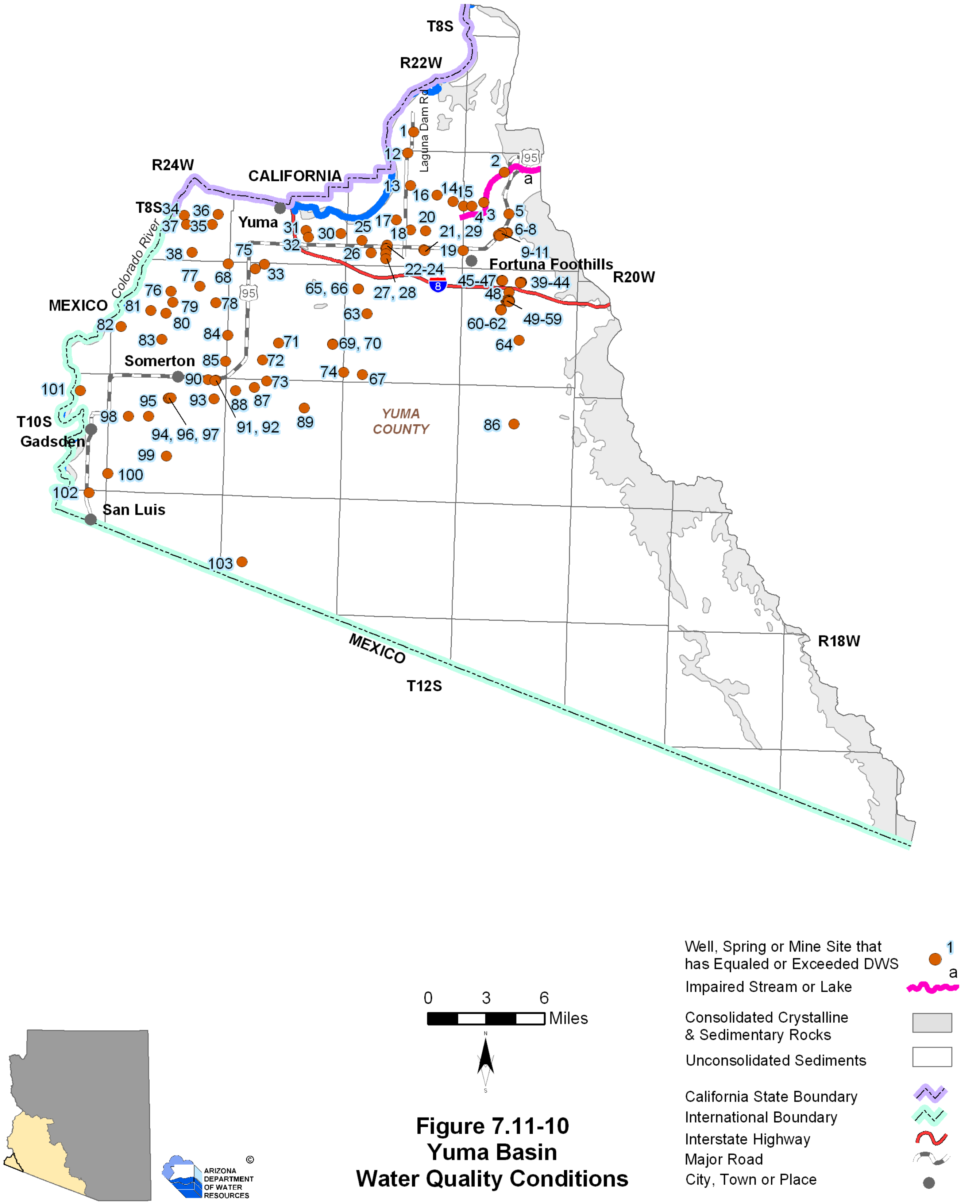


Figure 7.11-10
Yuma Basin
Water Quality Conditions

7.11.8 Cultural Water Demands in the Yuma 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 7.11-7. Effluent generation including facility ownership, location, population served and not served, volume treated, disposal method and treatment level is shown in Table 7.11-8. Figure 7.11-11 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 5.0.7.

Cultural Water Demands

- Refer to Table 7.11-7 and Figure 7.11-11.
- Population in this basin increased from 73,319 in 1980 to 152,928 in 2000.
- Most cultural water use is for irrigation in the western portion of the basin.
- Agricultural groundwater demand increased 12%, and agricultural surface water demand increased 7% between 1991 and 2005. This basin has the largest agricultural water demand in the planning area, with 232,200 acre-feet of groundwater demand and 762,000 acre-feet of surface water demand on average per year in 2001-2005.
- Municipal groundwater demand decreased during 2001-2005 compared to the 1996-2000 time period. Municipal surface water demand increased slightly from 31,000 AFA in 1996-2000 to 32,000 AFA in 2001-2005.
- Industrial groundwater demand has remained relatively constant and industrial surface water demand decreased from 3,900 AFA in 1996-2000 to 2,000 AFA in 2001-2005.
- As of 2005 there were 2,689 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 693 wells with a pumping capacity of more than 35 gallons per minute.

Effluent Generation

- Refer to Table 7.11-8.
- There are 24 wastewater treatment facilities in this basin.
- Information on population served was available for 19 facilities and information on the volume of effluent generated was available for 16 facilities. These facilities serve over 127,000 people and generate over 13,000 acre-feet of effluent per year.
- Three facilities discharge to the Colorado River, three discharge to evaporation ponds, two discharge for irrigation, three discharge to golf courses, three discharge to another facility and seven discharge to unlined impoundments that recharge the aquifer.

Table 7.11-7 Cultural Water Demand in the Yuma Basin[1]

Year	Estimated and Projected Population	Number of Registered Water Supply Wells Drilled		Average Annual Demand (in acre-feet)						Data Source
				Well Pumpage			Surface-Water Diversions			
		Q ≤ 35 gpm	Q > 35 gpm	Municipal	Industrial	Agricultural	Municipal	Industrial	Agricultural	
1971		959[2]	367[2]	253,000			1,251,000[5]			ADWR (1994a)
1972										
1973										
1974										
1975										
1976				229,000			1,102,000[5]			
1977										
1978										
1979										
1980	73,319									
1981	76,123	175	88	224,000			1,130,000[5]			
1982	78,926									
1983	81,730									
1984	84,533									
1985	87,337									
1986	90,140	276	59	211,000			1,229,000[5]			
1987	92,944									
1988	95,748									
1989	98,551									
1990	101,355									
1991	106,512	351	70	8,100	400	206,000	25,500	3,100	711,000	USGS (2007) ADWR (2008b) ADWR (2008c)
1992	111,669									
1993	116,827									
1994	121,984									
1995	127,141									
1996	132,299	438	61	10,500	500	218,000	31,000	3,800	771,000	
1997	137,456									
1998	142,613									
1999	147,771									
2000	152,928									
2001	158,662	490	48	8,300	500	232,200	32,000	2,000	762,000	
2002	164,397									
2003	170,131									
2004	175,866									
2005	181,600									
2010	210,272									
2020	261,091									
2030	305,904									
WELL TOTALS:		**2,689**	**693**							

[1] Does not include evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Includes pumpage and diversion of Colorado River Contract Water.
[4] Well pumpage for irrigation includes drainage wells and the 242 well field.
[5] Includes surface-water diversions in Parker and Yuma basins.

Table 7.11-8 Effluent Generation in the Yuma Basin

Facility Name	Ownership	City/Location Served	Population Served	Volume Treated/Generated (acre-feet/year)	Disposal Method								Current Treatment Level	Population Not Served	Year of Record
					Water-course	Evaporation Pond	Irrigation	Golf Course/Turf/ Landscape	Wildlife Area	Discharged to Another Facility	Infiltration Basins	Other			
Cocopah North Community	Cocopah Tribe	Reservation	140	17							X		Secondary	140	2000
Del Oro WWTF	Far West Water & Sewer	Yuma	1,240 [1,2]	160				Fortuna del Rey					Secondary	NA	2007
Del Pueblo RV & Tennis Resort	Private	RV Park	700	NA											
Desert Dunes/East Mesa	NA	Yuma	NA	112							X		NA		
Donavan Estates	Yuma County	Yuma	400							Yuma Figueroa			NA		2004
Gadsen WWTP	Gadsen SD	Gadsen	888	NA						San Luis SBR			NA		2001
Jack Rabbit Mesa WPCF	Yuma	Yuma	2,200	224		X							Secondary	NA	2004
Marine Corps Air Station-Main WWTP	US Marines	Yuma	NA	NA						Desert Dunes			NA		2004
Marine Corps Air Station-Recreation Area WWTF	US Marines	Yuma	NA												
Marwood WWTF	Far West Water & Sewer	Yuma	4,000 [1,2]	246				Foothills Executive					Secondary	NA	2007
Mesa del Ray	Far West Water & Sewer	Yuma	140 [1,2]	14				Mesa del Sol					Secondary	NA	2007
Palm Shadows WWTP	Far West Water & Sewer	Yuma	680 [1,2]	224							X		Secondary	NA	2007
Pioneer Center	Private	Yuma	NA												
San Luis SBR	San Luis	San Luis	20,888	1,680								X	Adv. Trt. I	NA	2003
Seasons RV Village	Far West Water & Sewer	Yuma	740 [1,2]	68							X		Secondary	NA	2007
Section 14 WWTP	Far West Water & Sewer	Yuma	880 [1,2]	92			X				X		Secondary	NA	2007
Somerton WWTF	Somerton	Somerton	7,355	612	Colorado River						X		Adv. Trt. I	NA	2003
Sweetwater Creek Utilities WWTF	Private	Yuma	590	106		X							Secondary	NA	2007
Villa Royale WWTF	Far West Water & Sewer	Yuma	60 [1,2]	5							X		Secondary	NA	2007
Windhaven RV Park	Private	RV Park	120	NA											2004
Yuma County Housing WWTP	Yuma County	Yuma	160	NA											2004
YUMA Figueroa WPCF	Yuma	Yuma	84,130	9,521	Colorado River								Adv. Trt. I	15,305	2001
Yuma, Jones & Main WTP	Yuma	Yuma	NA	34	Colorado River								NA		2000
Yuma WWTP	State of Arizona	Prison	2,100	336		X	X						NA	NA	2003
Total			**127,411**	**13,450**											

Source: Compilation of databases from ADWR & others

Notes:
Year of Record is for the volume of effluent treated/generated
NA: Data not currently available to ADWR
WWTF: Waste Water Treatment Facility
WWTP: Waste Water Treatment Plant
WPCF: Water Pollution Control Facility

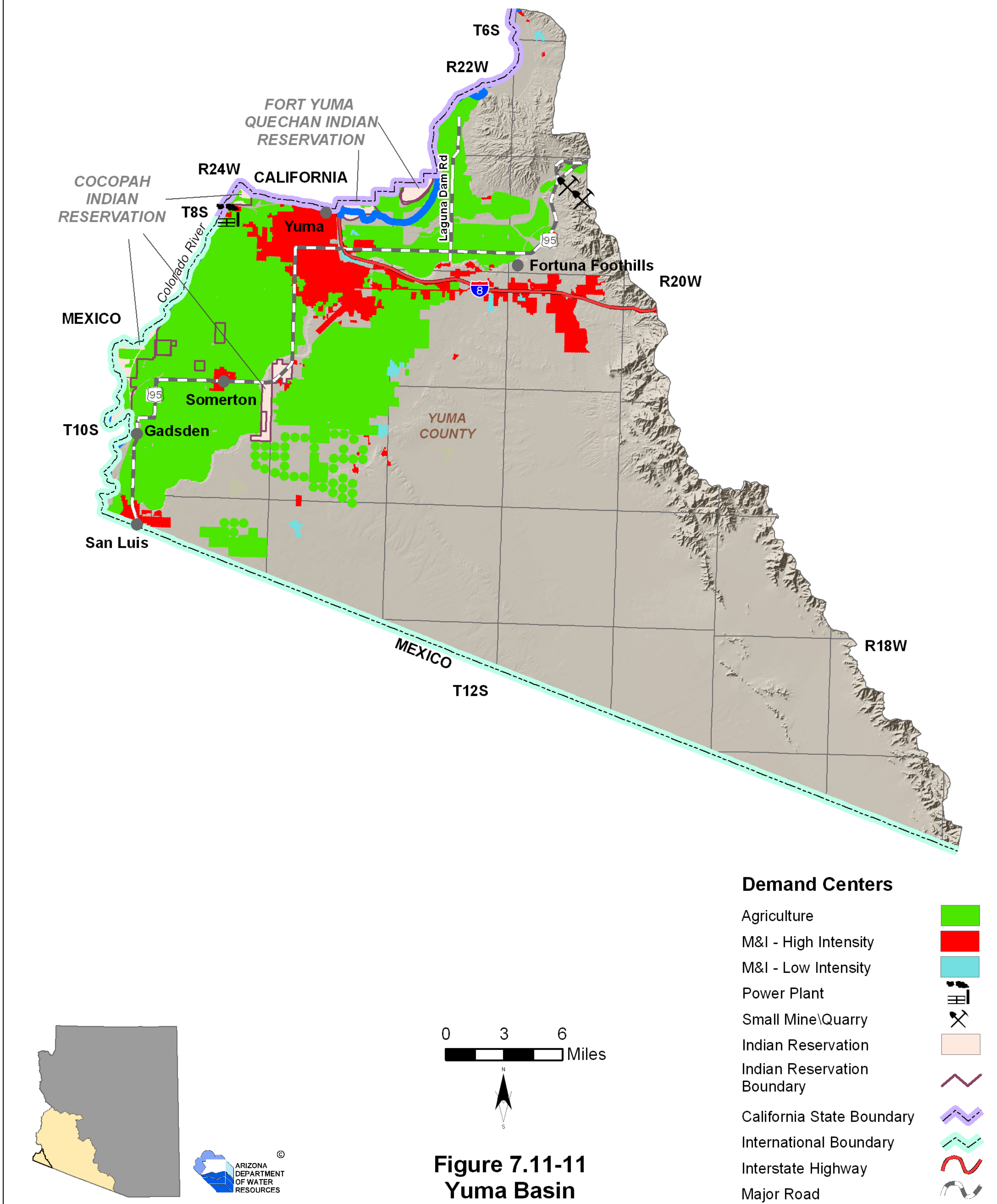


Figure 7.11-11
Yuma Basin
Cultural Water Demand

Primary Data Source: USGS National Gap Analysis Program, 2004

7.11.9 Water Adequacy Determinations in the Yuma Basin

Water adequacy determination information including the subdivision name, location, number of lots, adequacy determination, reason for an inadequacy determination, date of determination and subdivision water provider are shown in Table 7.11-9A and B for water reports and analysis of adequate water supply. Designated water provider information is shown in Table 7.11-9C with date of application, date the designation was issued and projected or annual estimated demand. Figure 7.11-12 shows the general locations of subdivisions (to the section level) and designated providers keyed to the Table. A description of the Water Adequacy Program is found in Volume 1, Appendix C. Adequacy determination data sources and methods are found in Volume 1, Appendix A.

- All subdivisions receiving an adequacy determination are in Yuma County. Two hundred and sixty-two water adequacy determinations for 29,264 lots have been made in this basin through December 2008. Twenty-seven thousand, five hundred and twenty-three lots in 241 subdivisions, or 94% of lots, were determined to be adequate.
- The most common reason for a determination of inadequacy was because the applicant chose not to submit necessary information and/or available hydrologic data were insufficient to make a determination.
- There is one analysis of adequate water supply for 54 lots.
- There is one designated provider, City of Yuma. The designation does not have a projected or annual estimated demand.

Table 7.11-9 Adequacy Determinations in the Yuma Basin[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
1	4E Industrial Park	Yuma	9 South	23 West	13	15	53-700287	Inadequate	A1	9/26/2007	Dry Lot Subdivision
2	Alborada	Yuma	10 South	24 West	4	12	53-402215	Adequate		9/11/2006	City of Somerton
3	Araby Eight Commercial Estates	Yuma	9 South	22 West	4	12	53-500281	Adequate		7/20/1973	Dry Lot Subdivision
4	Arroyo De Fortuna	Yuma	9 South	21 West	15	123	53-402282	Adequate		10/13/2006	Far West Water Company
5	Bienestar Estates	Yuma	11 South	25 West	12	448	53-500330	Adequate		9/29/1982	City of San Luis
6	Bienestar Estates #2	Yuma	11 South	24 West	7	450	53-500331	Adequate		9/26/1989	City of San Luis
7	Bienestar Estates #3	Yuma	11 South	24 West	7	291	53-500332	Adequate		12/17/1991	City of San Luis
8	Bienestar Estates #4	Yuma	11 South	25 West	1	303	53-500333	Adequate		12/15/1994	City of San Luis
9	Bienestar Estates #5	Yuma	11 South	24 West	6	281	53-500334	Adequate		3/9/1995	City of San Luis
10	Bienestar Estates #6	Yuma	11 South	24 West	7	364	53-300489	Adequate		7/7/1998	City of San Luis
11	Bienstar Estates 6A	Yuma	11 South	24 West	7	23	53-400687	Adequate		8/8/2002	City of San Luis
12	Bienestar Estates 7C	Yuma	11 South	24 West	6	20	53-401842	Adequate		11/14/2005	City of San Luis
13	Bienestar Estates No. 7a & 7b	Yuma	11 South	24 West	6	318	53-400677	Adequate		8/8/2002	City of San Luis
14	Bienestar Estates 8A & 8B	Yuma	11 South	24 West	7	403	53-401721	Adequate		7/8/2005	City of San Luis
15	Bienestar Estates 8A & 8B	Yuma	11 South	24 West	7	404	53-401843	Adequate		9/28/2005	City of San Luis
16	Bienestar Estates 9A Ph. 1 & 2	Yuma	11 South	24 West	10	396	53-700388	Adequate		1/28/2008	City of San Luis
17	Bienestar Estates 9B	Yuma	11 South	24 West	9	630	53-700389	Adequate		1/28/2008	City of San Luis
18	Blaisdell	Yuma	8 South	21 West	21	10	53-500343	Inadequate	C	2/26/1975	Dry Lot Subdivision
19	Bradley Estates	Yuma	9 South	24 West	11	32	53-500351	Adequate		2/21/1974	Dry Lot Subdivision
20	Calli Maya Development	Yuma	9 South	22 West	22	10	53-500064	Inadequate	A1	9/26/2007	Dry Lot Subdivision
21	Camarillo Estates	Yuma	9 South	24 West	34	30	53-401310	Inadequate	A1	8/5/2005	City of Somerton
22	Casa Del Sol Phase 1	Yuma	9 South	21 West	4	9	53-401869	Adequate		11/1/2005	Far West Water Company
23	Casa del Sol Townhouses #1	Yuma	9 South	21 West	4	26	53-500405	Adequate		12/18/1984	Far West Water Company
24	Citrus Business Park	Yuma	9 South	23 West	13	7	53-402241	Inadequate	A1	8/28/2006	Dry Lot Subdivision
25	Citrus Business Park Unit 2	Yuma	9 South	23 West	13	27	53-700517	Inadequate	A1	6/9/2008	Dry Lot Subdivision
26	Corcovado Townhouses	Yuma	9 South	21 West	10	37	53-500507	Adequate		12/22/1981	Far West Water Company
27	D J Ranch	Yuma	9 South	23 West	35	18	53-400458	Adequate		1/29/2001	Dry Lot Subdivision
28	Daybreak	Yuma	9 South	21 West	4	48	53-400134	Adequate		7/21/1999	Far West Water Company
29	Debra Jean Estates	Yuma	9 South	23 West	17	15	53-500544	Adequate		2/10/1978	Dry Lot Subdivision
30	Del Rey Estates	Yuma	9 South	21 West	6	31	53-401215	Adequate		6/16/2004	Far West Water Company
31	Del Sur	Yuma	9 South	22 West	12	64	53-500547	Adequate		7/17/1973	Subdivision wells
32	Desert Air Mobile Estates #1,2	Yuma	9 South	22 West	11	100	53-500551	Adequate		1/30/1978	Desert Air Water Company
33	Desert Fairways	Yuma	9 South	21 West	4	80	53-500554	Adequate		12/14/1993	Far West Water Company
34	Desert Foothills Estates #2	Yuma	9 South	21 West	8	49	53-500556	Adequate		12/3/1980	Far West Water Company

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
35	Desert Foothills Estates #3	Yuma	9 South	21 West	10	22	53-500557	Adequate		8/30/1982	Far West Water Company
36	Desert Foothills Estates #4	Yuma	9 South	21 West	10	20	53-500558	Adequate		9/1/1982	Far West Water Company
37	Desert Foothills #5	Yuma	9 South	21 West	10	39	53-500555	Adequate		4/27/1990	Far West Water Company
38	Desert Foothills Estates #6	Yuma	9 South	21 West	10	18	53-500560	Adequate		4/29/1992	Far West Water Company
39	Desert Foothills Estates #7	Yuma	9 South	21 West	10	61	53-500561	Inadequate	C	9/28/1994	Far West Water Company
40	Desert Foothills Estates #8	Yuma	9 South	21 West	10	28	53-400634	Adequate		2/12/2002	Far West Water Company
41	Desert Ranchos	Yuma	9 South	22 West	23	32	53-500574	Adequate		1/27/1975	Dry Lot Subdivision
42	Desert Star Estates Subdivision	Yuma	9 South	23 West	24	19	53-400592	Adequate		1/17/2002	Tierra Mesa Estate Water Co. Inc.
43	Desert Valley Estates	Yuma	10 South	24 West	3	104	53-400906	Adequate		3/31/2003	City of Somerton
44	Desert Valley Estates Phase II	Yuma	10 South	24 West	3	96	53-401635	Inadequate	A1	8/4/2005	City of Somerton
45	Desert Valley Estates, Phase 3	Yuma	10 South	24 West	3	104	53-700326	Inadequate	A1	6/28/2007	City of Somerton
46	Donley Estates	Yuma	10 South	23 West	8	14	53-400020	Adequate		3/1/1999	Dry Lot Subdivision
47	El Camino Casitas	Yuma	9 South	21 West	4	40	53-500600	Adequate		6/15/1981	Far West Water Company
48	El Pedregal	Yuma	9 South	24 West	34	8	53-402004	Adequate		1/22/2007	City of Somerton
49	El Prado Estates	Yuma	8 South	22 West	28	259	53-500607	Adequate		6/19/1992	El Prado Water Company
50	Escondido Beach 1 & 2	Yuma	11 South	25 West	1, 2	26	53-500618	Adequate		11/19/1973	Fortuna Water Company
51	Estrella at Mesa Del Sol Unit 1	Yuma	9 South	21 West	4, 6	149	53-400978	Adequate		7/7/2003	Far West Water Company
52	Estrella at Mesa Del Sol Unit 2	Yuma	9 South	21 West	5	126	53-401421	Adequate		11/5/2004	Far West Water Company
53	Estrella At Mesa Del Sol Unit 3	Yuma	9 South	21 West	5	156	53-402283	Adequate		10/17/2006	Far West Water Company
54	Foothills #05B	Yuma	9 South	21 West	9	16	53-500640	Adequate		8/28/1973	Far West Water Company
55	Foothills #05C	Yuma	9 South	21 West	9	69	53-500641	Adequate		9/23/1976	Far West Water Company
56	Foothills #05D	Yuma	9 South	21 West	9	18	53-500642	Adequate		8/17/1987	Far West Water Company
57	Foothills Mobile Estates	Yuma	9 South	21 West	15	343	53-500644	Adequate		2/1/1978	Far West Water Company
58	Foothills Mobile Estates #02	Yuma	9 South	21 West	15	98	53-500646	Adequate		8/8/1978	Far West Water Company
59	Foothills Mobile Estates #03	Yuma	9 South	21 West	15	343	53-500645	Adequate		12/28/1979	Far West Water Company
60	Foothills Mobile #04	Yuma	9 South	21 West	15	176	53-500643	Adequate		3/28/1980	Far West Water Company
61	Foothills Mobile Estates #05	Yuma	9 South	21 West	15	192	53-500647	Adequate		7/9/1981	Far West Water Company
62	Foothills Mobile Estates #06	Yuma	9 South	21 West	9	142	53-500648	Adequate		8/30/1982	Far West Water Company
63	Foothills Mobile Estates #07	Yuma	9 South	21 West	14, 15	214	53-500649	Adequate		10/25/1982	Far West Water Company
64	Foothills Mobile Estates #08	Yuma	9 South	21 West	15	17	53-500650	Adequate		9/1/1982	Far West Water Company
65	Foothills Mobile Estates #09	Yuma	9 South	21 West	22	284	53-500651	Adequate		3/8/1984	Far West Water Company
66	Foothills Mobile Estates #10	Yuma	9 South	21 West	9	91	53-500652	Adequate		12/22/1982	Far West Water Company
67	Foothills Mobile Estates #11	Yuma	9 South	21 West	22	240	53-500653	Adequate		2/10/1984	Far West Water Company

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
68	Foothills Mobile Estates #12	Yuma	9 South	21 West	22	278	53-500654	Adequate		3/6/1985	Far West Water Company
69	Foothills Mobile Estates #13	Yuma	9 South	21 West	22, 23	311	53-500655	Adequate		5/18/1989	Far West Water Company
70	Foothills Mobile Estates #14	Yuma	9 South	21 West	9	365	53-500656	Adequate		1/29/1986	Far West Water Company
71	Foothills Mobile Estates #15	Yuma	9 South	21 West	22, 23	276	53-500657	Adequate		5/12/1994	Far West Water Company
72	Foothills Mobile Estates #16	Yuma	9 South	21 West	15	188	53-500658	Adequate		10/6/1993	Far West Water Company
73	Foothills Mobile Estates #17	Yuma	9 South	21 West	22, 23	302	53-500659	Adequate		1/27/1995	Far West Water Company
74	Foothills Mobile Estates #18	Yuma	9 South	21 West	22, 23	267	53-300094	Adequate		2/15/1996	Far West Water Company
75	Foothills Mobile Estates #19	Yuma	9 South	21 West	22, 23	151	53-300132	Adequate		4/17/1996	Far West Water Company
76	Foothills Mobile Estates #19A	Yuma	9 South	21 West	23	13	53-400145	Adequate		10/19/1999	Far West Water Company
77	Foothills Mobile Estates #20	Yuma	9 South	21 West	22	264	53-300212	Adequate		10/18/1996	Far West Water Company
78	Foothills Mobile Estates #21	Yuma	9 South	21 West	22	196	53-300277	Adequate		5/1/1997	Far West Water Company
79	Foothills Mobile Estates #22	Yuma	9 South	21 West	22	172	53-300376	Adequate		12/9/1997	Far West Water Company
80	Foothills Mobile Estates #23	Yuma	9 South	21 West	22	45	53-300325	Adequate		7/28/1997	Far West Water Company
81	Foothills Mobile Estates #24	Yuma	9 South	21 West	22	203	53-300468	Adequate		6/9/1998	Far West Water Company
82	Foothills Mobile Estates #25	Yuma	9 South	21 West	16	294	53-300520	Adequate		9/8/1998	Far West Water Company
83	Foothills Mobile Estates #26	Yuma	9 South	21 West	16	288	53-300589	Adequate		2/17/1999	Far West Water Company
84	Foothills Mobile Estates #27	Yuma	9 South	21 West	23	248	53-400155	Adequate		8/18/1999	Far West Water Company
85	Foothills Mobile Estates #27A	Yuma	9 South	21 West	23	10	53-400486	Adequate		4/6/2001	Far West Water Company
86	Foothills Mobile Estates # 27B	Yuma	9 South	21 West	23	10	53-400796	Adequate		11/21/2002	Far West Water Company
87	Foothills Mobile Estates #28	Yuma	9 South	21 West	23	264	53-400485	Adequate		4/16/2001	Far West Water Company
88	Foothills Mobile Estates #29	Yuma	9 South	21 West	23	361	53-400559	Adequate		12/17/2001	Far West Water Company
89	Foothills Mobile Estates #30	Yuma	9 South	21 West	23	348	53-400754	Adequate		7/2/2002	Far West Water Company
90	Foothills Mobile Estates #31	Yuma	9 South	21 West	14	152	53-400911	Adequate		3/31/2003	Far West Water Company
91	Foothills Mountain Estates	Yuma	9 South	21 West	9	66	53-500660	Adequate		10/10/1974	Far West Water Company
92	Foothills North #2	Yuma	9 South	21 West	3	98	53-500662	Adequate		2/1/1978	Far West Water Company
93	Foothills North #3	Yuma	9 South	21 West	2	313	53-500663	Adequate		11/13/1984	Far West Water Company
94	Foothills North #4	Yuma	9 South	21 West	2	211	53-500664	Adequate		5/18/1994	Far West Water Company
95	Fortuna Golf Units 2 & 3	Yuma	9 South	21 West	3	32	53-401829	Adequate		11/1/2005	Far West Water Company
96	Fortuna Heights	Yuma	9 South	21 West	6	260	53-500677	Adequate		2/27/1974	Far West Water Company
97	Fortuna Hills	Yuma	9 South	21 West	2	63	53-300312	Adequate		5/16/1997	Far West Water Company
98	Fortuna Road Commercial	Yuma	9 South	21 West	8	6	53-500678	Adequate		3/30/1994	Far West Water Company
99	Fortuna Road Commercial #2	Yuma	9 South	21 West	8	15	53-300026	Adequate		6/27/1995	Far West Water Company
100	Fortuna Trails	Yuma	9 South	21 West	15	142	53-500679	Adequate		10/25/1984	Far West Water Company
101	Frontera Estates Unit No. 2	Yuma	11 South	25 West	12	87	53-700414	Inadequate	A1	10/2/2007	City of San Luis
102	Frontera Estates Unit No. 2	Yuma	11 South	25 West	12	87	53-700459	Adequate		5/5/2008	City of San Luis

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
103	Gadsden Estates #2	Yuma	10 South	25 West	13	56	53-500691	Adequate		3/30/1981	Gadsden Water Company
104	Gila Acres	Yuma	8 South	23 West	26	29	53-500703	Inadequate	A1	10/17/1973	Dry Lot Subdivision
105	Gold Cup Estates	Yuma	10 South	23 West	7	8	53-500707	Adequate		10/16/1974	Dry Lot Subdivision
106	Goldwater Ranch	Yuma	9 South	22 West	29	10	53-400457	Adequate		1/30/2001	Dry Lot Subdivision
107	Green Acres #2	Yuma	9 South	23 West	20	77	53-500729	Adequate		6/23/1980	Green Acres Water
108	Heritage Park	Yuma	9 South	22 West	18	39	53-500030	Inadequate	A1	1/17/2007	Dry Lot Subdivision
109	J & S	Yuma	9 South	21 West	22	7	53-401684	Adequate		4/6/2005	Far West Water Company
110	Jess Gomez' Mountain View Estates	Yuma	9 South	21 West	3	9	53-500820	Adequate		2/3/1994	Far West Water Company
111	Jones Resubdivision	Yuma	9 South	22 West	12	24	53-500822	Adequate		2/11/1977	Dry Lot Subdivision
112	King Ranch	Yuma	9 South	23 West	24	10	53-400219	Adequate		1/18/2000	Dry Lot Subdivision
113	La Quinta Estates	Yuma	9 South	24 West	25	23	53-500865	Adequate		9/19/1978	Dry Lot Subdivision
114	Lackner Estates	Yuma	9 South	24 West	34	17	53-500868	Adequate		3/11/1993	City of Somerton
115	Las Barrancas # 1	Yuma	9 South	21 West	14	230	53-401609	Adequate		9/19/2005	Far West Water Company
116	Las Barrancas No. 2	Yuma	9 South	21 West	14	105	53-401920	Adequate		6/15/2007	Far West Water Company
117	Las Brisas	Yuma	11 South	25 West	1	150	53-700382	Adequate		11/13/2007	City of San Luis
118	Las Estrellas Unit No. 4 (South)	Yuma	10 South	24 West	3	283	53-700281	Inadequate	A1	4/4/2007	City of Somerton
119	Las Estrellas Unit No. 5	Yuma	10 South	24 West	3	147	53-700488	Inadequate	A1	3/25/2008	City of Somerton
120	Las Fuentes	Yuma	11 South	24 West	7	132	53-300576	Adequate		4/19/1999	City of San Luis
121	Las Haciendas	Yuma	9 South	24 West	34	76	53-400204	Adequate		11/22/1999	City of Somerton
122	Las Quintas De San Luis, Phase 1&2	Yuma	11 South	24 West	6	207	53-400521	Adequate		6/20/2001	City of San Luis
123	Las Terrazzas	Yuma	11 South	24 West	7	37	53-500899	Adequate		10/4/1991	City of San Luis
124	Las Villas de San Luis, # 1 & 2	Yuma	11 South	24 West	7	202	53-400005	Adequate		4/19/1999	City of San Luis
125	Los Alamos	Yuma	10 South	24 West	32	381	53-402037	Adequate		6/6/2006	City of San Luis
126	Los Amigos	Yuma	9 South	21 West	6	206	53-500917	Adequate		1/20/1981	Far West Water Company
127	Los Jardines de la Plaza	Yuma	11 South	25 West	11	313	53-500918	Adequate		7/7/1992	City of San Luis
128	Los Olivos	Yuma	11 South	24 West	7	256	53-401722	Adequate		7/6/2005	City of San Luis
129	Los Portales de Alamo #2	Yuma	11 South	25 West	2	49	53-500921	Adequate		5/8/1980	City of San Luis
130	Los Portales del Alamo #3	Yuma	11 South	25 West	2	46	53-500923	Adequate		10/15/1980	City of San Luis
131	Los Portales del Alamo #4	Yuma	11 South	25 West	2	239	53-500924	Adequate		1/10/1992	City of San Luis
132	Los Portales del Alamo #4, Phases 4&5	Yuma	11 South	25 West	2	183	53-400208	Adequate		12/20/1999	City of San Luis
133	Los Portales del Alamo #6	Yuma	11 South	25 West	2	6	53-500925	Adequate		10/31/1982	City of San Luis
134	Los Portales del Alamo Unit IV, Phase I	Yuma	11 South	25 West	2	40	53-500926	Adequate		9/1/1989	City of San Luis
135	Los Portales del Alamo Unit IV, Phase II	Yuma	11 South	25 West	2	50	53-500927	Adequate		11/8/1989	City of San Luis
136	Lucky Lou Subdivision	Yuma	10 South	23 West	7	14	53-400066	Adequate		5/3/1999	Dry Lot Subdivision

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
137	Mesa Dunes Estates	Yuma	9 South	22 West	22	32	53-500966	Adequate		7/26/1976	Dry Lot Subdivision
138	Mesa View	Yuma	9 South	22 West	17	48	53-400518	Adequate		6/14/2001	Far West Water Company
139	Mesa del Sol #1	Yuma	9 South	21 West	4	72	53-500955	Adequate		8/24/1979	Far West Water Company
140	Mesa del Sol #1	Yuma	9 South	21 West	5	7	53-500956	Adequate		3/15/1993	Far West Water Company
141	Mesa del Sol #2	Yuma	9 South	21 West	4	121	53-500957	Adequate		1/23/1980	Far West Water Company
142	Mesa del Sol #3	Yuma	9 South	21 West	5	156	53-500958	Adequate		2/24/1981	Far West Water Company
143	Mesa del Sol #4	Yuma	9 South	21 West	4	32	53-500960	Adequate		5/4/1984	Far West Water Company
144	Mesa del Sol #5	Yuma	9 South	21 West	4	5	53-500961	Adequate		5/2/1984	Far West Water Company
145	Mesa del Sol #6	Yuma	9 South	21 West	5	65	53-500962	Adequate		1/3/1985	Far West Water Company
146	Mesa del Sol #7	Yuma	9 South	21 West	5	74	53-500963	Adequate		1/3/1985	Far West Water Company
147	Mesa del Sol #8	Yuma	9 South	21 West	4, 5	40	53-500964	Adequate		10/23/1991	Far West Water Company
148	Mesa del Sol #9	Yuma	9 South	21 West	5	54	53-500965	Adequate		1/17/1995	Far West Water Company
149	Mesa Del Sol Unit # 10	Yuma	9 South	21 West	5	52	53-400484	Adequate		7/6/2001	Far West Water Company
150	Mesa Del Sol Unit # 11	Yuma	9 South	21 West	5	50	53-400483	Adequate		2/15/2001	Far West Water Company
151	Mesa Del Sol Unit 12	Yuma	9 South	21 West	5	135	53-401488	Adequate		9/9/2004	Far West Water Company
153	Mesa del Sol Estates	Yuma	9 South	21 West	4	11	53-401911	Adequate		11/19/2005	Far West Water Company
154	Mountain Shadows #3	Yuma	9 South	21 West	4	59	53-501023	Adequate		4/13/1994	Far West Water Company
155	Mountain Shadows #4	Yuma	9 South	21 West	4	34	53-300155	Adequate		10/18/1996	Far West Water Company
156	Mountain View Estates #4	Yuma	9 South	21 West	4	23	53-501029	Adequate		8/2/1988	Far West Water Company
157	Mountain View Unit No 1	Yuma	9 South	21 West	5	83	53-400636	Adequate		1/3/2002	Far West Water Company
158	Mountain View Unit No. 2	Yuma	9 South	21 West	5	132	53-400897	Adequate		3/7/2003	Far West Water Company
159	Mountain View Unit 3	Yuma	9 South	21 West	5	180	53-401218	Adequate		5/25/2004	Far West Water Company
160	Mountain Vista Estates #1,2	Yuma	9 South	21 West	4	40	53-501038	Adequate		8/1/1983	Far West Water Company
161	Mountain Vista Estates #3,3A	Yuma	9 South	21 West	4	32	53-501039	Adequate		10/8/1985	Far West Water Company
162	Mountain Vista Estates Unit 5	Yuma	9 South	21 West	4	44	53-401427	Adequate		9/30/2004	Far West Water Company
163	Oasis del Este #2	Yuma	9 South	21 West	8	87	53-501070	Adequate		12/12/1983	Far West Water Company
164	Oasis del Este #3	Yuma	9 South	21 West	8	34	53-501071	Adequate		5/13/1986	Far West Water Company
165	Oasis del Este #4	Yuma	9 South	21 West	8	90	53-501072	Adequate		5/13/1986	Far West Water Company
166	Oasis del Oeste	Yuma	9 South	21 West	8	52	53-501073	Adequate		7/9/1981	Far West Water Company
167	Orange Grove Mobile Manor	Yuma	9 South	23 West	31	21	53-501079	Adequate		11/6/1973	Orange Grove Water Co.
168	Orange Grove Mobile Manor #2	Yuma	9 South	23 West	31	29	53-501080	Adequate		7/8/1975	Orange Grove Water Co.
169	Orange Grove Mobile Manor #3	Yuma	9 South	23 West	31	27	53-501081	Adequate		10/11/1977	Orange Grove Water Co.
170	Orange Grove Mobile Manor #4	Yuma	9 South	23 West	31	29	53-501082	Adequate		2/20/1979	Orange Grove Water Co.
171	Orange Grove Mobile Manor #5	Yuma	9 South	23 West	31	63	53-501083	Adequate		10/15/1980	Orange Grove Water Co.

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
172	Premier Storage Condominiums of Yuma Unit II L.L.C.	Yuma	9 South	23 West	12	519	53-700415	Inadequate	A1	10/18/2007	Dry Lot Subdivision
173	Puerta Bonita Subdivision	Yuma	9 South	21 West	10	31	53-500055	Adequate		2/20/2007	Far West Water Company
174	Purple Mountain Subdivision	Yuma	9 South	22 West	31	10	53-401312	Adequate		12/20/2004	Dry Lot Subdivision
175	R Circle J Estates	Yuma	9 South	22 West	12	46	53-501242	Adequate		6/26/1975	Dry Lot Subdivision
176	Rancheros Bonitos	Yuma	9 South	22 West	30	24	53-501249	Adequate		3/11/1978	Ranchos Bonitos Water Co.
177	Rancheros Bonitos #2	Yuma	9 South	22 West	30	24	53-300136	Adequate		11/21/1996	Ranchos Bonitos Water Co.
178	Rancho Bonitos Co-op Park	Yuma	9 South	22 West	30	121	53-501252	Inadequate	B	2/15/1987	Ranchos Bonitos Water Co.
179	Rancho Del Oro No. 2 Phases I & II	Yuma	9 South	21 West	5	97	53-400382	Adequate		8/18/2000	Far West Water Company
180	Rancho Del Sol	Yuma	8 South	23 West	8	15	53-400151	Adequate		8/18/1999	Dry Lot Subdivision
181	Rancho Don Carlos	Yuma	11 South	24 West	7	57	53-300131	Adequate		11/13/1996	City of San Luis
182	Rancho Encantado Phases 1 & 2	Yuma	9 South	21 West	21	220	53-700239	Adequate		5/15/2007	Far West Water Company
183	Rancho Los Oros	Yuma	11 South	25 West	2	183	53-400006	Adequate		4/19/1999	City of San Luis
184	Rancho Mesa Verde	Yuma	9 South	23 West	6	53	53-501266	Adequate		4/21/1984	Orange Grove Water Co.
185	Rancho Mesa Verde #2	Yuma	10 South	23 West	6	54	53-501267	Adequate		7/17/1986	Orange Grove Water Co.
186	Rancho Mesa Verde #3	Yuma	10 South	23 West	6	56	53-501268	Adequate		3/23/1989	Orange Grove Water Co.
187	Rancho San Luis	Yuma	11 South	25 West	2	143	53-501270	Adequate		9/1/1989	City of San Luis
188	Ranchos el Toreo	Yuma	9 South	22 West	12	28	53-501283	Adequate		8/22/1979	Dry Lot Subdivision
189	The Ravines #2	Yuma	9 South	21 West	14	212	53-401610	Adequate		9/19/2005	Far West Water Company
190	The Ravines #3	Yuma	9 South	21 West	14	210	53-401608	Adequate		9/19/2005	Far West Water Company
191	Riebe Ranchettes	Yuma	9 South	22 West	30	8	53-501297	Adequate		12/4/1984	Dry Lot Subdivision
192	Rio Sereno Subdivision	Yuma	11 South	25 West	2	95	53-400341	Adequate		6/9/2000	City of San Luis
193	Rivera Estates	Yuma	9 South	24 West	34	24	53-400013	Adequate		3/2/1999	City of Somerton
194	Sandy Ranch Subdivision	Yuma	9 South	22 West	18	34	53-700252	Inadequate	A1	9/27/2007	Dry Lot Subdivision
195	Santa Clara Estates Phase 1	Yuma	10 South	24 West	3	15	53-400535	Adequate		5/31/2001	City of Somerton
196	Santa Clara Estates Phase 2	Yuma	10 South	24 West	3	22	53-400534	Adequate		6/27/2001	City of Somerton
197	Santa Clara Estates Phase 3	Yuma	10 North	24 West	3	76	53-400782	Adequate		10/9/2002	City of Somerton
198	Schechert Estates	Yuma	9 South	21 West	23	16	53-400913	Adequate		3/31/2003	Far West Water Company
199	Scottsdale West Estates	Yuma	9 South	21 West	8	114	53-401187	Adequate		7/20/2004	Far West Water Company
200	Seasons RV Village Unit I, The	Yuma	9 South	21 West	6	157	53-400009	Adequate		2/5/1999	Far West Water Company
201	Seasons RV Village Unit 2, The	Yuma	9 South	21 West	6	136	53-400309	Adequate		4/5/2000	Far West Water Company
202	Seasons RV Village Unit 3	Yuma	9 South	21 West	6	125	53-400547	Adequate		10/10/2001	Far West Water Company
203	Seasons RV Village Unit 4	Yuma	9 South	21 West	6	133	53-400967	Adequate		6/17/2003	Far West Water Company
204	Seasons RV Village Unit 5	Yuma	9 South	21 West	6	133	53-400966	Adequate		6/17/2003	Far West Water Company

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
205	Sienna at Mesa Del Sol	Yuma	9 South	21 West	5	60	53-400724	Adequate		7/3/2002	Far West Water Company
206	Sierra Ridge	Yuma	9 South	21 West	9	171	53-401419	Adequate		8/16/2004	Far West Water Company
207	Sierra Sands	Yuma	9 South	22 West	30	32	53-300197	Adequate		10/16/1996	Dry Lot Subdivision
208	Sierra Sands, Phase 2	Yuma	9 South	22 West	31	8	53-700338	Inadequate	A1	9/14/2007	Dry Lot Subdivision
209	Sinclair Ranch	Yuma	9 South	23 West	13	8	53-501416	Adequate		6/24/1991	Dry Lot Subdivision
210	Somerton Heights	Yuma	10 South	24 West	3	102	53-501435	Adequate		8/18/1976	City of Somerton
211	Somerton Villa	Yuma	9 South	24 West	34	111	53-501436	Adequate		9/10/1987	City of Somerton
212	Southern Sands Mobile Estates	Yuma	9 South	21 West	6	51	53-501443	Adequate		10/11/1985	Far West Water Company
213	Sun Leisure Estates	Yuma	9 South	23 West	28	152	53-501480	Adequate		7/14/1978	Private
214	Sunburst Estates	Yuma	9 South	24 West	10	42	53-501494	Adequate		7/2/1976	Dry Lot Subdivision
215	Taub Subdivision	Yuma	9 South	22 West	20	31	53-400057	Adequate		4/14/1999	Dry Lot Subdivision
216	Tierra Bonita Subdivision	Yuma	9 South	23 West	24	15	53-400637	Adequate		2/11/2002	Tierra Mesa Estate Water Co. Inc.
217	Tierra Mesa Estates 1-5	Yuma	9 South	23 West	24	126	53-501554	Adequate		9/15/1978	Improvement District
218	Tierra Mesa Estates 6-9	Yuma	9 South	23 West	24	97	53-501555	Adequate		5/4/1989	Tierra Mesa Estate Water Co. Inc.
219	Tuscan Ranch	Yuma	9 South	23 West	36	36	53-500035	Inadequate	A1	1/29/2007	Dry Lot Subdivision
220	Tuscan Ranch Phase II	Yuma	9 South	23 West	36	32	53-700465	Adequate		9/4/2008	Dry Lot Subdivision
221	Valle Del Sol Phase 1 & 2	Yuma	10 South	24 West	3	201	53-401720	Adequate		9/8/2005	City of Somerton
222	Valle Sereno	Yuma	10 South	24 West	3	80	53-400342	Adequate		6/9/2000	City of Somerton
223	Valle Sereno Estates Phase 3	Yuma	10 South	24 West	3	18	53-400900	Adequate		3/20/2003	City of Somerton
224	Valle Sereno Estates Phase 4	Yuma	10 South	24 West	3	55	53-400910	Adequate		3/31/2003	City of Somerton
225	Valle Sereno Estates Phase 5	Yuma	10 South	24 West	3	39	53-401247	Adequate		6/16/2004	City of Somerton
226	Valle Sereno Estates Phase 6	Yuma	10 South	24 West	3	41	53-401287	Adequate		3/18/2005	City of Somerton
227	Valle del Sol Phase 3	Yuma	10 South	24 West	3	15	53-402213	Adequate		9/11/2006	City of Somerton
228	Valley Citrus Estates	Yuma	8 South	24 West	25	33	53-501598	Adequate		11/5/1973	Dry Lot Subdivision
229	Vargas Estates	Yuma	9 South	24 West	34	77	53-400834	Adequate		10/17/2002	City of Somerton
230	Venezia	Yuma	9 South	24 West	34	180	53-402041	Adequate		8/7/2006	City of Somerton
231	Veranda Estates Subdivision	Yuma	9 South	24 West	34	69	53-500076	Inadequate	A1	1/29/2007	City of Somerton
232	Villa Chaparral No. 1	Yuma	9 South	21 West	7	118	53-400783	Adequate		8/16/2002	Far West Water Company
233	Villa Chaparral No. 2	Yuma	9 South	21 West	7	59	53-401238	Adequate		5/25/2004	Far West Water Company
234	Villa Chaparral No. 3	Yuma	9 South	21 West	7	141	53-401288	Adequate		7/20/2004	Far West Water Company
235	Villa Chaparral No. 4	Yuma	9 South	21 West	7	157	53-401655	Adequate		4/8/2005	Far West Water Company
236	Villa Royale Townhouses	Yuma	9 South	21 West	4	35	53-501629	Adequate		5/20/1980	Far West Water Company
237	Villa de Coronado	Yuma	9 South	21 West	4	41	53-501618	Adequate		9/23/1983	Far West Water Company
238	Villa del Rey Townhouses	Yuma	9 South	21 West	4	144	53-501619	Adequate		8/8/1980	Far West Water Company

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

A. Water Adequacy Reports

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	ADWR Adequacy Determination	Reason(s) for Inadequacy Determination[3]	Date of Determination	Water Provider at Time of Application
			Township	Range	Section						
239	Villas, The	Yuma	9 South	21 West	8	62	53-501639	Adequate		9/27/1991	Far West Water Company
240	Vista Del Sol Subdivision-Unit No.1	Yuma	9 South	22 West	12	107	53-300510	Adequate		8/17/1998	Far West Water Company
241	Vista Montana #1	Yuma	9 South	21 West	15	44	53-501651	Adequate		5/8/1978	Far West Water Company
242	Vista Montana #2	Yuma	9 South	21 West	15	44	53-501652	Adequate		1/17/1979	Far West Water Company
243	Vizcaya	Yuma	9 South	24 West	34	344	53-402214	Adequate		3/27/2007	City of Somerton
244	Westhoff Manor Condominiums	Yuma	9 South	24 West	34	16	53-400236	Adequate		12/29/1999	City of Somerton
245	Yuma West #2	Yuma	9 South	21 West	8	127	53-501710	Adequate		5/16/1979	Far West Water Company
246	Yuma West #3,4	Yuma	9 South	21 West	10	506	53-501711	Adequate		12/3/1980	Far West Water Company
247	Yuma West #5	Yuma	9 South	21 West	7	87	53-501712	Adequate		4/23/1985	Far West Water Company
248	Yuma West #6	Yuma	9 South	21 West	8	22	53-501713	Adequate		3/30/1994	Far West Water Company
249	Yuma West Estates #1	Yuma	9 South	21 West	7	175	53-501714	Adequate		8/3/1994	Far West Water Company
250	Yuma West Estates #2	Yuma	9 South	21 West	7	137	53-300477	Adequate		6/11/1998	Far West Water Company
251	Yuma West Estates No. 5 & No. 6	Yuma	9 South	21 West	7	105	53-400915	Adequate		5/23/2003	Far West Water Company
252	Yuma West Estates No. 7 & 8	Yuma	9 South	21 West	7	130	53-401278	Adequate		7/20/2004	Far West Water Company
253	Yuma West Estates No. 9 & 10	Yuma	9 South	21 West	7	122	53-401656	Adequate		4/8/2005	Far West Water Company
254	Yuma West Estates Phase 3 & Phase 4	Yuma	9 South	21 West	7	104	53-400629	Adequate		2/12/2002	Far West Water Company
255	Yuma Meadows Unit III	Yuma	9 South	21 West	7	58	53-400673	Adequate		4/11/2002	Far West Water Company
256	Yuma Meadows Units I & II	Yuma	9 South	21 West	7	111	53-400435	Adequate		10/31/2000	Far West Water Company
257	Yuma Meadows, Unit IV	Yuma	9 South	21 West	7	91	53-400873	Adequate		2/12/2003	Far West Water Company
258	Yuma Mesa West	Yuma	9 South	21 West	8	52	53-501715	Adequate		11/9/1978	Far West Water Company
259	Yuma Venture	Yuma	9 South	21 West	9	125	53-501716	Adequate		12/5/1983	Far West Water Company
260	Yuma Vineyards	Yuma	9 South	23 West	36	9	53-402242	Inadequate	A1	8/31/2006	Dry Lot Subdivision
261	Zocalo Gardens #01	Yuma	10 South	24 West	3	68	53-501718	Adequate		3/10/1981	City of Somerton
262	Zocalo Gardens #03	Yuma	10 South	24 West	3	40	53-501719	Adequate		11/15/1983	City of Somerton
263	Zocalo Gardens #04	Yuma	10 South	24 West	3	100	53-501720	Adequate		2/3/1989	City of Somerton

B. Analysis of Adequate Water Supply

Map Key	Subdivision Name	County	Location			No. of Lots	ADWR File No.[2]	Date of Determination	Water Provider at the Time of Application
			Township	Range	Section				
152	Mesa Del Sol Unit 12 Phase I	Yuma	9 South	21 West	5	54	43-401385	7/20/2004	Far West Water Company

Table 7.11-9 Adequacy Determinations in the Yuma Basin (Cont)[1]

C. Designated Adequate Water Supply

Map Key	Provider Name	County	Designation No.	Projected or Annual Estimated Demand *(af/yr)*	Date Application Received	Date Application Issued	Year of Projected or Annual Demand
a	City of Yuma	Yuma	40-900019	No amount designated	NA	5/17/1973	No data, hydrologic study needed

Source: ADWR 2008a

Notes:

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

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

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

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

C. Water Quality

D. Unable to locate records

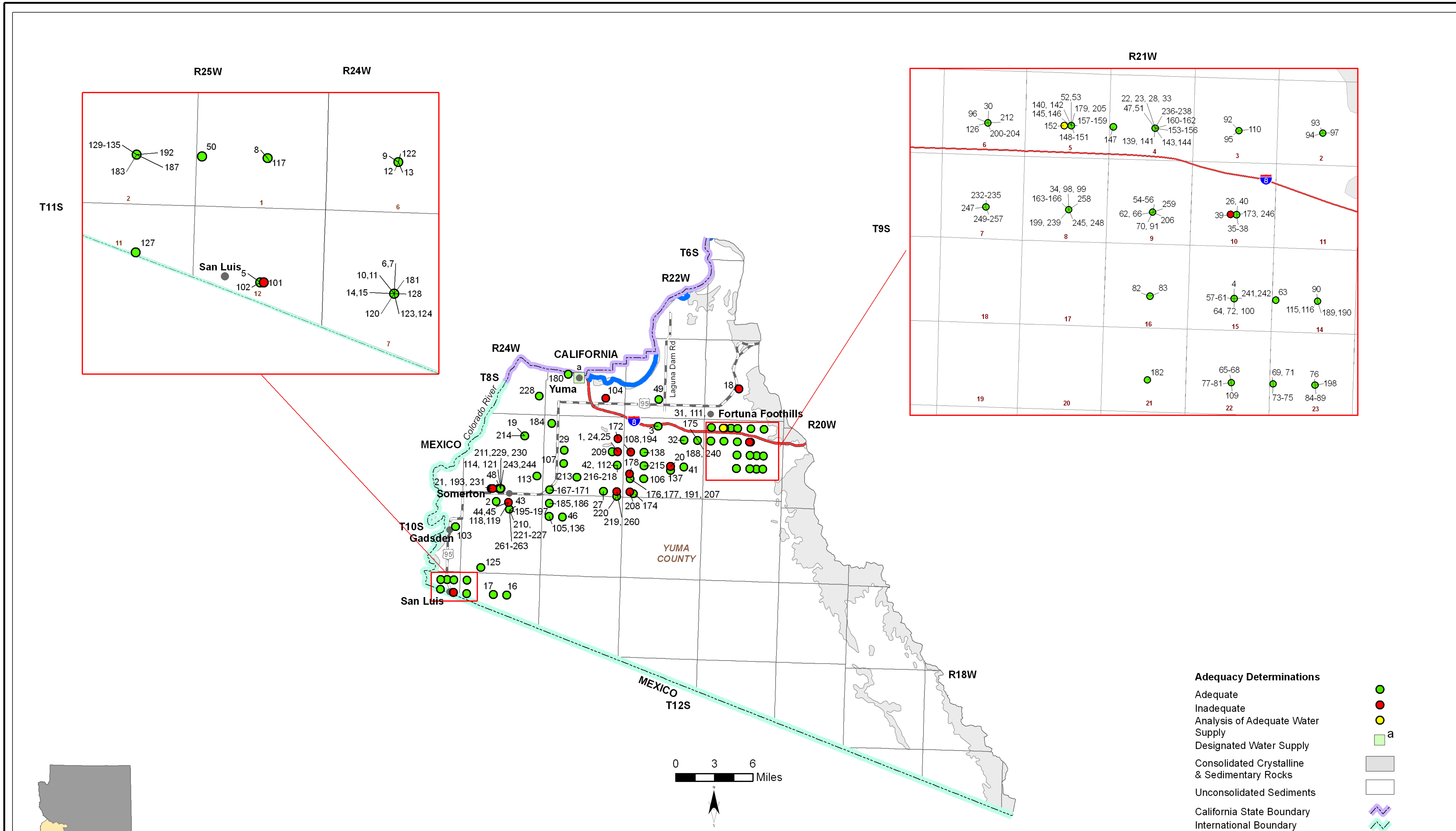


Figure 7.11-12
Yuma Basin
Adequacy Determinations

Yuma Basin
References and Supplemental Reading

References

A

Anning, D.W. and N.R. Duet, 1994, Summary of ground-water conditions in Arizona, 1987-90, USGS Open-file Report 94-476.

Arizona Corporation Commission (ACC), 2005, Annual reports, Private Sewer companies, 1990 to 2005: ACC Utilities Division. (Effluent Generation Table)

Arizona Department of Economic Security (DES), 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov. (Cultural Water Demand Table)

Arizona Department of Environmental Quality (ADEQ), 2005a, ADEQSWI: Data file, received September 2005.(Effluent Generation Table)

______, 2005b, ADEQWWTP: Data file, received August 2005. (Effluent Generation Table)

______, 2005c, Impaired lakes and reaches: GIS cover, received January 2006.

______, 2005d, WWTP and permit files: Miscellaneous working files, received July 2005.

______, 2004a, Water quality exceedences by watershed: Data file, received June 2004. (Water Quality Map and Table)

______, 2004b, Water quality exceedences for drinking water providers in Arizona: Data file, received September 2004. (Water Quality Map and Table)

______, 2004c, Water quality data base-Yuma Basin - 1/1900 to 6/2/04. (Water Quality Map and Table)

Arizona Department of Water Resources (ADWR), 2008a, Assured and adequate water supply applications: Project files, ADWR Hydrology Division.

______, 2008b, Industrial demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

______, 2008c, Municipal surface water demand outside of the Active Management Areas 1991-2007: Unpublished analysis by ADWR Office of Resource Assessment Planning.

______, 2005a, Flood warning gages: Database, ADWR Office of Water Engineering.

______, 2005b, Groundwater Site Inventory (GWSI): Database, ADWR Hydrology Division.

______, 2005c, Wells55: Database.

______, 2002, Groundwater quality exceedences in rural Arizona from 1975 to 2001: Data file, ADWR Office of Regional Strategic Planning. (Water Quality Map and Table)

______, 1994, Arizona Water Resources Assessment, Vol. I, Inventory and Analysis.

______, 1994, Arizona Water Resources Assessment, Vol. II, Hydrologic Summary.

Arizona Game and Fish Department (AZGF), 1997 & 1993, Statewide riparian inventory and mapping project: GIS cover.

Arizona Land Resource Information System (ALRIS), 2005, Springs: GIS cover, accessed January 2006 at http://www.land.state.az.us/alris/index.html.

______, 2004, Land ownership: GIS cover, accessed in 2004 at http://www.land.state.az.us/alris/index.html.

Arizona Meteorological Network (AZMET), 2007, Arizona climate stations: Pan evaporation data, accessed December 2005 at http://www.ag.arizona.edu/azmet/locate.html.

Arizona Water Commission, 1975, Summary, Phase I, Arizona State Water Plan, Inventory of resource and uses.

E

Environmental Protection Agency (EPA), 2005, Surf Your Watershed: Facility reports, accessed April 2005 at http://oaspub.epa.gov/enviro/ef_home2.water. (Effluent Generation Table)

____, 2005, 2000 and 1996, Clean Watershed Needs Survey: datasets, accessed March 2005 at http://www.epa.gov/owm/mtb/cwns/index.htm. (Effluent Generation Table)

F

Freethey, G.W. and Anderson, T.W. 1986, Predevelopment hydrologic conditions in the alluvial basins of Arizona and adjacent parts of California and New Mexico: USGS Hydrologic Investigations Atlas-HA664.

O

Oregon State University, Spatial Climate Analysis Service (SCAS), 2006, Average annual precipitation in Arizona for 1961-1990: PRISM GIS cover, accessed in 2006 at www.ocs.orst.edu/prism.

T

Tadayon, S., King, K and others, 1998, Field screening of water quality, bottom sediment and biota associated with irrigation drainage in the Yuma Valley, Arizona, 1995: USGS Water Resources Investigations Report 97-4236. (Water Quality Map and Table)

U

United States Geological Survey (USGS), 2008 & 2005, National Water Information System (NWIS) data for Arizona: Accessed October 2008 at http://waterdata.usgs.gov/nwis.

_____, 2007, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2005: Data file, received November 2007.

_____, 2006a, National Hydrography Dataset: Arizona dataset, accessed at http://nhd.usgs.gov/.

_____, 2006b, Springs and spring discharges: Dataset, received November 2004 and January 2006 from USGS office in Tucson, AZ.

_____, 2004, National Gap Analysis Program - Southwest Regional Gap analysis study- land cover descriptions: Electronic file, accessed January 2005 at http://earth.gis.usu.edu / swgap.

_____, 1981, Geographic digital data for 1:500,000 scale maps: USGS National Mapping Program Data Users Guide.

W

Western Regional Climate Center (WRCC), 2005, Pan evaporation stations: Data file accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

_____, 2005, Precipitation and temperature stations: Data file, accessed December 2005 at http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~GetCity~USA.

Supplemental Reading

Alavi, N., 2000, Groundwater investigation and remedial actions for operable Unit 1 at the Marine Corps Air Station, Yuma, Arizona: in Environmental Technologies for the 21st Century: Proceedings from the 13th annual Arizona Hydrological Society Symposium, September 2000, Phoenix, Arizona, p.78.

Andersen, M., 2005, Assessment of water availability in the Lower Colorado River basin: in Conservation and Innovation in Water Management: Proceedings of the 18th annual Arizona Hydrological Society Symposium, Flagstaff, Arizona, September, 2005.

Benemelis, P., 2003, Lower Colorado River Multi Species Program: in Sustainability Issues of Arizona's Regional Watersheds: Proceedings from the 16th annual Arizona Hydrological Society Symposium, September 2003, Mesa, Arizona.

Bureau of Reclamation, 2006, Final Environmental Assessment for the Laguna Reservoir Restoration Project. Prepared by SAIC.

_____, 2000, Colorado River Interim Surplus Criteria: Final Environmental Impact Statement.

Carollo Engineers, 2007, Yuma System Water Plan: Submitted to the Arizona Department of Water Resources, January 2007.

Carpio-Obeso, M.P., 1998, Study of toxic substances in the Lower Colorado River: in Water at the Confluence of Science, Law and Public Policy: Proceedings from the 11th annual Arizona Hydrological Society Symposium, September 1998, Tucson, Arizona, p. 181.

City of Somerton, 2006, Water Supply Plan: Submitted to the Arizona Department of Water Resources, December 2006.

City of Yuma, 2002, General Plan: Public Services Element.

Clean Colorado River Alliance, 2006, Recommendations to Address Colorado River Water Quality.

Colorado River Basin Salinity Control Forum, 2005, Water Quality Standards for Salinity: Colorado River System.

Coriolis, 2006, Far West Water and Sewer, Inc. Water Supply and Drought Preparedness Plan, Submitted to the Arizona Department of Water Resources December 2006.

Dickinson, J., M. Land, C. Faunt, S.A. Leake, E. Reichard, J.B Fleming, D.R Pool, 2006, Hydrogeologic framework refinement, ground-water flow and storage, water-chemistry analyses, and water-budget components of the Yuma area, southwestern Arizona and southeastern California, USGS Scientific Investigations Report 2006-5135.

Hart, R., 1999, Water quality of the Colorado River monitored by the USGS national stream accounting network: in Water Issues and Partnerships for Rural Arizona: Proceedings from the 12th annual Arizona Hydrological Society Symposium, September 1999, White Mountains Arizona.

Hill, B. M., 1993, Hydrogeology, numerical model and scenario simulations of the Yuma area groundwater flow model, Arizona, California and Mexico: Arizona Department of Water Resources, Groundwater Modeling Section, Final Report 115 p.

Jacobson Companies, 1976, Water Report for the Town of Somerton, Somerton, Arizona. Prepared for Arizona Department of Water Resources.

_____, 1979, Water Report for the Fortuna Water Co., San Luis, Arizona. Prepared for Arizona Department of Water Resources.

MacNish, R.D., 1992, Scientific challenges in managing the Colorado River: in Interdisciplinary Approaches to Hydrology and Hydrogeology: American Institute of Hydrology, October 1992, p.323-337.

Overby, A., 1997, Maps showing groundwater conditions in the Yuma basin, Yuma County, Arizona 1992: Arizona Department of Water Resources, Hydrologic Map Series #30.

Owen-Joyce, S.J. and S.L. Kimsey, 1996, An accounting system for water and consumptive use along the Colorado River, Hoover Dam to Mexico: USGS Water Supply Paper 2407, 94 p.

Owen-Joyce, S.J., R.P. Wilson, M.C. Carpenter and J.B. Funk, 2000, Method to identify wells that yield water that will be replaced by water from the Colorado River downstream from Laguna Dam in Arizona and California: USGS Water Resources Investigations Report 00-4085, 31 p.

Radtke, D.B., 1990, Environmental contaminants in the lower Colorado River Valley, Arizona, California and Nevada: in Water Quality and Quantity Issues into the 1990's-Adaptations to Current Realities: Phoenix Arizona: Proceedings from the 2nd annual Arizona Hydrological Society symposium, September 1990, Casa Grande, Arizona, part R, p.1-21.

Robertson, F.N., 1991, Geochemistry of groundwater in alluvial basins of Arizona, and adjacent \ parts of Nevada, New Mexico and California: USGS Professional Paper 1406-C.

Santec Consulting, 1999, Small and minor watercourses analysis for Yuma County, Arizona, Arizona State Land Department, Final Report.

SWCA Environmental Consultants, 2005, Hydrologic Report and Physical Availability Demonstration, Los Olivos Development, San Luis, Yuma County, Arizona. Prepared for Arizona Department of Water Resources.

_____, 2005, Hydrologic Report and Physical Availability Demonstration, Valle del Sol development, Somerton, Yuma County, Arizona. Prepared for Arizona Department of Water Resources.

Towne, D. 1998, Ambient groundwater quality in the Yuma basin: a 1995 baseline study, ADEQ Open File Report 98-7.

Yuma County, 2001, Yuma County 2010 Comprehensive Plan: Water Resources.

Yuma Desalting Plant/Cienega de Santa Clara Workgroup, 2005, Balancing Water Needs on the Colorado River: Recommendations of the Yuma Desalting Plant/Cienega de Santa Clara Workgroup.

ACRONYMS AND ABBREVIATIONS

AAWS	Analysis of Adequate Water Supply
ACC	Arizona Corporation Commission
ADWR	Arizona Department of Water Resources
ADEQ	Arizona Department of Environmental Quality
ADOC	Arizona Department of Commerce
AFA	Acre-feet per year (annum)
ALERT	Automated Local Evaluation in Real Time
ALRIS	Arizona Land Resource Information System
AMA	Active Management Area
APS	Arizona Public Service
ARS	Arizona Revised Statute
ASDM	Arizona-Sonora Desert Museum
ASLD	Arizona State Land Department
AWBA	Arizona Water Banking Authority
AWPF	Arizona Water Protection Fund
AZDA	Arizona Department of Agriculture
AZGF	Arizona Game and Fish Department
AZMET	Arizona Meteorological Network
BCPA	Boulder Canyon Project Act
BECC	Border Environment Cooperation Commission
BLM	United States Bureau of Land Management
bls	below land surface
CAP	Central Arizona Project
CFR	Code of Federal Regulations
CLIMAS	Climate Assessment for the Southwest
CNWR	Cibola National Wildlife Refuge
CRIT	Colorado River Indian Tribes
CVCA	Cibola Valley Conservation Area
CVIDD	Cibola Valley Irrigation and Drainage District
CWR	Certificate of Water Right
DES	Arizona Department of Economic Security
DOD	United States Department of Defense
DWID	Domestic Water Improvement District
EIS	Environmental Impact Statement
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ESA	Endangered Species Act
GIS	Geographic Information System
gpm	Gallons per minute
GSF	Groundwater Savings Facility
GWSI	Groundwater Site Inventory System
HSR	Hydrographic Survey Report
HUC	Hydrologic Unit Code

HVID	Harquahala Valley Irrigation District
ID	Irrigation District
IDD	Irrigation and Drainage District
IGA	Intergovernmental Agreement
INA	Irrigation Non-Expansion Area
INWR	Imperial National Wildlife Refuge
IOPP	Inadvertent Overrun and Payback Policy
ITCA	Intertribal Council of Arizona
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LDIG	Local Drought Impact Group
LUST	Leaking Underground Storage Tank
MCWA	Mohave County Water Authority
maf	million acre-feet
mg/L	milligrams per liter
M&I	Municipal and Industrial
MOD	Main Outlet Drain
MODE	Main Outlet Drain Extension
NHD	National Hydrography Dataset
NIB	Northerly International Boundary
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List (Superfund)
NPS	United States National Park Service
NWIS	National Water Information System
NWR	National Wildlife Refuge
NWS	National Weather Service
Pan ET	Pan Evaportranspiration
PCE	Tetrachloroethene
PG&E	Pacific Gas and Electric Company
P.L.	public law
POD	point of diversion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SB	Senate Bill
SIB	Southerly International Boundary
SNOTEL	SNOpack TELemetry
SOC	Statement of Claimant
sq. mi.	square mile
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TON	Tohono O'odham Nation
TOUA	Tohono O'odham Utility Authority
USBOR	United States Bureau of Reclamation
USDOI	United States Department of Interior
USF	Underground Storage Facility

USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VRP	Voluntary Remediation Program
WDA	Water Delivery Agreement
WMIDD	Wellton-Mohawk Irrigation and Drainage District
WQARF	Water Quality Assurance Revolving Fund
WRCC	Western Regional Climate Center
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant
YCWUA	Yuma County Water Users Association
YDP	Yuma Desalting Plant
YMCAS	Yuma Marine Corps Air Station

APPENDIX A

APPENDIX A
Arizona Water Protection Fund Projects
In the Lower Colorado River Planning Area through Fiscal Year 2008

LOWER COLORADO RIVER PLANNING AREA				
Groundwater Basin	**Map Number**	**AWPF Grant #**	**Project Title**	**Project Category**
Parker	**92**	96-0016	‘Ahakhav Tribal Preserve	Habitat Restoration & Revegetation
Parker	**162**	97-032	‘Ahakhav Tribal Preserve – Deer Island Revegetation	Exotic Species Control & Revegetation
Yuma	**109**	96-0011	Lower Colorado River – Imperial Division Restoration	Wetland Restoration
Yuma	**115**	96-0023	Watershed Restoration at the Yuma Conservation Gardens	Watershed Restoration
Yuma	**301**	04-124	Yuma East Wetlands Riparian Revegetation Project	Exotic Species Control & Revegetation
Yuma	**317**	05-134	Quechan Indian Nation Yuma East Wetlands Restoration Project – Phase I	Exotic Species Control & Revegetation
Yuma	**327**	06-140	Yuma Crossing National Heritage Area Yuma East Wetlands Restoration Project – Phase I	Wetland Restoration
Yuma	**340**	07-147	The Effects of Restoration on Wildlife Recovery at the Yuma East Wetlands Restoration Project	Research
Yuma	**341**	07-148	South Channel Phase II Restoration Project	Wetland Restoration
Yuma	**350**	08-152	AWPF Yuma East Wetlands 68-Acre Riparian Revegetation	Wetland Restoration
Yuma	**351**	08-153	The Effects of Restoration on Herpetophaunal and Mammalian Community Recovery Project	Research
Yuma	**354**	08-156	Cocopah Colorado River Restoration	Habitat & Stream Restoration

APPENDIX B

APPENDIX B: Community Water System Annual Report Data 2006-2007 and Submitted Plans

PCC	FACILITY	Basin	2006 Withdrawn	2006 Diverted	2006 Received	2006 Total Demand	2006 Delivered	2006 Delivered to	2007 Withdrawn	2007 Diverted	2007 Received	2007 Total Demand	2007 Delivered	2007 Delivered to
91-000207.0000	GILA BEND, TOWN OF	GIL	NR						557			557	557	CUSTOMER
91-000262.0000	PALOMA RANCH	GIL	359			359	359	CUSTOMER	359			359	359	CUSTOMER
91-000193.0000	EAGLETAIL WATER CO, L.C.	HAR	26			26	18	CUSTOMER	24			24	10	CUSTOMER
91-000456.0000	AJO DWID	LGB			4	4	4	CUSTOMER			4	4	4	CUSTOMER
91-000707.0000	ANTELOPE WATER CO	LGB			46	46	46	CUSTOMER		54		54	54	CUSTOMER
91-000412.0000	AZ WATER CO - AJO WATER SYSTEM	LGB			182	182	157	CUSTOMER			177	177	159	CUSTOMER
91-000708.0000	DATELAND PUBLIC SERVICE	LGB	NR						33			33	33	CUSTOMER
91-000718.0000	DATELAND WATER L.L.C.	LGB	3			3	3	CUSTOMER	4			4	4	CUSTOMER
91-000720.0000	FISHERS LANDING INC	LGB					61	CUSTOMER	NR					
91-000717.0000	MOHAWK UTILITY CO	LGB			63	63	61/2	CUSTOMER/ OTHER		64		64	64	CUSTOMER
91-000410.0000	PHELPS DODGE - AJO IMPROVEMENT CO	LGB	NR						517			517	291/226	CUSTOMER/ SYSTEM
91-000712.0000	SHEPARD WATER CO INC	LGB	NR						NR					
91-000714.0000	TACNA WATER CO	LGB	NR						NR					
91-000715.0000	WELLTON, TOWN OF	LGB	1	314		315	311	CUSTOMER		345		345	345	CUSTOMER
91-000733.0000	WELLTON-MOHAWK IRRIGATIO	LGB		97		97	13	CUSTOMER		87		87	87	CUSTOMER
91-000441.0000	WHY UTILITY CORPORATION	LGB	50			50	41	CUSTOMER	5			5	4	CUSTOMER
91-000749.0000	KEATON DEVELOPMENT CO	MMU	89			89	89	CUSTOMER	83			83	83	CUSTOMER
91-000745.0000	SALOME WATER COMPANY	MMU	NR						NR					
91-000746.0000	WENDEN, TOWN OF	MMU	NR						NR					
91-000750.0000	BOUSE WORLEY WATER SYSTEM	PKB	16			16	16	CUSTOMER	16			16	16	CUSTOMER
91-000740.0000	CIENEGA WATER COMPANY, INC.	PKB	NR						8			8	8	CUSTOMER
91-000752.0000	HOLIDAY HARBOR	PKB		84		84	59	CUSTOMER	NR					
91-000742.0000	LAKESIDE	PKB		163		163	137	CUSTOMER	NR					
91-000743.0000	MARINA VILLAGE	PKB		50		50	43	CUSTOMER	NR					
91-000741.0000	MOOVALYA KEYS	PKB		107		107	80	CUSTOMER	NR					
91-000748.0000	PARKER DAM	PKB		47		47	40	CUSTOMER	NR					
91-000744.0000	PARKER, TOWN OF	PKB		988		988	844	CUSTOMER		936		936	859	CUSTOMER
91-000756.0000	Q MOUNTAIN HOA	PKB	2,517			2,517	2,517	CUSTOMER	2,517			2,517	2517	CUSTOMER
91-000753.0000	Q-MOUNTAIN WATER COMPANY	PKB	57			57	51	CUSTOMER	NR					

APPENDIX B: Community Water System Annual Report Data 2006-2007 and Submitted Plans (Cont)

PCC	FACILITY	Basin	2006 Withdrawn	2006 Diverted	2006 Received	2006 Total Demand	2006 Delivered	2006 Delivered to	2007 Withdrawn	2007 Diverted	2007 Received	2007 Total Demand	2007 Delivered	2007 Delivered to
91-000754.0000	QUARTZSITE, TOWN OF	PKB	NR						NR					
91-000751.0000	RIO LINDO	PKB		7		7	6	CUSTOMER	NR					
91-000036.0000	DRAGOON WATER CO	SSW	37			37	35	CUSTOMER	44			44	32	CUSTOMER
91-000728.0000	ASPC YUMA	YUM	NR						NR					
91-000755.0000	EHRENBERG IMPROVEMENT ASSN	YUM		476		476	382	CUSTOMER		461		461	360	CUSTOMER
91-000737.0000	EL PRADO WATER COMPANY	YUM	NR						6			6	38	CUSTOMER
91-000709.0000	FAR WEST WATER CO	YUM	1,654		5,006	6,660	4776/446	CUSTOMER/ OTHER	2,195		3,736	5,931	5576/517	CUSTOMER/ OTHER
91-000739.0000	G & L MOBILE PARK	YUM	78			78	78	CUSTOMER	78			78	78	CUSTOMER
91-000719.0000	GADSDEN WC	YUM	591			591	590	CUSTOMER	598			598	598	CUSTOMER
91-000721.0000	GREEN ACRES WATER CO	YUM	NR						NR					
91-000730.0000	HIDDEN SHORES RV VILLAGE	YUM		396	39	435	39	CUSTOMER	NR					
91-000722.0000	JONES COOP WATER ASSOC	YUM	NR						9			9	9	CUSTOMER
91-000729.0000	LAGUNA MHP	YUM	NR						NR					
91-000731.0000	LEMON TREE TRAILER PARK	YUM	4			4	4	CUSTOMER	NR					
91-000736.0000	LUCKY PARK DEL S	YUM	NR						NR					
91-000732.0000	ORANGE GROVE WATER CO INC	YUM	803			803	803	CUSTOMER	102			102	102	CUSTOMER
91-000723.0000	RANCHEROS BONITOS	YUM	NR						NR					
91-000710.0000	SAN LUIS, CITY OF	YUM	3,366			3,366	2,027	CUSTOMER	3,195			3,195	3280	CUSTOMER
91-000727.0000	SIERRA PACIFIC MOBILE MAN	YUM	8			8	8	CUSTOMER	NR					
91-000713.0000	SOMERTON, CITY OF	YUM	1,403			1,403	588	CUSTOMER	1,359			1,359	1203	CUSTOMER
91-000724.0000	SUN LEISURE EST UTIL CO	YUM	11			11	11	CUSTOMER	14			14	13	CUSTOMER
91-000738.0000	SUN-SET MOBILE TRAILER P	YUM	NR						1			1	1	CUSTOMER
91-000725.0000	TIERRA MESA ESTATES WTR	YUM	NR						NR					
91-000735.0000	US ARMY YPG - MAIN ADMINISTRATIVE AREA	YUM	NR						673			673	106	CUSTOMER
91-000726.0000	USMC-AIR STATION-MAIN	YUM	168		1,612	1,780	1,780	CUSTOMER	83			83	83	CUSTOMER
91-000711.0000	VALLEY VISTA WATER CO	YUM	62			62	26/21	CUSTOMER/ OTHER	NR					
91-000734.0000	YUMA WEST MHP	YUM	NR						2			2	2	CUSTOMER
91-000716.0000	YUMA, CITY OF	YUM	4,241	16,180		20,421	16,116/64	CUSTOMER/ SYSTEM	4,390	14,429		18,819	18,814/64	CUSTOMER/ SYSTEM

Community Water Systems that have submitted a plan to the Department as of 12/2008

PCC	NAME	Basin
91-000207	GILA BEND, TOWN OF	Gila Bend
91-000262	PALOMA RANCH	Gila Bend
91-000193	EAGLETAIL WATER CO, L.C.	Harquahala
91-000410	PHELPS DODGE - AJO IMPROVEMENT CO	Lower Gila
91-000412	AZ WATER CO - AJO WATER SYSTEM	Lower Gila
91-000441	WHY UTILITY CORPORATION	Lower Gila
91-000707	ANTELOPE WATER CO	Lower Gila
91-000708	DATELAND PUBLIC SERVICE	Lower Gila
91-000715	WELLTON, TOWN OF	Lower Gila
91-000718	DATELAND WATER L.L.C.	Lower Gila
91-000720	FISHERS LANDING INC	Lower Gila
91-000733	WELLTON-MOHAWK IRRIGATION	Lower Gila
91-000749	KEATON DEVELOPMENT CO	McMullen Valley
91-000741	MOOVALYA KEYS	Parker
91-000742	LAKESIDE	Parker
91-000743	MARINA VILLAGE	Parker
91-000744	PARKER, TOWN OF	Parker
91-000747	HILLCREST WATER COMPANY	Parker
91-000748	PARKER DAM	Parker
91-000750	BOUSE WORLEY WATER SYSTEM	Parker
91-000751	RIO LINDO	Parker
91-000752	HOLIDAY HARBOR	Parker
91-000754	QUARTZSITE, TOWN OF	Parker
91-000756	Q MOUNTAIN HOA	Parker
91-000036	DRAGOON WATER CO	San Simon Wash
91-000709	FAR WEST WATER CO	Yuma
91-000711	VALLEY VISTA WATER CO	Yuma
91-000713	SOMERTON, CITY OF	Yuma
91-000716	YUMA, CITY OF	Yuma
91-000719	GADSDEN WC	Yuma
91-000726	USMC-AIR STATION-MAIN	Yuma
91-000727	SIERRA PACIFIC MOBILE MANOR	Yuma
91-000728	ASPC YUMA	Yuma
91-000731	LEMON TREE TRAILER PARK	Yuma
91-000735	US ARMY YPG - MAIN ADMINISTRATIVE AREA	Yuma
91-000739	G & L MOBILE PARK	Yuma
91-000755	EHRENBERG IMPROVEMENT ASSN	Yuma

APPENDIX C

Appendix C: Arizona Colorado River Water Use: Present Perfected Right Holders and Priority 1-6 Contractors in the Lower Colorado River Planning Area

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 1				
Satisfaction of Present Perfected Rights (PPRs) as defined and provided for in the *Arizona v. California* Decree (2006 Consolidated).				
Federal				
Cocopah Indian Reservation	PPR No. 1	9/27/1917	7,681	
	PPR No. 8	1915	1,140	
		Total	8,821	
Colorado River Indian Tribes Reservation	PPR No. 2	3/3/1865	358,400	
		11/22/1873	252,016	
		11/16/1874	51,986	
		Total	662,402	
Fort Yuma Indian Reservation	PPR No. 3a	1/9/1884	6,350	
		Total	**677,573**	
Water Projects				
Yuma County Water Users' Association *(also has unquantified water right certificates)*	PPR No. 4	1901	254,200	
Unit "B" Irrigation and Drainage District *(also has unquantified water right certificates)*	PPR No. 5	7/8/1905	6,800	
North Gila Valley Irrigation District *(also has 3rd Priority consumptive use entitlement of 41,203 AF)*	PPR No. 6	7/8/1905	24,500	
		Total	**285,500**	
Miscellaneous PPRs				
Powers	PPR No. 7	1915	960	
Molina	PPR No. 15	1928	318	
Gila Monster Farms, Inc. *(also has 6,285 AF of 3rd priority, 1,435 AF of 4th priority, 656 AF of 5th priority and an undetermined amount of 6th priority water - Contract No. 6-07-30-W0337)*	PPR No. 16	1925	780	
Phillips, Milton and Jean	PPR No. 19	1900	42	
Parker, Town of *(also has 1,030 AF of 4th priority and 2,000 AF of 5th and/or 6th priority water)*	PPR No. 20	1905	630	400
Yuma, City of *(also has a 3rd Priority consumptive use entitlement 48,522 AF)*	PPR No. 21	1893	2,333	1,478
		Total	**5,063**	**1,878**
PRIORITIES 2 and 3				
Second and third priorities are coequal. Priority 2 - Satisfaction of Federal Reservations and Perfected Rights established or effective prior to September 30, 1968 Priority 3 - Satisfaction of Entitlements pursuant to contracts between the United States and water users in Arizona executed on or before September 30, 1968				
Federal				
Ak-Chin Indian Community	AK-CHIN121180A	1/1/1956	50,000	
Cibola National Wildlife Refuge	Secretarial Reservation	8/21/1964	34,500	16,793
Department of the Navy - Marine Corps Air Station - Yuma	Contract No. 14-06-300-937	1/1/1959	3,000	
Department of the Army - Yuma Proving Grounds	Contract No. I76r-696	6/12/1951	1,129	
Imperial National Wildlife Refuge	1964 Supreme Court Decree	2/14/1941	28,000	23,000
Salt River Pima Maricopa Indian Community	SRPMIC021288N	3/4/1952	22,000	
		Total	**160,629**	**39,793**

[1] For Priorities 1 through 3 and Priorities 5 and 6, the totals for diversion and consumptive use entitlements **are not** additive.

Appendix C: Arizona Colorado River Water Use: Present Perfected Right Holders and Priority 1-6 Contractors in the Lower Colorado River Planning Area (Cont)

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITIES 2 and 3 (Continued)				
Water Projects				
Unit "B" Irrigation and Drainage District *(also has PPR for 6,800 AF)*	Water right certificates Contract No. 14-06-300-44	12/22/1952	Unquantified water right certificates	
North Gila Valley Irrigation District *(also has a PPR for 24,500 AF)*	Contract Nos.14-06-W-54 14-06-W-102 14-06-300-1270 *(These 3 Districts share a consumptive use entitlement of 250,000 AF, which*	1/1/1956		41,203
Yuma Irrigation District				67,278
Yuma Mesa Irrigation and Drainage District				141,519
Wellton-Mohawk Irrigation and Drainage District	Contract No. 1-07-30-W0021	3/4/1952		278,000
Yuma County Water Users' Association *(also has a PPR for 254,200 AF)*	Water right certificates Contract No. 14-06-300-621	4/1/1957	Unquantified water right certificates	
		Total		**528,000**
Others				
Arizona, University of	Contract No. 14-06-300-144	1/1/1954	1,088	
C. Allec Company, Inc. (formerly Allec, Camille)	Contract No. 14-06-303-528	12/23/1953	120	
Desert Lawn Memorial Park Association (Cemetery in Yuma) *(also has 360 AF of 4th priority water for undeveloped land near Unit B)*	Contract No. 14-06-303-1079	5/1/1956	200	
Gila Monster Farms, Inc. *(also has 780 AF of 1st priority, 1,435 AF of 4th priority and 656 AF of 5th priority and an undetermined amount of 6th priority water)*	Contract No. 6-07-30-W0337	1/1/1952	6,285	
Kaman, Inc.	Contract No. 14-06-303-1555	12/2/1959	2	
Union Pacific Railroad Company *(formerly Southern Pacific Railroad Company)*	Contract No. 14-06-303-1524	12/21/1959	48	
Yuma, City of *(also has a PPR for 1,478 AF consumptive use)*	Contract No. 14-06-W-106	11/12/1959		48,522
Yuma, City of *(Cemetery)*	Contract No. 14-06-303-1078	5/1/1956	60	
Yuma Mesa Fruit Growers Association	Contract No. 14-06-303-1196	1/1/1956	15	
Yuma Union High School	Contract No. 14-06-303-179	5/3/1960	200	
		Total	**8,018**	**48,522**
PRIORITY 4				
Satisfaction of Entitlements pursuant to: (i) contracts, Secretarial Reservations, and other arrangements between the United States and water users in the State of Arizona entered into or established subsequent to September 30, 1968, for use on Federal, State, or privately owned lands in the State of Arizona (for a total quantity of not to exceed 164,652 acre-feet of diversions annually); and (ii) Contract No. 14-06-W-245 dated December 15, 1972, as amended, between the United States and the Central Arizona Water Conservation District for the delivery of Mainstream Water for the Central Arizona Project, including use of Mainstream Water on Indian lands.				
Municipal and Industrial				
Arizona Game and Fish Commission *(entitlement is available for domestic & irrigation use. Also has 750 AF of fifth priority and 1,000 AF of sixth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	1,419	
Arizona State Land Department	Contract No. 7-07-30-W0358	2/2/2004	1,534	
B & F Investments, LLC	Contract No. 06-XX-30-W0453	10/25/2006	60	
Bureau of Land Management	Secretarial Reservations and IGA No. 8-07-30-W0373	8/30/1973		800
		9/29/1981		1,280
		4/27/1987		1,930
		6/13/2000		
		Total		4,010
Central Arizona Water Conservation District (CAP) (*Balance of Arizona Colorado River allocation, approximately 1.5 MAF/Year,*	Contract No. 14-06-W-245	12/01/1988		
Desert Lawn Memorial Park Association (Cemetery in Yuma) (also has 200 AF of 3rd priority water)	Contract No. 14-06-300-2587	5/30/1975	360	
Ehrenberg Improvement Association	Contract No. 8-07-30-W0006	10/14/1977	500	
Fisher Landing Water and Sewer	Contract No. 06-XX-30-W0450	12/21/2006	53	
Gold Dome Mining Company	Contract No. 0-07-30-W0250	6/6/1990	7	
Gold Standard Mines Corporation	Contract No. 3-07-30-W0038	8/25/1983	75	

For Priorities 1 through 3 and Priorities 5 and 6, the totals for diversion and consumptive use entitlements **are not** additive.

Appendix C: Arizona Colorado River Water Use: Present Perfected Right Holders and Priority 1-6 Contractors in the Lower Colorado River Planning Area (Cont)

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 4 (Continued)				
Municipal and Industrial (Continued)				
Parker, Town of *(also has a PPR for 630 acre-feet, and 2,000 acre-feet of Priority 5 and/or Priority 6 water)*	Contract No. 2-07-30-W0025	1/6/1998	1,030	
Quartzsite, Town of	Contract No. 7-07-30-W0353	1/28/1999	1,070	
Roy, Edward P.	Contract No. 9-07-30-W0124	2/24/1986	1	
Smucker Park	Contract No. 14-06-303-2702	11/12/1969	33	
Somerton, City of	Contract No. 3-XX-30-W0419	2/8/2006	750	
Verizon California, Inc. (formerly Continental Telephone of California)	Contract No. 14-06-300-2506	2/5/1974	1	
Water reserved by the Secretary for use in Indian settlements			3,500	
		Total	**10,393**	**4,010**
Municipal and Industrial Recommendations				
Martinez Lake cabin sites - *(had 87 AF of which 53 AF was allocated to Fisher Water and Sewer; 8 AF to Shepard Water; and 3 AF to ASLD)*			23	
Shepard Water Company			50	
		Total	**73**	
Agricultural				
Arizona State Land Department *(also has 9,097 AF of 5th and/or 6th priority water)*	Contract No. 4-07-30-W0317	6/28/1999	6,607	
Beattie Farms Southwest	Contract No. 5-XX-30-W0446	2/17/2006	1,110	
Cibola Valley Irrigation and Drainage District (includes *300 AF for M&I use and also has 1,500 AF of 5th priority and 2,000 AF of 6th priority water)*	Contract No. 2-07-30-W0028	1/31/1983	12,066	
Cocopah Indian Reservation *(lands south of Morelos Dam)*	Contract No. 6-07-30-W0346 Supreme Court Decree	6/24/1974	2,026	
Curtis, Armon	Contract No. 3-07-30-W0037	8/29/1983	300	
Gila Monster Farms, Inc. (*also has a PPR for 780 AF, 6,285 AF of 3rd priority, 656 AFof 5th priority and an undetermined amount of 6th priority water)*	Contract No. 6-07-30-W0337 PPR No. 16	7/28/1997	1,435	
Hopi Tribe *(also has 750 AF of 5th priority and 1,000 AF of 6th priority water)*	Contract No. 4-XX-30-W0432	1/31/1983	5,997	
JRJ Partners LLC *(formerly part of Dulin Farms)*	Contract No. 06-XX-30-W0448	9/25/2007	1,080	
North Baja, LLC (formerly Jamar Produce) *(408 AF for agricultural use; 72 AF for M&I use)*	Contract No. 5-07-30-W0066	12/3/1984	480	
George Ogram, Ogram Farms	Contract No. 1-XX-30-W0398	9/4/2003	480	
Ogram Boys Enterprises *(formerly known as GOBO Farms)*	Contract No. 4-XX-30-W0402	7/1/2005	924	
Pasquinelli, Gary J. *(Hall contract assigned and amended from 510 to 486 AF)*	Contract No. 5-07-30-W0065	3/27/2003	486	
Rayner Ranches	Contract No. 5-07-30-W0064	10/29/1984	4,500	
		Total	**37,491**	
Agricultural Recommendations				
CHA CHA, LLC *(Amended contract includes: Auza Farms - 960 AF, Dulin Farms-West portion - 936 AF, and Youmans - 204 AF)*			2,100	
Peach, John *(formerly Bruce Church)*			456	
Phillips, Milton and Jean			18	
		Total	**2,574**	

[1] For Priorities 1 through 3 and Priorities 5 and 6, the totals for diversion and consumptive use entitlements **are not** additive.

Appendix C: Arizona Colorado River Water Use: Present Perfected Right Holders and Priority 1-6 Contractors in the Lower Colorado River Planning Area (Cont)

Entity	Type of Entitlement	Priority Date	Annual Diversion Entitlement (Acre-Feet)[1]	Annual Consumptive Use Entitlement (Acre-Feet)[1]
PRIORITY 5 AND 6				
Priority 5 - Satisfaction of Entitlements to any Unused Arizona Entitlement Priority 6 - Satisfaction of Entitlements to Surplus Apportionment Water				
Priority 5				
Arizona Game and Fish Commission *(also has 1,419 AF of fourth priority and 1,000 AF of sixth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	750	
Cibola Valley Irrigation and Drainage District *(also has 12,066 acre-feet of 4th priority water and 2,000 AF of 6th Priority water)*	Contract No. 2-07-30-W0028	1/31/1983	1,500	
Hopi Tribe *(also has 5,997 AF of 4th Priority water and 1,000 AF of 6th Priority water)*	Contract No. 04-XX-30-W0432	1/31/1983	750	
Gila Monster Farms, Inc. - 5th priority *(also has a PPR for 780 AF, 6,285 AF of 3rd priority, 1,435 AF of 4th priority water)*	Contract No. 6-07-30-W0337	7/28/1997	656	
Prioirty 5 and/or 6				
Arizona Public Service (Yucca Power Plant)	Contract No. 6-07-30-W0336	10/3/2000	1,500	
Arizona State Land Department (*also has 6,607 acre-feet of 4th priority water)*	Contract No. 4-07-30-W0317	6/28/1999	9,067	
Parker, Town of (*also has PPR for 630 AF and 1,030 AF of 4th priority)*	Contract No. 2-07-30-W0025	1/6/1998	2,000	
Priority 6				
Arizona Game and Fish Commission *(also has 1,419 AF of fourth priority and 750 AF of fifth priority water)*	Contract No. 07-XX-30-W0509	9/25/2007	1,000	
Cibola Valley Irrigation and Drainage District (*also has 12,066 AF of 4th Priority water and 1,500 AF of 5th priority water)*	Contract No. 2-07-30-W0028	1/31/1983	2,000	
Gila Monster Farms, Inc. - 6th priority *(also has a PPR for 780 AF, 6,285 AFof 3rd priority, 1,435 AFof 4th priority)*	Contract No. 6-07-30-W0337	7/28/1997	unspecified	
Hopi Tribe *(also has 5,997 AF of 4th Priority water and 750 AF of 5th Priority water)*	Contract No. 04-XX-30-W0432	1/31/1983	1,000	
		Total	**20,223**	

COLOR KEY

(yellow) A portion of the contractor lands are located in the Upper Colorado River Planning Area

[1] For Priorities 1 through 3 and Priorities 5 and 6, the totals for diversion and consumptive use entitlements **are not** additive.

APPENDIX D

APPENDIX D
Colorado River Management

The "Law of the River" as described briefly below, is a collection of federal and state laws, interstate compacts, Supreme Court decisions and international treaties that govern the operation and use of the Colorado River. In the Lower Colorado River Basin, the United States Secretary of the Interior (Secretary) is the Watermaster. Acting through the Bureau of Reclamation, the Secretary operates Colorado River dams and accounts for water use on an annual basis. Pursuant to Section V of the Boulder Canyon Project Act, the Secretary contracts with water users in the Lower Basin for water up to the total amount of each state's apportionment.

Colorado River Compact – 1922

In 1921, the seven Colorado River Basin states authorized the appointment of commissioners to negotiate a compact for the apportionment of the water supply of the Colorado River. Although the states were unable to negotiate an allocation of water for each state, an agreement was signed in November 1922, the Colorado River Compact (Compact) that divided the Colorado River Basin into the Upper Basin and the Lower Basin.

The Compact apportioned to the Upper Basin (Colorado, New Mexico, Utah, and a portion of Arizona) and to the Lower Basin (Arizona, California, and Nevada) the exclusive beneficial consumptive use of 7.5 million acre-feet of water to each basin annually. Because the Colorado River Basin includes a portion of Mexico, the Compact recognized Mexico's right to use River water. Water for this purpose was to be met from surplus water supplies in excess of the amounts apportioned to the Upper and Lower Basins. Any burden that might arise because of a water treaty with Mexico was to be shared equally by the two basins. The Compact recognized that the ability of the Upper Basin to meet the requirement to deliver 7.5 million acre-feet to the Lower Basin could be impacted by climatic factors, therefore the Compact only required the Upper Basin to restrict its use so that delivery to the Lower Basin would not be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years.

Boulder Canyon Project Act - 1928

The Boulder Canyon Project Act (Project Act) authorized construction of the Hoover Dam and Power Plant and the All-American Canal. It also authorized Arizona, California and Nevada to enter into an agreement whereby the 7.5 million acre-feet of water apportioned to the Lower Basin by the Colorado River Compact would be apportioned as follows: to California, 4.4 million acre-feet per year; to Arizona, 2.8 million acre-feet per year; and to Nevada, 0.3 million acre-feet per year.

Treaty between the U.S. and Mexico – 1944

The water treaty between the United States and Mexico involving waters of the Colorado River (and the Rio Grande and Tijuana Rivers) was signed in 1944 and became effective November 8, 1945. The Treaty allocated to Mexico 1.5 million acre-feet of Colorado River system waters annually. The Treaty also provided an additional 200,000 acre-feet in years of supply surplus. In years of extraordinary drought, Mexico's entitlement is to be reduced in the same proportion as consumptive uses in the U.S. are reduced.

Minute 242 was adopted and executed in 1973 in response to Mexico's concerns regarding the quality of Colorado River water being delivered to the Mexicali Valley. Minute 242 obligates the United States to implement measures that will maintain the salinity of the Colorado River waters delivered to Mexico at nearly the same quality as that diverted at Imperial Dam for use within the United States. The Colorado River Basin Salinity Control Act was signed into law on June 24, 1974, providing for the physical works necessary to implement Minute 242 without permanent loss of water to the Colorado River Basin states.

Upper Colorado River Basin Compact - 1948

This Compact divided the water apportioned to the Upper Basin by the Colorado River Compact between the five states with territory in the Upper Basin. Arizona was allocated 50,000 acre-feet per year with the remainder of the Upper Basin entitlement divided according to the following percentages: Colorado, 51.75; New Mexico, 11.25; Utah, 23.00; and Wyoming, 14.00.

Arizona v. California - 1964, U.S. Supreme Court Decree (Consolidated 2006)

On August 13, 1952, the State of Arizona filed a complaint with the U.S. Supreme Court against California and seven agencies within that state to resolve the contention by California that the Central Arizona Project should not be authorized. At California's insistence, the U.S. Congress would not authorize the Central Arizona Project until Arizona's right to the necessary Colorado River entitlement was clarified.

The Decree, handed down in 1964, confirmed that Congress had already apportioned, through the Boulder Canyon Project Act, the entitlement of water to the three Lower Basin states as follows: Arizona, 2.8 million acre-feet; California, 4.4 million acre-feet; and Nevada, 300,000 acre-feet. Any surplus above 7.5 million acre-feet was apportioned 50 percent to California and 50 percent to Arizona, except that Nevada was given the right to contract for 4 percent of the excess, which would come out of Arizona's share. The Decree also confirmed each of the Lower Basin state's entitlements to the flow of the tributaries within their boundaries, supporting Arizona's utilization of water from its in-state rivers, separate from its entitlement to its full 2.8 million acre-feet of Colorado River water.

The Decree left shortage allocation to the discretion of the Secretary after providing for satisfaction of present perfected rights in the order of their priority dates. These rights were defined as rights existing and used prior to the effective date of the Boulder Canyon Project Act. The allocation of shortages was later determined by Congress in the Colorado River Basin Project Act (1968).

Colorado River Basin Project Act - 1968

The Colorado River Basin Project Act on September 30, 1968 authorized construction of the Central Arizona Project and other water development projects in the Upper Basin. A significant concession was a provision that allowed existing California, Arizona, and Nevada Colorado River contractors to receive a priority over the Central Arizona project in times when the useable supply from the River was inadequate to provide 7.5 million acre-feet to the Lower Basin states, with California's priority limited to its 4.4 million acre-foot entitlement.

The Act directed the Secretary to propose criteria for the "coordinated long-range operation of the reservoirs" in the Upper Basin with the operation of the reservoirs in the Lower Basin. To accomplish this, the Act required the development of an Annual Operating Plan, in consultation with representatives of the seven Basin states.

Current Colorado River Issues

Shortage Criteria

In December 2007, the Secretary of the Interior signed the Record of Decision (ROD) on interim operating criteria (2008-2026) including the coordinated operation of Lakes Powell and Mead and criteria for implementing shortage reductions in the Lower Basin. At this time Lake Powell and Lake Mead are operated independently; annual Lake Powell water releases are determined based on applicable law and relevant factors contained in the Long-Range Operating Criteria. Proposed coordinated operation of the reservoirs would address two goals: avoid Lower Basin shortages and avoid curtailment of Upper Basin water use. If regional drought conditions continue shortage operations could begin as early as 2011.

In May 2005, Arizona water users asked ADWR to convene a stakeholder technical workgroup to develop a recommendation regarding appropriate Lower Basin shortage criteria and a strategy for apportioning shortage reductions between the Central Arizona Project (CAP) and equivalent priority mainstream Colorado River water users. In October, 2006 the Workgroup forwarded their recommendation to the Director, and with minor modifications it has been incorporated into the Reclamation Environmental Impact Study as part of the Basin States Alternative.

The modified shortage recommendation implements shortage reductions when Lake Mead water storage is depleted to key elevation triggers: In years when Lake Mead content is projected on January 1 to be at or below elevation 1075 ft and at or above 1050 ft, Arizona's share of shortage reductions would be 320,000 acre-feet, below 1050 ft and at or above 1025 ft, 400,000 acre-feet and below 1025 feet elevation, 480,000 acre-feet. Reclamation will reconsult with the states if conditions continue to worsen necessitating additional water supply reductions. The available shortage water supply would be apportioned within Arizona between the fourth priority mainstream water users and the CAP by first determining the mainstream available supply, based upon entitlement.

(Total fourth priority mainstream diversion entitlement = total fourth priority water supply before shortage reduction) X (total fourth priority water supply – shortage reduction volume)

The remaining fourth priority water supply after deducting the mainstream supply would be available for diversion by the CAP.

Entitlement Transfers

Arizona communities along the Colorado River have experienced explosive growth over the last decade. These Arizona communities are unique because groundwater is not readily available as a supplementary water supply to meet this growing demand. Regardless of whether Colorado River water is diverted from the mainstream or pumped from wells that are hydraulically connected to the river, the water is legally Colorado River water, and annual use is limited to a defined, maximum amount.

The Boulder Canyon Project Act requires U.S. Colorado River water users in the Lower Basin to have a contract for such water with the Secretary of the Interior. The Regional Director of Reclamation contracts with Lower Basin water users on behalf of the Secretary. The Supreme Court Decree in Arizona v. California requires Reclamation to account annually for all diversions and use of Colorado River water against the total Arizona allocation of 2.8 million acre-feet.

To meet this growing domestic demand, some Colorado River communities have acquired, transferred and changed the type of use of existing agricultural water entitlements. For non-federal Arizona contractors of mainstream Colorado River entitlements, these transfer actions are subject to review by the ADWR and consultation with ADWR and Reclamation. The Department has developed a substantive policy statement titled Policy and Procedures for Transferring an Entitlement of Colorado River Water that provides information regarding the Department's review of a proposed transfer action. This policy is available on the Department's website at www.azwater.gov. To date, using its substantive policy statement, the Department has made three assignment and two conveyance recommendations involving agricultural water entitlements. The Department is currently experiencing increasing contact from entities that are interested in the acquisition and conversion of agricultural entitlements to municipal and industrial uses and it expects to process additional contract transfer requests in the future.

A separate substantive policy statement governs the transfer of CAP subcontract entitlements within the three county CAP service area. The Revised Policy Regarding Transfer of Central Arizona Project Municipal and Industrial Water Subcontract Entitlements describes the criteria the Department evaluates and the priority of proposed transfer actions. This policy is also available on the Department's website at www.azwater.gov. Growth in the CAP service area has resulted in increased use of existing CAP subcontract water, and the Department expects few future transfer action proposals.

<u>Lower Colorado River Planning Area Entitlement Transfer Actions</u>
The following are a list of assignment and conveyances that have been conducted in accordance with the Department's Colorado River transfer policy that affects entities in the Lower Colorado River Planning Area. All involve a series of assignments and conveyances that began with the initial partial assignment of Cibola Valley Irrigation and Drainage District's entitlement in 2004. Since that time, two assignment and seven conveyance actions have been completed in the planning area. See Appendix B for a complete list of Colorado River entitlements within the planning area.

1. Through several assignment actions, Cibola Valley Irrigation and Drainage District (CVIDD) has reduced its entitlement from 24,120 acre-feet of 4th priority, 3,000 acre-feet of 5th priority and 4,000 acre-feet of 6th priority to its current entitlement of 9,366 acre-feet of 4th priority, 1,500 acre-feet of 5th priority and 2,000 acre-feet of 6th priority. In December 2004, CVIDD assigned 5,997 acre-feet of 4th priority each to The Hopi Tribe and to Mohave County Water Authority (MCWA). Both entities also acquired 750 acre-feet of 5th priority and 1,000 acre-feet of 6th priority

entitlement. In 2006, CVIDD assigned 60 acre-feet of 4th priority entitlement to Cibola Resources and in 2008 assigned another 2,700 acre-feet of 4th priority to Arizona Recreational Facilities, Inc. CVIDD's 4th priority entitlement includes 300 acre-feet for domestic water uses.

2. In December 2004, the Mohave County Water Authority (MCWA) was assigned 5,997 acre-feet of 4th priority, 750 acre-feet of 5th priority and 1,000 acre-feet of 6th priority irrigation entitlement from CVIDD. On July 6, 2007, MCWA conveyed its 4th priority entitlement for M&I use in its Mohave County contract service area, but retained its ability to use the entitlement for irrigation use on its Cibola Valley farmland until it was needed for use in Mohave County. On September 25, 2007 the MCWA conveyed 1,419 acre-feet of 4th priority, 750 acre-feet of fifth priority and 1,000 acre-feet of sixth priority entitlement to the Arizona Game and Fish Commission (AGFC) to use for Multi-Species Conservation Program (MSCP) purposes on the associated Cibola Valley land that it acquired simultaneously from MCWA. In June 2008, MCWA conveyed a total of 300 acre-feet of 4th priority entitlement. The first 50 acre-feet were conveyed to Springs del Sol Water Improvement District, while 250 acre-feet were conveyed to La Paz County.

3. In December 2004, The Hopi Tribe was assigned 5,997 acre-feet of 4th priority, 750 acre-feet of 5th priority and 1,000 acre-feet of 6th priority irrigation entitlement from CVIDD. On October 9, 2008, The Hopi Tribe conveyed 1,419 acre-feet of its 5,997 acre-feet 4th priority entitlement to the AGFC. In June 2008, it conveyed 50 acre-feet to Springs del Sol Water Improvement District, while 250 acre-feet were conveyed to La Paz County.

4. On October 25, 2006, 60 acre-feet of 4th priority entitlement was conveyed to B&F Investment LLC from Cibola Resources, Inc. Cibola Resources had initially acquired the 60 acre-feet from CVIDD and immediately transferred the entitlement to B&F for domestic use in the Ehrenberg area.

Note:
Assignments: Entitlement is assigned to a new entity, the type and place of use remain the same.
Conveyances: Entitlement may or may not be transferred to a new entity, but the place of use and/or the type of use is changed.

Inadvertent Overrun and Payback Policy

In October 2003, the Secretary of the Interior signed the Record of Decision to implement the Colorado River Water Delivery Agreement (WDA). The WDA includes the Inadvertent Overrun and Payback Policy (IOPP) to identify inadvertent overruns and to establish procedures to account for overruns and define subsequent payback requirements for Colorado River water users in the Lower Basin.

Inadvertent overruns occur when Colorado River water is diverted, pumped or received by an entitlement holder in excess of the water user's entitlement for that year. The IOPP creates a process and criteria to structure payback of the amount of water received in excess of the entitlement for that year.

Federal Rulemaking to Establish the Accounting Surface

In August 2006, Reclamation initiated a rulemaking process to regulate the non-contract use of Colorado River water in the Lower Basin. The Boulder Canyon Project Act requires U.S. Colorado River water users in the Lower Basin to have a contract for such water with the Secretary of the Interior. The Regional Director of Reclamation contracts with Lower Basin water users on behalf of the Secretary. The Supreme Court Decree in Arizona v. California requires Reclamation to account annually for all diversions and use of Colorado River water against the total Arizona allocation of 2.8 million acre-feet.

The rulemaking is intended to ensure that all Colorado River water use is covered by an entitlement and correctly accounted for within the state's apportionment. Reclamation has contracted with the U.S. Geological Survey, to document non-contract water uses in the Lower Basin. The rule will establish the methodology that Reclamation will use to determine if a well is pumping Colorado River water and will also establish an appeal process. At this time, approximately 11,500 acre-feet of unallocated fourth-priority Colorado River water is available for allocation. Some of this water will be allocated to existing uses, after currently uncontracted uses have been quantified. The inventory is expected to provide comprehensive information about existing water uses that need an entitlement. The Department will use this information to allocate the remaining supply for domestic purposes.

Yuma Desalination Plant

One unintended consequence of utilizing Colorado River water for domestic and agricultural purposes has been the steady increase in the salinity of its waters. The salinity problem created international discord in the 1960's when crops in the Mexicali Valley were damaged by the high salinity of the Colorado River water used for irrigation. An amendment to the 1944 treaty with Mexico guaranteed that the treaty water delivery would be no more than 115 ppm (+/- 30 ppm) more saline than the water diverted at Imperial Dam.

To comply with this requirement, the U.S. implemented a number of measures including re-routing drainage water from the Wellton-Mohawk Irrigation and Drainage District (WMIDD), to the Cienega de Santa Clara in Mexico. The U.S. also built a $250 million desalinization plant in Yuma to treat WMIDD drainage water, before returning it to the mainstream. The Yuma Desalinization Plant (YDP) was completed in 1992, operated briefly in 1993 and then put on standby status until a recent "demonstration run" in 2007.

Wellton-Mohawk drainage water that is bypassed each year to the Cienega, is not counted against the total amount of Colorado River water that must be delivered to Mexico under the terms of the Treaty. In dry years, this results in Lake Mead storage decreasing by approximately 100,000 acre-feet annually since the bypassed water must be "made-up" from storage in Lake Mead. Recently, the decrease in Lake Mead storage after more than a decade of drought has increased the risk of shortage to Arizona Colorado River water users.

Operation of the YDP and the subsequent discharge of treated water to the Colorado River to meet U.S. Treaty obligations with Mexico would significantly reduce water flow to the Cienega. In 2004, the Yuma Desalination Plant/Cienega de Santa Clara Workgroup was formed to identify and develop potential strategies to maintain the Cienega while making the treated irrigation return flows available for delivery as part of Mexico's allocation. Workgroup recommendations, which were released in April, 2005, identify a combination of various methods for bypass recovery or replacement that could meet these objectives.

In 2007, Reclamation conducted a demonstration run of the YDP by operating it at about ten percent capacity for three months. The purposes of the run were to test new equipment, acquire current operational data, and identify design deficiencies to better determine whether the facility could reliably and efficiently be operated on a long-term basis. Although the study results were favorable, it was determined that to obtain more conclusive information, the plant needed to be operated at a scale and for a duration which covers seasonal variations associated with chemical use and power consumption. As a result, Reclamation plans to conduct a second pilot run of the facility. During this pilot run, which is scheduled to be initiated in May 2010, the plant will operate at up to one-third capacity for 365 operating days during a 12- to 18-month period.
During this demonstration run, flows bypassed to the Cienega will be reduced by up to 29,000 acre-feet, while salinity levels will increase by about 540 parts per million. Reclamation, through the International Boundary and Water Commission, initiated consultation with Mexico regarding the proposed pilot project.

As a result this consultation, a Joint Report dated July 17, 2009 was drafted. The U.S., Mexico, and other non-governmental parties have committed to offsetting the reduced bypass flows with up to 30,000 acre-feet of water and to participate in the Colorado River Joint Cooperative Process to further identify and develop potential long-term strategies for maintaining environmental values associated with the Cienega.

Salinity

Increased salinity levels in the Colorado River affect agricultural, municipal and industrial users. Agricultural water users suffer economic damage due to reduced crop yields, added labor costs for irrigation management and added drainage requirements. Urban users must replace plumbing and water-using appliances more often, or spend money on water softeners or bottled water. Industrial users and water and wastewater treatment facilities incur reductions in the useful life of system infrastructure. Damages in the United States are estimated at $330 million per year, and while economic damage in Mexico is not quantified it is also a significant concern.

In 1972, EPA required development of water quality standards for salinity in the Colorado River in accordance with Clean Water Act Section 303. The seven Colorado River Basin States formed the Colorado River Basin Salinity Control Forum (the Forum) in 1973. The Forum has developed numeric salinity standards for three locations in the Lower Basin as well as a basin-wide plan of implementation. The EPA has approved the standards and the plan of implementation adopted by the Colorado River Basin States. The water quality standards establish a flow-weighted average annual salinity standard that must be maintained on the lower Colorado River at the following locations:

Below Hoover Dam (to Parker Dam) - 723 mg/L
Below Parker Dam (to Imperial Dam) - 747 mg/L

At Imperial Dam - 879 mg/L

Implementation of the salinity control plan has ensured compliance with the numeric criteria while the Basin States continue to develop the water allocated to them by the Colorado River Compact. Millions of dollars have been spent to prevent 1.9 million tons of salt from entering the river.

Other Water Quality Issues

In 2005, the Governor of Arizona appointed The Clean Colorado River Alliance (Alliance) stakeholder group to address water quality issues for the Colorado River. In addition to salinity, the Alliance identified several other water quality concerns including nutrients, metals, endocrine disrupting compounds, perchlorate, bacteria and pathogens, and sediment. The Alliance issued a report titled Clean Colorado River Alliance Recommendations to Address Colorado River Water Quality, January 2006. The report includes a number of recommendations to monitor and mitigate the impacts of these pollutants.

APPENDIX E

APPENDIX E
SURFACE WATER RIGHT AND ADJUDICATION FILINGS

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

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

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

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

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

- "3R" – application to construct a reservoir filed before 1972;
- "4A" – application to appropriate surface water filed before 1972;
- "33" – application for permit to appropriate public water or construct a reservoir filed after 1972. In addition to surface water diversions and reservoirs, instream flow maintenance

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

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

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

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

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

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

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

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

Arizona currently has two general stream adjudications – the Gila Adjudication and the LCR Adjudication. The purpose of these judicial proceedings is to determine the nature, extent, and priority of water rights across the entire river systems. In addition to confirming existing state-based surface water rights, the adjudications will quantify and prioritize reserved water rights for Indian and non-Indian federal lands. The latter include military bases, national parks and monuments, and national forests. The adjudications will also determine which wells are pumping appropriable underground water (subflow) and therefore are subject to the jurisdiction of the court. The Gila and LCR Adjudications are being conducted in the Superior Court of Arizona in Maricopa and Apache Counties, respectively. ADWR provides technical, legal and administrative support to the adjudication court, as described in A.R.S. § 45-256.

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

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

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

Figure E-1 General Stream Adjudications in Arizona

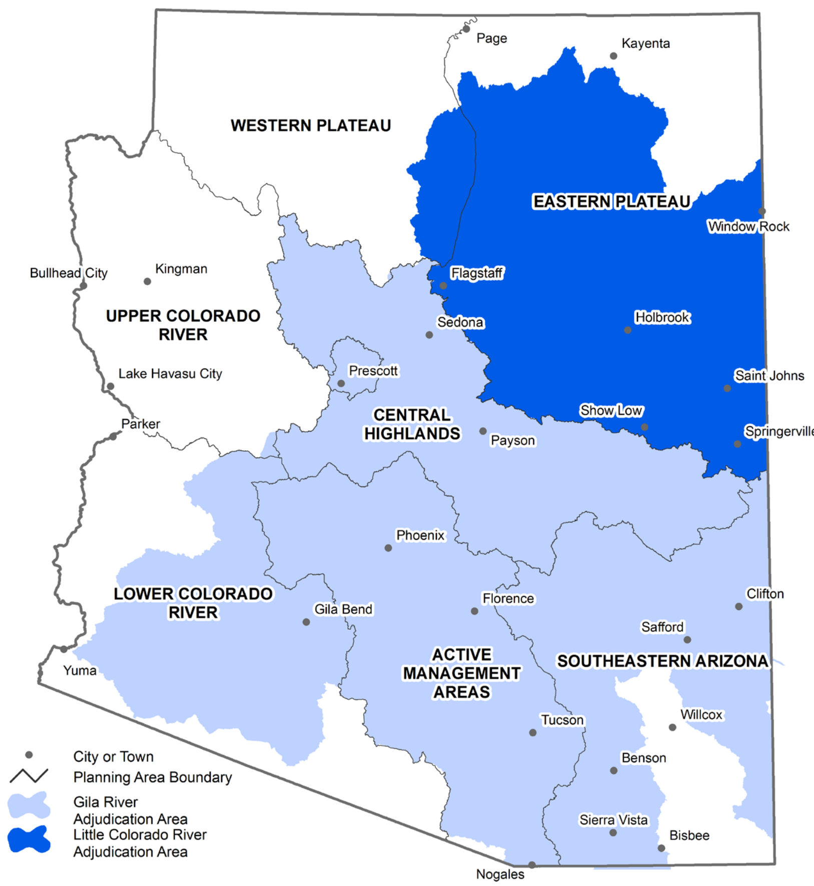


Table C-1 summarizes the number of surface water right and adjudication filings for each planning area. The table was generated by querying ADWR's surface water right and SOC registries in February 2009. Files are only counted in the table if they include sufficient locational information (Township,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

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

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

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

Notes:

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

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

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

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

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

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

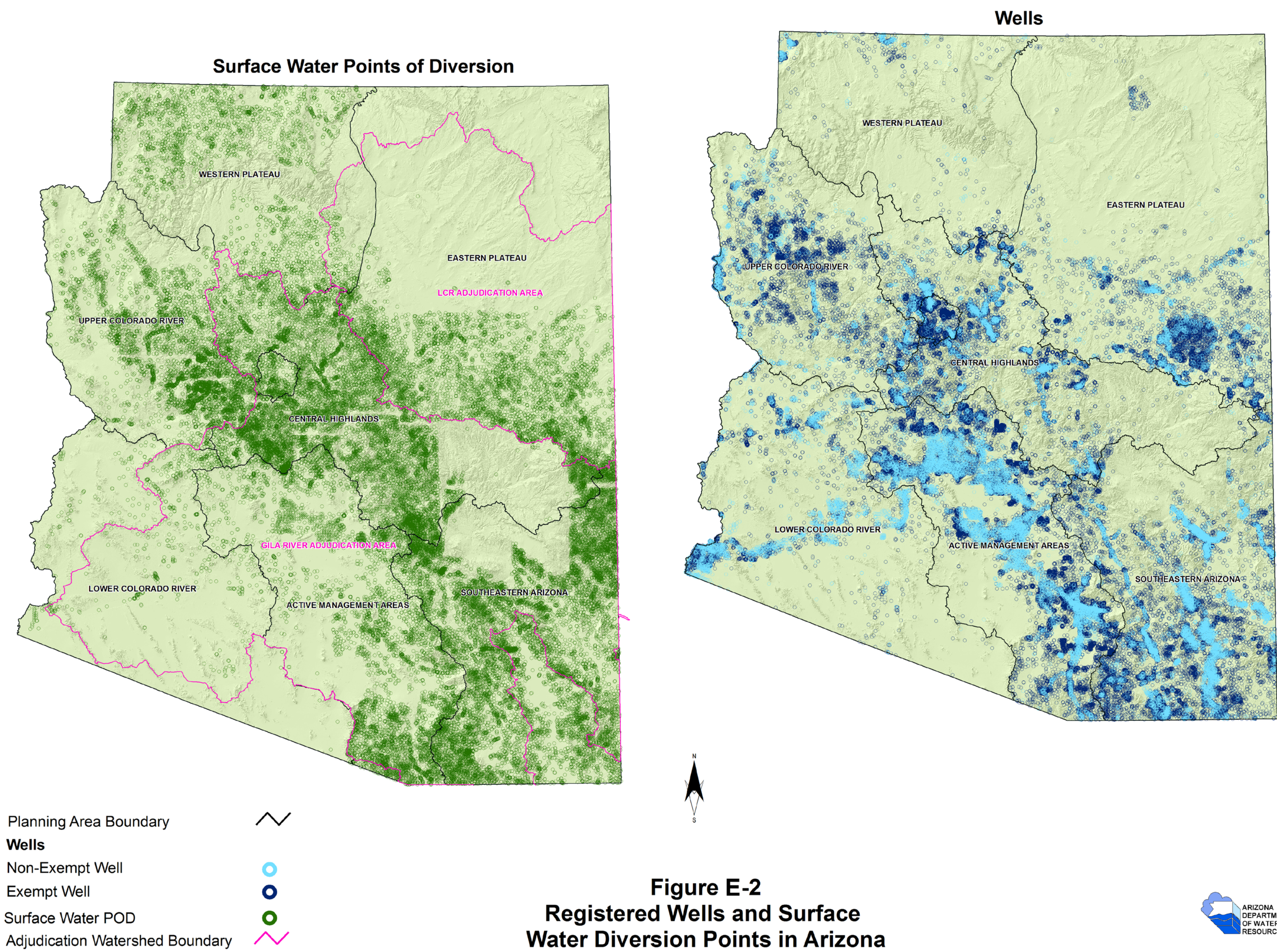


Figure E-2
Registered Wells and Surface Water Diversion Points in Arizona