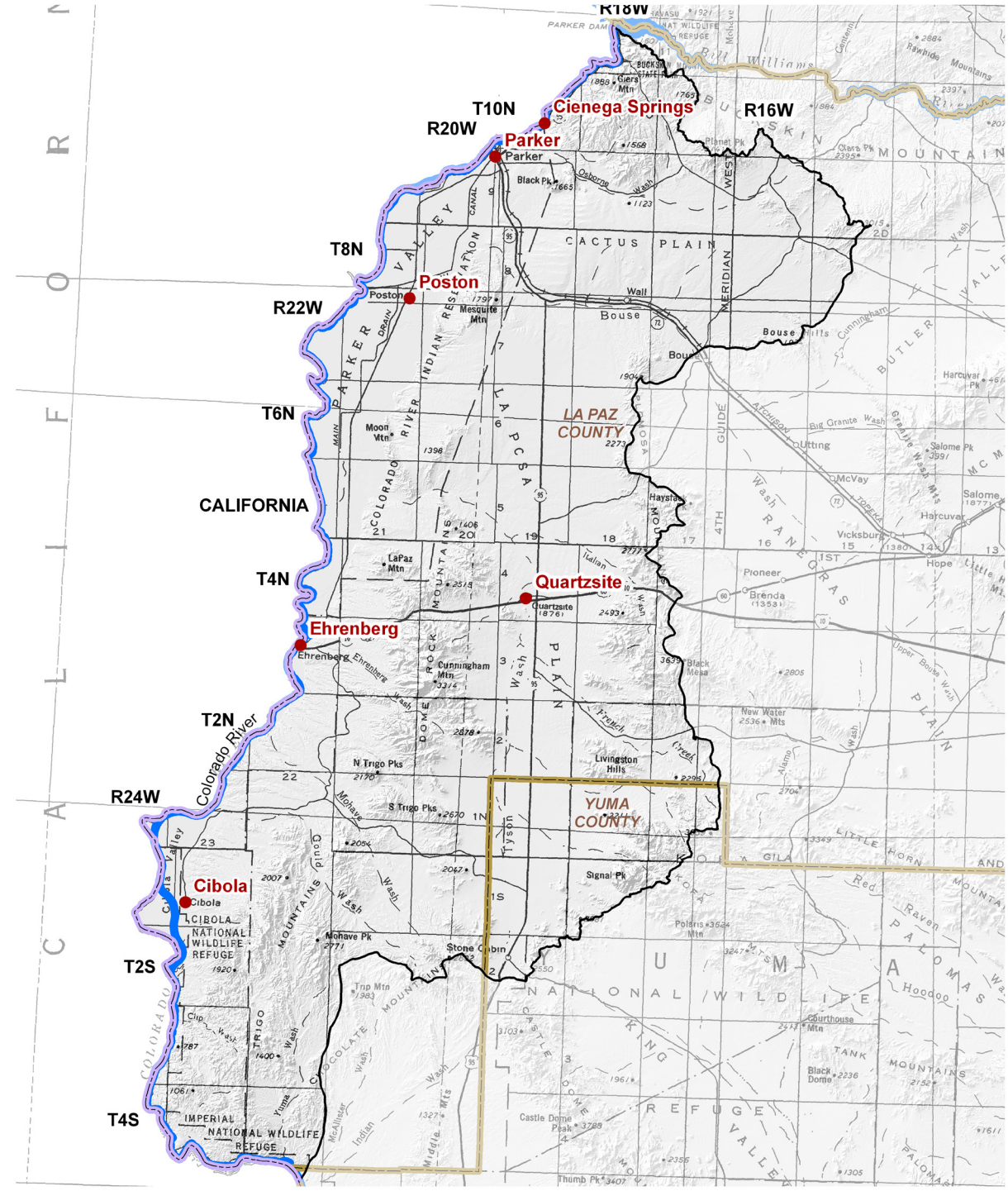
# Section 7.6
# Parker Basin

### 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.




Base Map: USGS 1:500,000, 1981

**Figure 7.6-1**
**Parker Basin**
**Geographic Features**

California State Boundary
*COUNTY*
City, Town or Place

### 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.

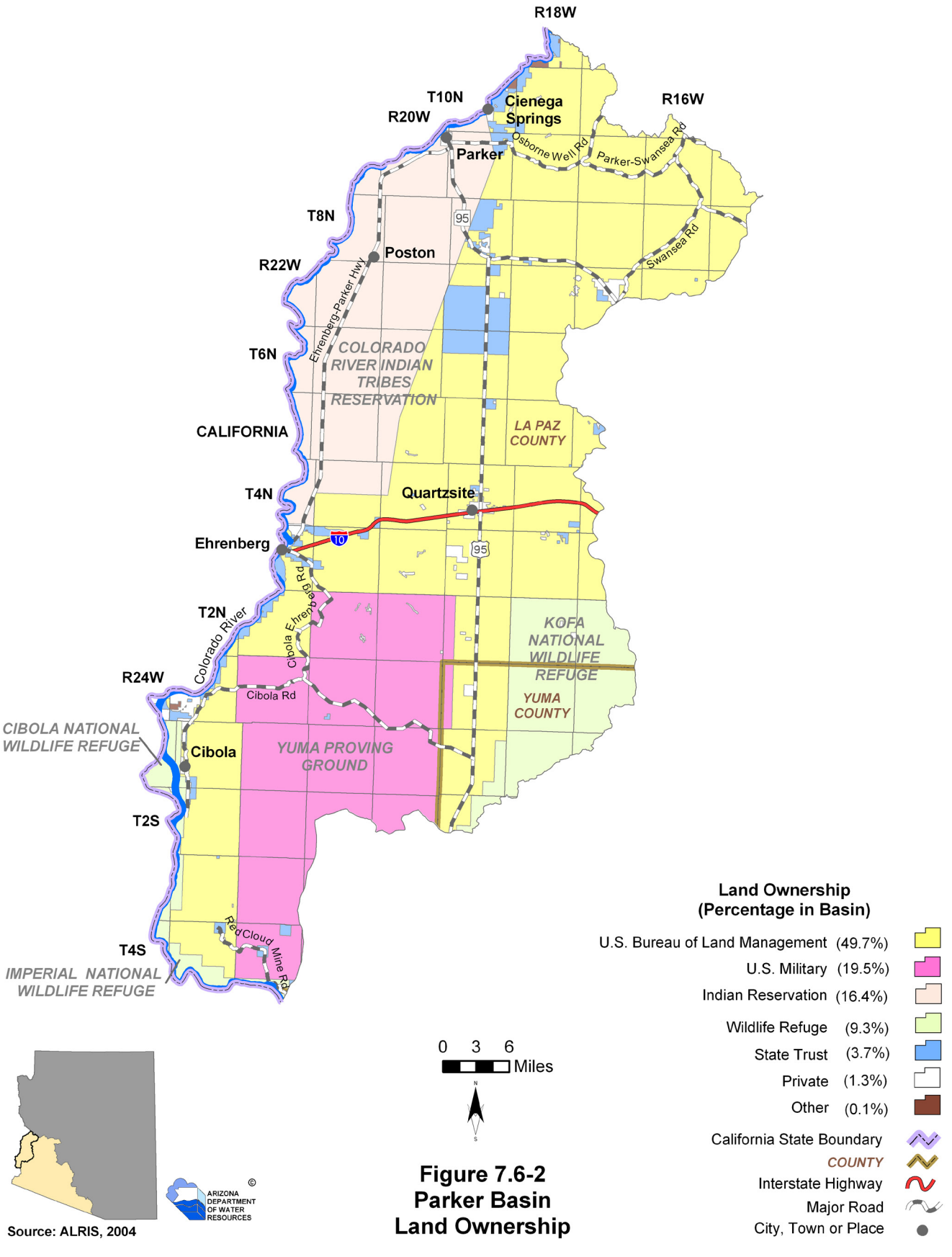



**Figure 7.6-2**
**Parker Basin**
**Land Ownership**

### 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 | | | |

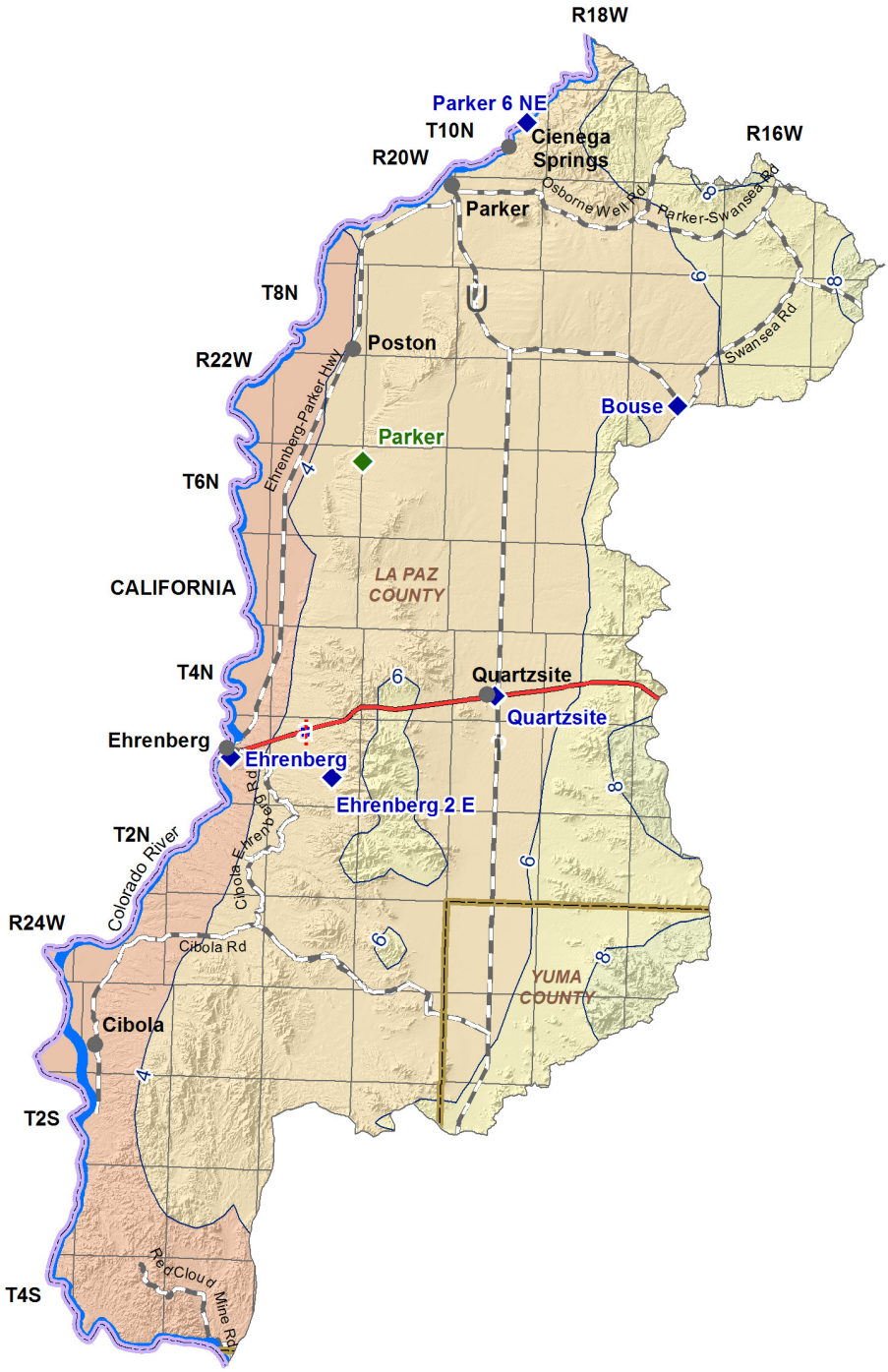
**C. AZMet:**

| 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 | | | | | | | | |




Precipitation Data Source: Oregon State University, 1998

0 3 6 Miles

**Figure 7.6-3**
**Parker Basin**
**Meteorological Stations**
**and Annual Precipitation**

**Average Annual Precipitation (1961-1990)**
inches per year
0-4
4-6
6-8
8-10

**Meteorological Stations**
NOAA/NWS
AZMET
Precipitation Contour 12
California State Boundary
COUNTY
Interstate Highway
Major Road
City, Town or Place

### 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**

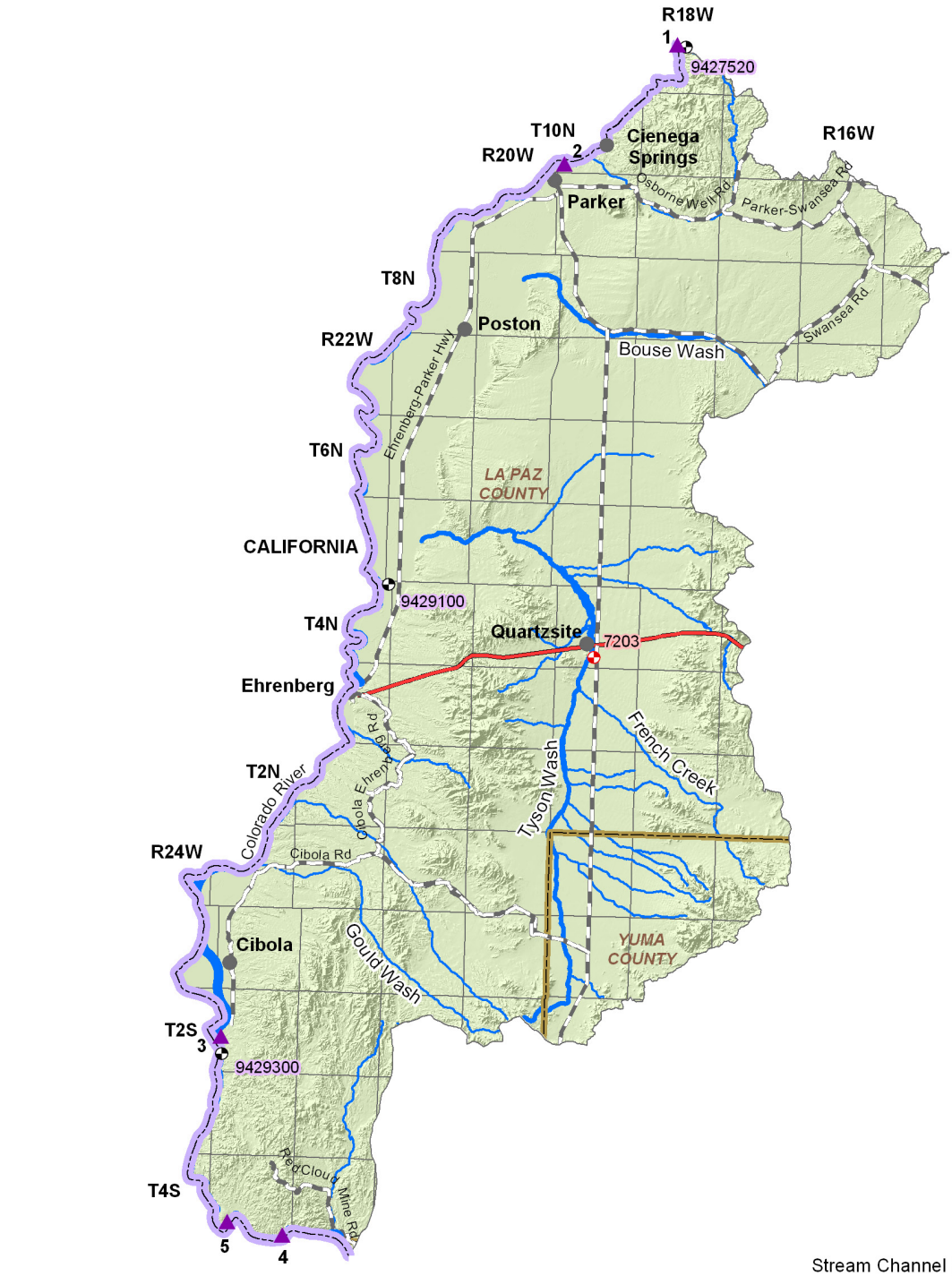
**Notes:**

[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




ARIZONA DEPARTMENT OF WATER RESOURCES ©

Stream Data Source: ALRIS, 2005

0 3 6 Miles

N

S

Stream Channel (width of line reflects stream order)

Large Reservoir 1

USGS Gage and Station ID 9999999

Flood ALERT Equip. & Station ID 9999

California State Boundary

COUNTY

Interstate Highway

Major Road

City, Town or Place

**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**


ARIZONA DEPARTMENT OF WATER RESOURCES ©

Stream Data Source: AGFD, 1993 & 1997

0 3 6
Miles

N
S

**Figure 7.6-5**
**Parker Basin**
**Perennial\Intermittent Streams and Major (>10 gpm) Springs**

Perennial Stream
California State Boundary
COUNTY
Interstate Highway
Major Road
City, Town or Place

### 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<br>Median 100<br>(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

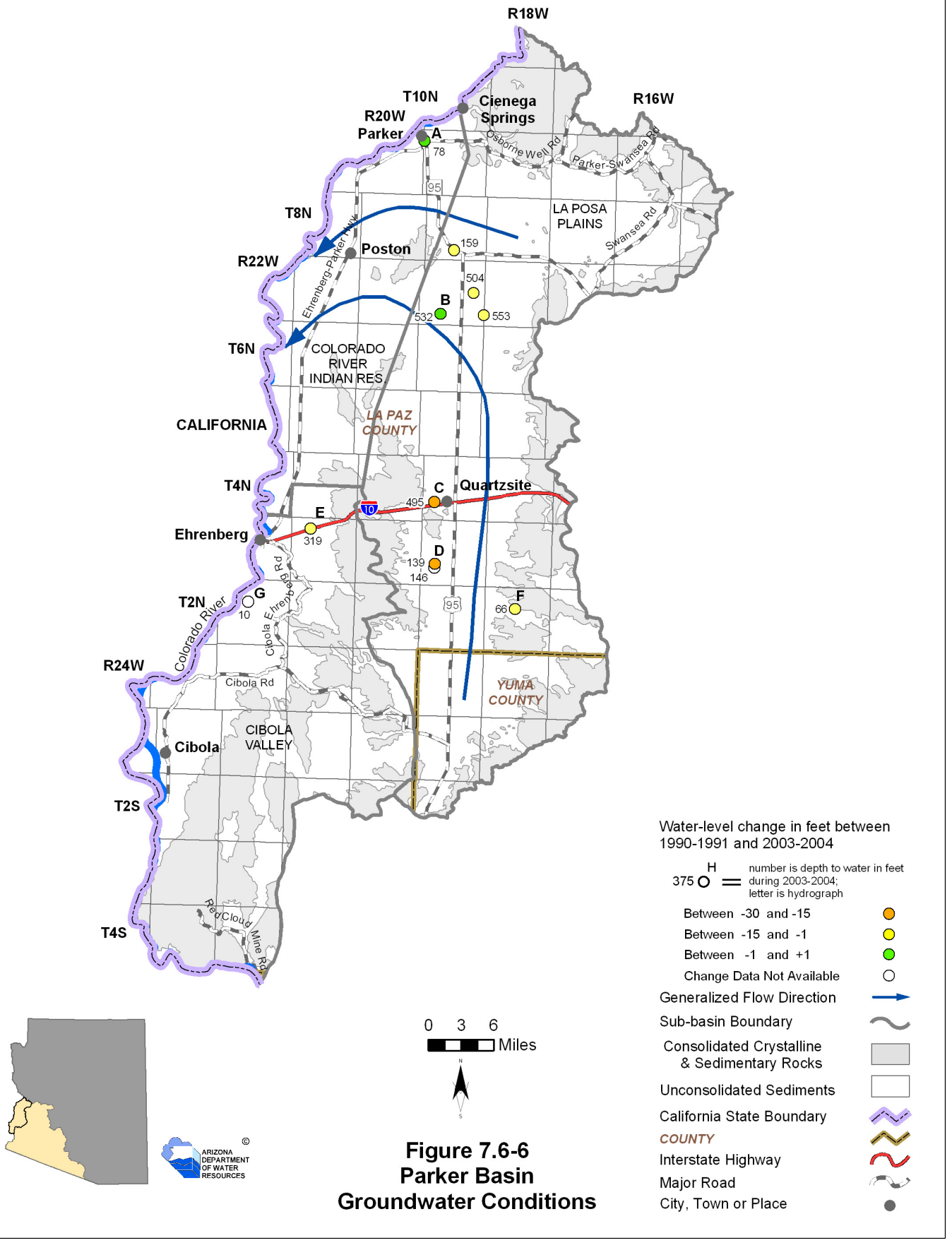
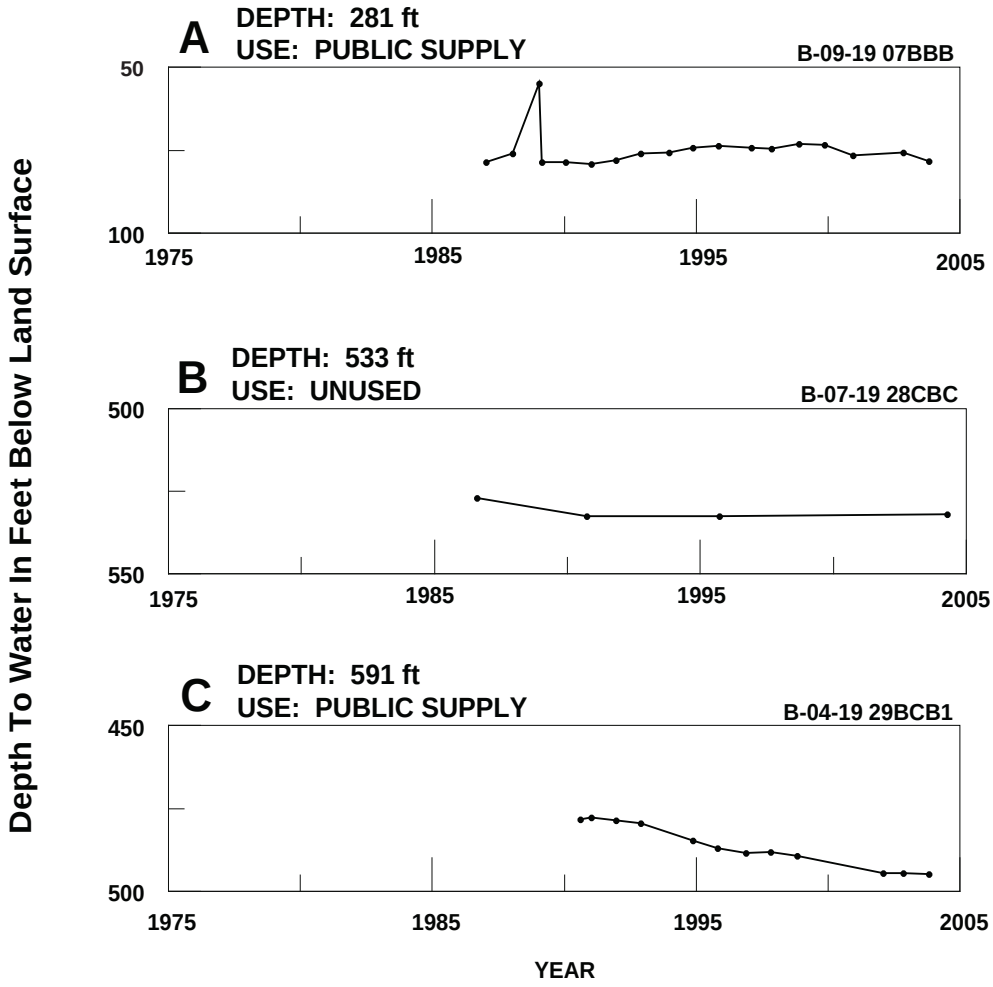
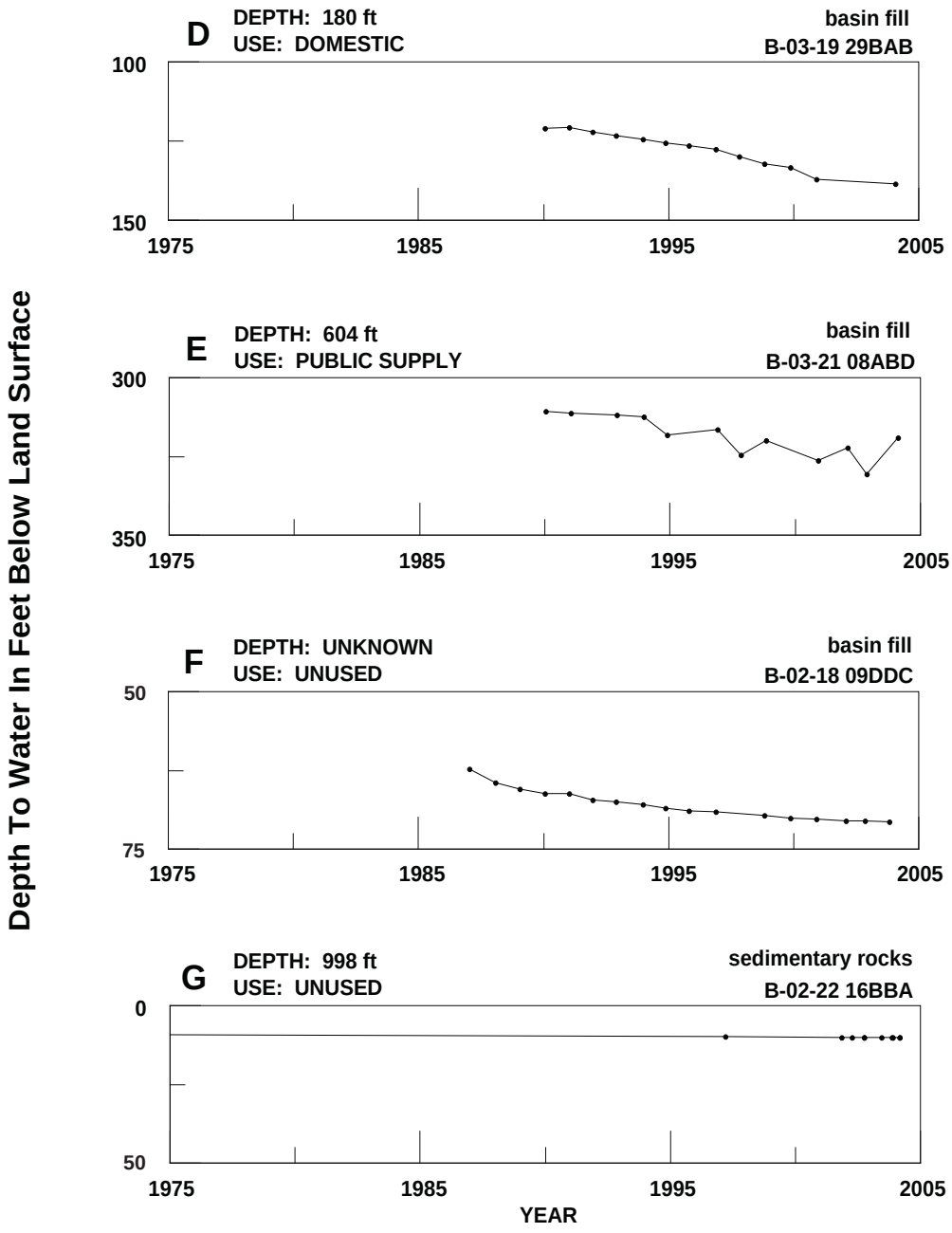



**Figure 7.6-6**
**Parker Basin**
**Groundwater Conditions**

## 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



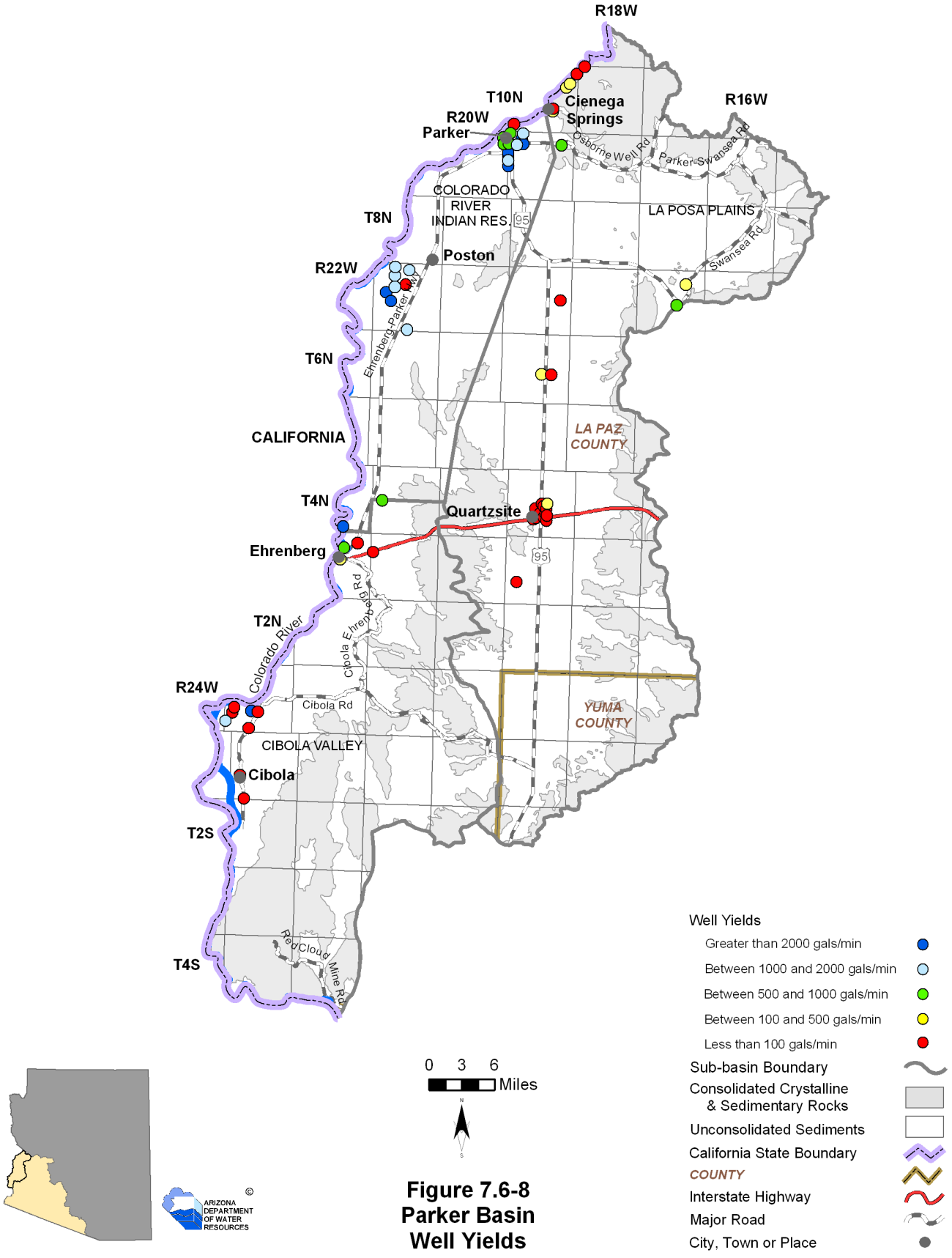



**Figure 7.6-8**
**Parker Basin**
**Well Yields**

### 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

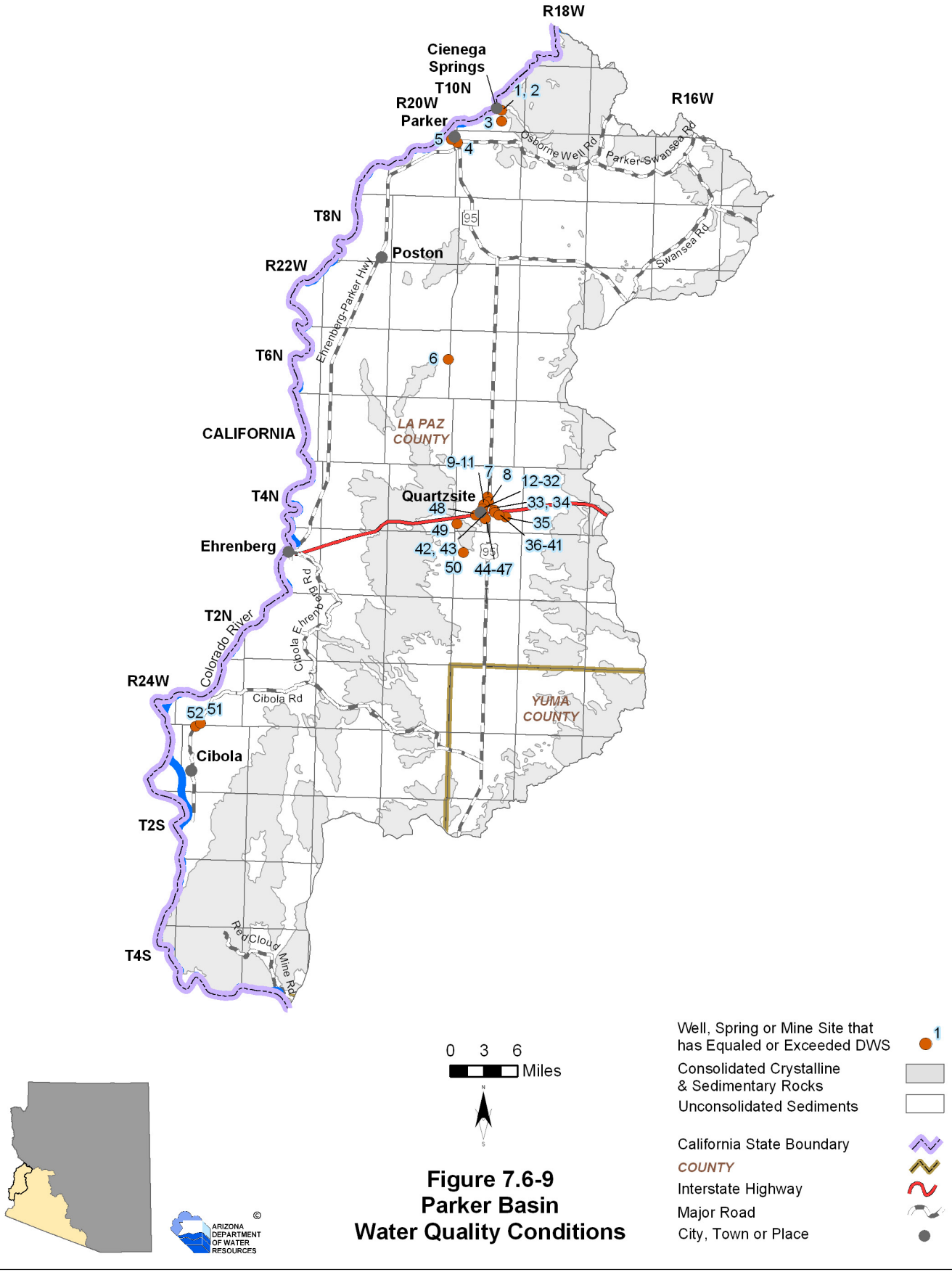



**Figure 7.6-9**
**Parker Basin**
**Water Quality Conditions**

### 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) | | | | | | Data Source |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Well Pumpage | | | Surface-Water Diversions | | | |
| | | Q ≤ 35 gpm | Q > 35 gpm | Municipal | Industrial | Agricultural | Municipal | Industrial | Agricultural | |
| **1971** | | 850[2] | 105[2] | 9,000 | | | 1,251,000[4] | | | ADWR (1994a) |
| **1972** | | | | | | | | | | |
| **1973** | | | | | | | | | | |
| **1974** | | | | | | | | | | |
| **1975** | | | | | | | | | | |
| **1976** | | | | 21,000 | | | 1,102,000[4] | | | |
| **1977** | | | | | | | | | | |
| **1978** | | | | | | | | | | |
| **1979** | | | | | | | | | | |
| **1980** | 11,339 | | | | | | | | | |
| **1981** | 11,398 | 181 | 26 | 25,000 | | | 1,130,000[4] | | | |
| **1982** | 11,457 | | | | | | | | | |
| **1983** | 11,516 | | | | | | | | | |
| **1984** | 11,575 | | | | | | | | | |
| **1985** | 11,634 | | | | | | | | | |
| **1986** | 11,693 | 203 | 26 | 18,000 | | | 1,229,000[4] | | | |
| **1987** | 11,752 | | | | | | | | | |
| **1988** | 11,810 | | | | | | | | | |
| **1989** | 11,869 | | | | | | | | | |
| **1990** | 11,928 | | | | | | | | | |
| **1991** | 12,351 | 130 | 7 | 2,900 | NR | 1,300 | 400 | NR | 662,000 | USGS (2007) ADWR (2008b) ADWR (2008c) |
| **1992** | 12,774 | | | | | | | | | |
| **1993** | 13,196 | | | | | | | | | |
| **1994** | 13,619 | | | | | | | | | |
| **1995** | 14,042 | | | | | | | | | |
| **1996** | 14,464 | 118 | 8 | 3,200 | NR | <1,000 | 400 | NR | 667,000 | |
| **1997** | 14,887 | | | | | | | | | |
| **1998** | 15,310 | | | | | | | | | |
| **1999** | 15,732 | | | | | | | | | |
| **2000** | 16,155 | | | | | | | | | |
| **2001** | 16,351 | 267 | 19 | 3,800 | <300 | <1,000 | 500 | NR | 630,600 | |
| **2002** | 16,548 | | | | | | | | | |
| **2003** | 16,744 | | | | | | | | | |
| **2004** | 16,941 | | | | | | | | | |
| **2005** | 17,137 | | | | | | | | | |
| **2010** | 18,119 | | | | | | | | | |
| **2020** | 20,037 | | | | | | | | | |
| **2030** | 21,775 | | | | | | | | | |
| | ***WELL TOTALS:*** | **1,749** | **191** | | | | | | | |

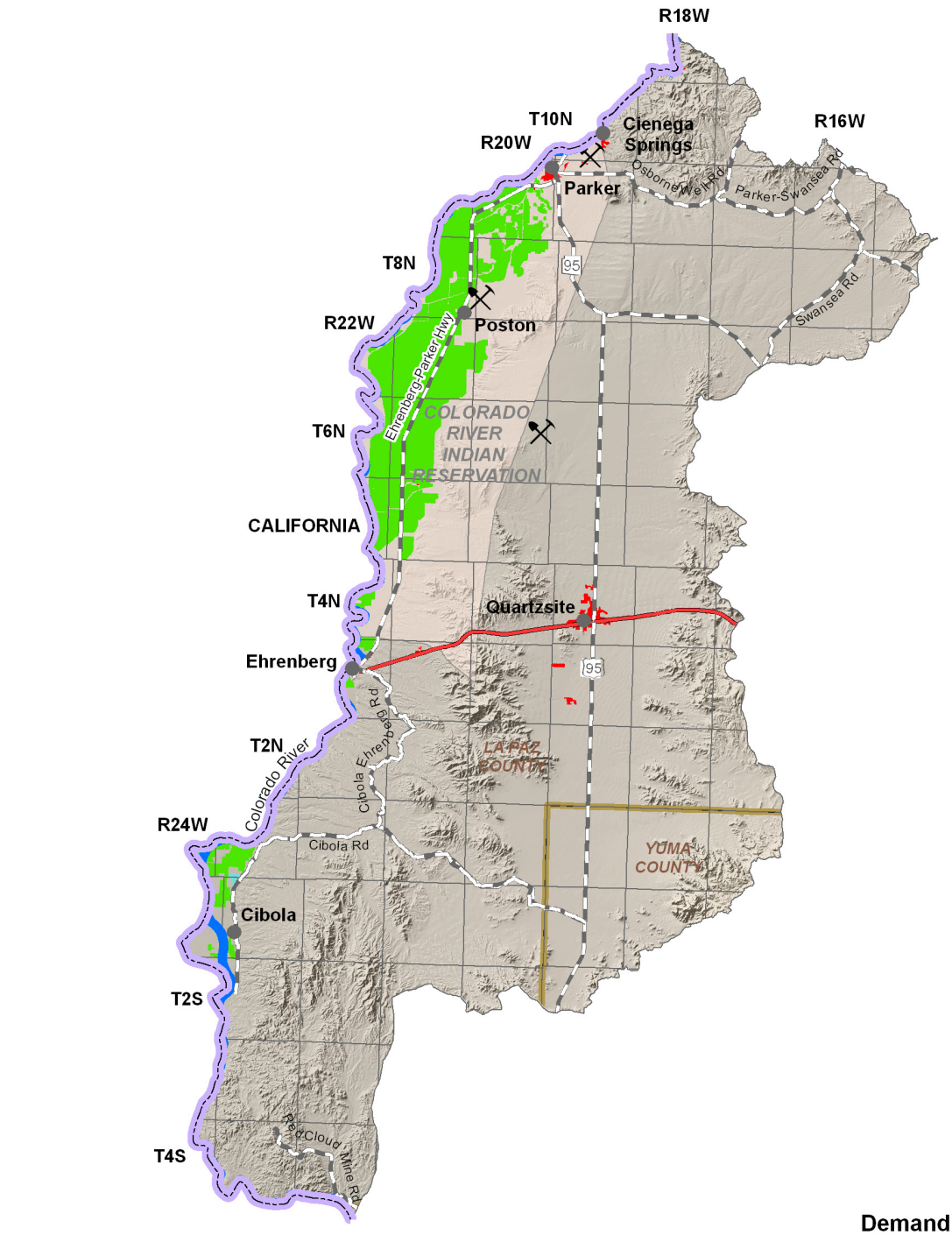
[1] Does not include effluent or evaporation losses from stockponds and reservoirs.
[2] Includes all wells through 1980.
[3] Includes pumpage and diversion of Colorado River Contract Water.
[4] Includes surface-water diversions in the Lower Gila and Yuma basins.
NR - Not reported

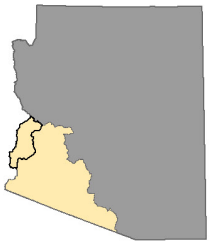
**Table 7.6-9 Effluent Generation in the Parker Basin**

| 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



ARIZONA DEPARTMENT OF WATER RESOURCES ©

Primary Data Source: USGS National Gap Analysis Program, 2004

0 3 6
Miles

N
S

**Figure 7.6-10**
**Parker Basin**
**Cultural Water Demand**

**Demand Centers**

- Agriculture
- M&I - High Intensity
- M&I - Low Intensity
- Small Mine / Quarry
- Indian Reservation
- California State Boundary
- COUNTY
- Interstate Highway
- Major Road
- City, Town or Place

### 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

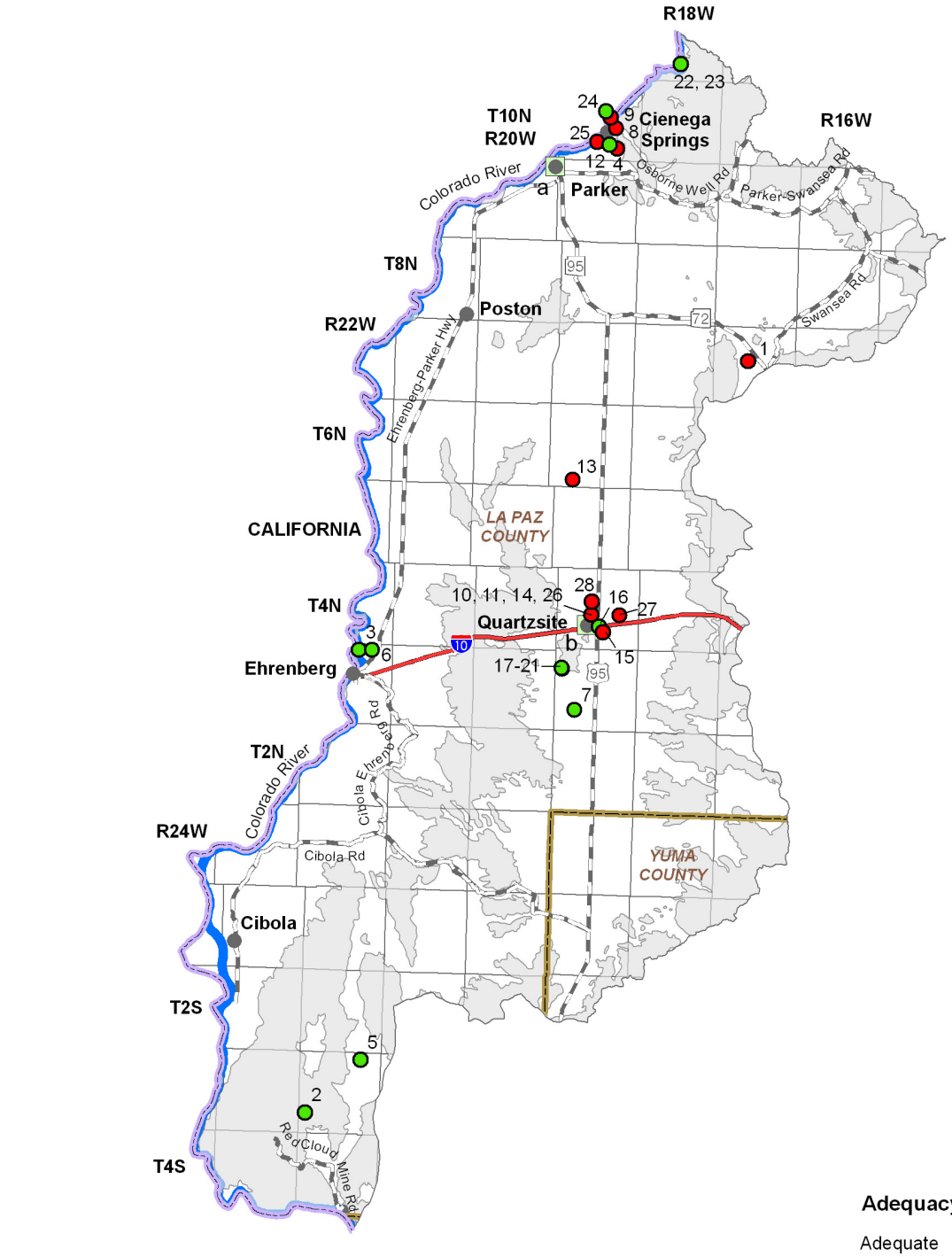



**Figure 7.6-11**
**Parker Basin**
**Adequacy Determinations**

# 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.