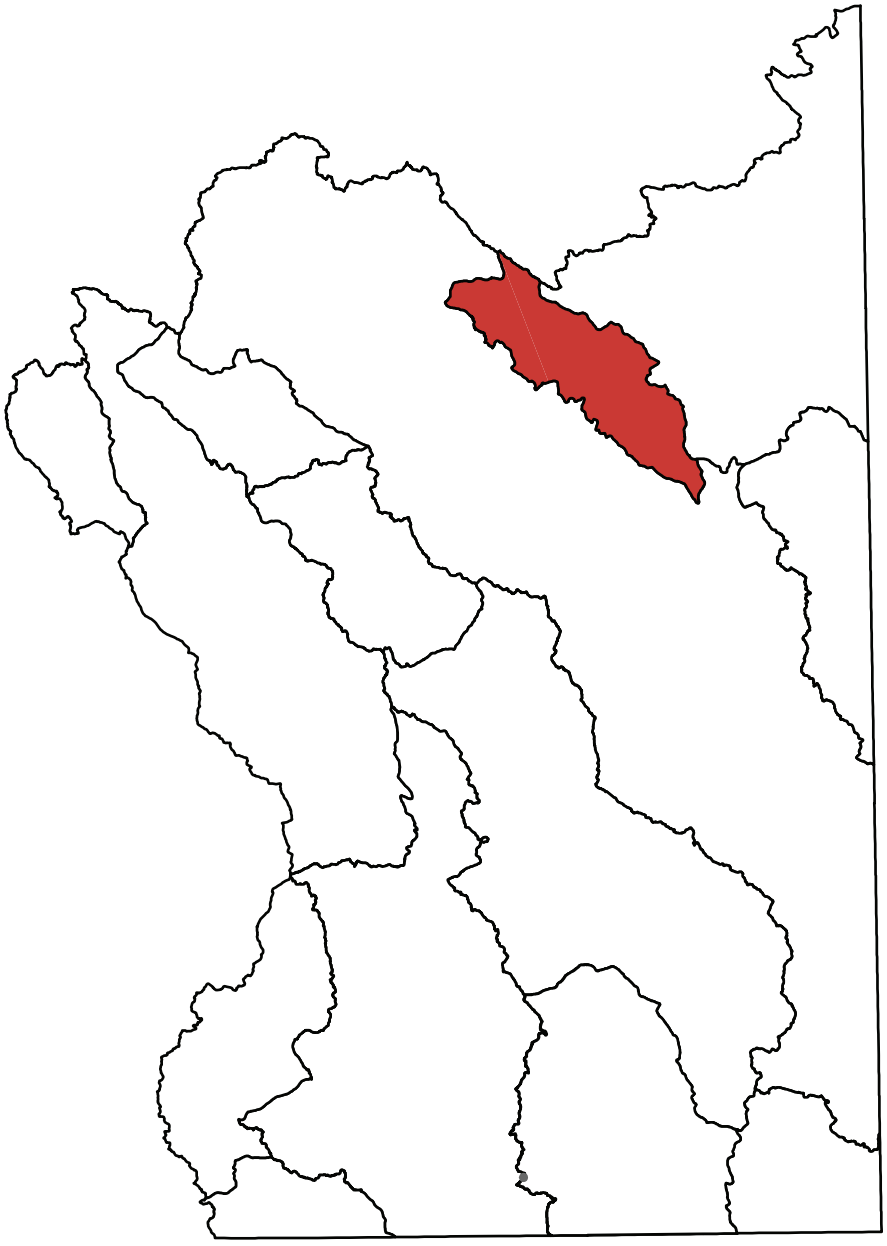
Section 3.2
Bonita Creek Basin



3.2.1 Geography of the Bonita Creek Basin

The Bonita Creek Basin is a relatively small, 457 square mile basin in the northeast portion of the planning area. Geographic features and principal communities are shown on Figure 3.2-1. The basin is characterized by medium-high elevation plains and mountain ranges. Vegetation is primarily Plains and Great Basin grassland with smaller areas of Great Basin conifer forest, interior chaparral, Chihuahuan desertscrub, semi-desert grassland and Arizona uplands Sonoran desertscrub (see Figure 3.0-10). Riparian vegetation includes mixed broadleaf, strand and mesquite on Bonita Creek.

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

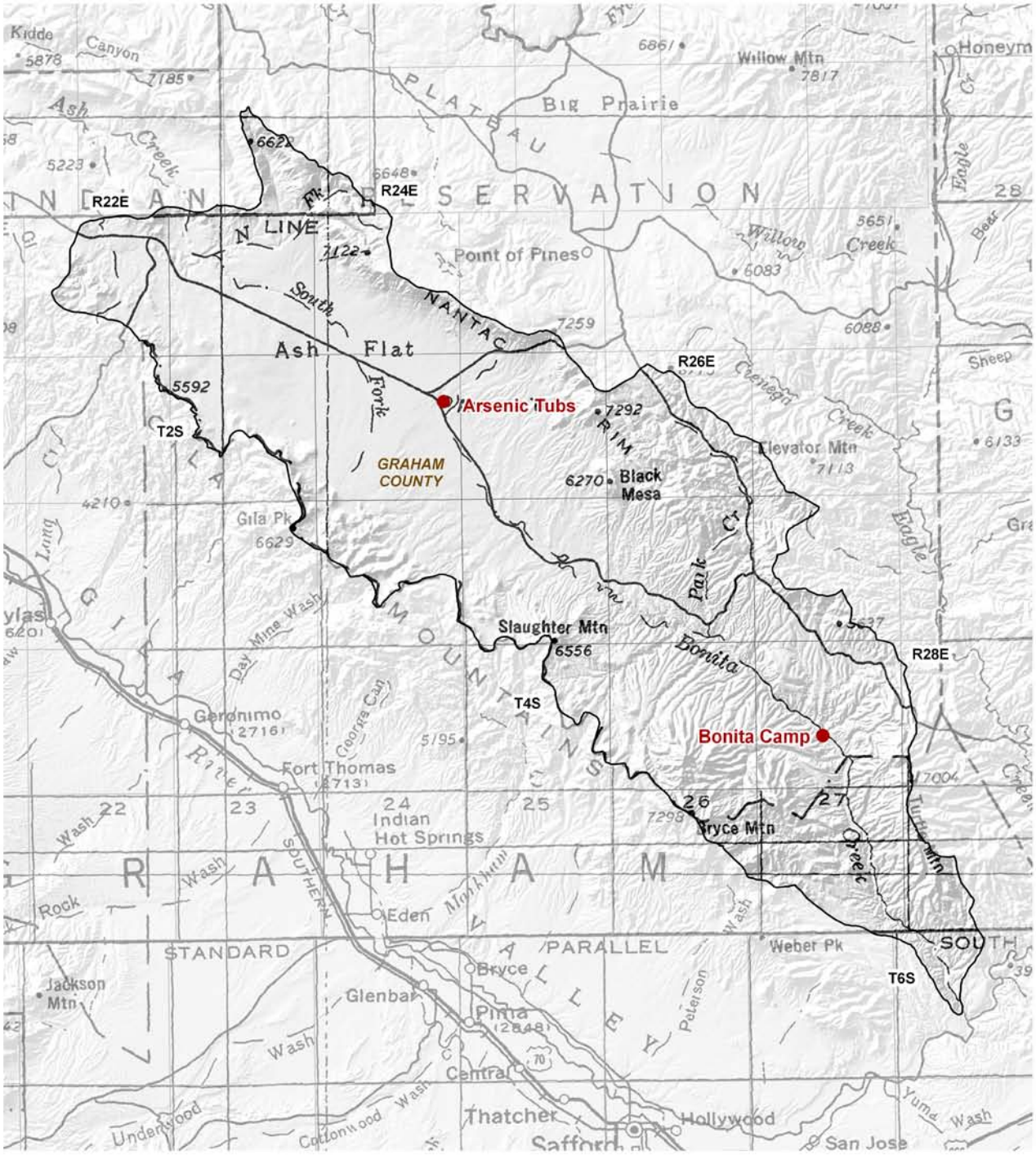


Figure 3.2-1
Bonita Creek Basin
Geographic Features

3.2.2 Land Ownership in the Bonita Creek Basin

Land ownership, including the percentage of ownership by category, for the Bonita Creek Basin is shown in Figure 3.2-2. Principal features of land ownership in this basin are the large amount of San Carlos Apache tribal land, the largely solid portion of U.S. Bureau of Land Management lands in the south and the lack of diversity in land ownership types. A description of land ownership data sources and methods is found in Volume 1, Appendix A. More detailed information on National Parks, Monuments, Riparian, Conservation, Wildlife and Wilderness Areas is found in Section 3.0.3. The San Carlos Apache Indian Reservation was established in 1871, and covers three counties, Gila, Graham and Pinal. This basin includes 403 of the 2,867 square mile reservation. Land ownership categories are discussed below in the order of percentage from largest to smallest in the basin.

Indian Reservation

- 88.4% of the land in this basin is under ownership of the San Carlos Apache Tribe.
- Primary land uses are domestic and grazing.

U.S. Bureau of Land Management (BLM)

- 11.0% of the land is federally owned and managed by the Safford Field Office of the Bureau of Land Management
- The majority of the BLM land is in the southern portion of the basin, however, there are a few very small portions of BLM land along the western boundary of the basin in T2S, R23E; T3S, R24E and T4S, R25E.
- The basin contains a portion of the Gila Box Riparian National Conservation Area in T5S, R27E and T6S, R28E. (see Figure 3.0-13)
- Primary land use is grazing.

Private

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

State Trust

- 0.2% of land in this basin is held in trust for public schools.
- The very small portion of state trust land can be found on the southeast basin boundary, T6S, R28E and on the western basin boundary T4S, R26E.
- Primary land use is grazing.

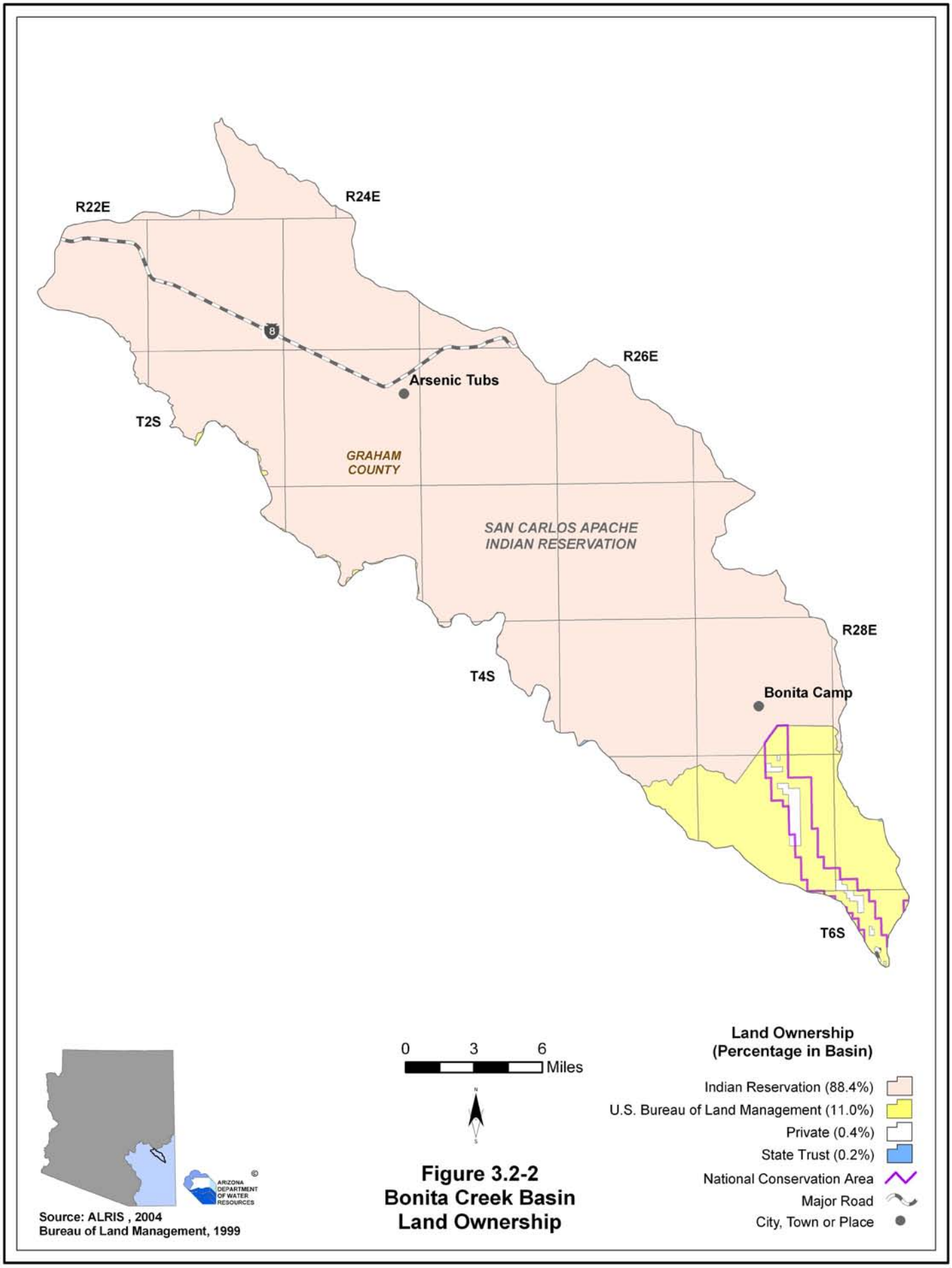


Figure 3.2-2
Bonita Creek Basin
Land Ownership

3.2.3 Climate of the Bonita Creek Basin

The Bonita Creek Basin does not contain any NOAA/NWS, Evaporation Pan, AZMET or SNOTEL/ Snowcourse stations. Figure 3.2-3 also shows precipitation contour data from the Spatial Climate Analysis Service (SCAS) at Oregon State University. More detailed information on climate is found in Section 3.0.4. A description of climate data sources and methods is found in Volume 1, Appendix A.

SCAS Precipitation Data

- See Figure 3.2-3
- Average annual precipitation is as high as 24 inches along the Nantac Rim in the northeastern part of the basin and as low as 10 inches at the southern tip of the basin where the Gila Mountains meet the San Simon Valley.
- The range of 14 inches between areas of highest and lowest precipitation recorded is common for the planning area.

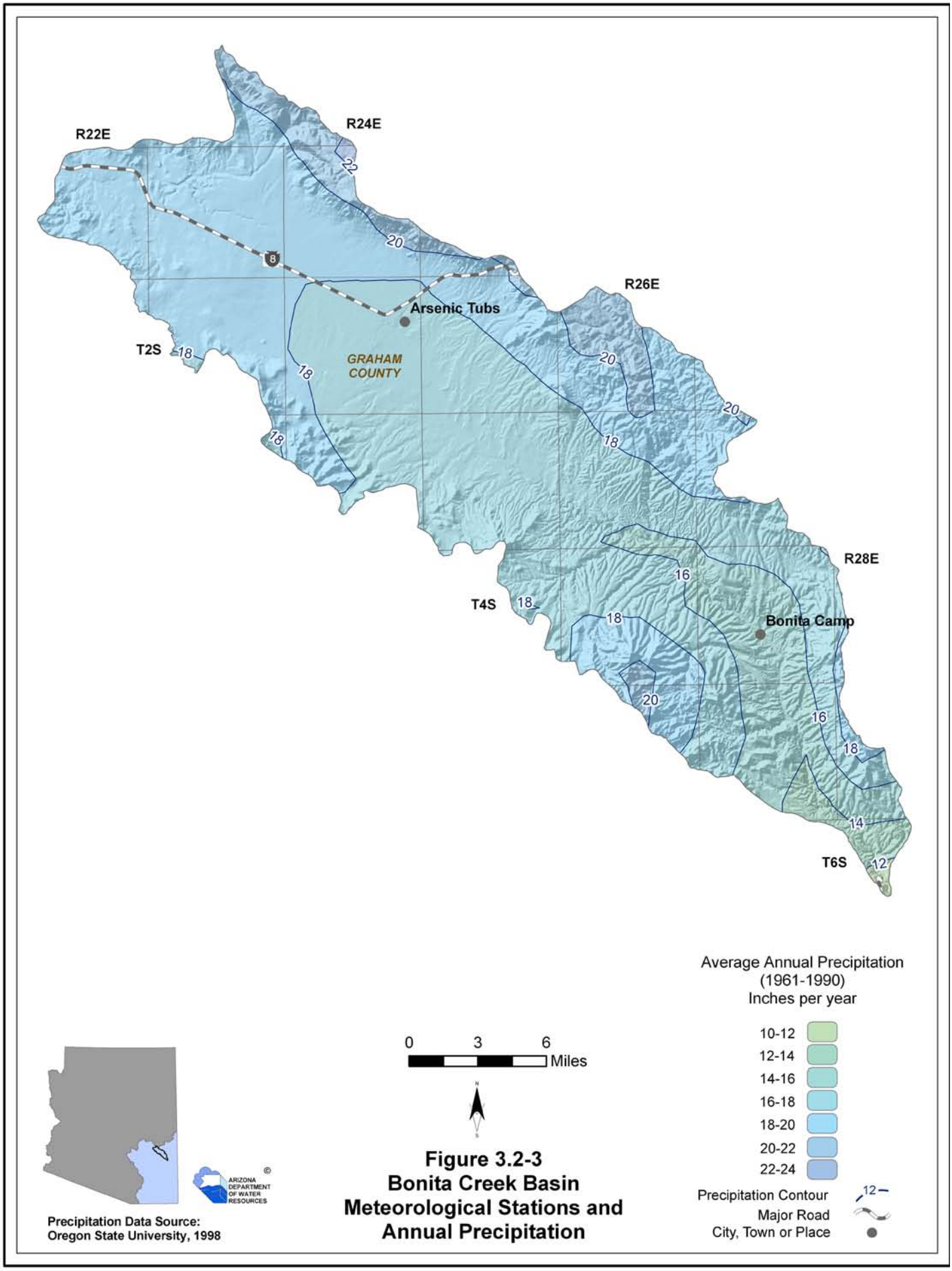


Figure 3.2-3
Bonita Creek Basin
Meteorological Stations and
Annual Precipitation

3.2.4 Surface Water Conditions in the Bonita Creek Basin

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

Streamflow Data

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

Reservoirs and Stockponds

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

Runoff Contour

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

Table 3.2-1 Streamflow Data for the Bonita Creek Basin

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

Source: USGS (NWIS) 2005 & 2008

Notes:
NA=Not available to ADWR
Statistics based on Calendar Year
Annual Flow statistics based on monthly values
Summation of Average Annual Flows may not equal 100 due to rounding.
Period of record may not equal Year of Record used for annual Flow/Year statistics due to only using years with a 12 month record
In Period of Record, current equals November 2008
Seasonal and annual flow data used for the statistics was retreived in 2005

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

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

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

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

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

Source: Compilation of databases from ADWR & others

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

Total number: 2
Total maximum storage: 289 acre-feet

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

Total number: 14
Total surface area: 121 acres

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

Total number: 24 (from water rights filings)

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

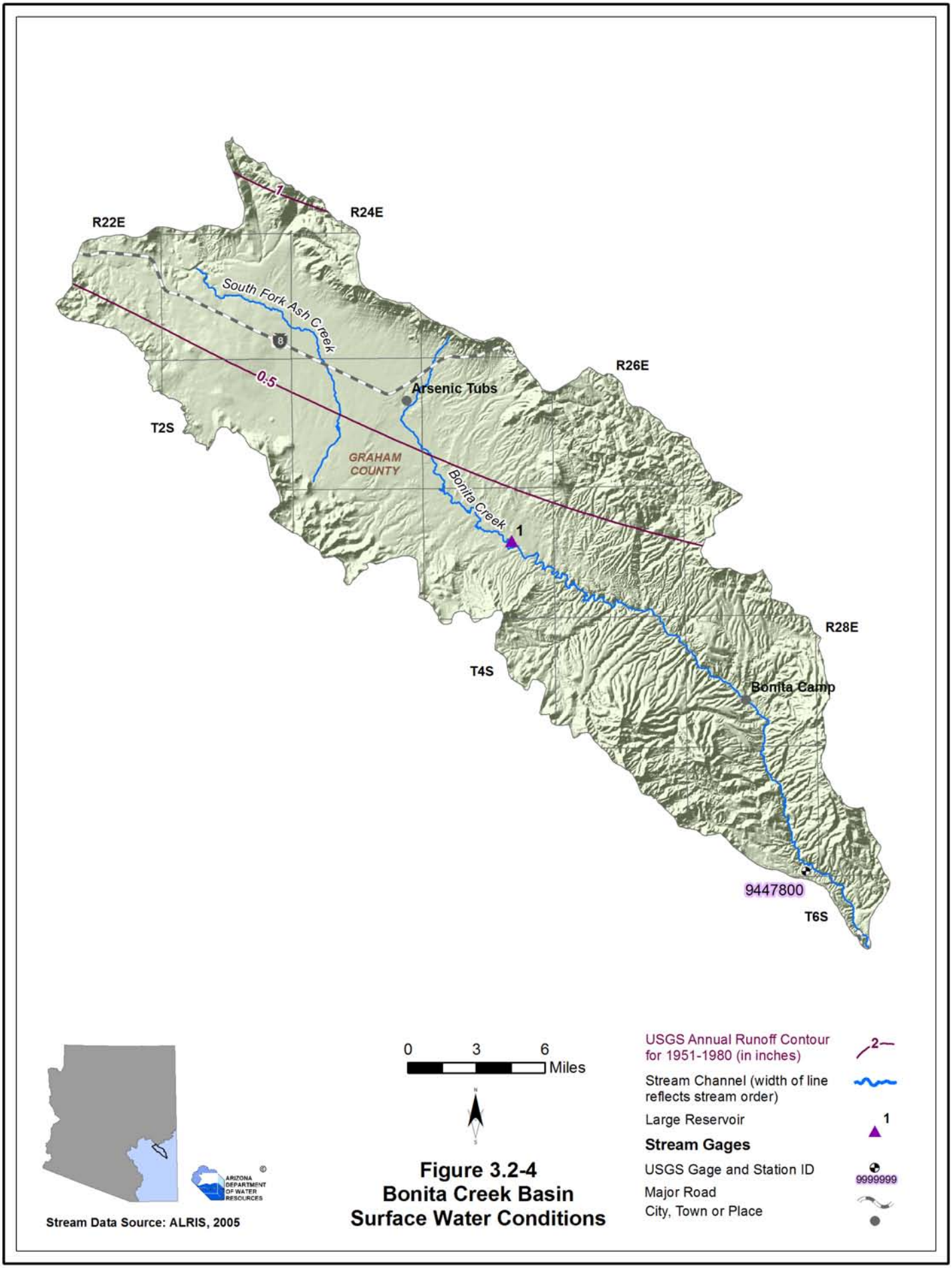


Figure 3.2-4
Bonita Creek Basin
Surface Water Conditions

3.2.5 Perennial/Intermittent Streams and Major Springs in the Bonita Creek Basin

Major and minor springs with discharge rates and date of measurement, and the total number of springs in the basin are shown in Table 3.2-3. The locations of major springs and perennial and intermittent streams are shown on Figure 3.2-5. Descriptions of data sources and methods for intermittent and perennial reaches and springs are found in Volume 1, Appendix A.

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

Table 3.2-3 Springs in the Bonita Creek Basin

A. Major Springs (10 gpm or greater):

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

B. Minor Springs (1 to 10 gpm):

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

Source: Compilation of databases from ADWR & others

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

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

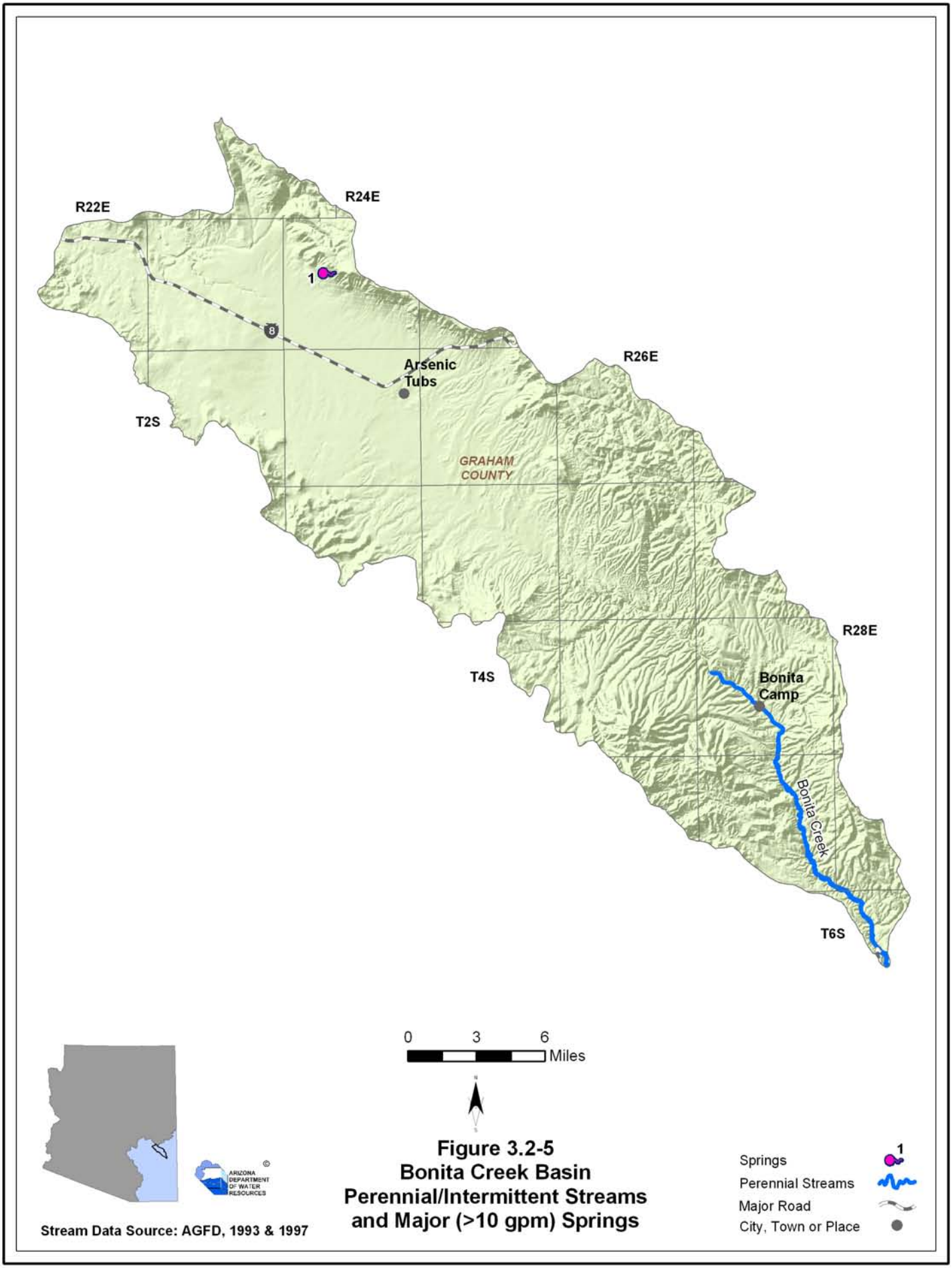


Figure 3.2-5
Bonita Creek Basin
Perennial/Intermittent Streams and Major (>10 gpm) Springs

3.2.6 Groundwater Conditions of the Bonita Creek Basin

Major aquifers, well yields, estimated natural recharge, estimated water in storage, number of index wells and date of last water-level sweep are shown in Table 3.2-4. Figure 3.2-6 shows aquifer flow direction and water-level change between 1990-1991 and 2003-2004. Figure 3.2-7 shows well yields in three yield categories. A description of aquifer data sources and methods as well as well data sources and methods, including water-level changes and well yields are found in Volume 1, Appendix A.

Major Aquifers

- Refer to Table 3.2-4 and Figure 3.2-6.
- Major aquifers in the basin include recent stream alluvium, basin fill and volcanic rock.
- Flow direction is generally from the northwest to the southeast.

Well Yields

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

Natural Recharge

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

Water in Storage

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

Water Level

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

Table 3.2-4 Groundwater Data for the Bonita Creek Basin

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

Notes:
NA = Not Available
[1]Predevelopment Estimate

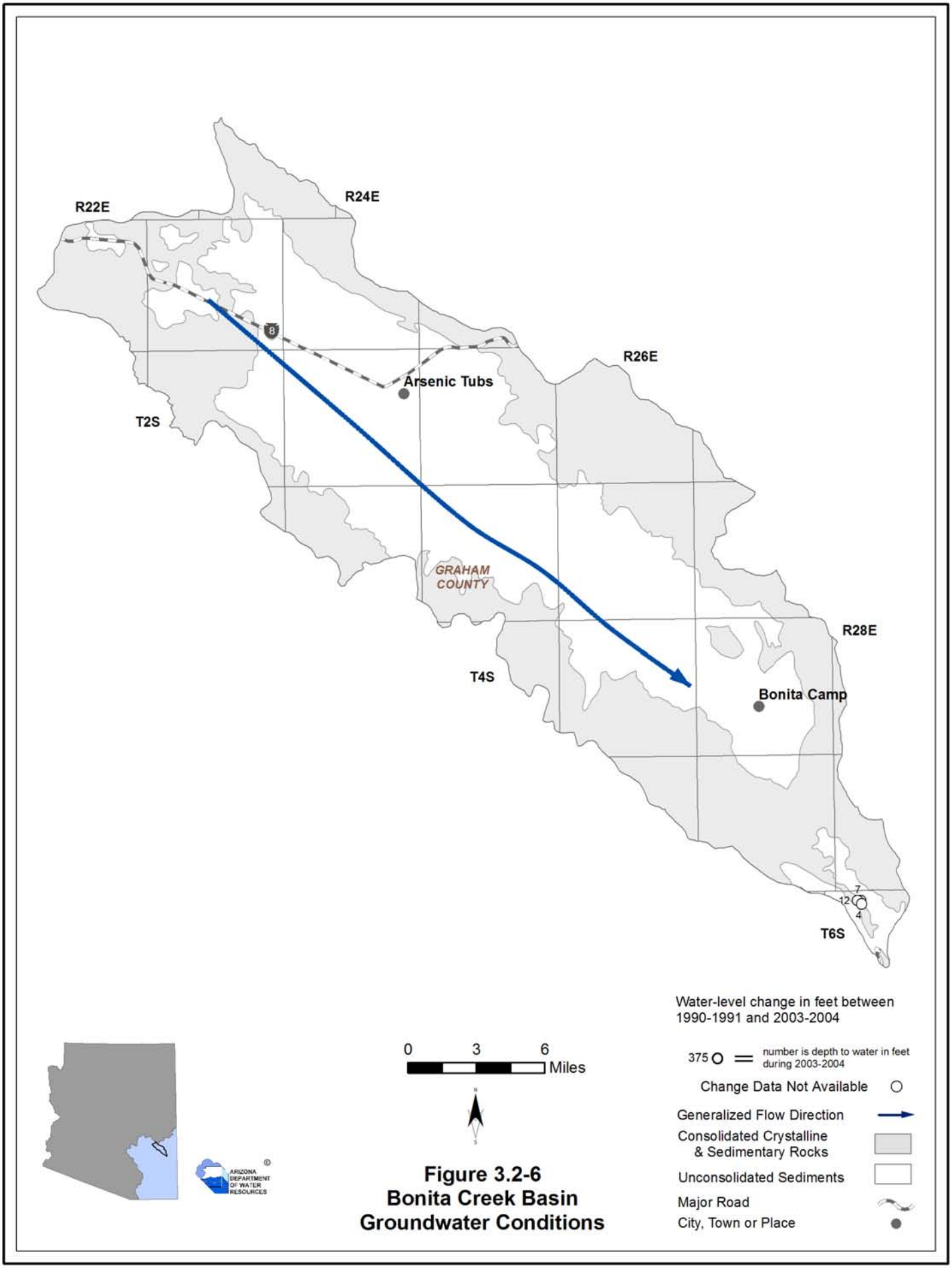


Figure 3.2-6
Bonita Creek Basin
Groundwater Conditions

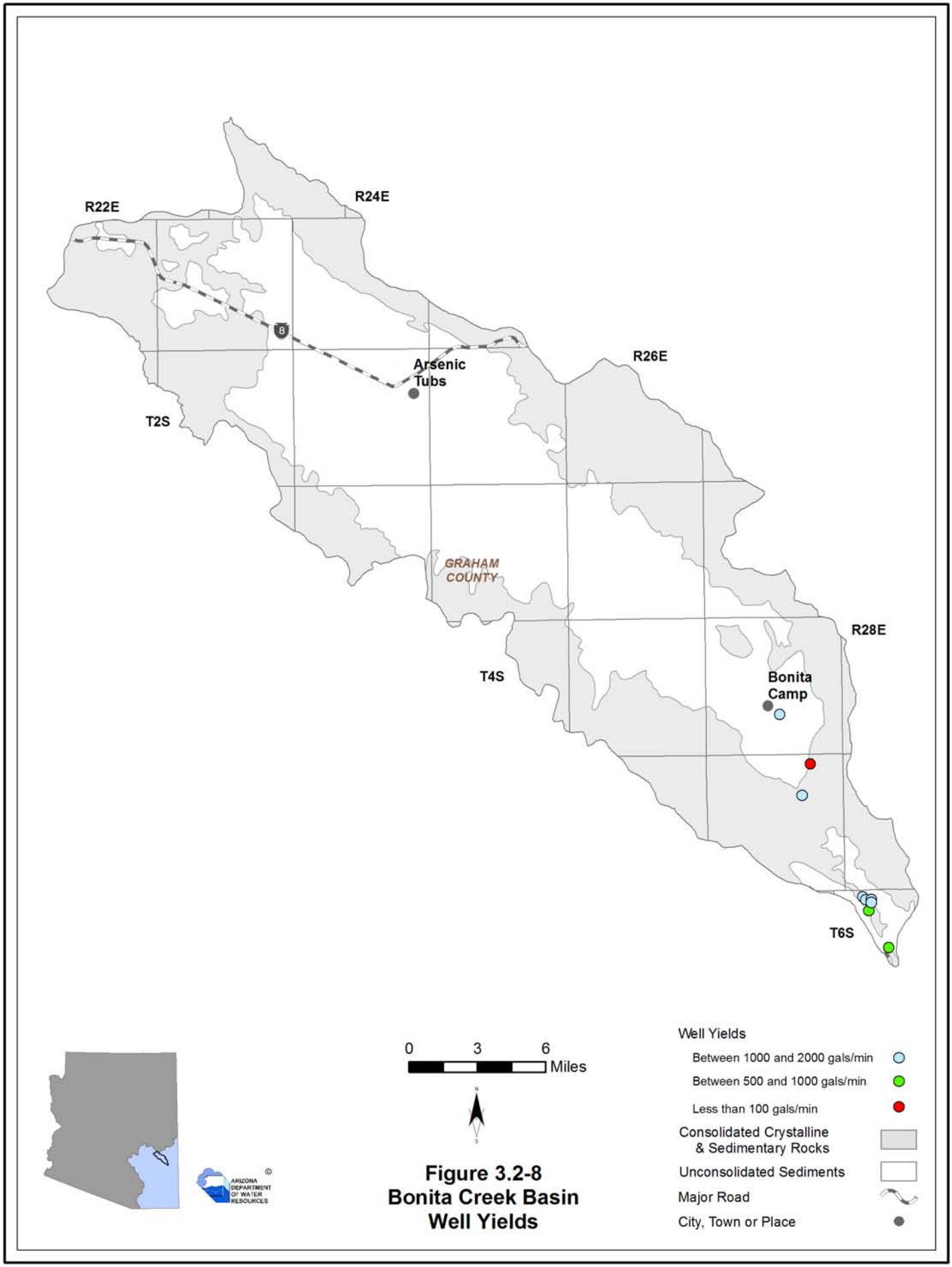


Figure 3.2-8
Bonita Creek Basin
Well Yields

3.2.7 Water Quality of the Bonita Creek Basin

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

3.2.8 Cultural Water Demands in the Bonita Creek Basin

Cultural water demand data including population, number of wells and the average well pumpage and surface water diversions by the municipal, industrial and agricultural sectors are shown in Table 3.2-5. There is no recorded effluent generation in this basin. Figure 3.2-8 shows the location of demand centers. A description of cultural water demand data sources and methods is found in Volume 1, Appendix A. More detailed information on cultural water demands is found in Section 3.0.7.

Cultural Water Demands

- Refer to Table 3.2-5 and Figure 3.2-8.
- Population in this basin is very small with 21 residents in 2000. Projections suggest a slight increase in population through 2050.
- Overall groundwater pumping is relatively constant between 1971 and 2005 with an average of 3,200 acre-feet per year in the period from 2001-2005. Almost all groundwater demand in the basin is water collected in infiltration galleries near Bonita Creek and delivered to the Safford Basin for municipal use. This water is considered to be groundwater in the Atlas.
- There are no recorded surface water diversions in the basin.
- The only municipal demand center according to the USGS Gap Analysis Program (2004) is located near Highway 8 in T1S, R23E. However, there is also municipal demand at Arsenic Tubs.
- As of 2005 there were 12 registered wells with a pumping capacity of less than or equal to 35 gallons per minute and 15 wells with a pumping capacity of more than 35 gallons per minute. This is the smallest number of registered wells in a planning area basin.

Table 3.2-5 Cultural Water Demands in the Bonita Creek 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		10[2]	15[2]	3,100[3]			NR			USGS (2007)
1972										
1973										
1974										
1975										
1976				3,100[3]			NR			
1977										
1978										
1979										
1980	5	0	0	3,100[3]			NR			
1981	7									
1982	8									
1983	10									
1984	11									
1985	13									
1986	14	0	0	3,100[3]			NR			
1987	16									
1988	17									
1989	19									
1990	20									
1991	20	0	0	2,700	NR	NR	NR			
1992	20									
1993	21									
1994	21									
1995	21									
1996	21	1	0	3,300	NR	NR	NR			
1997	21									
1998	21									
1999	21									
2000	21									
2001	21	1	0	3,200	NR	NR	NR			
2002	22									
2003	22									
2004	22									
2005	23									
2010	24									
2020	26									
2030	28									
	WELL TOTALS:	**12**	**15**							

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

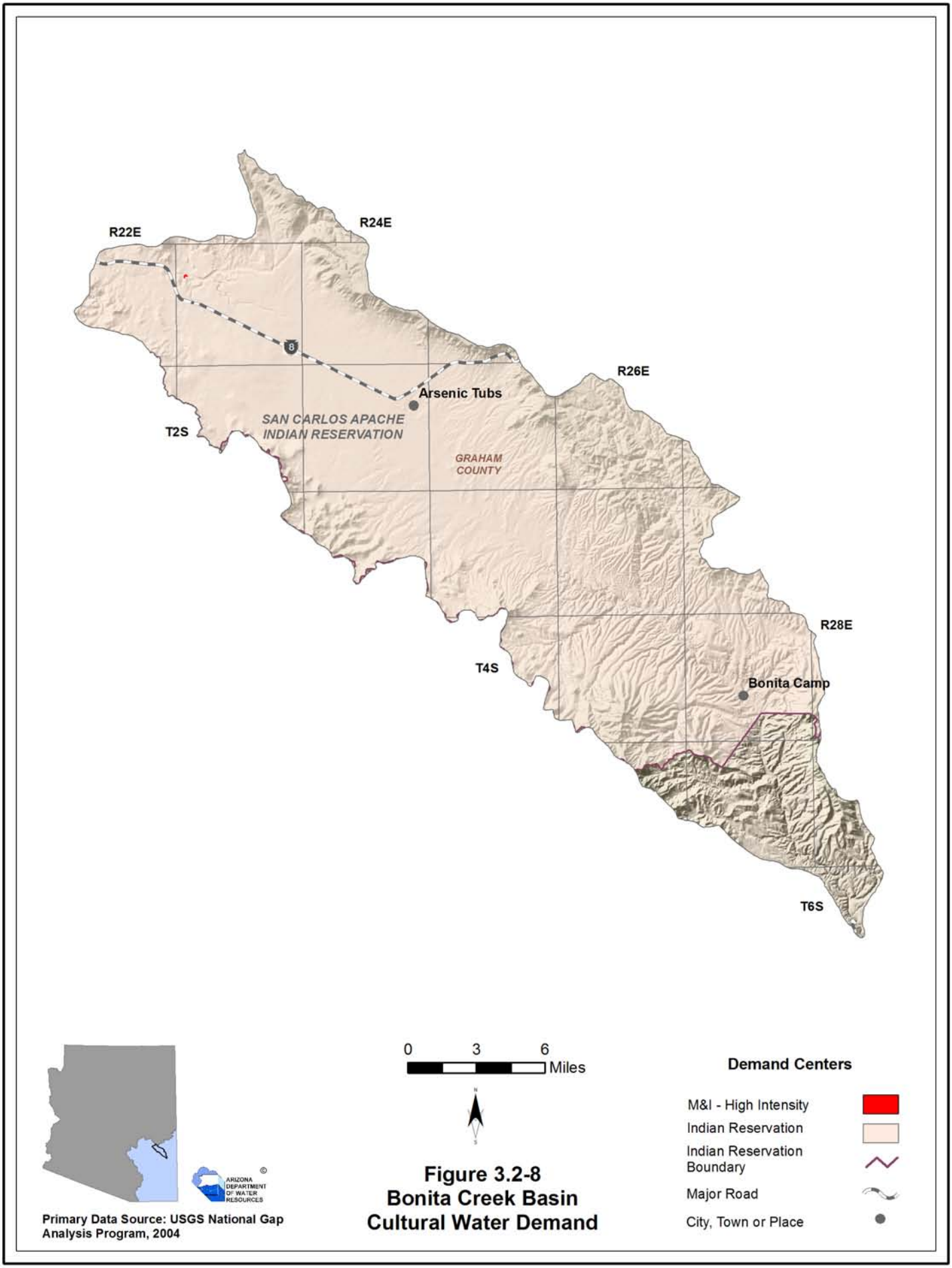


Figure 3.2-8
Bonita Creek Basin
Cultural Water Demand

3.2.9 Water Adequacy Determinations in the Bonita Creek Basin

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

BONITA CREEK BASIN

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, 2005, Workforce Informer: Data file, accessed August 2005, http://www.workforce.az.gov.

Arizona Department of Water Resources (ADWR), 2005a, Automated recorder sites: Data files, ADWR Basic Data Unit.

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

_____, 2005c, Wells55: Database.

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

_____, 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, January 16, 1990.

Arizona Game and Fish Department, 2005, Arizona Waterways: Data file, received April 2005.

_____, 1997 & 1993, Statewide 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 2005 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.

B

Bureau of Land Management (BLM), 2005, Springs in the Safford region: Data file received January 2005.

F

Fisk, G.G., D.W, Duet, C.E. Evans, N.K. Angernoth, and S.A Longsworth, 2004, Water Resources Data, Arizona Water Year 2003: USGS Water-Data Report AZ-03-1.

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.

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.

P

Pope, G.L., P.D. Rigas and C.F. Smith, 1998, Statistical summaries of streamflow data and characteristics of drainage basins for selected streamflow-gaging stations in Arizona through water year 1996: USGS Water Resources Investigations Report 98-4225.

T

Tadayon, S., 2004, Water withdrawals for irrigation, municipal, mining, thermoelectric-power, and drainage uses in Arizona outside of the active management areas, 1991-2000: USGS Scientific Investigations Report 2004-5293, 27 pp.

U

United States Geological Survey, 2008, 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, 2000-2005: 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.

V

Valencia, R.A., J.A. Wennerlund, R.A. Winstead, S. Woods, L. Rile, E. Swanson and S. Olson, 1993, Arizona riparian inventory and mapping project: Arizona Game and Fish.

W

Wahl, C.R., S.R. Boe, R.A. Wennerlund, R.A. Winstead, L.J. Allison and D.M. Kubly, 1997, Remote sensing mapping of Arizona intermittent stream riparian areas: Arizona Game and Fish Technical Report 112.

Water Infrastructure Finance Authority of Arizona (WIFA), 2005, Clean Watershed Needs Survey-2004: Unpublished data sheets, received July 2005.

Supplemental Reading

Ajami, H., D. P Guertin, L.R. Levick and K. Uhlman, 2005, NEMO Watershed Based Plan Upper Gila Watershed, University of Arizona.

Baker, D. L. and K.A. King, 1994, Environmental contaminant investigation of water quality, sediment and biota of the upper Gila River basin, Arizona: US Fish and Wildlife service, Project No. 22410-1130-90-2-053, 53 p.

Baldys, S., III, L.K. Ham and K.D. Fossum, 1995, Summary statistics and trend analysis of water quality data at sites in the Gila River Basin, New Mexico and Arizona: USGS Water Resources Investigations Report 95-4083 86 p.

Baldys, S., and J.A. Bayles, 1990, Flow characteristics of streams that drain the Ft.Apache and San Carlos Indian Reservations, east central Arizona: USGS Water Resources Investigation Report 90-4053.

Bureau of Reclamation, 1990, Upper Gila water supply analyses and sizing studies: Arizona Projects Office, draft report, April 1990.

Sobczak, R.V., 1994, Confusion where ground and surface waters meet: Gila River general adjudication, Arizona and the Search for subflow: University of Arizona, M.S. thesis.

Tellman, B., R. Yarde and M.G. Wallace, 1997, Arizona's Changing Rivers: How People Have Affected the Rivers. Water Resources Research Center, University of Arizona.

Wittler, R. J., J.E. Klawon and K.L. Collins, 2004, Upper Gila River fluvial geomorphology study: Bureau of Reclamation final report.