U.S. Department of the Interior
U.S. Geological Survey

Precipitation and Streamflow Conditions in Arizona, Winter and Spring, 1996

USGS

According to precipitation and streamflow data collected in the State, Arizona experienced one of the driest periods on record from January 1 to June 30, 1996. During this period, Arizona averaged less than –4.5 on the Palmer Drought Index (PDI), a widely used index that compares monthly rainfall to soil moisture for a given area. PDI values less than –4.0 indicate extreme drought conditions. PDI values for Arizona have ranged from less than –5 to greater than 7 since 1895. Governor Fife Symington declared a state of emergency for Arizona on May 3, 1996, because of the extremely dry conditions.

STREAMFLOW-GAGING STATIONS

1. *Gila River at Calva, 09466500*
2. *San Pedro River at Charleston, 09471000*
3. *White River near Fort Apache, 09494000*
4. *Salt River near Roosevelt, 09498500*
5. *Oak Creek near Sedona, 09498500*
6. *Tonto Creek above Gun Creek, near Roosevelt, 09499000*
7. *West Clear Creek near Camp Verde, 09505800*
8. *East Verde River near Childs, 09507980*
9. *Verde River below Tangle Creek, above Horseshoe Dam, 09508500*

Figure 1. Selected U.S. Geological Survey streamflow-gaging stations.

Precipitation

Arizona's climate is extremely varied and can range from enduring droughts to frequent local and regional flooding. Mean annual precipitation in Arizona ranges from about 4 inches in Yuma and other areas along the lower Colorado River to more than 30 inches at higher elevations in the mountain regions. Isolated thunderstorms during the summer months typically produce intense rainfall for short periods. Regional frontal systems during winter months produce less intense precipitation usually over longer periods. Although summer rainfall generally does not contribute significantly to usable supplies of surface water, winter precipitation can result in substantial runoff to reservoirs and other impoundments.

Precipitation was far below normal for much of the State during the winter and spring of 1996. On the basis of data for the 30-year period, 1961–90, rainfall in the Salt and Verde River Basins from January through June was 30 percent of normal (Dallas Reigle, Senior Hydrologist, Salt River Project, written commun., 1996), and snowpack on four of the major basins that normally produce significant spring runoff in central Arizona was less than 40 percent of normal from January through March and less than 20 percent of normal during April (Larry Martinez, Water Supply Specialist, National Resources Conservation Service, written commun., 1996). Additionally, water content of the snowpack in the Salt River Basin, Verde River Basin, and Upper Gila River Basin was measured in March and found to be 1, 1, and 13 percent of normal, respectively.

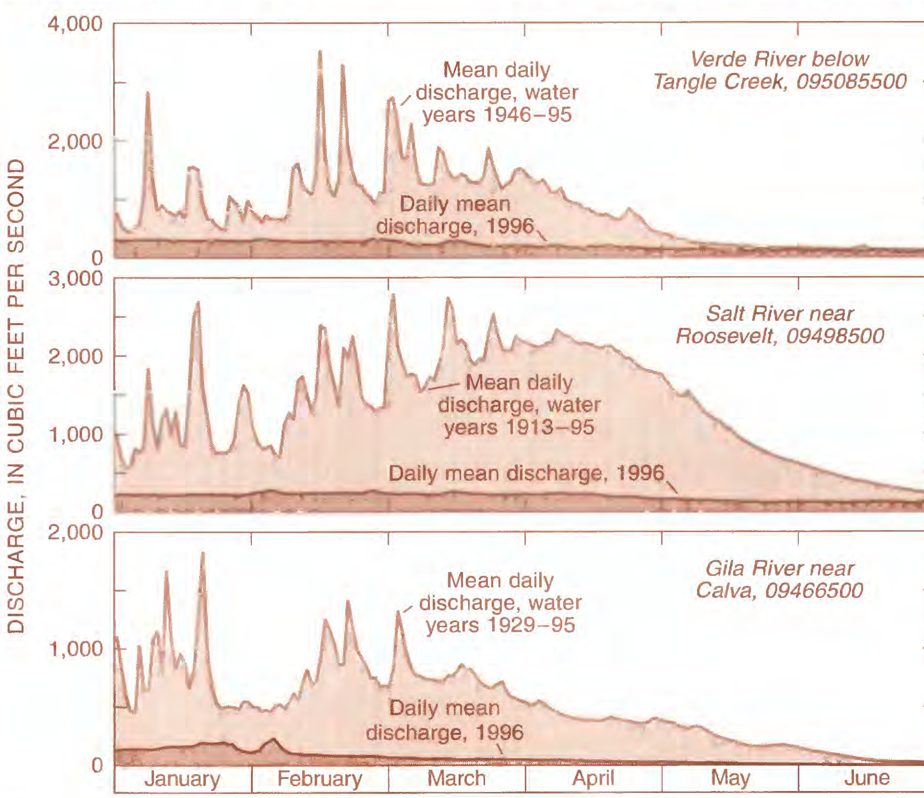

Figure 2. Daily mean discharge for January 1 to June 30, 1996, and the mean daily discharges for the period of record at Verde River below Tangle Creek, Salt River near Roosevelt, and Gila River near Calva (data for 1996 are provisional and are subject to revision).

Streamflow

As a result of below normal precipitation and snowpack conditions in Arizona, streamflow in the perennial rivers that drain these basins also was well below normal. From January 1 through June 30, 1996, daily mean flows recorded at U.S. Geological Survey (USGS) streamflow-gaging stations on the Salt River near Roosevelt (09498500), Verde River below Tangle Creek (09508500), and Gila River near Calva (09466500; fig. 1) were significantly less than the mean daily flows for the period of record (POR) (fig. 2). The volume of flow at these sites averaged 17 percent of normal from January 1 through June 30 (table 1).

Table 1. Streamflow data for three major rivers in Arizona

	Verde River below Tangle Creek (09508500)	Salt River near Roosevelt (09498500)	Gila River at Calva (09466500)
Period of record (POR)	1945–96	1914–96	1929–96
Mean of total flow, Jan. 1 to June 30 for POR (acre-feet[1])	291,770	484,670	181,930
Total flow, January 1 to June 30, 1996 (acre-feet[1])	[2]72,840	[2]68,620	[2]21,710
Percent of normal	25.0	14.2	11.9

[1] One acre-foot of water is enough to meet the needs of a family of four for 1 year.
[2] Provisional data—subject to revision.

Flows at several other perennial streams in the State reached record lows during the spring of 1996. The mean monthly flow for May was the lowest on record at the streamflow-gaging stations—San Pedro River at Charleston (09471000, POR = 31 years), Oak Creek near Sedona (09504420, POR = 15 years), White River near Fort Apache (09494000, POR = 40 years), and West Clear Creek near Camp Verde (09505800, POR = 32 years).

Although low-flow data from perennial rivers are believed to provide an accurate representation of extremely dry conditions in the State, most streams in Arizona are not perennial but are ephemeral. Ephemeral streams flow only occasionally during the year in direct response to rainfall. During 1996, no flow was recorded on the earliest date of the year, May 23, and for the most consecutive days, 44, on record, at one of these ephemeral streams, Tonto Creek above Gun Creek, near Roosevelt (09499000, POR = 56 years). Additionally, no flow was recorded for 17 days during the month of June 1996 at the East Verde River near Childs (09507980, POR = 34 years)—a stream designated as perennial that has never gone dry since the streamflow-gaging station was installed in 1962.

As a result of the extreme low-flow conditions throughout Arizona, the amount of water in most of the State's reservoirs is well below 50 percent of capacity (fig. 3). To augment water supplied from these reservoirs, additional water is withdrawn from aquifer systems, and surface water from the Colorado River is transported to the central and southern parts of Arizona by the Central Arizona Project canal.

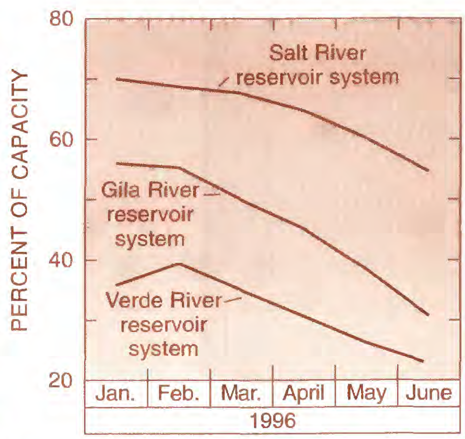

Figure 3. Amount of water available in central Arizona reservoirs since January, 1996; as a percentage of total storage capacity (Dallas Riegle, Senior Hydrologist, Salt River Project, written commun., 1996).

Although many parts of the State experienced an active monsoon season during the summer of 1996, as mentioned previously, runoff generated by these storms generally does not contribute significantly to water supplies in Arizona. A substantial amount of precipitation from winter storm systems, therefore, will be required to replenish the State's reservoir systems.

Streamflow Monitoring

The USGS operates a network of 220 streamflow-gaging stations in Arizona. Most of these stations are operated with at least partial support from more than 20 other Federal, State, and local agencies. At 128 of these stations, the data recorded by the gage are relayed by satellite telemetry to USGS offices in Arizona. The advanced satellite telemetry technology provides the USGS, cooperating agencies, and the public with streamflow conditions on a near "real-time" basis. These data are required to adequately monitor and manage the State's surface-water supply, especially during droughts.

The USGS streamflow data base maintains long-term data that are invaluable to water-management agencies, especially during periods of extreme flow conditions. High-flow data may be used for flood warning, management of reservoirs, and flood-frequency analyses. During droughts, low-flow data are essential for determining inflow to reservoirs, allocating limited water supplies to users, forecasting future streamflow conditions, and many other purposes.

Beginning this year (1996), the USGS has made streamflow data and other hydrologic information available on the Internet through the Arizona District home page at **http://wwwdaztcn.wr.usgs.gov** to provide the public with immediate access to streamflow conditions in the State. Currently, the Arizona District has made available on the Internet streamflow data from 40 streamflow-gaging stations in Arizona. Additional data from USGS gaging stations nationwide can be accessed at **http://www.usgs.gov**.

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