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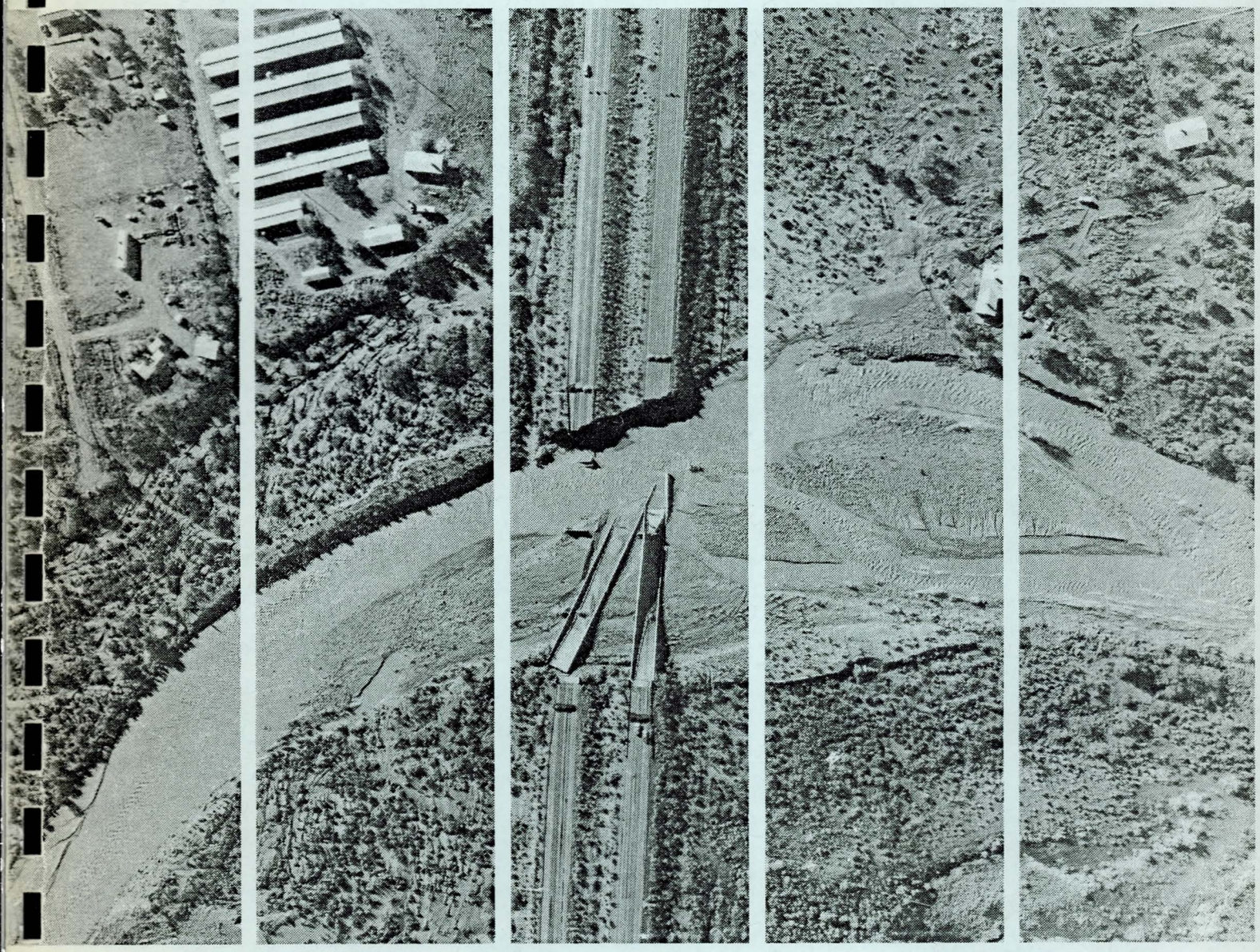
# FLOODS OF NOVEMBER 1978 TO MARCH 1979 IN ARIZONA AND WEST-CENTRAL NEW MEXICO



OPEN·FILE REPORT 83-201

Cover photo—Interstate Highway 17 at Agua Fria River near Black Canyon City, Ariz., December 20, 1978. Photo courtesy of Arizona Department of Transportation.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

# FLOODS OF NOVEMBER 1978 TO MARCH 1979 IN ARIZONA AND WEST-CENTRAL NEW MEXICO

By B. N. Aldridge and T. A. Hales

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Open-File Report 83-201

Prepared in cooperation with the

U.S. BUREAU OF RECLAMATION; U.S. ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT; ARIZONA DEPARTMENT OF WATER RESOURCES; FLOOD CONTROL DISTRICT OF MARICOPA COUNTY; AND SALT RIVER VALLEY WATER USERS' ASSOCIATION

Tucson, Arizona
April 1983

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

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## CONVERSION FACTORS

For those readers who may prefer to use metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

| Multiply inch-pound unit | By | To obtain metric unit |
|---|---|---|
| inch (in.) | 25.4 | millimeter (mm) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| square mile ($mi^2$) | 2.590 | square kilometer ($km^2$) |
| acre | 0.4047 | hectare (ha) |
| acre-foot (acre-ft) | 0.001233 | cubic hectometer ($hm^3$) |
| cubic foot per second ($ft^3/s$) | 0.02832 | cubic meter per second ($m^3/s$) |
| cubic foot per second per square mile [$(ft^3/s)/mi^2$] | 0.01093 | cubic meter per second per square kilometer [$(m^3/s)/km^2$] |
| degree Fahrenheit (°F) | (temp °F-32)/1.8 | degree Celsius (°C) |

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called mean sea level.

# FLOODS OF NOVEMBER 1978 TO MARCH 1979 IN ARIZONA AND WEST-CENTRAL NEW MEXICO

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## ABSTRACT

Severe flooding occurred in parts of the Little Colorado and Gila River basins as a result of a storm that occurred December 17-20, 1978. The central highlands received 3 to 10 inches of precipitation that was augmented by snowmelt to altitudes of 10,000 feet. The storm was preceded by extremely large amounts of rainfall and runoff in November and was followed by other periods of high runoff in January and March 1979. In some areas flood peaks in November, January, or March were higher than the peak of December 1978.

At Winslow, the discharge of the Little Colorado River in December 1978 was the highest since at least 1952. The discharge of the Gila River above the San Francisco River was probably the highest since at least 1891, and in the Safford Valley, the peak was the highest since 1916. The Agua Fria River below Waddell Dam had the highest discharge since 1919.

The flood of December 1978 caused 12 deaths and caused damage that was probably in excess of $150 million in Arizona and west-central New Mexico. Damage was estimated to be $51.8 million in Maricopa County, Arizona. Floods caused extensive agricultural damage along the Gila River in Virden Valley in New Mexico and Duncan, York, and Safford Valleys in Arizona. Duncan, Arizona, was flooded with as much as 7 feet of water.

The flood crest on the Gila River in December 1978 moved from Redrock, New Mexico, to Duncan, Arizona, in about 6 hours, which is more rapid than during other recent floods but is comparable to the travel-time recorded in 1941. Traveltime in the reach varies with discharge and is about 14 hours for discharges of 10,000 cubic feet per second and 5 hours for discharges of more than 40,000 cubic feet per second.

Water-conservation reservoirs on the Gila, Salt, Verde, and Agua Fria Rivers and a flood-control reservoir on the Gila River had a major influence on the magnitude of floods downstream from the reservoirs. All runoff from the Gila River basin upstream from Coolidge Dam, Arizona, during the floods of November 1978 to January 1979 was stored in San Carlos Reservoir, and major flooding was averted along the Gila River between Coolidge Dam and Salt River. Minor flooding occurred along the Gila River downstream from San Pedro River. Floods in central and

western Maricopa County, Arizona, were caused by the release of water from full reservoirs on the Salt, Verde, and Agua Fria Rivers, but peak discharges and duration of the floods were much less than would have occurred if the reservoirs did not exist. Flow continued in the Salt River through Phoenix until May 1979. Floodwater was stored in the flood-control reservoir above Painted Rock Dam on the Gila River in order to prevent major damage along the Gila and Colorado Rivers. Water was released from Painted Rock Dam until January 1980. The prolonged flows and reduction in ground-water pumping caused ground-water levels to rise appreciably in many areas.

## INTRODUCTION

Several storms and periods of high water occurred in Arizona from November 1978 to March 1979. The most widespread damage occurred in December 1978 when severe flooding occurred in much of Arizona and west-central New Mexico. Flooding was most severe along the Gila River upstream from San Carlos Reservoir and along the Salt, Agua Fria, and Gila Rivers near Phoenix. The flood caused 12 deaths, and damage exceeded $150 million. After the flood of December 1978, the President declared ten counties in Arizona and three counties in New Mexico eligible for Federal disaster aid.

The purpose of this report is to document the floods by bringing together hydrologic and economic data from many sources. Related purposes are to (1) analyze the floods in regard to antecedent conditions, sources of runoff, traveltimes, and damage; (2) provide detailed hydrograph data that are not readily available elsewhere; and (3) compare the floods to past events. Data presented in the section entitled "Streamflow Data at Gaging Stations and Miscellaneous Measuring Sites" can be used to develop models for flood routing and time-of-travel studies. The report covers northward-flowing tributaries of the Little Colorado River and Havasu Creek in Arizona and most of the Gila River basin in Arizona and New Mexico (fig. 1). Emphasis is placed on the floods of December 18-20 in the Gila River basin upstream from San Carlos Reservoir and near Phoenix. Lesser floods in November 1978 and January and March 1979 are also described.

The report was prepared in cooperation with the Arizona Department of Water Resources; Flood Control District of Maricopa County; Salt River Valley Water Users' Association; U.S. Bureau of Reclamation; and the U.S. Army Corps of Engineers, Los Angeles District. The authors wish to express thanks to the personnel of these agencies who provided data and to personnel from the Arizona Department of Transportation, Arizona Emergency Services, U.S. Soil Conservation Service, U.S. Forest Service, U.S. Environmental Data and Information Service, Rocky Mountain Forest and Range Experiment Station, Forestry Sciences Laboratory, City of Phoenix, Maricopa County Highway Department, and Maricopa County Municipal Water Conservation District No. 1. Special thanks also are extended to U.S. Geological Survey personnel who helped collect and tabulate the streamflow data, especially John P. Boland for tabulating the data from streams in New Mexico.

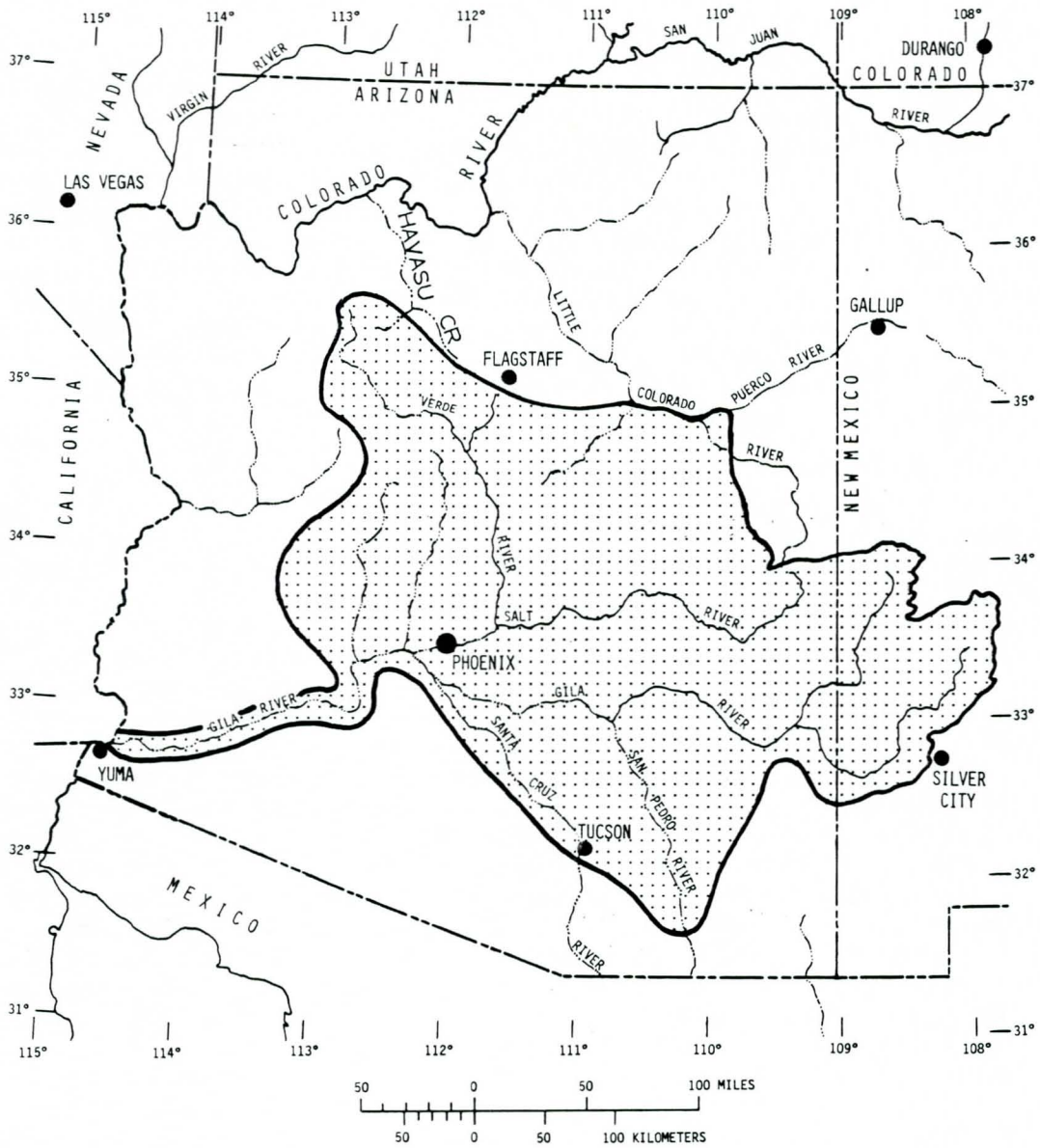


Figure 1.--Area of report (shaded).

## GEOGRAPHIC SETTING

The floods of November 1978 to March 1979 originated mainly in the mountainous area of central Arizona and west-central New Mexico and in scattered mountain ranges of southern Arizona (pl. 1). The mountainous area is drained by the Little Colorado and Gila Rivers, which flow across Arizona to the Colorado River and form the principal drainage basins in Arizona. Little Colorado River drains about 27,000 $mi^2$ in northwestern New Mexico and northeastern Arizona, but flooding occurred mainly in the 9 percent of the basin drained by Silver, Chevelon, and Clear Creeks in Arizona. Flooding occurred in about half of the 58,000 $mi^2$ drained by the Gila River. Flooding also occurred in the headwaters of Havasu Creek, which heads west of Flagstaff, Ariz., and flows northward to the Colorado River.

The Gila River flows generally westward from New Mexico to the Colorado River. In New Mexico, the Gila River has a large dendritic drainage pattern that consists of three main forks—East, Middle, and West Fork Gila River—and several large tributaries. All major tributaries in New Mexico enter the Gila River upstream from the town of Cliff, N. Mex. Principal tributaries to the Gila River in Arizona upstream from Coolidge Dam are the San Francisco River, Eagle Creek, Bonita Creek, and San Carlos River, which drain from the mountains along the north side of the basin, and the San Simon River, which drains from the south.

Six large tributaries—San Pedro, Santa Cruz, Salt, Agua Fria, and Hassayampa Rivers and Centennial Wash—join the Gila River between Coolidge and Gillespie Dams. Flooding occurred in parts of the San Pedro and Santa Cruz Rivers, which enter the Gila River from the south, but flow from these streams was largely dissipated upstream from the confluence of the Gila and Santa Cruz Rivers. Principal sources of flooding downstream from the Santa Cruz River were the Salt and Agua Fria Rivers, which join the Gila River from the north. Tributaries to the Gila River downstream from Gillespie Dam had little runoff from November 1978 to March 1979.

The Salt River, which is the principal tributary to the Gila River, heads at altitudes of more than 10,000 ft above the National Geodetic Vertical Datum (NGVD) of 1929 in the White Mountains and flows southwestward to join the Gila River west of Phoenix. Downstream from the confluence of the Black and White Rivers, five main tributaries—Carrizo, Cibecue, Canyon, Cherry, and Tonto Creeks—drain from the Mogollon Rim and enter the river within a 90-mile reach. The five main tributaries are separated by steeply sloping, sparsely vegetated mountain ranges that extend southward from the Mogollon Rim and cause orographic uplift to the eastward-moving storms. The Salt River is joined by its major tributary, the Verde River, 25 mi upstream from Phoenix. Drainage areas of the Salt and Verde Rivers at their confluence are 6,300 $mi^2$ and 6,600 $mi^2$, respectively. Downstream from the Verde River, the Salt River flows through Phoenix and is crossed by many streets that connect the southern and northern parts of the metropolitan area.

The Aqua Fria River heads near Prescott and flows southward to join the Gila River near Avondale 3 mi downstream from the Salt River. Principal tributaries are Black Canyon Creek and New River. Black Canyon Creek drains the Bradshaw Mountains and enters the Agua Fria River upstream from Lake Pleasant. New River drains the New River Mountains and enters the Agua Fria River downstream from Lake Pleasant.

Much of the Gila River is bounded by flood plains or valleys that are highly developed for agriculture. Several small valleys that border the Gila River near Gila Hot Springs, Cliff, and Redrock, N. Mex., and four large valleys upstream from San Carlos Reservoir—Virden, Duncan, York, and Safford Valleys—sustained damage from the flood of December 1978. Virden Valley begins about 5 mi upstream from Virden, N. Mex. At the New Mexico-Arizona State line, Virden Valley becomes Duncan Valley. Duncan Valley extends about 12 mi northeast of Duncan. York Valley begins just downstream from Duncan Valley and extends about 5 mi downstream to where the Gila River enters a steep-walled rock canyon upstream from the San Francisco River. Safford Valley, which is the most extensively developed area above San Carlos Reservoir, begins where the canyon ends about 2 mi upstream from Solomon, Ariz., and extends to the upper end of San Carlos Reservoir. Several towns—Pima, Thatcher, Safford, and Solomon—are located on the edge of the flood plain in Safford Valley. Narrow, sparsely developed flood plains exist between San Carlos Reservoir and Florence; wide flood plains border the Gila River between Florence and the mouth of the Gila River.

## DAMS AND RESERVOIRS

Eight water-conservation reservoirs on the Gila, Salt, Verde, and Agua Fria Rivers and one large flood-control reservoir on the Gila River have a major influence on floods. The operational pattern of the conservation reservoirs and the probability of various amounts of inflow and storage must be considered when applying data in this report to flood forecasting. Key factors that determine the magnitude of floodflows below the reservoirs are the volume of inflow during a flood and the amount of water in storage at the start of the flood. The latter is a function of carryover storage and runoff before the flood.

Principal conservation reservoirs are San Carlos Reservoir on the Gila River and Roosevelt Lake on the Salt River. San Carlos Reservoir has a capacity of 1,070,000 acre-ft and is formed by Coolidge Dam, which was completed in 1929. Roosevelt Lake on the Salt River just below Tonto Creek is formed by Roosevelt Dam and was completed in 1910. The capacity table in use at the time of the flood showed a capacity of 1,382,000 acre-ft; however, the capacity table put in use January 1982 shows a capacity of 1,337,000 acre-ft. Three smaller reservoirs on the Salt River—Apache, Canyon, and Saguaro Lakes—have a combined capacity of 373,000 acre-ft. Horse Mesa, Mormon Flat, and Stewart Mountain Dams, which form these reservoirs, were built between 1924 and 1930. The Verde River reservoirs—Horseshoe and Bartlett Reservoirs—have a combined capacity of 309,600 acre-ft. Horseshoe and Bartlett Dams were

completed in 1945 and 1938, respectively. Releases from Stewart Mountain Dam on the Salt River and Bartlett Dam on the Verde River plus floodflows from small uncontrolled drainages constitute the floodflow of the Salt River through Phoenix.

The capacity of Lake Pleasant above Waddell Dam on the Agua Fria River is 157,600 acre-ft; Waddell Dam was completed in 1927. Painted Rock Dam on the Gila River near Gila Bend was completed in 1959. Painted Rock Reservoir, which has a capacity of about 2.5 million acre-ft, provides flood control for the lower reaches of the Gila River and for the Colorado River downstream from the Gila River.

The conservation reservoirs were built solely for storing water for future use; no storage capacity is specifically dedicated to flood control. The dams have small outlets designed to carry only as much water as needed for power generation and downstream uses. Large quantities of water cannot be released until the stage reaches the spillway, which has the sole purpose of protecting the dam. The capacity of each reservoir is greater than the median annual runoff of the stream on which it is located (table 1). The reservoirs can store enough water to meet the needs during several dry years and can be filled only during years of high runoff. Before December 1978, San Carlos Reservoir on the Gila River had not spilled; reservoirs on the Salt River had spilled eight times. Reservoirs on the Verde River had spilled five times, and Lake Pleasant had spilled three times. The large storage capacities and the drawn-down condition that generally precedes the high-runoff season make a large amount of flood control possible. Storage provided by the reservoirs greatly reduced peak discharges and duration of past floods. Aldridge and Eychaner (1978, table 12) compared the actual discharge that occurred below Granite Reef Dam on the Salt River during 18 flood periods with discharges that would have occurred without the reservoirs. Actual discharges ranged from less than 2,000 $ft^3/s$ to 130,000 $ft^3/s$. The estimates of discharges that would have occurred without the reservoirs during the same periods range from 85,000 to 260,000 $ft^3/s$. Severe flooding occurred downstream from the Salt River reservoirs in December 1978 and January and March 1979; therefore, the Salt River reservoirs are used to illustrate the general operational pattern of the conservation reservoirs. Past records show periods of as much as 7 consecutive years when inflow into the Salt River reservoirs was less than the demand. One such period is indicated by the progressive decline in reservoir contents during 1942-48 (fig. 2). The importance of filling the reservoirs whenever possible is exemplified by the fact that in 9 years, the latest being 1977, the carryover storage in the reservoir system on the Salt River would not have been adequate to meet the demand during 1 more dry year.

The reservoirs generally are at the lowest level of each year shortly before the high-runoff season, which can begin any time from November to March (fig. 3). Large amounts of runoff in the spring of 1978 allowed above-average carryover storage in reservoirs on the Salt, Verde, and Agua Fria Rivers. Carryover storage in San Carlos Reservoir

Table 1.--Minimum, median, and maximum annual runoff and reservoir capacities, Gila, Salt, Verde, and Agua Fria Rivers

[Runoff and reservoir capacities, in acre-feet. Modified from Aldridge, 1981]

| Capacity | Gila River | Salt River | Verde River | Agua Fria River |
|---|---|---|---|---|
| Annual runoff: | | | | |
| Minimum..... | [1]34,800 | [2]189,000 | [3]137,000 | [4]3,000 |
| 25th percentile.. | [1]93,500 | [2]317,000 | [3]193,000 | [4]11,000 |
| Median..... | [1]174,000 | [2]530,000 | [3]240,000 | [4]24,000 |
| 75th percentile.. | [1]340,000 | [2]822,000 | [3]410,000 | [4]60,000 |
| Maximum..... | [1]1,767,000 | [2]2,731,000 | [3]1,238,000 | [4]221,000 |
| Reservoir capacities..... | 1,070,000 | 1,755,000 | 309,600 | 157,600 |

[1]Gila River at Coolidge Dam, 1914-28; summation of Gila River near Calva and San Carlos River near Peridot, 1929-78.

[2]Summation of Salt River near Roosevelt; Tonto Creek near Roosevelt, 1914-41; and Tonto Creek above Gun Creek, near Roosevelt, 1941-78. Represents at least 95 percent of the inflow to Roosevelt Lake.

[3]Based on records from several sites between Tangle Creek and the mouth of the Verde River, 1905-78. Represents nearly all inflow to Horseshoe Reservoir.

[4]Computed inflow to Lake Pleasant, 1914-19, 1933-78.

was low. Minimum storage levels in the reservoirs before the high runoff began in November 1978 were 69,000 acre-ft in San Carlos Reservoir on October 20; 1,267,000 acre-ft in the Salt River system on November 10; 165,400 acre-ft in the Verde River system on September 20; and 108,000 acre-ft in Lake Pleasant, October 23 to November 10.

Three low-head diversion dams on the Salt and Gila Rivers serve as measuring points for streamflow. Inflow to the Phoenix metropolitan area from the Salt River is measured at Granite Reef Dam, which is 3.4 mi downstream from the Verde River (pl. 1). Outflow from the Phoenix area is measured at Gillespie Dam on the Gila River south of Buckeye. An intermediate measurement is made at Jointhead Dam on the Salt River in Phoenix.

Several other reservoirs in the flood area had little impact on floodflows of major streams. Lyman Lake on the Little Colorado River had little impact on floodflows because the inflow was small. Records of inflow, outflow, and lake levels are not available for most reservoirs on Show Low, Silver, Chevelon, and Clear Creeks in the Little Colorado River basin; Cataract Creek in the Havasu Creek basin; Sullivan Reservoir on the

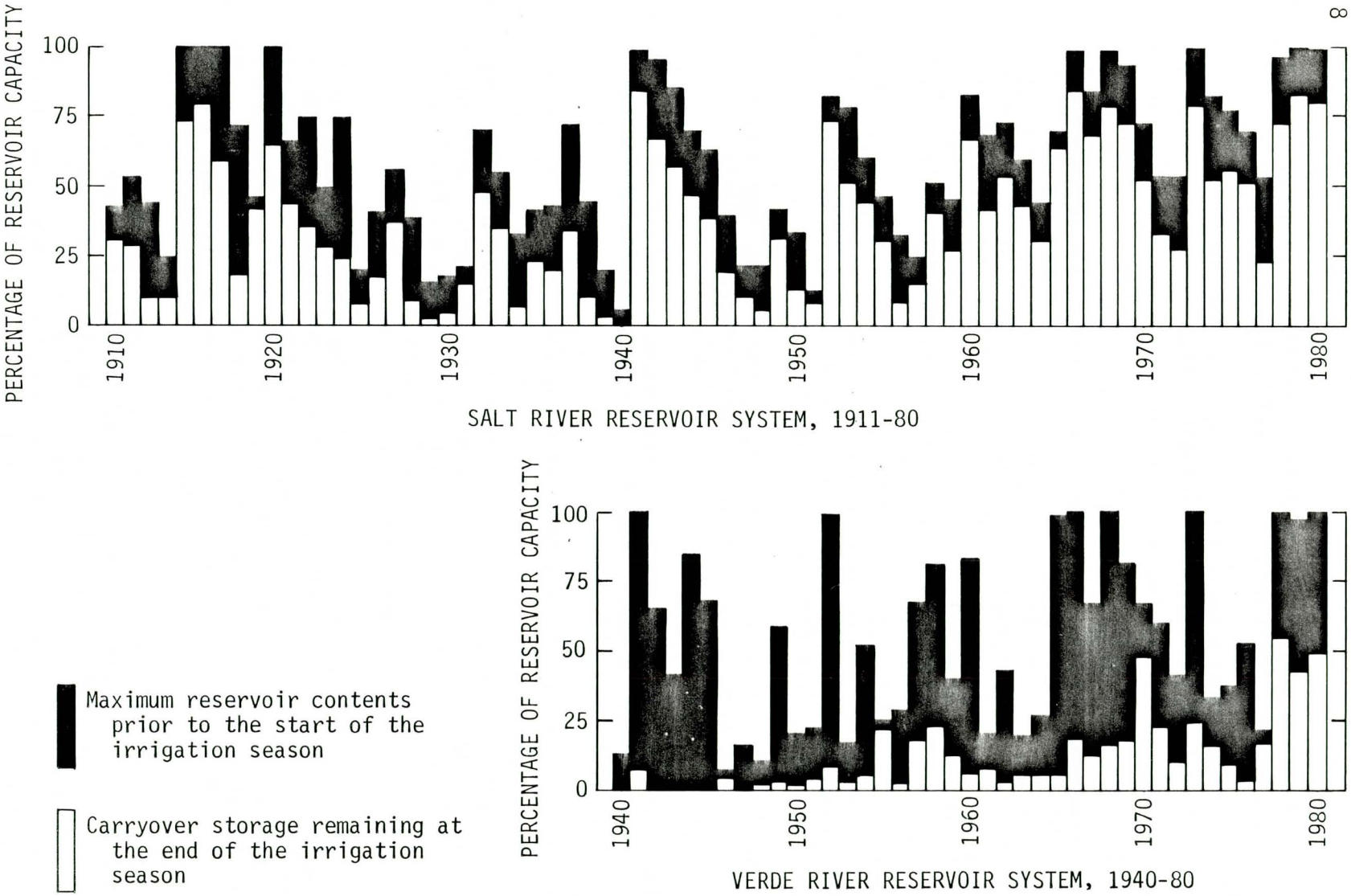


Figure 2.--Maximum reservoir contents and carryover storage, Salt River reservoir system, 1911-80, and Verde River reservoir system, 1940-80 (Aldridge, 1981).

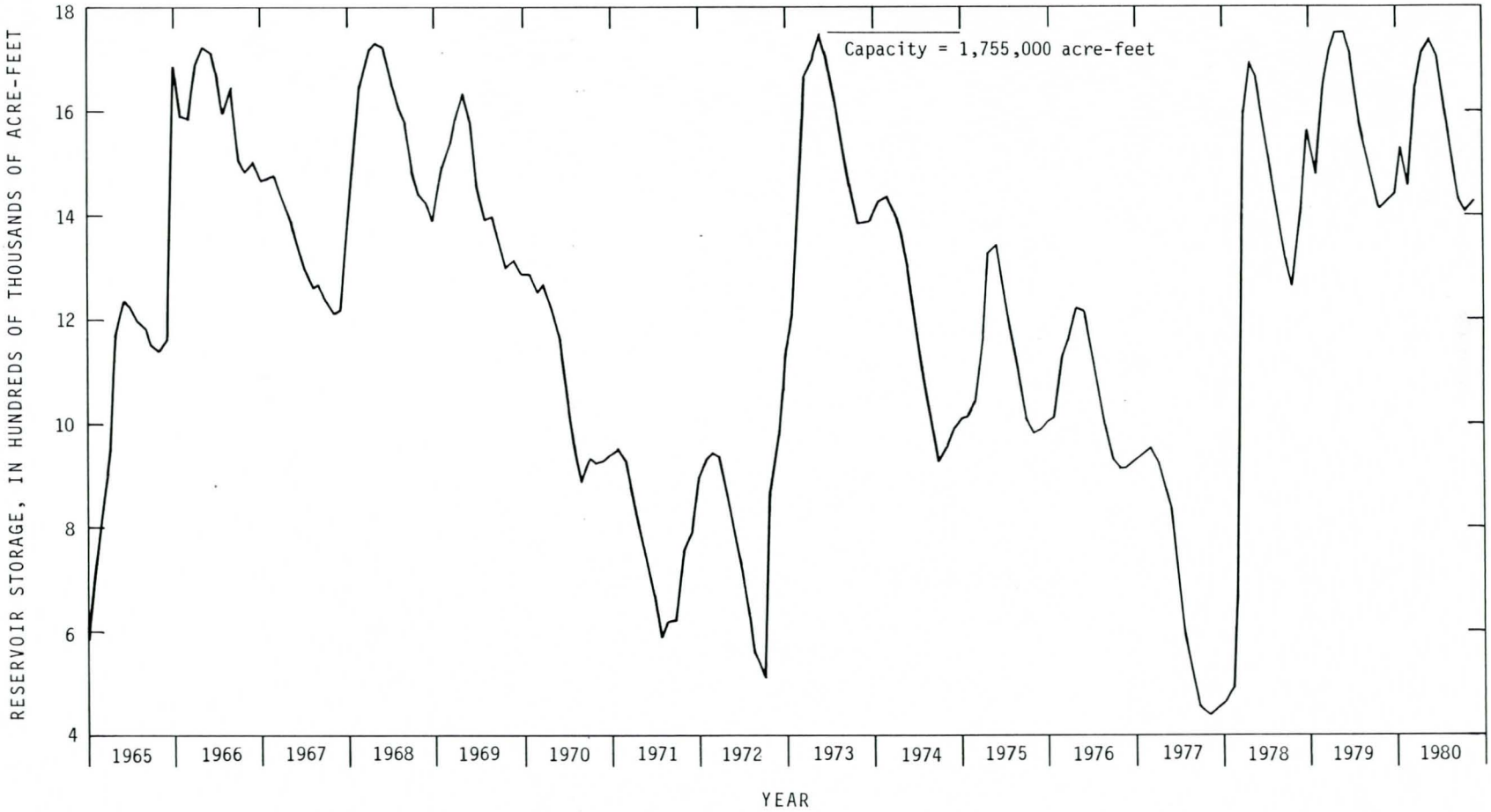


Figure 3.--Monthend storage in the Salt River reservoir system, 1965-80.

Verde River; and small reservoirs on Granite and Willow Creeks near Prescott. Flood-control reservoirs on Queen Creek, Cave Creek, and several small drainages may have prevented or reduced flooding downstream from the reservoirs but had little impact on floods in the Gila and Salt Rivers. These reservoirs have not been considered in subsequent analyses of the flood.

## METEOROLOGY

### General Conditions, November 1978 to March 1979

A series of upper-level low-pressure centers developed off the southwest coast of California and the west coast of Baja California in November 1978 through January 1979 and again in March 1979. These low-pressure centers caused frequent periods of widespread precipitation in Arizona and western New Mexico. November 1978, December 1978, and March 1979 each had three distinct periods of heavy precipitation. Precipitation occurred almost daily in January and early February. Unusually large amounts of precipitation occurred on November 10-12, November 23-26, December 17-20, January 17-18, and March 28-31 (U.S. Environmental Data and Information Service, 1978a-f; 1979a-g). Precipitation of 2 to 7 in. fell over north-central Arizona on November 10-12, 1978; the Crown King station reported 8.55 in. Precipitation of 1 to 5 in. fell on much of eastern Arizona and western New Mexico on November 23-26, 1978; Palisades Ranger Station in the mountains near Tucson, Ariz., reported 5.62 in. (U.S. Environmental Data and Information Service, 1978b, e). From 3 to 10 in. of precipitation fell in most of the study area on December 17-20.

Between 30 and 40 in. of precipitation fell at Hawley Lake, Sunrise Mountain, Palisades Ranger Station, Crown King, Junipine, and McNary from November 1978 through March 1979. More than 20 in. fell at 21 other locations in the central mountains of Arizona (table 2). The locations of climatological stations are shown on plate 2. The maximum precipitation was about 39 in. at Hawley Lake and Sunrise Mountain (U.S. Environmental Data and Information Service, 1978b, c; 1979b). The total departure above normal for the period was more than 20 in. at Junipine and Crown King and more than 10 in. at 21 other climatological stations where departures are published (table 2). Departures of this magnitude probably occurred at many more stations; however, the U.S. Environmental Data and Information Service only publishes departures for about 25 percent of the precipitation stations. Nine stations reported departures above normal of more than 4 in. for both November and December. Departures above normal for several stations were from 2 to nearly 8 in. for January and 2 to 3 in. for March 1979.

Throughout the study period, precipitation fell partly as rain and partly as snow, and alternate periods of snowfall and snowmelt occurred. In November and December a constant snow cover existed only above an altitude of about 8,000 ft. The constant snow cover dropped to

Table 2.--Precipitation and departures above normal at climatological stations in Arizona, November 1978 to March 1979

[Stations where precipitation exceeded 20 inches or published departures above normal exceeded 10 inches. Data from U.S. Environmental Data and Information Service, 1978a, b; 1979a, b, c]

| Site number (See pl. 2) | Station name | Altitude, in feet, above NGVD of 1929 | Total precipitation, in inches, November-March | Departure above normal, in inches | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1978 | | 1979 | | | Total |
| | | | | November | December | January | February | March | November-March |
| 1 | Alpine..... | 8,050 | 17.42 | 6.78 | 2.76 | 2.09 | -0.26 | -0.02 | 11.35 |
| 6 | Bartlett Dam..... | 1,650 | 16.33 | 2.28 | 2.42 | 3.42 | -.73 | 2.97 | 10.36 |
| 13 | Bumble Bee..... | 2,500 | 21.53 | ----- | ----- | ----- | ----- | ----- | ----- |
| 17 | Chevelon Ranger Station..... | 7,006 | 16.75 | 4.60 | 2.60 | 2.02 | -.27 | 1.05 | 10.00 |
| 18 | Childs..... | 2,650 | 23.63 | 5.11 | 4.87 | 3.80 | -.66 | 2.66 | 15.78 |
| 22 | Crown King..... | 5,920 | 33.91 | 8.48 | 5.53 | 5.24 | -.43 | 1.92 | 20.74 |
| 26 | Flagstaff AP..... | 7,006 | 21.34 | 4.83 | 3.24 | 3.65 | .26 | .69 | 12.67 |
| 29 | Gisela..... | 2,900 | 18.31 | 2.51 | 2.33 | 2.73 | -.09 | 3.19 | 10.67 |
| 32 | Happy Jack Ranger Station..... | 7,840 | 26.32 | ----- | ----- | ----- | ----- | ----- | ----- |
| 33 | Hawley Lake..... | 8,180 | 38.86 | ----- | ----- | ----- | ----- | ----- | ----- |
| 35 | Horseshoe Dam..... | 2,020 | 20.23 | ----- | ----- | ----- | ----- | ----- | ----- |
| 38 | Irving..... | 3,795 | 22.39 | 5.16 | 2.27 | 4.80 | -.40 | 1.88 | 13.71 |
| 39 | Junipine..... | 5,134 | 35.44 | 6.30 | 6.54 | 7.76 | .43 | 1.33 | 22.36 |
| 40 | Kelvin..... | 1,850 | 20.48 | 4.74 | 3.77 | 3.65 | .04 | 1.69 | 13.89 |
| 44 | McNary..... | 7,320 | 30.76 | 6.74 | 6.49 | 4.70 | -.54 | 2.51 | 19.90 |
| 45 | Miami..... | 3,560 | 24.60 | 5.99 | 5.11 | 2.75 | .32 | 1.84 | 16.01 |
| 52 | Palisades Ranger Station..... | 7,945 | 36.75 | ----- | ----- | ----- | ----- | ----- | ----- |
| 54 | Payson..... | 4,913 | 21.16 | ----- | ----- | ----- | ----- | ----- | ----- |
| 56 | Pinetop Fish Hatchery..... | 7,200 | 23.91 | ----- | ----- | ----- | ----- | ----- | ----- |
| 57 | Pleasant Valley Ranger Station.... | 5,050 | 21.54 | 3.76 | 2.17 | 4.45 | .02 | 2.94 | 13.34 |
| 59 | Punkin Center..... | 2,350 | 23.11 | ----- | ----- | ----- | ----- | ----- | ----- |
| 65 | Roosevelt 1WNW..... | 2,205 | 21.79 | 3.87 | 5.51 | 3.44 | -.17 | 1.72 | 14.37 |
| 67 | San Carlos Reservoir | 2,532 | 20.57 | 4.50 | 4.91 | 3.00 | .75 | .69 | 13.85 |
| 71 | Sierra Ancha..... | 5,100 | 29.61 | 5.57 | 4.16 | 4.32 | -.03 | 3.20 | 17.22 |
| 72 | Stewart Mountain.... | 1,422 | 14.37 | 2.39 | 3.11 | 4.12 | -.84 | 1.25 | 10.03 |
| 74 | Sunflower 3NNW..... | 3,720 | 29.92 | ----- | ----- | ----- | ----- | ----- | ----- |
| 76 | Sunrise Mountain.... | 9,370 | 38.95 | ----- | ----- | ----- | ----- | ----- | ----- |
| 78 | Superior..... | 2,995 | 21.50 | 4.40 | 4.29 | 3.86 | -.14 | 2.46 | 14.87 |
| 79 | Superior 2ENE..... | 4,155 | 28.82 | ----- | ----- | ----- | ----- | ----- | ----- |
| 85 | Tonto Creek Fish Hatchery 2..... | 6,390 | 29.61 | ----- | ----- | ----- | ----- | ----- | ----- |
| 87 | Walnut Grove..... | 3,764 | 19.54 | 6.40 | 2.63 | 1.07 | -.23 | 2.51 | 12.38 |
| 97 | Jerome..... | 5,245 | 20.83 | 5.72 | 1.72 | 4.33 | -.21 | 2.01 | 13.57 |
| 98 | Cordes..... | 3,773 | 17.05 | 4.35 | 1.45 | 2.98 | -.47 | 2.94 | 11.25 |
| 99 | White River..... | 5,280 | 16.70 | 3.97 | 2.79 | 2.40 | -.13 | 1.01 | 10.04 |

about 7,000 ft in January and below 6,000 ft in February. Before the storm of December 17-20, the snow depth reached a maximum on December 7 and decreased rapidly until December 17. Little snow was reported on the ground December 17 at National Weather Service stations below 8,000 ft, but U.S. Soil Conservation Service SNOTEL recorders showed some snow at lower altitudes. Satellite photographs show that more than 75 percent of the Salt River basin had snow cover on December 7, and about 16 percent of the basin had snow on December 14. Extrapolation from these figures indicates that about 10 percent of the basin had snow cover on December 17.

The decrease in snow cover occurred even though record low daily minimum temperatures were reported in early December by many climatological stations. At Winslow, Ariz., daily minimum temperatures during December 7-12, 1978, ranged from -3° to -11°F, and maximum temperatures ranged from 17° to 23°F. Temperatures during the first 2 weeks of December dropped as low as -32°F at a U.S. Forest Service climatological station about 10 mi southeast of Alpine. Below-zero temperatures were reported at all National Weather Service temperature stations in the study area that are located at altitudes of more than 5,000 ft except Jerome and Sierra Ancha and at five stations below 5,000 ft. After December 12, temperatures moderated. Minimum temperatures in the mountains were generally in the high twenties or low thirties; maximum temperatures ranged from the low forties to low seventies.

The effect of precipitation, snow cover, and temperatures on soils cannot be evaluated from the data available. The large amounts of precipitation followed by periods of snowmelt in November and December may have saturated soils, but significant soil drainage could have occurred between periods of wetting. The snowpack in areas where extreme cold temperatures occurred may have insulated the ground from freezing, and the moderate to warm temperatures during December 12-17 may have allowed frozen soils to thaw.

## Conditions, December 17-20, 1978

The heaviest and most extensive rainfall of the study period occurred December 17-20. Total precipitation during this period ranged from less than 1 in. in northeastern and southwestern Arizona to about 10 in. in the Mazatzal Mountains northeast of Phoenix.

The U.S. Environmental Data and Information Service (1979h) described the storm as follows:

> "Several days before the onset of this storm on the night of December 16, an upper low was meandering over the eastern Pacific near 27°N [latitude] and 133°W [longitude]. This cutoff low developed several days previously from an eastern Pacific trough. The north portion of the trough moved eastward and a strong zonal flow was established across the northeastern

Pacific, much of the United States, and southern Canada. The air in these westerlies [winds moving from the west] was quite dry. Arizona, likewise was dry.

"As the upper low continued to meander, moisture began to increase over the southwestern United States. Satellite imagery from December 14 through 17 showed a large mass of cloudiness stretching from Baja, [Mexico] southwestward. The flow across the Baja Peninsula and southern California was still anticyclonic, and cloudiness streaming into Arizona from the southwest were cirriform [high thin clouds].

"By Friday, December 15, it was evident that a short-wave trough was intensifying near 170°W. Within 24 hours this developed into a moderately strong trough in the Gulf of Alaska near 140°W. By 00Z Sunday, December 17, [1400 hours December 16 MST] the trough had deepened, moved to 133°W., and absorbed the low-latitude low [thus] forming a large amplitude quasi-stationary trough.

"The trough continued to deepen while remaining nearly stationary. As the upper portion of the trough moved eastward, the lower portion remained between 120°-130°W., from Sunday morning, December 17, to Tuesday morning, December 19. At the same time, a short wave rotated out of the long-wave trough resulting in a steady flow of nearly saturated air from the southwest into Arizona. Cloudiness over Arizona thickened rapidly Saturday night as the flow backed from west-southwest of southwest. Rain began over most of Arizona before dawn Sunday and gradually increased in intensity. The most intense rains were Sunday night and Monday morning, decreasing slowly until they were virtually over by Wednesday morning, [December 20]."

As the heavy flow of moist tropical air encountered mountain ranges, such as the Bradshaw, Mazatzal, and Sierra Ancha Mountains and the Mogollon Rim, large amounts of precipitation occurred because of the orographic uplift. Rainfall intensities were moderate to high but in themselves were not responsible for the high runoff. Few, if any, extreme intensities of short duration occurred during this storm, but rates of 0.25 to 0.5 in./hr were common throughout the foothills and mountainous areas of central Arizona on December 17 and 18, 1978. The time distribution of precipitation at a few selected stations is shown in figure 4.

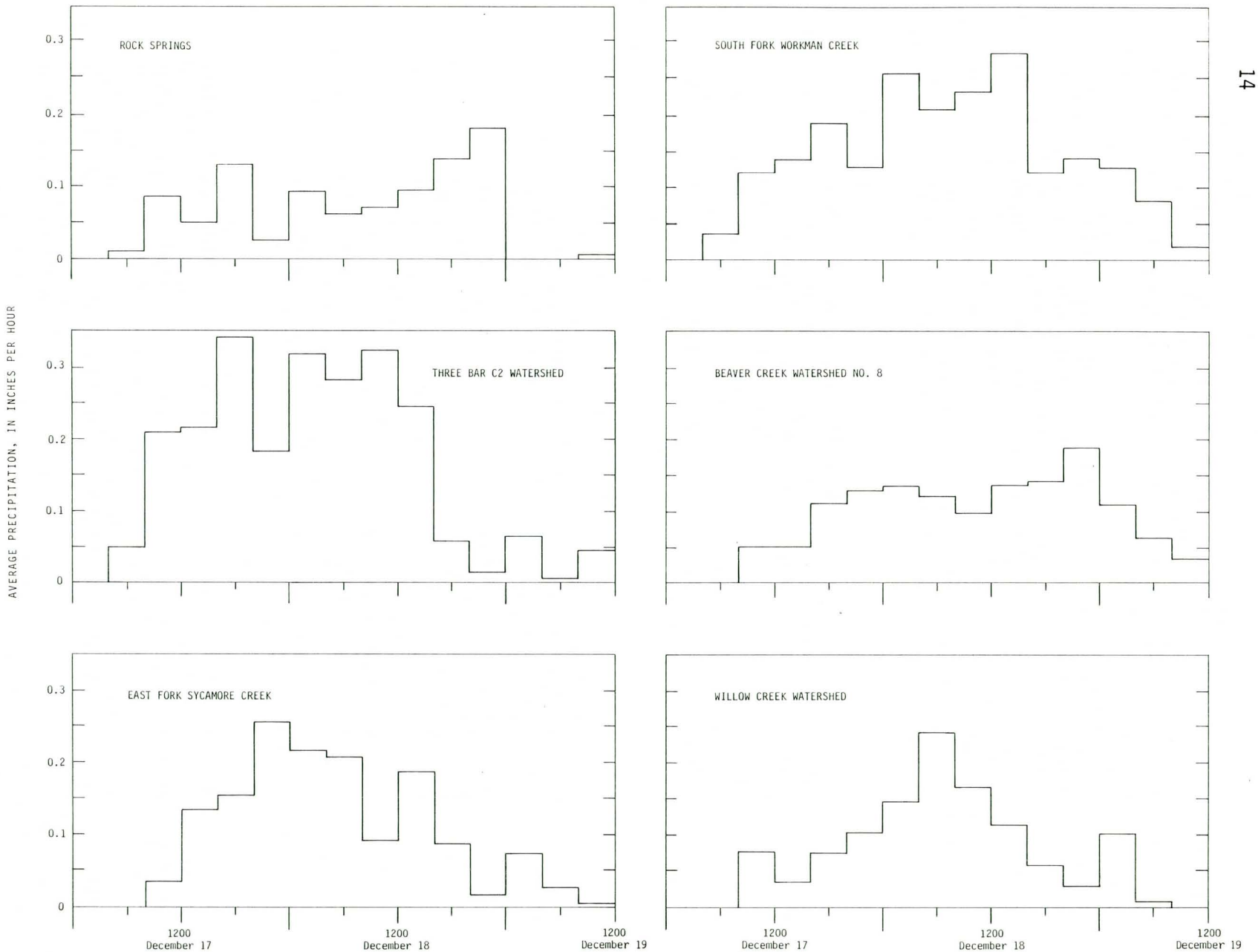


Figure 4.--Time distribution of precipitation at selected stations in Arizona, December 17-19, 1978.

Total precipitation for December 17-20, 1978, is presented on plate 2, which is based on data published by the U.S. Environmental Data and Information Service (1978c, f) and unpublished data furnished by the U.S. Department of Agriculture Rocky Mountain Forest and Range Experiment Station, Flagstaff, Ariz.; Forestry Sciences Laboratory, Tempe, Ariz.; Soil Conservation Service, Phoenix, Ariz.; and the U.S. Geological Survey. The information on plate 2 presents more detailed information than the generalized isohyetal map of the U.S. Environmental Data and Information Service (1979h). Table 3 shows daily precipitation values at 96 precipitation sites reporting more than 3 in. during December 17-20.

The tropical nature of the air mass caused rain during most of the storm period to altitudes of 11,000 ft in central Arizona and western New Mexico. Near the end of the storm, the snow level dropped several thousand feet (U.S. Army Corps of Engineers, 1980). In places the snow melted, and in other places, snow accumulated. At Hawley Lake, 7 in. of old snow, which contained about 1 in. of water, melted December 17-18 before snow fell again on December 19-20 (U.S. Environmental Data and Information Service, 1978c). Data from U.S. Soil Conservation Service SNOTEL recorders provide an inconclusive record of changes during the storm in the overall snowpack. From December 15 to December 18, the amount of water in the snowpack decreased at three sites and increased at five sites; decreases ranged from 0.5 to 1.0 in.

## RUNOFF

The large amount of precipitation in November and early December caused above-normal runoff, which may have been an antecedent cause of later floods. The runoff wet the soils and streambeds and filled channel depressions. In the Salt and Agua Fria River basins, the runoff brought reservoirs to an unusually high level at the end of November. In comparison to volumes of storage on November 30 during past years, the November 1978 storage ranks third highest since 1910 in the Salt River system, second highest since 1938 in the Verde River system, and second highest since 1927 in Lake Pleasant.

The volume of runoff during the study period was outstanding in the San Pedro and Santa Cruz River basins and in the Gila River above San Carlos Reservoir. In spite of the large volume of runoff, all inflow to San Carlos Reservoir from November 1978 to February 1979 was stored. Spill over the dam began April 22, 1979, when the reservoir filled for the first time since storage began in 1929. Long periods of sustained, above-average runoff that occurred in the San Pedro and Santa Cruz River basins caused the runoff for each month—November 1978 through March 1979—to exceed the previous maximum for that calendar month since 1915. The mean discharge of San Pedro River near Charleston for January 1979 is 507 $ft^3/s$. The highest previous mean discharge for January was 278 $ft^3/s$ in 1915. At most stations in the San Pedro and Santa Cruz River basins, the volumes of runoff in December and January are among the four highest monthly values of record.

Table 3.--Precipitation at climatological stations in central Arizona reporting at least 3 inches, December 17-20, 1978

| Site number (See pl. 2) | Station name | Altitude, in feet above NGVD of 1929 | [1]Time of reading | Precipitation, in inches, for indicated day | | | | Total precipitation, in inches |
|---|---|---|---|---|---|---|---|---|
| | | | | 17 | 18 | 19 | 20 | |
| 1 | Alpine | 8,050 | 1700 | 0.16 | 1.91 | 1.10 | Trace | 3.17 |
| 2 | Apache Junction | 1,720 | 1700 | 1.25 | 1.35 | .47 | 0 | 3.07 |
| 3 | Bagdad 2 | 4,117 | 1800 | 1.05 | 2.49 | .23 | .16 | 3.93 |
| 4 | Baker Butte | [2]7,500 | ---- | ----- | ----- | ----- | ----- | 4.6 |
| 5 | Baldy (snow course) | 9,125 | ---- | ----- | ----- | ----- | ----- | 3.1 |
| 6 | Bartlett Dam | 1,650 | 0800 | .07 | 3.43 | 0 | 0 | 3.50 |
| 7 | Beaver Creek Watershed 3 | 5,000 | 2400 | .78 | 1.81 | .53 | ----- | 3.12 |
| 8 | Beaver Creek Watershed 4 | 6,240 | 2400 | 1.19 | 3.12 | .74 | ----- | 5.05 |
| 9 | Beaver Creek Watershed 8 | 7,400 | 2400 | 1.39 | 3.32 | 1.10 | 0 | 5.81 |
| 10 | Black River pumps | 6,040 | 2400 | .7 | 1.9 | .4 | 0 | 3.0 |
| 11 | Blue Ridge Ranger Station | 6,810 | 0800 | 0 | 2.50 | 1.85 | 1.00 | 5.35 |
| 12 | Bonito River | ----- | ---- | ----- | ----- | ----- | ----- | 3.3 |
| 13 | Bumble Bee | 2,500 | 1800 | 1.12 | 3.49 | 1.35 | 0 | 5.96 |
| 14 | Carefree | 2,300 | 1700 | ----- | ----- | ----- | ----- | 3.02 |
| 15 | Castle Creek | 7,840 | ---- | ----- | ----- | ----- | ----- | 3.22 |
| 16 | Castle Hot Springs Hotel | 1,990 | 1700 | 2.20 | 1.43 | 1.27 | 0 | 4.90 |
| 17 | Chevelon Ranger Station | 7,006 | ---- | .05 | 2.76 | .26 | 0 | 3.07 |
| 18 | Childs | 2,650 | 0800 | .12 | 2.52 | 3.90 | 0 | 6.54 |
| 19 | Claypool | ----- | ---- | ----- | ----- | ----- | ----- | 3.20 |
| 20 | Concord | [2]5,500 | ---- | ----- | ----- | ----- | ----- | 6.25 |
| 21 | Cordes Junction | 3,800 | ---- | ----- | ----- | ----- | ----- | 3.33 |
| 22 | Crown King | 5,920 | 1300 | ([3]) | 4.61 | 3.69 | .05 | 8.35 |
| 23 | Eagle Creek 2 | 4,870 | 1000 | 0 | 1.80 | .40 | 1.00 | 3.20 |
| 24 | Fish Creek | 2,550 | ---- | ----- | ----- | ----- | ----- | 6.62 |
| 25 | Flagstaff (highway shop) | [2]6,900 | ---- | ----- | ----- | ----- | ----- | 4.32 |
| 26 | Flagstaff WSO AP | 7,006 | 2400 | 1.20 | 2.65 | .37 | 0 | 4.22 |
| 27 | Flying V | ----- | ---- | ----- | ----- | ----- | ----- | 4.28 |
| 28 | Fry | ----- | ---- | ----- | ----- | ----- | ----- | 3.9 |
| 29 | Gisela | 2,900 | 1800 | 0 | 2.50 | 1.20 | .03 | 3.73 |
| 30 | Globe | 3,710 | 0800 | .08 | 1.83 | 1.69 | .11 | 3.71 |
| 31 | Greer | 8,490 | 1700 | .23 | 2.15 | .69 | Trace | 3.07 |
| 32 | Happy Jack Ranger Station | 7,480 | 0800 | 0 | 1.72 | 2.58 | .44 | 4.74 |
| 33 | Hawley Lake | 8,180 | 0800 | .02 | 3.30 | 3.44 | .70 | 7.46 |
| 34 | Horse Mesa Dam | 2,000 | ---- | ----- | ----- | ----- | ----- | 5.67 |
| 35 | Horseshoe Dam | 2,020 | 0700 | .07 | 3.47 | 1.58 | .03 | 5.15 |
| 36 | Humbolt Mountain | ----- | ---- | ----- | ----- | ----- | ----- | 5.00 |
| 37 | Iron Spring | 5,900 | ---- | ----- | ----- | ----- | ----- | 4.53 |
| 38 | Irving | 3,795 | 1000 | .11 | 1.55 | 1.90 | 0 | 3.56 |
| 39 | Junipine | 5,134 | 1700 | .93 | 2.68 | 2.30 | 0 | 5.91 |

See footnotes at end of table.

Table 3.--Precipitation at climatological stations in central Arizona reporting at least 3 inches, December 17-20, 1978—Continued

| Site number (See pl. 2) | Station name | Altitude, in feet above NGVD of 1929 | [1]Time of reading | Precipitation, in inches, for indicated day | | | | Total precipitation, in inches |
|---|---|---|---|---|---|---|---|---|
| | | | | 17 | 18 | 19 | 20 | |
| 40 | Kelvin | 1,850 | 1700 | ([3]) | 2.30 | 0.90 | 0 | 3.20 |
| 41 | Lakeside | 6,800 | 1300 | 0.05 | 1.85 | 1.87 | 1.28 | 5.05 |
| 42 | Little Antelope | 6,480 | ---- | ----- | ----- | ----- | ----- | 6.00 |
| 43 | Maverick | 7,800 | ---- | ----- | ----- | ----- | ----- | 4.00 |
| 44 | McNary | 7,320 | 0800 | 0 | 2.80 | 2.91 | .41 | 6.12 |
| 45 | Miami | 3,560 | 0800 | .08 | 3.48 | 2.23 | .11 | 5.90 |
| 46 | Mormon Flat Dam | 1,715 | 0800 | 0 | 3.20 | .94 | .30 | 4.44 |
| 47 | Mormon Mountain | 7,400 | ---- | ----- | ----- | ----- | ----- | 5.6 |
| 48 | New River | ----- | ---- | ----- | ----- | ----- | ----- | 3.4 |
| 49 | Oak Creek Rim | 6,500 | ---- | ----- | ----- | ----- | ----- | 7.68 |
| 50 | Oracle 2SE | 4,510 | 0700 | 2.60 | .36 | .40 | 0 | 3.36 |
| 51 | Orme Ranch | 3,900 | ---- | ----- | ----- | ----- | ----- | 3.90 |
| 52 | Palisades Ranger Station | 7,945 | 1700 | 1.58 | 6.51 | .37 | .06 | 8.52 |
| 53 | Parker Creek | 5,000 | ---- | ----- | ----- | ----- | ----- | 5.25 |
| 54 | Payson | 4,913 | 1700 | .55 | 2.82 | .13 | .07 | 3.57 |
| 55 | Pinedale Work Center | ----- | ---- | 0 | 2.38 | 1.98 | .18 | 4.54 |
| 56 | Pinetop Fish Hatchery | 7,200 | 1700 | 0 | ([3]) | 3.68 | .20 | 3.88 |
| 57 | Pleasant Valley Ranger Station | 5,050 | 1700 | 1.30 | 1.44 | .87 | 0 | 3.61 |
| 58 | Prescott | 5,510 | ---- | ----- | ----- | ----- | ----- | 3.85 |
| 59 | Punkin Center | 7,350 | 0800 | 0 | 3.86 | 1.15 | .10 | 5.11 |
| 60 | Rattlesnake | [2]7,800 | ---- | ----- | ----- | ----- | ----- | 4.70 |
| 61 | Rock Springs | ----- | 2400 | 1.20 | 2.56 | .38 | 0 | 4.14 |
| 62 | Rocky Prairie | ----- | 2400 | ----- | ----- | ----- | ----- | 3.00 |
| 63 | Roosevelt | ----- | ---- | ----- | ----- | ----- | ----- | 4.77 |
| 64 | Roosevelt Dam | ----- | ---- | ----- | ----- | ----- | ----- | 5.16 |
| 65 | Roosevelt 1 WNW | 2,205 | 0800 | .03 | 3.88 | 1.36 | 1.00 | 6.27 |
| 66 | San Carlos AP | 2,890 | 1300 | .81 | 1.44 | 1.04 | 0 | 3.29 |
| 67 | San Carlos Reservoir | 2,532 | 0700 | .08 | 3.00 | 1.85 | .06 | 4.99 |
| 68 | Sedona Ranger Station | 4,320 | 2400 | .8 | 2.10 | .2 | .1 | 3.2 |
| 69 | Show Low | 6,400 | ---- | ----- | ----- | ----- | ----- | 4.00 |
| 70 | Show Low City | 6,440 | 0800 | .16 | 2.11 | .75 | .06 | 3.08 |
| 71 | Sierra Ancha | 5,100 | 2400 | 2.1 | 3.5 | .5 | 0 | 6.1 |
| 72 | Stewart Mountain Dam | 1,422 | 1700 | 2.74 | .79 | .10 | 0 | 3.63 |
| 73 | Sugarloaf | 6,120 | ---- | ----- | ----- | ----- | ----- | 3.2 |
| 74 | Sunflower 3NNW | 3,720 | 1800 | 1.95 | 1.55 | 2.82 | 0 | 6.32 |
| 75 | Sunrise | ----- | ---- | ----- | ----- | ----- | ----- | 3.22 |
| 76 | Sunrise Mountain | 9,370 | 0800 | 0 | 3.22 | 1.89 | .58 | 5.69 |
| 77 | Sunset Point | 3,400 | ---- | ----- | ----- | ----- | ----- | 5.00 |
| 78 | Superior | 2,995 | 2400 | .20 | 2.79 | 2.04 | .17 | 5.20 |

See footnotes at end of table.

Table 3.--Precipitation at climatological stations in central Arizona reporting at least 3 inches, December 17-20, 1978—Continued

| Site number (See pl. 2) | Station name | Altitude, in feet above NGVD of 1929 | [1]Time of reading | Precipitation, in inches, for indicated day | | | | Total precipitation, in inches |
|---|---|---|---|---|---|---|---|---|
| | | | | 17 | 18 | 19 | 20 | |
| 79 | Superior 2ENE..... | 4,155 | 2400 | 2.6 | 3.8 | 0.7 | 0 | 7.1 |
| 80 | Sycamore Creek, East Fork..... | ----- | 2400 | 2.33 | 3.24 | .55 | 0 | 6.12 |
| 81 | Thomas Creek..... | ----- | 2400 | 1.07 | 2.70 | .26 | 0 | 4.03 |
| 82 | Three Bar C-2..... | 3,700 | 2400 | 4.00 | 4.46 | .84 | 0 | 9.30 |
| 83 | Three Bar D-2..... | 3,700 | 2400 | 5.31 | 3.81 | .71 | 0 | 9.83 |
| 84 | Tonto basin..... | 3,100 | ---- | ----- | ----- | ----- | ----- | 3.00 |
| 85 | Tonto Creek Fish Hatchery..... | 6,930 | 0700 | .04 | 2.35 | 1.83 | .30 | 4.52 |
| 86 | Walnut Canyon National Monument..... | 6,685 | 1700 | .17 | 2.14 | 1.15 | 0 | 3.46 |
| 87 | Walnut Grove..... | 3,764 | 1800 | 1.51 | 2.32 | .33 | 0 | 4.16 |
| 88 | White Horse Lake..... | 6,600 | ---- | ----- | ----- | ----- | ----- | 3.8 |
| 89 | Williams (El Paso Gas)..... | ----- | ---- | ----- | ----- | ----- | ----- | 3.3 |
| 90 | Williams (highway shop)..... | ----- | ---- | ----- | ----- | ----- | ----- | 5.00 |
| 91 | Willow Creek..... | 8,800 | ---- | 1.15 | 3.37 | .08 | 0 | 4.60 |
| 92 | Willow Springs Ranch..... | 3,690 | 0700 | 3.02 | 0 | 0 | 0 | 3.02 |
| 93 | Workman Creek..... | 6,970 | 2400 | 2.62 | 5.30 | 1.07 | 0 | 8.99 |
| 94 | Workman Creek, South Fork..... | ----- | 2400 | 2.42 | 5.01 | 1.00 | 0 | 8.43 |
| 95 | Workman Creek, North Fork..... | ----- | 2400 | 2.11 | 4.28 | .78 | 0 | 7.17 |
| 96 | Young..... | ----- | ---- | ----- | ----- | ----- | ----- | 3.5 |

[1]Precipitation for the 24-hour period preceding time of reading.

[2]Approximate altitude.

[3]Precipitation for this date included in reading of the next day.

# FLOODS

Flood peaks occurred throughout most of the study area November 24-25 and December 18-20, 1978, and January 17-18, 1979; additional peaks occurred in some areas. In places the highest discharge during the study period occurred in November 1978 or January or March 1979. In the upper part of the San Francisco River basin, the November peak was the highest. The January peak was the highest on the San Pedro River upstream from Aravaipa Creek, Tonto Creek, and Cherry Creek. The March peak was the highest at New River near Rock Springs. Detailed peak discharge and flood-hydrograph data are given in the section entitled "Streamflow Data of Gaging Stations and Miscellaneous Measuring Sites."

The most widespread flooding occurred December 18-20, 1978, when peaks of record occurred at many sites. Floods with recurrence intervals of more than 100 years occurred on the Gila River above the San Francisco River. Flood crests occurred on small streams early December 18, reached the larger creeks and rivers late December 18, and continued down main-stem streams on December 19-22. On most streams, the runoff occurred in a single sharp crest. Two or more peaks occurred at some sites where a peak from the main stem lagged that from a large tributary by several hours. Dual peaks occurred on the Gila River downstream from San Francisco River and Santa Cruz River below Rillito Creek.

Water was released from reservoirs for periods varying from several days to 13 months. The Salt River through Phoenix flowed for several weeks at a time over a 6-month period, and floodwater was released from Painted Rock Dam until January 1980.

In the following sections, streamflow and physical damage are discussed for four geographical areas. One area is north of the Mogollon Rim and includes part of the Little Colorado River and Havasu Creek basins. The Gila River basin was divided into three areas—Gila River basin upstream from Coolidge Dam, Gila River basin from Coolidge Dam to the Salt River, and Gila River basin downstream from the Salt River. The division points were selected at Coolidge Dam and at the Salt River because (1) no water other than leakage passed Coolidge Dam from November 1978 to February 1979 and (2) peaks upstream from the Salt River were not significant to flooding farther downstream on the Gila River.

## North of Mogollon Rim

Flooding north of the Mogollon Rim was slight during November. Heavy rains during December 17-20 on a snow-covered watershed caused high runoff in much of the Little Colorado River basin. Peaks of record occurred on Show Low Creek and in the headwaters of Chevelon and Clear Creeks.

Flooding along Show Low Creek caused damage at the community of Pinedale and the town of Show Low where several businesses were evacuated and the municipal water supply was damaged. Floods in Silver Creek caused damage at Taylor and Snowflake, and people were evacuated from 40 to 50 homes. Pinedale was isolated for 2 days because of road and bridge washouts. Many recreational facilities were damaged by erosion and silt deposition. Two small dams on Show Low Creek were damaged.

The most severe flood problem along the Little Colorado River developed at Winslow, Ariz.,—a community of 8,000—downstream from Chevelon and Clear Creeks. The peak discharge on Chevelon Creek was the highest since 1929. Peak discharges in Clear Creek and the Little Colorado River below Clear Creek were the highest since 1952. A slope-area measurement on the Little Colorado River near Winslow showed a peak discharge of 57,600 $ft^3/s$. Water spilled over and eroded one of two dikes protecting low-lying subdivisions along the Little Colorado River north of Winslow. Winslow Plaza subdivision, where homes were 5 to 10 years old and valued at about $50,000 each, received a large amount of yard damage and a small amount of interior damage. Water was as much as 5 ft deep in Ames Acres and Bushman Acres where houses were 40 to 50 years old and valued at about $17,000 (U.S. Army Corps of Engineers, 1980). About 1,700 people were evacuated from the three subdivisions, and patients were evacuated from Winslow Hospital. A logjam at a dam on Clear Creek caused concern, although the dam held.

Floodflows in Cataract Creek, the head of Havasu Creek, caused Santa Fe Dam at Santa Fe Reservoir above the town of Williams to crack and sag. People were evacuated from businesses and 100 homes in Williams because of the crack. In the city, culverts plugged with debris causing the creek to overflow into residential areas. More than 80 homes sustained yard damage, but water entered only 2 homes (U.S. Army Corps of Engineers, 1980). Street crews breached crossings to prevent more serious damage. A 10-year-old girl was rescued in good condition after being swept away by the creek and carried three blocks through four culverts (U.S. Army Corps of Engineers, 1980).

## Gila River Basin Upstream from Coolidge Dam

Several periods of high water occurred in the Gila River basin upstream from Coolidge Dam during November 1978 to March 1979. The highest and most damaging floods occurred November 24-25 and December 18-20. Peak discharges during the flood in November have a recurrence interval of 10-25 years. On the Gila River upstream from San Francisco River, the flood in December is the highest in the 20th century; peak discharges have recurrence intervals of more than 100 years. The November flood was most outstanding in the headwaters of the Gila and San Francisco Rivers and along the Blue River, which is a tributary of the San Francisco River. At Gila River near Gila, N. Mex., the peak is the fifth largest in the 52-year period of record. At San Francisco River near Reserve, N. Mex., the peak discharge was 11,800 $ft^3/s$ or 100 $ft^3/s$ less than the peak of record in October 1972. At Reserve, N. Mex., 19 homes and businesses and 10 acres of farmland were damaged.

## Flood of December 18-20, 1978

Gila River above San Francisco River.--The flood of December 18, 1978, on the Gila River upstream from the San Francisco River originated mainly in the Gila Wilderness Area of New Mexico and mountainous areas between the wilderness area and Cliff, N. Mex. (pl. 1). Jim Williams and Marc Willcox (U.S. Forest Service, written commun., 1980) reported and photographed severe damage to roads, trails, and campgrounds throughout much of the Gila National Forest and Gila Wilderness Area. Three forks of the Gila River—East, Middle, and West—drain 1,500 $mi^2$ of high, pine-covered mesas bounded by steep rock cliffs mostly in the wilderness area. The mesas lie 2,000 to 3,000 ft above the valley floors and range in altitude from 6,000 to 8,000 ft; some mountain peaks rise to as much as 11,000 ft. The three forks form a large dendritic drainage pattern and come together in a 6-mile reach near Gila Hot Springs, N. Mex.

A hydrologic analysis for the wilderness area is difficult to develop because the few precipitation stations are in the valleys and no stream-gaging stations are in the area. The nearest gaging station is 30 mi downstream from the wilderness area. The highest officially recorded daily rainfall in the wilderness area is 2.7 in., although higher amounts probably occurred in the mountains. One U.S. Soil Conservation Service remote reading recorder indicated 5.3 in. of precipitation, but the transmitting system was in a test phase, and the accuracy of the data is unknown (Ronald Jones, U.S. Soil Conservation Service, oral commun., 1981). The large amounts of duff in the pine forests would have greatly retarded runoff. On the basis of observations in other pine forests, it appears unlikely that the large runoff could have been caused by rainfall of less than several inches per day unless the rain melted a large amount of snow. Mr. D. Campbell (oral commun., 1980)—a resident of Gila Hot Springs for 60 years—reported that storms in November and early December 1978 had saturated the soil cover and left several inches of snow above 9,000 ft. The U.S. Army Corps of Engineers (1980) reported 10 in. of snow at higher altitudes at the time of the December 18 storm.

Mr. Campbell gave the following information. The flood crested after 2300 hours December 19, and water was 2 ft deep in a bathhouse built at Gila Hot Springs in the 1880's. No other flood had reached the bathhouse; the previous high stage in 1941 had been 1 ft below the bathhouse floor. Extreme runoff came from high-altitude parts of West Fork and Middle Fork, especially from the large rhyolite exposures in the Diablo and Mogollon Mountains, and from Little Creek, a tributary that enters the Gila River from the west just upstream from Gila Hot Springs. The creek has caused frequent flooding since the basin was burned off in 1951. Campbell indicated that only moderate runoff came from East Fork Gila River. The flood plain of West Fork was devastated by the flood. Large amounts of erosion extended to the extreme headwaters of the West and Middle Forks where many large pine trees were uprooted and carried away by the flood. Many of the trees were deposited in huge windrows paralleling the river near Gila Hot Springs. The trees caught large amounts of rock debris and subsequently formed large dikes. Gravel deposited on the

streambed after the flood raised the streambed above adjacent farmlands. S. R. Anderson (U.S. Geological Survey, oral commun., 1979) visited the area after the flood of December 1978 and estimated discharges of 15,000 to 20,000 $ft^3/s$ in the West Fork and 8,000 to 10,000 $ft^3/s$ in the Middle Fork.

Although little information is available about the floodflows between Gila Hot Springs and the Gila River near Gila, N. Mex., gaging station, fairly large contributions apparently came from Sapillo and Turkey Creeks, the two largest tributaries. The hydrograph for Gila River near Gila shows one sharp crest with no evidence of any secondary crest (fig. 5). Large amounts of runoff came from Mogollon, Duck, and Mangas Creeks and probably Bear Creek, which enter the Gila River between Gila and Redrock, N. Mex. Evidence from an aerial inspection indicated that although some flow occurred in most of the tributaries between the Redrock gage and Blue Creek, none of the tributaries had an outstanding flow. Low flood terraces along Blue Creek were not inundated. A ground inspection showed minimal contributions from the tributaries between Blue Creek and the San Francisco River.

As the floodwave moved from Gila River near Gila, N. Mex., to Gila River below Blue Creek, near Virden, N. Mex., the peak discharge increased and the duration of the crest became shorter. The U.S. Environmental Data and Information Service (1979h) attributed the large discharge near Redrock to the formation and destruction of a debris dam in Gila Middle Box. Gila Middle Box is an extremely narrow canyon between Gila and Redrock where the river channel is less than 20 ft wide in places. Flood debris was found about 150 ft above the channel bottom. Neither the debris dam nor its effect can be completely discounted; however, strong evidence indicates that, if such a debris dam did form, it only had a minor effect on the peak discharge. Several items of data tend to discredit the theory of a debris dam. Although the discharge at Redrock was much greater than at any previous time in the past 90 years, it is not unreasonable for the size of drainage area. At points upstream from Gila Middle Box, the discharge also was much greater than at any other time in the past 90 years. The unit discharge in cubic feet per second per square mile of the peak at Redrock was no greater than that at Gila, although considerable inflow from several large tributaries occurred in the reach.

All the hydrographs for gaging stations near Gila (upstream from Gila Middle Box), Redrock, and below Blue Creek (downstream from Gila Middle Box) are similar in shape (fig. 5). At each station, a steep rise occurred; however, no sharp spike occurred as would be expected if a debris dam had broken, and the recession appeared to have a natural shape. The crest moved from the Redrock gaging station to Duncan in about 6 hours, which is several hours faster than during most floods; however, the traveltime is comparable to the 1941 flood. (See "Traveltime.") The extreme narrowness of the Gila Middle Box could have caused depths of 150 ft without a debris dam.

Floodwaters from the Gila River spilled over a 2-mile-long dike along the east side of Duncan, Ariz. Large holes developed in the dike

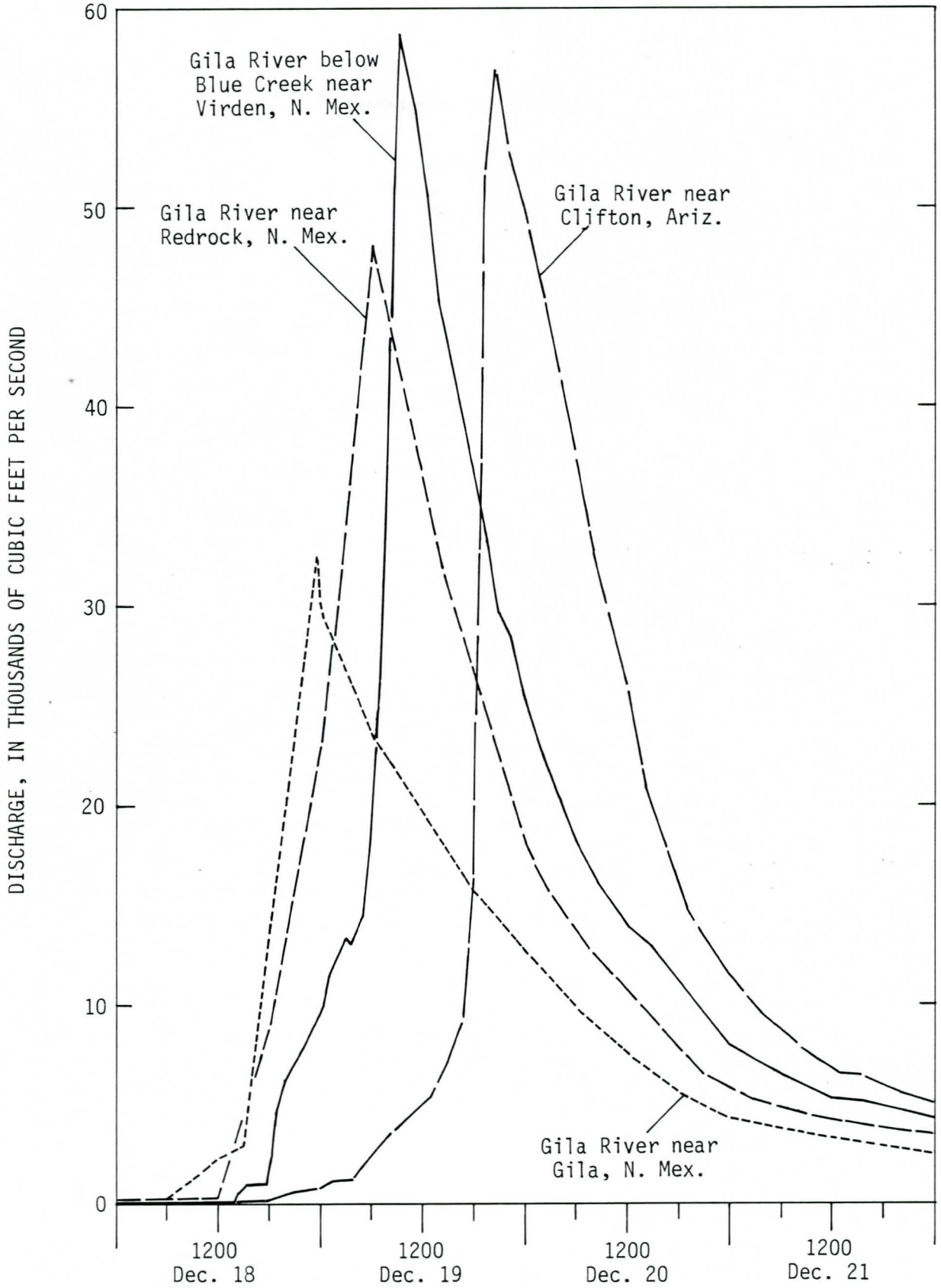


Figure 5.--Discharge of the Gila River at gaging stations upstream from San Francisco River in Arizona and New Mexico, December 18-21, 1978.

and allowed a wall of silt and water to rush through the community destroying or damaging homes, businesses, and most public buildings and facilities. Water averaged about 2.5 ft deep but was as much as 7 ft deep in places. About 75 homes were totally destroyed (U.S. Army Corps of Engineers, 1980), and approximately 400 persons received emergency food and (or) shelter. Seventy-two families were living in temporary housing 6 months after the flood, and businesses were closed for 3 to 6 weeks. All transportation routes into and out of Duncan were closed for 1 day. Although residents had about 18 hours warning, many failed to move household contents and personal property to higher ground (U.S. Army Corps of Engineers, 1980).

Overflow and erosion occurred at many places in the valleys near Gila, Cliff, Redrock, and Virden, N. Mex., and in the Duncan and York Valleys of Arizona. About 1,500 acres of grain and pastureland near Cliff and Gila, 1,200 acres—mostly in cotton—in the Virden Valley, and about 4,100 acres in the Duncan and York Valleys were damaged. Many fences, irrigation ditches, dikes, and other property improvements were destroyed, and thousands of acres of farmland were eroded.

San Francisco River, Eagle Creek, and Bonita Creek.--San Francisco River, the main tributary of the Gila River above San Carlos Reservoir, heads at altitudes above 9,000 ft near Alpine, Ariz., and flows eastward into New Mexico, southward to Glenwood, N. Mex., and then westward into Arizona. The flood of December 18, 1978, was outstanding only in the lower part of the basin. Near Reserve, N. Mex., the December peak was only 3,390 $ft^3/s$, whereas the November peak was 11,800 $ft^3/s$. The December flood was the second highest since about 1917 at Alma, N. Mex., and downstream points and was exceeded only by the flood of October 20, 1972. The December flood on Eagle Creek, which heads in the mountains west of the San Francisco River, is the highest during the period of record that began in 1944 and may be the highest since at least 1916. Bonita Creek was extremely high, but the discharge was not measured.

Overflow and minor flood damage occurred along the San Francisco River near Alma, Pleasanton, and Glenwood, N. Mex., where levees, irrigation ditches, and fences were damaged. Some fields near the community of Blue, Ariz., were silted over to a depth of 3 ft. Roads were damaged along the San Francisco and Blue Rivers. Residents of Blue were isolated for 5 days (Gerald K. Colmer, Apache-Sitgreaves National Forest, written commun., 1979).

Most of the damage occurred in Clifton, Ariz., which occupies a narrow flood plain between steep cliffs along the San Francisco River. About 20 homes in Patterson Addition on the north side of Clifton and 22 businesses in downtown Clifton were flooded. Roads, sewer lines, utilities, and the railroad were damaged. About 1,500 of the 5,100 residents were evacuated. The peak stage in December 1978 was lower than that in October 1972. Stages of the two floods differed by 0.8 ft in Patterson Addition and 1.0 ft at the stream-gaging station at the south

end of town. The 1978 stage on the shoreward side of floodwalls in north Clifton was 3.5 ft lower than in 1972. Floodwall heights were increased after the 1972 flood, and this was a significant factor in reducing the stage in north Clifton in 1978. Water, however, did reach the area behind the walls through drains and other small openings.

The flood caused little change in the channel of the San Francisco River. Discharge measurements made at the stream-gaging station on the highway bridge near the south edge of town show a scour of a few tenths of a foot, which was not enough to greatly affect the stage of the December flood. The cross section of the river channel near the bridge in central Clifton has been measured several times. The bed of the channel changed little between 1917 and 1973 (B. N. Aldridge and Otto Moosburner, U.S. Geological Survey, written commun., 1973), and it is unlikely that a major change occurred in 1978.

Safford Valley.--The crests of December 18 from San Francisco River, Eagle Creek, and Bonita Creek reached the Gila River almost simultaneously and combined to produce a peak discharge of about 100,000 $ft^3/s$ (fig. 6). The peak discharge was the highest since 1916, at the head of Safford Valley. The crest at the head of Safford Valley occurred about 2.5 hours after the crest on the San Francisco River at Clifton. Twenty hours later the peak from the headwaters of the Gila River became superimposed on the recession of the earlier peak; the discharge at the head of Safford Valley during the second crest was 88,000 $ft^3/s$. Each crest inundated large parts of the valley near Safford (U.S. Army Corps of Engineers, 1980; pl. 6). Little Hollywood, a small community of 51 families that borders the Gila River 2 mi east of Safford, was damaged severely. The 30-year-old community had been severely damaged in 1965, 1967, and 1972 (Aldridge, 1970; Condes de la Torre, 1972; Courier Publishing Company, 1972; U.S. Army Corps of Engineers, 1973; and Burkham 1976). As much as 6 ft of floodwater swirled through Little Hollywood, lifted houses from their foundations, and carried away personal belongings that were later found scattered throughout the area. Highway bridges at Solomon, Safford, Pima, Thatcher, Cork, and Bylas were destroyed or damaged leaving 400 families on the north side of the river isolated and without phone service or electricity. Major agricultural damage occurred throughout the valley as the flooding river eroded massive areas of farmland and destroyed fences, irrigation ditches, crops, and cattle. Deposits of as much as 7 ft of silt were left in places. Although the flood occurred late in the normal harvest season, about 25 percent of the cotton crop was still in the fields because wet ground after the November storms had delayed the harvest. The flood caused the complete loss of the unharvested crops within the overflow areas.

During the flood of December 1978, peak discharges of 2,000 to 5,000 $ft^3/s$ occurred on small streams that drain the eastern and northern slopes of the Pinaleno Mountains south of Safford where previous maximum discharges had been a few hundred cubic feet per second. The peak discharges of Deadman and Marijilda Creeks near Safford were more than 500 $(ft^3/s)/mi^2$, which were the highest measured in the report area. Late

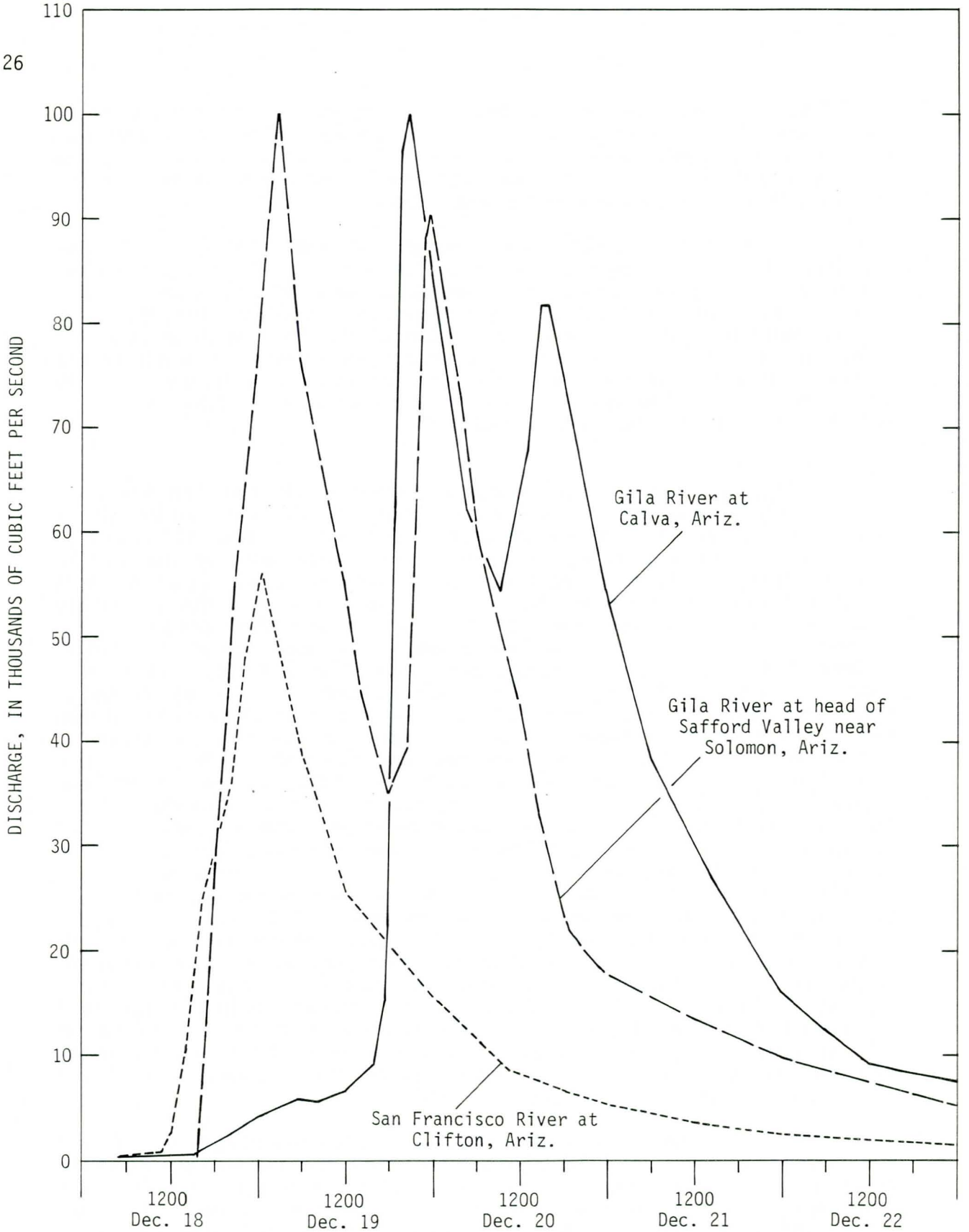


Figure 6.--Discharge of the San Francisco River at Clifton and Gila River at gaging stations between San Francisco River and San Carlos Reservoir, December 18-22, 1978.

December 18, water began leaking through an 18-foot-long crack in the earthen dam on Graveyard Wash 2 mi south of Safford. Fear that the dam might give way caused 2,000 people to be evacuated. Another leak was found on December 19; both leaks were repaired, and the dam held. Local sources expressed the opinion that the entire community of Safford would have been engulfed by 6 ft of water if the dam had failed (U.S. Army Corps of Engineers, 1980).

Comparison of the December flood to past floods.--From gaging-station data, newspaper articles, historical documents, photographs, and local interviews, Aldridge and Moosburner (U.S. Geological Survey, written commun., 1973) developed a record of the highest floods on the San Francisco River at Clifton, Ariz., since the town was settled in 1870. From that record, it can be established that the flood of December 1978 on the San Francisco River at Clifton is the seventh highest since 1870; the highest flood was in December 1906.

The comparison of the floods of December 1978 to other floods cannot be so well established on the Gila River. Lippincott (1900, p. 34) stated, "The greatest rise so far recorded on the Gila River [near Florence] occurred on the 22d of February 1891. Considerable evidence was obtained that no such flood has occurred since a date many years before the advent of the white man [about 1870]. Irrigating ditches supposed to be extremely old were overflowed and destroyed. Lands were overflowed that had retained no evidence of any previous inundation." Lippincott also stated that the peak discharge near Florence during the 1891 flood was computed to be 102,566 $ft^3/s$. All subsequent studies indicate this to be a reasonable value. Some authors have attempted to transfer the data from Florence to the Safford Valley, but the long travel distance—more than 130 mi—and a large intervening drainage area of about 10,000 $mi^2$ make such a transfer questionable.

The U.S. Army Corps of Engineers (1914) stated, "Since . . . [Lippincott, 1900] one greater flood is known to have occurred, that of 1905. . . . During the present investigation, lodged driftwood was found at San Carlos several hundred feet upstream from the proposed dam site at an elevation 26 ft above low water in the river along side, which indicates a flow of possibly as much as 150,000 $ft^3/s$ at the point." The quotation is assumed to refer to the flood of November 1905, although Murphy and others (1906) briefly describe the destructive nature of the floods in January and February 1905 but fail to mention the November flood. Other evidence indicates that the discharge in November was considerably greater than in January and February. Burkham (1970) explained that the November flood did less damage than the earlier floods because the channel had been widened and deepened by the earlier floods. Although the estimate of 150,000 $ft^3/s$ for the flood of November 1905 has been carried through literature, the U.S. Army Corps of Engineers (1945, p. 55) questioned the value and stated that it was probably high. Present knowledge indicates that the discharge may have been closer to 100,000 $ft^3/s$.

Olmstead (1919) mentioned the floods of 1833, 1869, 1884, and 1916. Sources of information for the 1833 and 1869 floods were a tribal calendar of the Pima Indians and an elderly Indian who observed the floods near Sacaton. The Indian described the 1833 flood as the maximum he had seen. If the Indian's comparison of the 1833 flood to other floods was accurate and his statement was made in 1917 as inferred by Olmstead, then the 1833 flood is still the maximum known near Sacaton. Nothing is known about the 1833 and 1869 floods in the Safford Valley or at sites farther upstream. The highest known flood on the San Francisco River at Clifton, which occurred in December 1906, probably caused a high flood in Safford Valley; but neither U.S. Army Corps of Engineers (1914) or Olmstead (1919) mentioned it; however, that flood was discussed in a later report (U.S. Army Corps of Engineers, 1945).

The U.S. Army Corps of Engineers (1945, p. 52) discussed other Gila River basin floods that occurred in 1862 and 1880 and stated that the 1884 flood was equal to those of 1891, 1905, 1906, and 1916. In the same report (appendix 5, p. 60), a subsequent ranking of floods on the Gila River near Solomonsville (now Solomon) placed the 1884 flood below the flood of October 1916 and seventh in the list of peaks from 1884 to 1945. The six highest peaks in descending order of magnitude are those of February 1891, November 1905, December 1906, January 1916, February 1905, and October 1916. The ranking contradicts the statement by the U.S. Army Corps of Engineers (1914) that the 1905 flood exceeded the 1891 flood. The flood shown for February 1905 probably occurred in January 1905 because in most of the Gila River basin the flood in January was higher than the flood in February. Otherwise, the ranking appears to be the most reasonable of any postulated.

In a later report the U.S. Army Corps of Engineers (1962) stated that the five major floods up to that time—1884, 1891, 1905, 1906, and 1916—were equal, but did not state where the peaks were compared. Although the 1884 flood was large on the Salt River and may have been comparable to the large floods in parts of the Gila River basin, considerable doubt exists whether it was among the highest floods in the Safford Valley. The source of that flood cannot be identified. Burkham (1970) added the floods of 1889, 1895, and 1896 to the list of outstanding historic floods but infers that these floods were less severe than the floods of 1891, 1905, 1906, and 1916. Although actual discharges for early floods on the Gila River are unknown, the peak discharges during at least four floods since 1861—February 1891, November 1905, December 1906, January 1916—probably were either approximately equal to, or greater than, the peak of December 1978 at the head of Safford Valley.

The flood history for the Gila River upstream from the San Francisco River is documented by gaging-station records since 1911. Little is known about floods before 1911 except that large floods reportedly occurred on the Gila River at Gila, N. Mex., in November 1905 and December 1906 (U.S. Geological Survey, 1980a) and at Gila Hot Springs, N. Mex., in the spring of 1907 (D. Campbell, resident, oral commun., 1980). The three highest floods measured at Gila River near Clifton since 1911, in descending order of magnitude, occurred in December 1978,

October 1972, and September 1941. Before 1972, the 1941 flood was reported to be the highest since either 1891 (Patterson and Somers, 1966) or 1881 (U.S. Geological Survey, 1954). Throughout most of the reach from Gila Hot Springs to the San Francisco River, the flood in December 1978 was several feet higher than the floods in 1941 and 1972. The flood in 1978, therefore, is the highest since at least 1891 at the gaging station near Clifton and is probably the highest in that period at all points between Gila Hot Springs and the San Francisco River. A strong possibility exists that the flood in December 1978 is the highest in a much longer time span.

Data are not available for the flood in February 1891 upstream from the San Francisco River. Mr. Campbell stated that the first major flood after development of Gila Hot Springs in the mid-1880's occurred in the spring of 1907, which indicates that the floods of 1891, 1905, and 1906 did not extend that far east. Mr. Campbell stated that the storm of December 1906 deposited snow but did not cause flooding at Gila Hot Springs. The 1907 flood is not mentioned in accounts of flooding in the downstream valleys, although Mr. Campbell said that the 1907 flood was almost as high as the 1941 flood at Gila Hot Springs.

Olmstead (1919) estimated a peak discharge of 110,000 $ft^3/s$ for the flood on September 5, 1897, in Bear Creek, a large tributary that enters the Gila River near Cliff, N. Mex., but does not discuss the effect of this flood on the Gila River. No other documentation of that flood was found. If this flood did occur, it must have diminished in magnitude before reaching the valleys near Virden, N. Mex., and Duncan, Ariz.

## Traveltime of Floods

Traveltime must be considered in developing mathematical models for flood-warning systems. Upstream from the San Francisco River, the flood of December 1978 moved down the Gila River faster than the smaller flood of November 1978. In November the flood crests at Gila River near Clifton, Ariz., occurred 17 hours after the corresponding crest at Gila River below Blue Creek, near Virden, N. Mex., and 30 hours after the crest near Gila, N. Mex. The corresponding times during the December flood are 11 and 21 hours, respectively. The rapid movement of the December flood prompted a study of traveltimes during past floods. Recorder charts for the highest floods from 1940 to 1980 were examined. Most flood events have complex hydrographs that show several crests; the number and magnitude of crests depend on the sources of flood runoff. Frequently, crests originate between gaging stations, and crests that pass an upstream site are obscured by tributary inflow before reaching downstream sites. The complex hydrographs dictate that traveltime be computed from a study of individual crests (tables 4 and 5). Traveltime cannot be computed from the time of occurrence for peaks above a designated base such as those published annually by the Geological Survey. The published time is for the highest in a series of crests. Seldom is the same crest the highest at all gaging stations. Tables 4 and 5 include all

Table 4.--Time and discharge of selected flood peaks—Gila River near Gila N. Mex., to Gila River near Calva, Ariz., 1941-79

[Crests are traced downstream from the first gaging station where the crest began to the point where the crest was lost in the recession of an earlier crest or two or more crests merged to form a single crest]

| Date | 09430500 Gila River near Gila, N. Mex., river mile 572.5 | | | 09431500 Gila River near Redrock, N. Mex., river mile 539.2 | | | 09432000 Gila River below Blue Creek, near Virden, N. Mex., river mile 523 | | | 09432500 Gila River at Arizona-New Mexico State line, river mile 507.7 | | | 09442000 Gila River near Clifton, Ariz., river mile 471 | | | 09448500 Gila River at head of Safford Valley, Ariz., river mile 448 | | | 09458000 Gila River at Safford, Ariz., river mile 433.3 | | | 09466500 Gila River at Calva, Ariz., river mile 383 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second |
| Sept. 1941... | ---- | ---- | ---- | 28 | [1]2000 | [1]17,000 | 29 | 0200 | 17,700 | 29 | 0800 | 17,000 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Do. | ---- | ---- | ---- | 29 | 0900 | [1]40,000 | 29 | 1100 | 41,700 | 29 | 1400 | 39,500 | 29 | 2330 | 28,200 | 30 | 0320 | 69,900 | 30 | [1]0700 | 33,000 | Oct. 1 | 0330 | 27,900 |
| Do. | 29 | 1300[4] | 25,400 | 29 | [1]2000 | [1]26,000 | 30 | 0010 | 26,800 | 30 | 0400 | 23,300 | 30 | 1200 | 22,000 | 30 | 1520 | 22,200 | ---- | ---- | ---- | ---- | ---- | ---- |
| Jan. 1949.... | 13 | 1130 | 15,000 | 14 | 0630 | 18,200 | 14 | 1300 | 15,600 | 14 | 1530 | 14,800 | 15 | 0300 | 13,900 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Jan. 1952.... | 19 | 0640 | 4,870 | 19 | 1700 | 9,100 | 19 | 2330 | 6,100 | | ([2]) | | 20 | 1400 | 4,280 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Oct. 1955.... | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | | ([2]) | | 3 | 0130 | 10,800 | 3 | 0530 | 6,380 | | ([2]) | | 3 | 2330 | 3,720 |
| Do. | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | | ([2]) | | 4 | 0400 | 12,700 | 4 | 1230 | 13,300 | | ([2]) | | 5 | 1230 | 4,240 |
| Dec. 1965.... | ---- | ---- | ---- | 23 | 0200 | 16,800 | 23 | 1000 | 11,000 | | ([2]) | | 24 | 0900 | 10,700 | 24 | 1400 | 17,300 | 24 | 1900 | 17,500 | 26 | 1600 | 8,400 |
| Do. | 31 | 0800 | 3,560 | 31 | 1300 | 6,520 | 31 | 2000 | 4,420 | | ([2]) | | Jan. 1 | 1600 | 2,230 | Jan. 1 | 1900 | 7,500 | | ([2]) | | Jan. 3 | 0600 | 8,700 |
| Aug. 1967[3]... | ---- | ---- | ---- | ---- | ---- | ---- | 12 | 0500 | 11,500 | | ([2]) | | 12 | 2000 | 4,000 | 12 | 2400 | 15,000 | ---- | ---- | ---- | ---- | ---- | ---- |
| Do. | ---- | ---- | ---- | 12 | 1145 | 6,860 | 12 | 2030 | 5,040 | | ([2]) | | 13 | 1200 | 3,500 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Do. | ---- | ---- | ---- | ---- | ---- | ---- | 13 | 1000 | 5,810 | | ([2]) | | 14 | 0230 | 3,900 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Do. | 13 | 0530 | 5,810 | 13 | [1]1500 | [1]6,000 | 13 | 2300 | 5,000 | | ([2]) | | 14 | 1100 | 3,700 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Do. | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | | ([2]) | | 14 | 2300 | 7,730 | 15 | 0200 | 8,420 | | ([2]) | | 16 | 0200 | 7,800 |
| Do. | ---- | ---- | ---- | ---- | ---- | ---- | 15 | 0600 | 3,930 | | ([2]) | | 15 | 1700 | 2,500 | 16 | 0200 | 4,000 | | ([2]) | ---- | ---- | ---- | ---- |
| Oct. 1972.... | 20 | Unknown | 12,500 | 20 | 1615 | 26,200 | 20 | 2330 | 27,200 | | ([2]) | | 21 | 1330 | 33,000 | 21 | 1800 | 41,900 | | ([2]) | ---- | ---- | ---- | ---- |
| Sept. 1975... | ---- | ---- | ---- | ---- | ---- | ---- | 8 | 0230 | 7,720 | | ([2]) | | 8 | 2330 | 4,200 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Mar. 1978.... | [4]2 | Unknown | 4,790 | [4]2 | 2330 | 12,700 | 3 | 0300 | 7,800 | | ([2]) | | 4 | 0800 | 8,420 | 4 | 1500 | 13,500 | | ([2]) | ---- | ---- | ---- | ---- |
| Nov. 1978.... | 25 | 1215 | 9,430 | 25 | Unknown | 24,700 | 26 | 0200 | 13,400 | | ([2]) | | 26 | 1830 | 11,000 | 26 | 2330 | 15,100 | | ([2]) | | 27 | 0900 | 13,600 |
| Dec. 1978.... | 18 | 2330 | 32,400 | 18 | 0600 | 48,800 | 18 | 0930 | 58,700 | | ([2]) | | 18 | 2030 | 57,000 | 18 | 2330 | 88,000 | | ([2]) | | 19 | 1530 | 81,600 |
| Jan. 1979.... | 18 | 1045 | 5,600 | | ([2]) | | 18 | 1500 | 10,000 | | ([2]) | | 19 | 0100 | 7,200 | 19 | 0200 | 18,000 | | ([2]) | | 20 | 0800 | 22,100 |

[1]Estimated.

[2]Station not in operation.

[3]Several crests of August 1967 that are identifiable at only one gaging station are not included.

[4]Revised.

Table 5.--Time and discharge of selected flood peaks—San Francisco River near Alma, N. Mex., to Gila River near Calva, Ariz., 1941-79

[Crests are traced from the first gaging station where the crest began to the point where the crest was lost in the recession of an earlier crest or two or more crests merged to form a single crest]

| Date | 09443000 San Francisco River near Alma, N. Mex., river mile 523 | | | 09444400 San Francisco River at Glenwood, N. Mex., river mile 511.5 | | | 09444500 San Francisco River at Clifton, Ariz., river mile 476.0 | | | 09448500 Gila River at head of Safford Valley, Ariz., river mile 448 | | | 09458000 Gila River at Safford, Ariz., river mile 433.3 | | | 09466500 Gila River at Calva, Ariz., river mile 383 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second | Day | Hour | Discharge, in cubic feet per second |
| Sept. 1941... | ---- | | | | | | 28 | 2330 | 6,520 | 29 | 0230 | 10,900 | 29 | [1]0600 | 8,320 | ---- | | |
| Jan. 1949.... | | ([2]) | | 13 | 1400 | 7,800 | 13 | 2000 | 24,100 | 14 | 0200 | 25,200 | 14 | 0600 | 23,900 | 15 | 1300 | 19,400 |
| Jan. 1952.... | | ([2]) | | 19 | Unknown | 5,410 | 19 | 0500 | 15,800 | 19 | 1130 | 19,700 | 19 | [1]1500 | 15,700 | 20 | 2130 | 13,200 |
| Oct. 1955.... | | ([2]) | | 4 | 0330 | 2,400 | 4 | 0730 | 5,820 | ---- | | | | | | | | |
| Dec. 1965.... | ---- | | | | | | | | | 22 | 2400 | 43,000 | 23 | 0600 | 42,000 | 24 | 1900 | 39,000 |
| Do. | ---- | | | | | | 23 | 1000 | 30,500 | 23 | 1500 | 36,200 | 23 | 1800 | 36,500 | ---- | | |
| Do. | 23 | 0830 | 5,900 | 23 | 1100 | 6,860 | 23 | 1900 | 19,000 | 23 | 2400 | 20,000 | ---- | | | | | |
| Do. | ---- | | | | | | 30 | 1900 | 17,300 | 30 | 2300 | 22,300 | 31 | [1]0400 | [1]22,000 | Jan. 1 | 0530 | 20,000 |
| Do. | 30 | 1900 | 7,500 | 30 | 2230 | 8,200 | 31 | 0700 | 16,000 | 31 | 1000 | 15,000 | 31 | 1400 | 8,500 | ---- | | |
| Aug. 1967.... | ---- | | | | | | 12 | 0600 | 34,700 | 12 | 0930 | 34,800 | | ([2]) | | 13 | 0800 | 40,100 |
| Do. | 12 | 1300 | 6,230 | 12 | [1]1500 | 8,000 | 12 | 2200 | 23,300 | 13 | 0300 | 14,200 | | ([2]) | | 14 | 0900 | 14,000 |
| Oct. 1972.... | ---- | | | | | | 20 | 0300 | 64,000 | 20 | 0800 | 82,400 | | ([2]) | | 20 | 2400 | 80,000 |
| Do. | 20 | 0530 | 30,600 | 20 | 0630 | 34,100 | ---- | | | | | | | | | | | |
| Sept. 1975... | ---- | | | | | | 9 | 0030 | 30,000 | 9 | 0330 | 35,000 | | ([2]) | | 10 | 1500 | 15,800 |
| Do. | 9 | 0045 | 15,600 | 9 | 0300 | 10,300 | ---- | | | | | | | | | | | |
| Mar. 1978.... | ---- | | | | | | 2 | 1800 | 8,350 | 2 | 1900 | 21,600 | | ([2]) | | 4 | 0100 | 17,800 |
| Do. | 2 | 1500 | 4,390 | 2 | 1600 | 3,750 | ---- | | | | | | | | | | | |
| Do. | ---- | | | | | | 3 | 1130 | 9,500 | 3 | 1500 | 19,600 | | ([2]) | | 4 | 1830 | 19,000 |
| Nov. 1978.... | ---- | | | | | | 25 | 0200 | 31,000 | 25 | 0630 | 41,000 | | ([2]) | | 26 | 1400 | 22,400 |
| Do. | 25 | 0130 | 19,400 | 25 | 0430 | 12,600 | 25 | 0830 | 28,500 | 25 | 1330 | 28,000 | | ([2]) | | 26 | 1800 | 21,000 |
| Dec. 1978.... | ---- | | | | | | 19 | 0030 | 56,000 | 19 | 0330 | 100,000 | | ([2]) | | 19 | 2100 | 100,000 |
| Do. | 18 | 2100 | 24,500 | 18 | [1]2300 | 20,500 | ---- | | | | | | | | | | | |
| Jan. 1979.... | ---- | | | | | | 17 | 2400 | 22,000 | 18 | 0700 | 39,200 | | ([2]) | | 18 | 2300 | 27,900 |
| Do. | 17 | 2330 | 13,500 | 18 | 0200 | 10,900 | 18 | 0800 | 27,200 | ---- | | | | | | | | |

[1]Estimated.

[2]Station not in operation.

crests for each storm period during which a discharge exceeded one of the following: (1) 10,000 $ft^3/s$ at Gila River near Clifton, Ariz.; (2) 15,000 $ft^3/s$ at San Francisco River at Clifton, Ariz.; or (3) 20,000 $ft^3/s$ at Gila River at head of Safford Valley near Solomon, Ariz. Flood crests that originated in the Gila River upstream from San Francisco River are shown in table 4. Peaks that originated in the San Francisco River, Eagle Creek, or Bonita Creek are shown in table 5. Each crest was traced downstream on the Gila River or San Francisco River from the originating point until the crest can no longer be identified as an individual peak on the hydrograph.

On the Gila River upstream from the San Francisco River, traveltime is a function of the discharge (fig. 7). Traveltime from the Redrock gaging station to Duncan averages about 5 hours for discharges of 40,000 to 50,000 $ft^3/s$ and about 14 hours for discharges of about 10,000 $ft^3/s$.

The first peak through Safford Valley generally is the result of a peak from San Francisco River, Eagle Creek, or Bonita Creek. Traveltime from San Francisco River at Clifton to Safford is about 8 to 10 hours, but a crest that includes a large inflow from Eagle and Bonita Creeks may occur at Safford in as little as 5 hours after the crest at Clifton. Crests from Eagle and Bonita Creeks generally reach the Gila River about 3 hours earlier than those from the San Francisco River. The traveltime from Clifton to Safford is approximately the same for all discharges. The traveltime from Clifton to Safford is equally divided between the reach upstream from the head of Safford Valley and the reach downstream and is 4 to 5 hours in each reach.

Crests on the San Francisco River at Clifton, Ariz., generally result from crests that originate in Blue River and occur 2 to 4 hours after the crest at Blue River near Clifton. The peaks at Clifton generally occur before the peaks of San Francisco River at Glenwood, N. Mex. Peaks that pass Glenwood either cause a secondary crest at Clifton or are lost in the recession from the earlier crest. The two-crest pattern occurred on the San Francisco River at Clifton during the floods of November 24-25, 1978, and January 17-18, 1979. During each event, one crest originated in the Blue River and a later one originated upstream from Blue River. The first crest occurred 2 to 4 hours after the crest at the gaging station at Blue River near Clifton, Ariz. The second crest occurred 7 to 8 hours after the crest of the San Francisco River at Alma, N. Mex., and about 4 hours after the crest of San Francisco River at Glenwood, N. Mex. The single-crest pattern occurred December 18 as crests from Blue River and the San Francisco River combined.

## Gila River Basin from Coolidge Dam to Salt River

Four peaks that occurred at the Gila River near Kelvin gaging station from November 1978 to January 1979 originated in the San Pedro River and in small streams that are tributary to the Gila River downstream

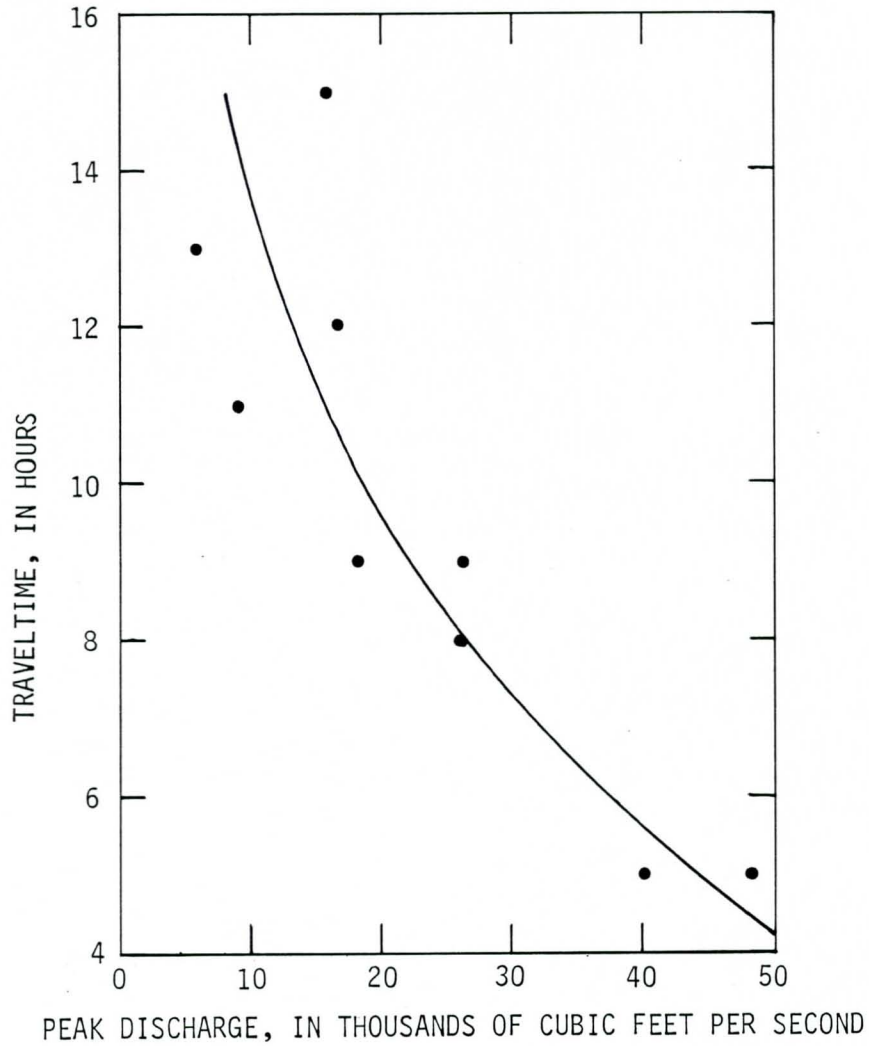


Figure 7.--Relation between peak discharge at Gila River near Redrock, N. Mex., and traveltime to Duncan, Ariz.

from Coolidge Dam. No water was released from Coolidge Dam except for leakage until February 1979. Flood peaks occurred in the San Pedro and Santa Cruz River basins on November 24-25 and December 18-22, 1978, and January 17-18 and January 25-26, 1979. An additional peak occurred December 31, 1978, in the Santa Cruz River basin. Peak discharges during November 1978 to March 1979 on the San Pedro River upstream from Aravaipa Creek and on the Santa Cruz River upstream from Rillito Creek were large for winter floods but were much smaller than past summer floods caused by tropical or convective storms.

On Aravaipa Creek and Rillito Creek, 20- to 40-year floods occurred December 18, 1978. On each individual tributary of the San Pedro River and Rillito Creek, runoff occurred as a single sharp crest that followed intense rain on the morning of December 18. In places the entry points of the tributaries to the main streams are separated by several miles. The traveltime between the tributaries and downstream locations caused multiple crests to develop on the major streams. The multiple crests were especially evident in the record for the San Pedro River near Redington.

On Aravaipa Creek 6 mi above the mouth, the flood of December 1978 is the highest in the period of record that began in 1965 and probably is the second highest in the 20th century. The highest flood occurred in 1920. Residents living near the mouth of Aravaipa Creek disagreed whether the 1967 flood or the 1978 flood was higher at that point (Ray Jordan, Arizona Department of Transportation, written commun., 1980).

The flows of the San Pedro River and Aravaipa Creek joined to cause two crests of long duration on the San Pedro River downstream from the confluence. The peak discharge at the mouth of the San Pedro is the highest since 1940. The long-duration flow below Aravaipa Creek caused severe erosional damage. Large sections of flood plain were washed away, and several new channels developed.

At Gila River near Kelvin, 17 mi downstream from the San Pedro River, the peak discharge of 27,000 $ft^3/s$ in December 1978 is about equal to peak discharges in December 1965 and December 1967. In places the stage was much higher than those for the earlier floods because the river channel was constricted by vegetation that grew after 1967. Riverside, Ariz., which is on the Gila River 16 mi downstream from the San Pedro River, was flooded with several feet of water.

On the Santa Cruz River upstream from Rillito Creek, the flood of December 18, 1978, was the third highest winter flood in a period of record that began in 1905 and was exceeded only by the peaks of December 1914 and December 1967. The flood of December 18 was not exceptional, however, in relation to the overall peak record. The peak was exceeded by several peaks that occurred in August, September, and October of past years. The highest peaks in at least 25 years on tributaries that drain to Rillito Creek from the Santa Catalina and Rincon Mountains occurred December 18, 1978. Records are not adequate,

however, to define the exact period. Sabino Creek reached the highest stage in a period of record that began in 1933. Rillito Creek, which had the highest peak discharge since 1929, eroded large sections of bank near Tucson and flooded at least one subdivision. Flow from Rillito Creek combined with flows from a few minor tributaries to produce a peak of 18,800 $ft^3/s$ on the Santa Cruz River at Cortaro. The only higher peak during the period of record that began in 1940 was in October 1977 (Aldridge and Eychaner, 1982). A second crest of 18,200 $ft^3/s$ occurred on the Santa Cruz River at Cortaro when the peak that passed the gaging station at Tucson was superimposed on the recession of the peak from Rillito Creek. High flows continued for most of the day on December 18. The 1-day mean discharge of the Santa Cruz River at Cortaro was 14,500 $ft^3/s$, which exceeded the previous maximum 1-day mean discharge of 12,600 $ft^3/s$ in October 1977.

As the floods of December 1978 moved downstream along the Gila and Santa Cruz Rivers, the peak discharges were greatly reduced through attenuation and infiltration. Peak discharges were delayed by the long traveltime from the source of the flooding to the confluence of the Gila and Santa Cruz Rivers. Neither stream contributed significantly to flooding below the Salt River. Peak discharges above the confluence near Laveen were 9,720 $ft^3/s$ in the Gila River and 4,120 $ft^3/s$ in the Santa Cruz River. The Santa Cruz River inundated hundreds of acres near Red Rock and Chuichu. Water was high enough to flow out into the channel that the Santa Cruz River followed before it was diverted into Greene Canal about 1900. Feedlots between Stanfield and Casa Grande were flooded, and erosional damage occurred near Casa Grande and Maricopa.

Another large peak occurred on the San Pedro and Santa Cruz Rivers on January 17-18, 1979. On the San Pedro River upstream from Aravaipa Creek, the January flood was the highest winter peak since at least 1916. High flows continued on the Santa Cruz River and Rillito Creek through March 1979. After several weeks of flow, riverbanks became saturated and extensive bank scour occurred, especially near Marana where a large section of flood plain was eroded by the Santa Cruz River. Erosion was stopped when hundreds of car bodies were anchored along the bank.

## Salt River Basin and Gila River Basin Downstream from Salt River

The sources of flooding in the lower reaches of the Gila River are the Salt and Aqua Fria Rivers. In the Salt River basin above Roosevelt Lake, the number of peaks between November 1978 and March 1979 depended on the altitude of the basin. Only the peak of December 18 occurred in basins above 7,500 ft; the number of peaks was greater at lower altitudes. In the Verde and Agua Fria River basins, the number of peaks was a function of both altitude and location. Peaks occurred at one or more stations in the Salt, Verde, or Agua Fria River basins on November 11-12 and 24-25; December 18-19 and 31, 1978; January 17-18; February 11 and 15; March 8-9, 20-21, and 28-29, 1979. The highest

peaks occurred November 24-25 and December 18-19, 1978, and January 17-18 and March 28-29, 1979. Peaks of record occurred on January 17-18, 1979, on Cherry and Tonto Creeks.

Severe flooding occurred in Phoenix and suburban areas on December 18, 1978, and January 17 and March 29, 1979, when inflow to reservoirs exceeded the unfilled storage capacities. More than half of the monetary damage that resulted from the flood of December 1978 occurred along the Salt and Agua Fria Rivers. The effects of floods on the Salt and Agua Fria Rivers extended to the mouth of the Gila River.

## Upstream from Reservoirs, December 18-20, 1978

The large amount of precipitation on a moderate snow cover on December 18, 1978, was accentuated in the Salt River basin because of the large amount of high-altitude drainage that contributes to the Salt River. About 16 percent of the Salt River basin above Roosevelt Lake is above 8,000 ft (Schumann, 1982). The warm rain that fell to altitudes of 11,000 ft on December 18 melted an unknown amount of snow that had been deposited by earlier storms.

Peaks of record occurred on Black River, Big Bonito Creek, and White River in the Salt River basin and on West Clear Creek in the Verde River basin. The length of record at these stations, however, is less than 25 years, and the probability is high that larger floods occurred in the early part of the 20th century. At long-term gaging stations, four or five higher discharges have occurred since 1890.

An unusual aspect of the December flood is the uniform distribution of runoff from the Salt River basin above the reservoir system. Discharges of 15 to 45 $(ft^3/s)/mi^2$ were recorded at gaging stations throughout the Salt River basin upstream from Roosevelt Dam; whereas, during other floods in the past 25 years, runoff came from only part of the basin. For example, in March 1978, runoff came almost entirely from altitudes of 5,000 to 7,000 ft. Runoff during the flood of December 1978 was distributed less uniformly in the Verde River. Low peak discharges occurred in the Verde River basin upstream from Oak Creek. High peak discharges occurred in Oak, Wet Beaver, and West Clear Creeks. Moderate peak discharges occurred in the East Verde River and tributaries to the Verde River downstream from the East Verde River. Unit discharges in the Verde River basin ranged from less than 1 $(ft^3/s)/mi^2$ on Volunteer Canyon to more than 250 $(ft^3/s)/mi^2$ on small watersheds in the Beaver Creek watershed.

The maximum rate of ungaged inflow to Roosevelt Lake during the December flood was estimated as 35,000 $ft^3/s$. The peak rate of inflow to the lake was 152,000 $ft^3/s$ (U.S. Army Corps of Engineers, 1980), which is probably the second highest since storage began in 1910 and was exceeded in March 1978.

A high volume of runoff occurred during the flood. The 1-day volume is the second highest since at least 1905 at Verde River below Tangle Creek, near Horseshoe Dam and third highest since at least 1913 at Salt River near Roosevelt and Tonto Creek above Gun Creek, near Roosevelt. The 3-day volumes were third highest on Tonto Creek, fourth highest on Salt River, and fifth highest on Verde River. The total volume of inflow to the reservoirs, gaged plus ungaged, during the 3 highest days of the flood was about 425,000 acre-ft into the Salt River system and 250,000 acre-ft into the Verde River system. The unfilled capacities preceding the flood were 330,000 acre-ft and 67,000 acre-ft, respectively. These volumes of inflow in December could have been retained in the reservoirs during about 8 out of 9 years on the Salt River and 2 out of 3 years on the Verde River.

The flood hydrographs for stations along the Black River upstream from the pumping station near Point of Pines exhibit a typical downstream progression of the floodwave (fig. 8). The crest at Black River above pumping plant, near Morenci occurred about 11 hours after the crest at Black River near Maverick. Downstream from the pumping plant, the crest occurred more or less concurrently at all stations on the Black and Salt Rivers. In some reaches of the channel, the crest occurred at a downstream station earlier than at an upstream station. This pattern is typical of floods in the Salt River because large amounts of tributary inflow enter the river between each pair of gaging stations.

In contrast the peak on the Verde River occurred progressively later as the floodwave moved downstream from the gaging station near Clarkdale to the gaging station below Tangle Creek (fig. 9). The time between peaks at various stations probably equals the traveltime between the stations. Traveltimes along the Verde River from the station near Clarkdale are 7 hours to Camp Verde, 12 hours to East Verde River, and 13 hours to Tangle Creek. Peak discharge at Verde River near Paulden occurred 7 hours after the peak at Verde River near Clarkdale because water that reached the Paulden station was delayed by a circuitous route from source areas and by storage in Sullivan Lake.

The peak discharge at Agua Fria River near Mayer was about 35 percent greater than the previous maximum during the period of record that occurred during the Labor Day flood of 1970 (Roeske and others, 1978). The largest amount of runoff came from the Bradshaw Mountains where rainfall of 8.3 in. was reported at Crown King. The Black Hills, which are along the east side of the basin, contributed a small amount of runoff. Three small U.S. Forest Service research watersheds (Mingus A, B, and C) in this area, each of which drain less than 0.1 $mi^2$, had peak unit discharges of only a few cubic feet per second per square mile. A large part of the Agua Fria River basin between the Bradshaw Mountains and the Black Hills received less than 3 in. of rain during the storm period and probably did not contribute much runoff. Downstream from the Mayer gaging station, large amounts of runoff came from Black Canyon Creek and tributaries to Lake Pleasant. A local resident stated that the peak stage of Black Canyon Creek, about 1 mi above the mouth, was the second highest since he moved there in 1958 and was 0.8 ft lower than the

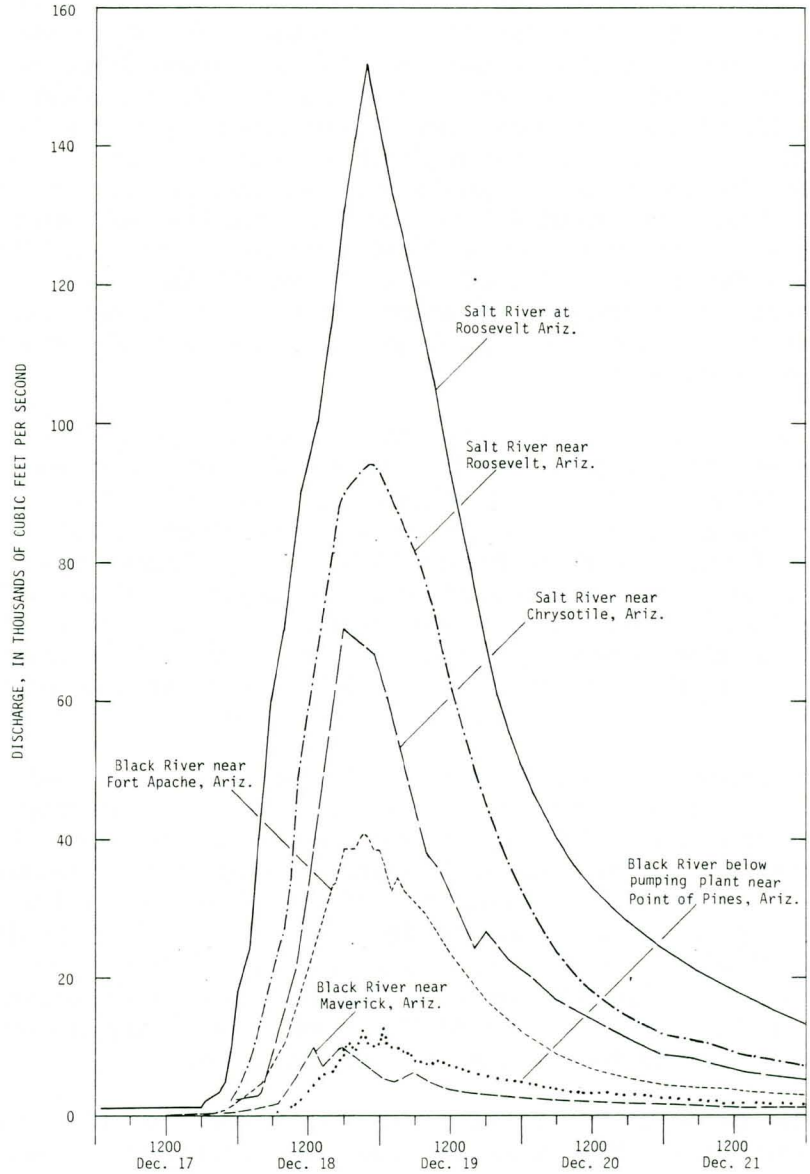


Figure 8.--Discharge at gaging stations on the Black and Salt Rivers upstream from Roosevelt Lake, Ariz., December 17-21, 1978.

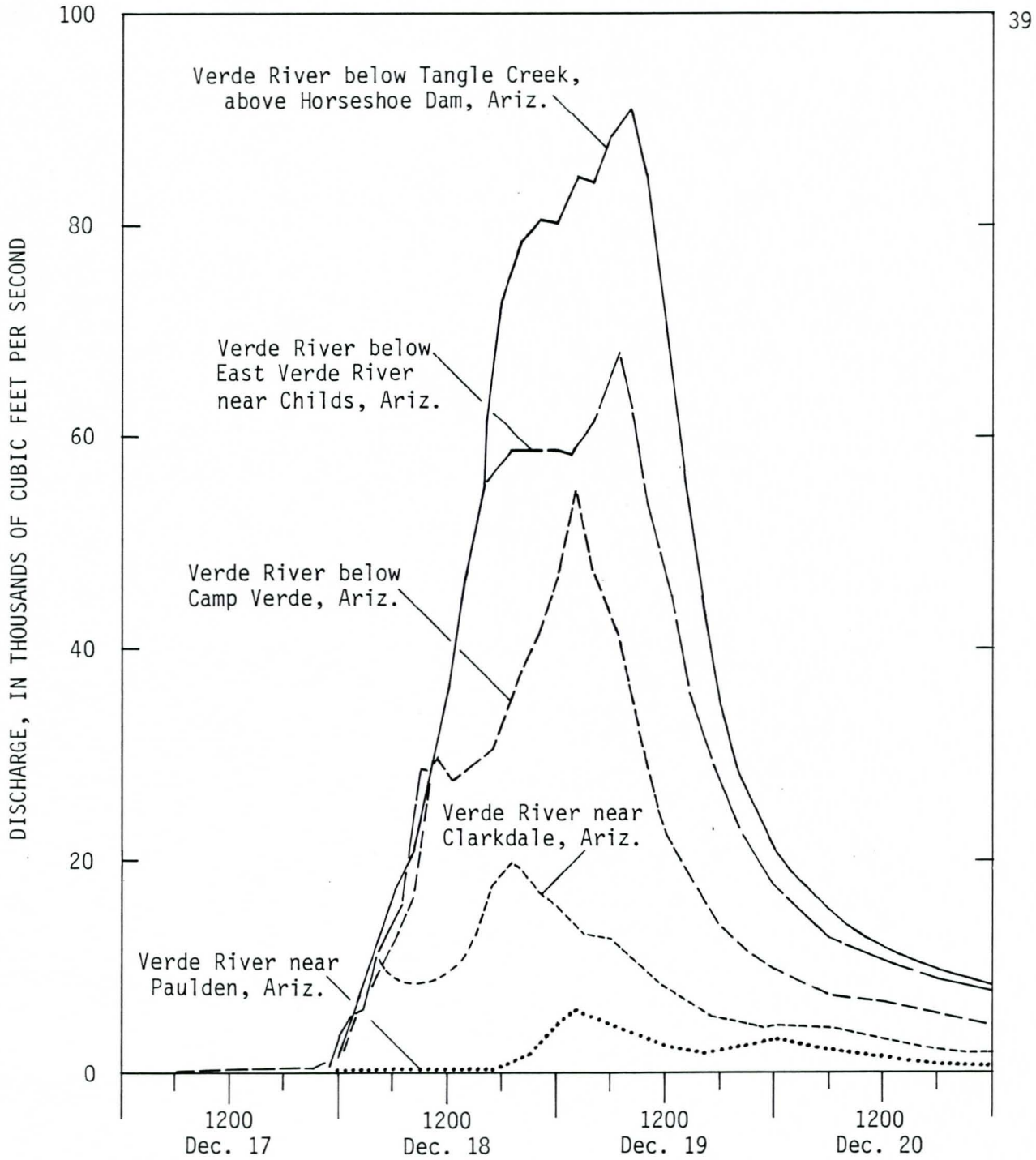


Figure 9.--Discharge at gaging stations on the Verde River upstream from Horseshoe Reservoir, Ariz., December 17-20, 1978.

stage in 1970. Five people drowned in the Agua Fria River when the bridge on Interstate Highway 17 at Black Canyon City was destroyed by floodwaters.

## Downstream from Reservoirs, December 18-23, 1978

Severe flooding occurred December 18-19 along the Salt and Agua Fria Rivers through Phoenix and neighboring cities when water was released from Stewart Mountain Dam on the Salt River, Bartlett Dam on the Verde River, and Waddell Dam on the Agua Fria River at rates of 51,000, 75,800, and 59,900 $ft^3/s$, respectively. Releases from the Salt and Verde River reservoirs and tributary inflow produced a peak discharge of 126,000 $ft^3/s$ on the Salt River at Jointhead Dam in Phoenix, which was about equal to that in March 1978. Peak discharges in March 1978 and December 1978 were the highest since 1920. Higher discharges that have occurred on the Salt River at Jointhead Dam are listed below:

| Date | Discharge, in cubic feet per second |
|---|---|
| February 19, 1891 | 267,000 |
| February 23-24, 1891 | 300,000 |
| November 27, 1905 | >200,000 |
| February 16, 1980 | 170,000 |

Without the storage provided by upstream reservoirs, the peak discharge in December 1978 would have been about 234,000 $ft^3/s$.

Less than 800 $ft^3/s$ was released from either Bartlett Dam or Stewart Mountain Dam until about 0800 hours December 18 (fig. 10). The main release of water began about 1000 hours at Bartlett Dam and 1200 hours at Stewart Mountain Dam. The main release of water reached Jointhead Dam at Phoenix at 1800 hours December 18 and Gillespie Dam at 0200 hours December 20. The crest passed Granite Reef Dam about 1500 hours December 19, Jointhead Dam at 2300 hours, and Gillespie Dam at 1400 hours December 20.

The peak discharge of 59,900 $ft^3/s$ released from Waddell Dam on the Agua Fria River was nearly four times the previous maximum of 16,300 $ft^3/s$ released in March 1978. The peak discharge of December 1978 remained nearly constant as the flow moved downstream to the gaging station at El Mirage where a slope-area measurement indicated a discharge of 58,200 $ft^3/s$. The discharge decreased to 29,300 $ft^3/s$ at the gaging station near Avondale, which is 3 mi upstream from the mouth. Larger floods occurred on the Agua Fria River in 1891, 1916, 1917, 1919, and 1980. The highest discharge on the Agua Fria River at Waddell Dam was about 105,000 $ft^3/s$ in January 1916 and November 1919. The peak discharge at Gila River below Gillespie Dam on December 20, 1978, was 125,000 $ft^3/s$, which at the time was the highest since records began in

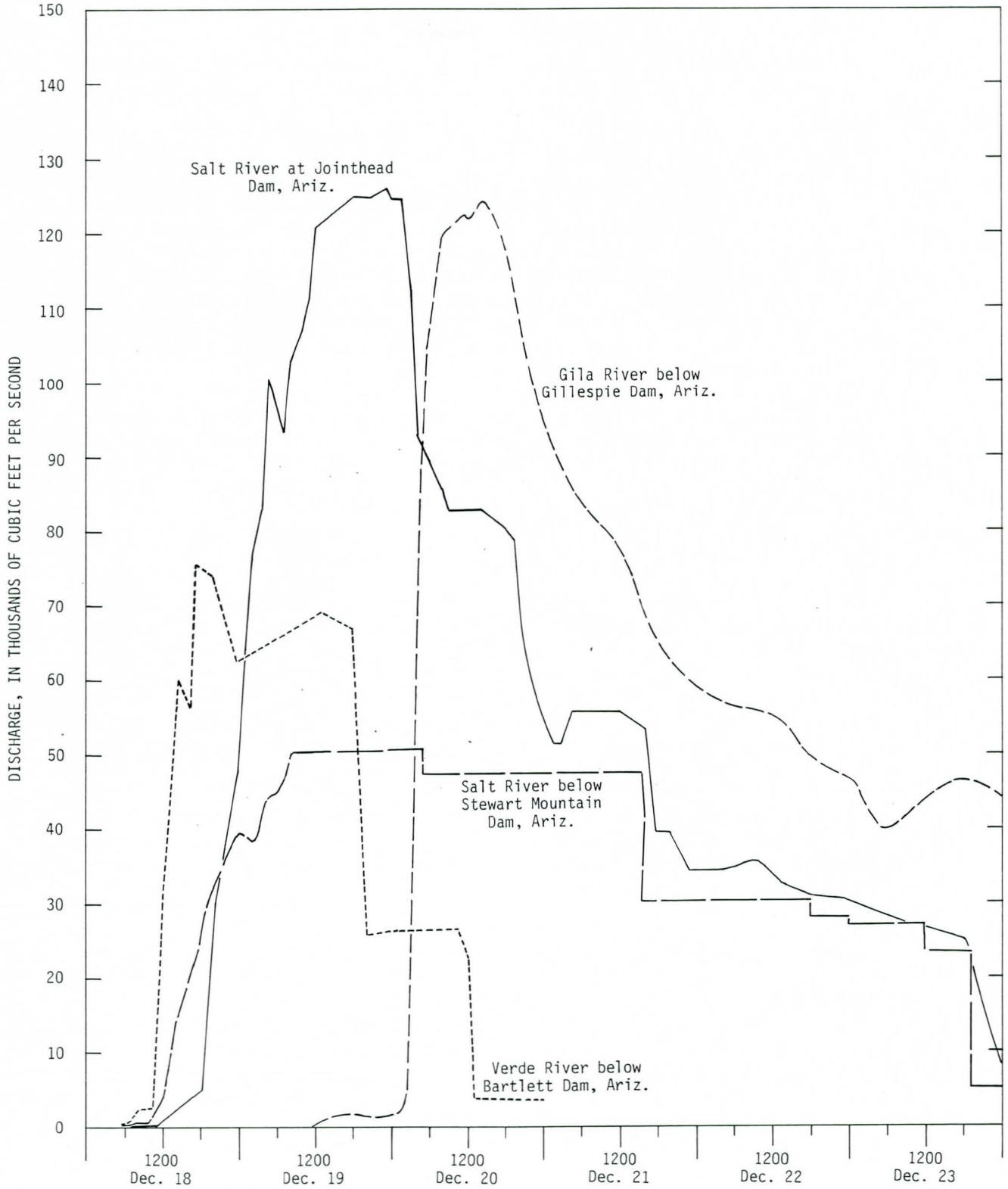


Figure 10.--Regulated discharge of Salt, Verde, and Gila Rivers, December 18-23, 1978.

1921. Larger floods occurred at this site in February 1891, November 1905, January 1916, and February 1980.

During the flood, the Salt River was as much as 6,000 ft wide, and the Gila River downstream from the Salt River was as much as 14,000 ft wide. The two rivers cut all but three of the north-south streets in Phoenix and its suburbs. The bridges that were destroyed had just been rebuilt after the March 1978 flood. The area that was inundated by the December flood was mapped by the U.S. Army Corps of Engineers (1979) and was about the same area inundated by the flood of March 1978. The Salt River destroyed sanitary landfills and sewage-interceptor lines. Several hundred feet of runway at the Phoenix Sky Harbor Airport was washed out, but operations continued at a near-normal rate. Three persons drowned in the Salt River.

The Agua Fria River damaged two small unplatted subdivisions in the rural area northwest of Phoenix and enlarged its channel throughout most of its length. The area inundated by the Agua Fria River was approximately equal to that inundated in 1980 and mapped by Thomsen (1980). Although the discharge was larger in 1980 than in 1978, the inundation was less in some places in 1980 because the channel was enlarged and cleaned by flows in January and March 1979.

Several commercial enterprises along the Salt, Agua Fria, and Gila Rivers including an auto-wrecking yard and tire-recycling plant were damaged. Seventeen sand- and gravel-processing facilities along the Salt River, nine along the Agua Fria, and one along the Gila River were damaged. Downstream from the Salt River, large areas of farmland along the Gila River were inundated, and several dairies and feedlots were damaged. The flood damaged the land that had not been damaged in March 1978 and cut an extensive number of new channels through the farmland. Irrigation ditches, fences, equipment, wells, pumps, and crops were damaged throughout the reach from the Salt River to Painted Rock Dam. The subdivisions of Allenville and Holly Acres, which were being rebuilt after being devastated in March 1978, were devastated again by flow from the Gila River.

## Postflood Reservoir Storage and Releases and Streamflow Depletion

A few thousand cubic feet per second were released from both Stewart Mountain Dam on the Salt River and Bartlett Dam on the Verde River through December 29, when the releases were reduced to a few hundred cubic feet per second for each dam. On December 29, the unfilled storage was about 200,000 and 39,000 acre-ft in the Salt and Verde River reservoir systems, respectively. Between December 29, 1978, and January 16, 1979, daily mean discharges of as much as 5,780 and 2,920 $ft^3/s$ were released from Stewart Mountain and Bartlett Dams, respectively. Storage in the reservoirs was held nearly constant during the first half of January. The maximum variation in contents of either system during that time was about 10,000 acre-ft.

Floodflows from Tonto Creek and a localized area upstream from Roosevelt Lake on January 16-17, 1979, rapidly increased the storage in the reservoir system on the Salt River. The unfilled storage capacity of 200,000 acre-ft that had been established before January 16 was insufficient to contain the 380,000 acre-ft of inflow that occurred on January 17, 1979, and water was again released to the Salt River. The peak discharge of 65,000 $ft^3/s$ of Salt River below Stewart Mountain Dam was the maximum since the dam was constructed in 1930. The peak discharge on January 17 may have been exceeded in 1916 when a daily mean discharge of 50,000 $ft^3/s$ was released from Roosevelt Dam. The release from Bartlett Dam during the peak of January 1979 was 26,400 $ft^3/s$. The peak of Salt River at Jointhead Dam in Phoenix was 85,100 $ft^3/s$. The January flood on the Salt River washed out temporary repairs that had been made after the flood of December 1978 and caused a pier of the Interstate 10 bridge to settle. The bridge was one of three bridges that remained in use after the December flood.

Preflood storage levels were re-established within a few days after the January flood. Reservoirs were drawn down during late January and early February by continuous release of a few thousand cubic feet per second. Gradual filling occurred during late February and most of March as the flood potential decreased and reservoirs reached a nearly full condition—1,708,000 acre-ft in the Salt River system and 302,000 acre-ft in the Verde River system—just before the March 28 storm. The unfilled capacities were 47,000 acre-ft in the Salt River system and 7,000 acre-ft in the Verde River system. Peak discharges of March 28 on the Salt River and Tonto Creek combined to cause a peak inflow to Roosevelt Lake of about 55,000 $ft^3/s$. The maximum release from Stewart Mountain Dam of 48,600 $ft^3/s$ in combination with the release from Bartlett Dam produced a peak of 67,400 $ft^3/s$ in Phoenix.

Following the March storm, the Salt River and Verde River reservoirs were again drawn down for a period of 1 week on the Verde River system and slightly more than 2 weeks on the Salt River system, after which the reservoirs were allowed to fill. The Verde River system reached its maximum storage level on April 15, and the Salt River system reached a maximum level on May 30. Water flowed over Granite Reef Dam on most days from December 18, 1978, through June 1979. Reservoir storage dropped gradually during the remainder of the water-use season.

Lake Pleasant above Waddell Dam on the Agua Fria River filled during the December flood and remained essentially full through March 1979. The maximum unfilled capacity from December 18, 1978, through April 30, 1979, was 6,000 acre-ft. Lake Pleasant was full when the floods of January 17 and March 28 occurred. These floods passed through the reservoir without being reduced. Although water spilled over the diversion dam below Waddell Dam almost continuously from December 18, 1978, through April 30, 1979, water reached the mouth of the Agua Fria River only on December 18-22, January 16-21, and March 29-31. A peak of 24,600 $ft^3/s$ reached the mouth of the Agua Fria River on January 17, 1979.

The volume of water released from Stewart Mountain and Bartlett Dams from December 1978 through June 1979 was 3,108,700 acre-ft. About 672,000 acre-ft was diverted upstream from Granite Reef Dam, and more than 2.4 million acre-ft was wasted to the Salt River below Granite Reef Dam. Gaged inflow from other sources between Granite Reef and Gillespie Dams was 424,900 acre-ft (table 6), and the unmeasured inflow may have been on the order of several tens of thousands of acre-feet. The volume of water reaching Gillespie Dam was 2,764,100 acre-ft.

The flood runoff was stored in Painted Rock Reservoir for controlled release, which began on December 22, 1978. Water reached the Gila River near Mohawk gaging station on January 2, 1979, and reached the mouth of the Gila River on January 18, 1979. Storage in Painted Rock Reservoir increased more than 1 million acre-ft in December 1978 and January 1979 and reached a maximum of about 1.85 million acre-ft in April 1979. Outflow from the reservoir began to exceed inflow in May 1979, and the reservoir was gradually drawn down until January 28, 1980. The

Table 6.--Measured inflow and outflow to the reach from Stewart Mountain Dam on the Salt River to Gillespie Dam on the Gila River, December 1978 to June 1979

| Station number | Station name | Measured inflow and outflow, in acre-feet |
|---|---|---|
| | INFLOW | |
| 09479500 | Gila River near Laveen..... | 134,800 |
| 09489000 | Santa Cruz River near Laveen..... | 45,700 |
| 09502000 | Salt River below Stewart Mountain Dam... | 2,139,000 |
| 09510000 | Verde River below Bartlett Dam..... | 969,700 |
| 09510200 | Sycamore Creek near Fort McDowell..... | 78,400 |
| 09513970 | Agua Fria River at Avondale..... | 72,400 |
| 09517000 | Hassayampa River near Arlington..... | 6,400 |
| 09517500 | Centennial Wash near Arlington..... | 400 |
| -------- | City of Phoenix sewage effuent..... | 86,800 |
| | Total ..... | 3,533,600 |
| | OUTFLOW | |
| --------- | City of Phoenix diversions..... | 19,400 |
| --------- | Canals at Granite Reef Dam..... | 653,000 |
| --------- | Buckeye Irrigation Canal..... | 39,300 |
| --------- | Canals at Gillespie Dam..... | 32,700 |
| 09519500 | Gila River below Gillespie Dam..... | 2,731,400 |
| | Total ..... | 3,475,800 |

maximum release rate from Painted Rock Dam was 3,340 $ft^3/s$. The volume of water released from Painted Rock Dam from November 1978 to January 1980 was 2,226,500 acre-ft; about 774,600 acre-ft or nearly 35 percent was lost to evaporation and infiltration. The volumes of streamflow for Gila River below Painted Rock Dam to the mouth of the Gila River are shown in table 7.

## MONETARY DAMAGE

A complete tabulation of damage caused by the floods of November 1978 through March 1979 has not been compiled. Detailed damage analyses for the flood of December 1978 were prepared only for parts of the flood-affected area. Damage from the floods of November 1978 and January and March 1979 has not been identified separately.

Emergency expenditures and loans made as a result of the flood of December 1978 in Arizona were tabulated by the Arizona Emergency Services (written commun., 1980) and the U.S. Army Corps of Engineers (1979). The two tabulations show totals of $134 million and $132 million, respectively, but differ drastically in categories used and in dollar values assigned to common categories. Some duplication is possible, and damage was not assessed in some areas. The true amount of damage will never be known but is probably between $150 million and $200 million.

Table 7.--Streamflow at gaging stations and inflow, diversions, and losses between gaging stations, in acre-feet, Painted Rock Dam to mouth of Gila River, November 1978 to January 1980

[Volume, in acre-feet]

| Station number | Station name | Streamflow | Inflow | Diversion | Loss |
|---|---|---|---|---|---|
| 09519800 | Gila River below Painted Rock Dam..... | 2,226,500 | ------- | ------- | ------- |
| 09520360 | Gila River near Mohawk..... | 1,795,300 | ------- | ------- | 431,200 |
| 09520500 | Gila River near Dome..... | 1,579,000 | ------- | [1]77,600 | 138,700 |
| 09520700 | Gila River near mouth..... | 1,436,300 | [2]62,000 | ------- | 204,700 |
| | Total loss..... | | | | 774,600 |

[1]At Norton Siphon 1 mi downstream from station 09520360.

[2]Return flow from Colorado River diversions.

The U.S. Army Corps of Engineers (1979, 1980) tabulated damage caused by the December flood in Maricopa County and selected outlying areas that include Winslow on Little Colorado River, Williams on Cataract Creek, the Gila River basin above San Carlos Reservoir, and along the Gila River near Gila Bend, Ariz., (table 8). The tabulations show $51.8 million in damage in Maricopa County of which $20.5 million or 40 percent was damage to roads and bridges or traffic delay because of the damage.

The outlying areas assessed by the U.S. Army Corps of Engineers (1979, 1980) sustained $39.8 million in damage. Sixty-three percent, or $25.2 million, was to agricultural lands, crops, and equipment. The authors were able to obtain information on damage in a few other localities. The U.S. Soil Conservation Service (written commun., 1980) estimated $2.8 million damage along the Santa Cruz River and its distributaries downstream from the community of Redrock, Ariz. Damage in the Wellton-Mohawk Irrigation and Drainage District was estimated at $3.4 million (Arizona Water Commission, 1980). The damage primarily involved losses to crops, farmland and improvements, bridge repairs, and increased transportation costs. An expense of $505,000 was incurred by the Yuma County Highway Department for maintenance of Gila River crossings from July 1979 to February 1980 (Mr. Fortney, Yuma County Highway Department, oral commun., 1980). About $250,000 was spent by the U.S. Bureau of Reclamation for riprap along the Gila River from Dome to its confluence with the Colorado River (Harold Pritchart, U.S. Bureau of Reclamation, oral commun., 1980). Large areas where damage has not been assessed include the San Pedro River basin, the Gila River between Winkelman and the Salt River, Santa Cruz River basin upstream from Redrock, and all the mountain drainages in the Little Colorado and Gila River basins in Arizona.

## EFFECTS OF THE FLOODS ON GROUND-WATER LEVELS

In some areas the rise in ground-water level that accompanied the flood was a benefit. In the Wellton-Mohawk and South Gila Valleys, however, rises in water levels damaged irrigation projects along the Gila River. More than 2,600 acres of cropland were taken out of production because of waterlogging. In those areas where waterlogging occurred, water was pumped to keep water levels low enough for growing crops.

For purposes of publishing ground-water data, the U.S. Geological Survey divided Arizona into separate ground-water areas (U.S. Geological Survey, 1980b). Selected wells in each area are measured annually. In wells along major flood plains where flooding occurred, the ground-water level rose substantially between 1978 and 1980 (table 9). Table 9 shows net rises between annual measurements and does not account for intervening declines. The measurements in 1978 were made before the flood of March 1978; measurements in 1979 were made after the flood of December 1978 but before the end of the high-water period in March 1979. Only annual measurements made by the U.S. Geological Survey are shown

Table 8.--Summary of property damage and other costs associated with the flood of December 1978 in Maricopa County, Ariz., and selected outlying areas

[Data from U.S. Army Corps of Engineers, 1979, 1980]

| Type of property | Property damage | Income losses | Emergency costs | Total |
|---|---|---|---|---|
| Maricopa County[1] | | | | |
| Agricultural..... | $3,829,000 | $1,808,000 | $56,000 | $5,693,000 |
| Commercial..... | 1,396,000 | 703,000 | 26,000 | 2,125,000 |
| Industrial: | | | | |
| Sand and gravel.... | 3,098,000 | 1,930,000 | 215,000 | 5,243,000 |
| Other..... | 797,000 | 359,000 | 10,000 | 1,166,000 |
| Public: | | | | |
| Roads and bridges.. | 8,009,000 | 12,016,000 | 485,000 | 20,510,000 |
| Other..... | 12,519,000 | 1,056,000 | 847,000 | 14,422,000 |
| Residential..... | 2,486,000 | 81,000 | 30,000 | 2,597,000 |
| Total..... | $32,134,000 | $17,953,000 | $1,669,000 | $51,756,000 |
| Outlying areas in Arizona and west-central New Mexico[2] | | | | |
| Agricultural..... | $24,750,000 | $447,000 | -------- | $25,197,000 |
| Commercial..... | 2,037,000 | 137,000 | $1,000 | 2,175,000 |
| Industrial..... | 10,000 | -------- | -------- | 10,000 |
| Public: | | | | |
| Roads and bridges.. | 6,737,000 | -------- | 387,000 | 7,124,000 |
| Other..... | 2,636,000 | 25,000 | 95,000 | 2,756,000 |
| Residential..... | 2,584,000 | -------- | 4,000 | 2,588,000 |
| Total..... | $38,754,000 | $609,000 | $487,000 | $39,850,000 |

[1]Damage in Maricopa County downstream from reservoirs on Salt, Verde, and Agua Fria Rivers.

[2]Damage in Gila River basin above San Carlos Reservoir in eastern Arizona and west-central New Mexico; Winslow and Williams in northern Arizona; and Gila Bend in southwestern Arizona.

in table 9. In some irrigation districts, water levels were measured in many additional wells. Water levels rose an average of 22 ft between January 1978 and April 1979 in 183 wells near Phoenix. Much of the rise was due to the below-average pumping during periods of surplus surface water. Only part of the rise was due to recharge. Records from water-level recorders in wells along the Salt River showed rises of as much as 80 ft from December 1978 to June 1979 (fig. 11). Ground-water levels rose 6 ft under about 200 acres downstream from Dome and 2 ft or more under about 4,000 acres in valleys near the mouth of the Gila River.

## STREAMFLOW DATA AT GAGING STATIONS AND MISCELLANEOUS MEASURING SITES

### Explanation of Data

The detailed flood information given in this report for gaging stations and miscellaneous sites is in addition to that published in the regular annual reports of the Geological Survey. The sites are numbered consecutively in downstream order, and the numbers identify the locations in plate 1. The permanent station numbers for the gaging stations correspond to those used and explained in the annual report "Water Resources Data for Arizona" (U.S. Geological Survey, 1980a). Records of stage and discharge at gaging stations, contents of reservoirs and reservoir systems, and peak discharges at miscellaneous sites are given.

### Summary of Flood Stages and Discharges

Maximum stages and discharges at continuous-recording stations, crest-stage stations, and miscellaneous sites are summarized in table 10. The first column under "maximum previously known" shows the period of known floods prior to November 1978. The period does not necessarily correspond to that in which continuous records of discharge were obtained; where available, records of historical floods are included, and overlapping time periods may be shown. The next three columns give data for the maximum known discharge and gage height. Separate listings are given for stations where the maximum discharge and gage height did not occur concurrently. Separate listings also are given for periods that have different degrees of regulation. The last four columns present data for the maximum discharge, November 1978 to March 1979.

Table 9.--Rises in ground-water levels in the Gila River basin in Arizona, 1978-80

[Includes only annual measurements by U.S. Geological Survey]

| Ground-water area | Number of wells | | Maximum rise, in feet | |
|---|---|---|---|---|
| | Measured | In which water level rose | 1978-79 | 1979-80 |
| Duncan basin..... | 6 | 4 | 1.6 | ---- |
| Safford basin..... | 24 | 22 | [1]27.4 | ---- |
| San Carlos Reservoir to Kelvin..... | 3 | 2 | 3.6 | ---- |
| Upper San Pedro River basin..... | 23 | 10 | 4.3 | ---- |
| Lower San Pedro River basin..... | 24 | 21 | 81.5 | ---- |
| Upper Santa Cruz River basin..... | 37 | 19 | 27.5 | ---- |
| Lower Santa Cruz River basin[2]..... | 76 | 44 | 72.7 | ---- |
| Upper Verde River..... | 6 | 5 | 10.6 | ---- |
| Agua Fria basin..... | 2 | 1 | 5.2 | ---- |
| Salt River Valley: | | | | |
| Tempe..... | 13 | 7 | 56.6 | ---- |
| | 13 | 8 | ---- | 38.9 |
| Buckeye..... | 7 | 5 | 19.5 | ---- |
| | 7 | 6 | ---- | 16.6 |
| Queen Creek..... | 19 | 11 | 48.4 | ---- |
| | 23 | 17 | ---- | 62.2 |
| Phoenix..... | 18 | 17 | 36.6 | ---- |
| | 12 | 6 | ---- | 12.0 |
| Beardsley..... | 11 | 8 | 21.9 | ---- |
| | 10 | 5 | ---- | 9.5 |
| Gila Bend basin[3]..... | 14 | 9 | 28.7 | ---- |
| | 12 | 12 | ---- | 32.0 |
| Gila River Drainage: | | | | |
| Painted Rock to Texas Hill..... | 5 | 2 | 7.4 | ---- |
| | 4 | 4 | ---- | 15.3 |
| Texas Hill to Dome..... | 5 | 3 | .9 | ---- |
| | 5 | 5 | ---- | 9.7 |

[1]Anomalous rise; most rises less than 12 feet.

[2]Includes Gila River below Kelvin excluding Queen Creek.

[3]Rises of 1978-79 include effect of March 1978 flood. Measurements of 1980 made prior to February 1980 flood.

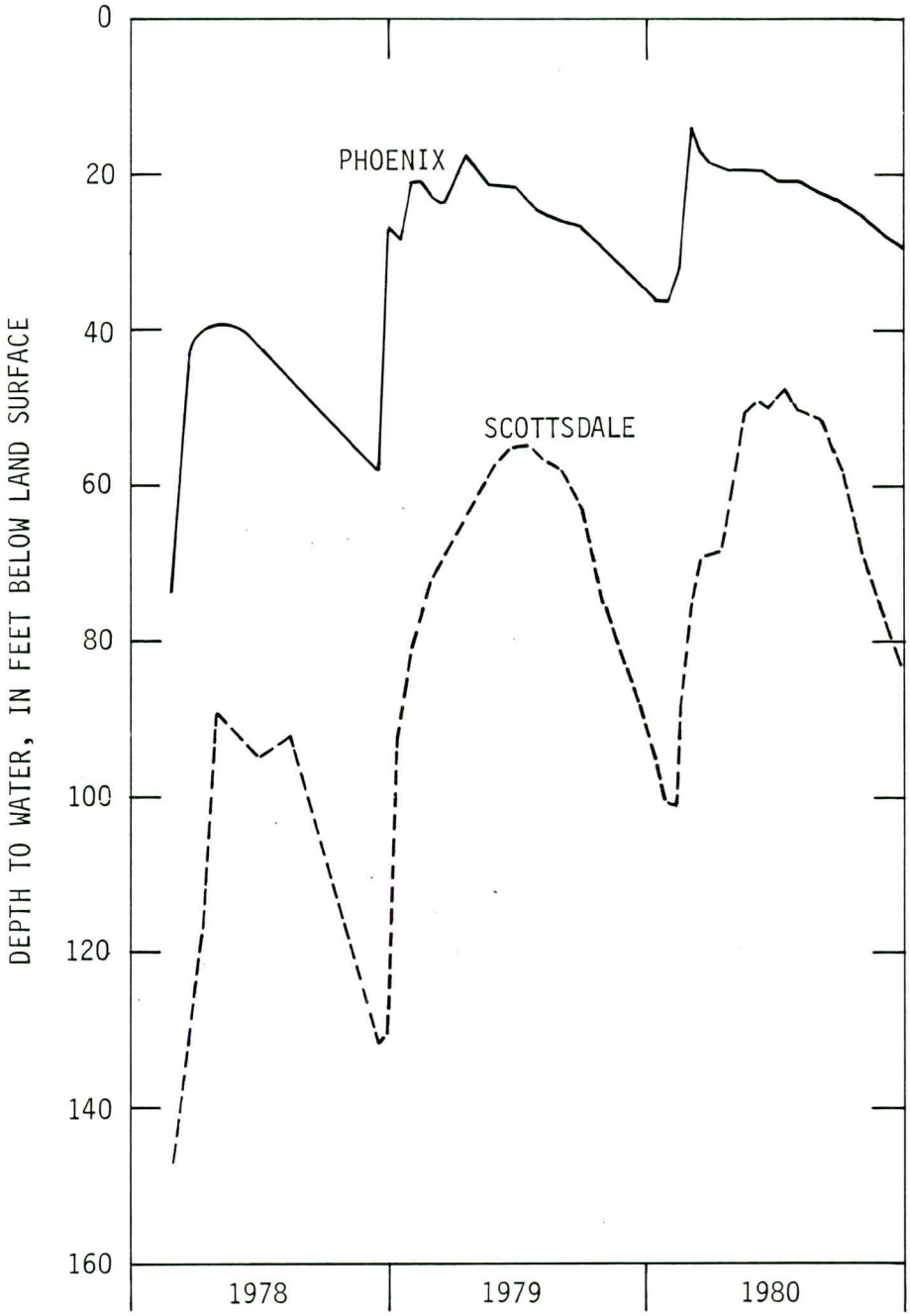


Figure 11.--Depth to water recorded in wells near the Salt River at Phoenix and Scottsdale, Ariz., 1978-80.

Table 10.--Summary of flood stages and discharges

| Location number shown on plate 1 | Station number | Stream and place of determination | Drainage area ($mi^2$) | Maximum previously known | | | | Maximum November 1978 to March 1979 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Period | Year | Gage height (ft) | Discharge ($ft^3/s$) | Date | Gage height (ft) | Discharge ($ft^3/s$) | Recurrence interval (years) |
| 1 | 09390500 | Show Low Creek near Lakeside, Ariz. | 68.6 | 1953-78 | 1971 | 9.53 | 5,450 | 12-18-78 | 9.16 | 5,550 | 18 |
| 2 | 09392000 | Show Low Creek below Jaques Dam, near Show Low, Ariz. | 73.0 | [1]1941-53 | 1952 | [2]9.9 | 6,250 | 12-18-78 | -------- | [3]4,410 | 20 |
| | | | | [4]1953-78 | 1971 | -------- | 2,500 | | | | |
| 3 | 09393500 | Silver Creek near Snowflake, Ariz. | 886 | 1929-78 | 1940 | [2]12.37 | 11,000 | 12-19-78 | 15.33 | 7,700 | 8 |
| 4 | 09394500 | Little Colorado River at Woodruff, Ariz. | [5]8,100 | 1916-19 | 1916 | [2]12.7 | ([6]) | 12-19-78 | 22.9 | 9,320 | 9 |
| | | | | [7]1929-78 | 1940 | [2]13.45 | 13,000 | | | | |
| 5 | 09396100 | Puerco River near Chambers, Ariz. | 2,160 | 1971-78 | 1971 | 9.65 | 17,800 | 12-18-78 | [3]7.99 | [3]13,800 | 4 |
| 6 | 09397000 | Little Colorado River at Holbrook, Ariz. | [5]11,300 | 1870-1978 | 1923 | -------- | 60,000 | 12-19-78 | 12.40 | ([8]) | ------- |
| 7 | 09397300 | Little Colorado River near Joseph City, Ariz. | [5]12,200 | 1971-78 | 1974 | 6.90 | 20,600 | 12-19-78 | 7.64 | 25,400 | 14 |
| 8 | 09397500 | Chevelon Creek below Wildcat Canyon, near Winslow, Ariz. | 275 | 1929-78 | 1952 | 18.2 | 19,800 | 12-18-78 | 18.25 | [9]19,900 | 20 |
| 9 | 09398000 | Chevelon Creek near Winslow, Ariz. | 794 | 1915-19 | 1952 | 19.8 | 25,300 | 12-19-78 | 24.46 | [9]33,600 | 70 |
| | | | | 1929-78 | | | | | | | |
| 10 | 09398500 | Clear Creek below Willow Creek, near Winslow, Ariz. | 321 | 1947-78 | 1952 | 21.5 | 16,400 | 12-18-78 | 22.32 | [9]19,700 | 18 |
| 11 | 09399000 | Clear Creek near Winslow, Ariz. | 607 | 1929-78 | 1929 | 18.1 | 50,000 | 12-19-78 | 16.67 | [9]36,300 | 55 |
| 12 | 09399400 | Jacks Canyon Creek near Winslow, Ariz. | 280 | 1970-75 | 1972 | 13.50 | 2,600 | 12-18-78 | 16.98 | 4,600 | ------- |
| 13 | 09400000 | Little Colorado River near Winslow, Ariz. | [5]16,600 | 1978 | ---- | -------- | ---------- | 12-20-78 | -------- | 57,600 | 90 |
| 14 | 09402000 | Little Colorado River near Cameron, Ariz. | [5]26,500 | 1870-1978 | 1923 | -------- | 120,000 | 12-23-78 | 17.36 | 17,800 | 25 |
| 15 | 09430500 | Gila River near Gila, N. Mex. | 1,864 | 1927-78 | 1941 | 17.2 | 25,400 | 12-18-78 | 12.5 | 32,400 | >100 |
| 16 | 09430600 | Mogollon Creek near Cliff, N. Mex. | 69.0 | 1967-78 | 1967 | 13.7 | 10,800 | 12-18-78 | 12.4 | 10,100 | 16 |
| 17 | 09430900 | Duck Creek at Cliff, N. Mex. | 228 | 1957-78 | 1967 | 11.09 | 6,900 | 12-18-78 | 9.36 | 5,800 | 6 |
| 18 | 09431500 | Gila River near Redrock, N. Mex. | 2,829 | 1912-78 | 1941 | 31 | 40,000 | 12-19-78 | 34.1 | 48,800 | >100 |
| 19 | 09432000 | Gila River below Blue Creek, near Virden, N. Mex. | 3,203 | 1892-1978 | 1941 | 25.78 | 41,700 | 12-19-78 | 29.0 | 58,700 | >100 |
| 20 | 09437200 | Mexican Canyon at Virden, N. Mex. | 3.40 | 1968-78 | ---- | -------- | ---------- | --------- | -------- | ([10]) | ------- |
| 21 | 09442000 | Gila River near Clifton, Ariz. | 4,010 | 1892-78 | 1972 | 18.7 | 33,000 | 12-19-78 | 23.80 | 57,000 | >100 |
| 22 | 09442630 | Mail Hollow near Luna, N. Mex. | 4.20 | 1970-78 | 1972 | 3.90 | ([11]) | 11-24-78 | 3.05 | 66 | 3 |
| 23 | 09442660 | Trout Creek at Luna, N. Mex. | 31.9 | 1954-78 | 1972 | 4.47 | 2,250 | 11-24-78 | 3.07 | 720 | 10 |
| 24 | 09442680 | San Francisco River near Reserve, N. Mex. | 350 | 1959-78 | 1972 | [2]7.47 | 11,900 | 11-25-78 | 9.40 | 11,800 | >100 |
| 25 | 09442695 | Negro Canyon at Aragon, N. Mex. | 9.62 | 1958-78 | 1959 | 11.60 | 5,200 | 11-24-78 | 1.48 | 230 | 3 |
| 26 | 09442740 | Tularosa River near Reserve, N. Mex. | 426 | 1956-78 | 1956 | -------- | 2,280 | 11-24-78 | 6.22 | 850 | 7 |
| 27 | 09443000 | San Francisco River near Alma, N. Mex. | 1,546 | 1904-14 | 1972 | 18.16 | 30,600 | 12-18-78 | 15.84 | 24,500 | 16 |
| | | | | 1927-78 | | | | | | | |
| 28 | 09444000 | San Francisco River near Glenwood, N. Mex. | 1,653 | 1927-78 | 1972 | 16.61 | 24,000 | 12-18-78 | 15.60 | 20,500 | 24 |
| 29 | 09444100 | Campbell Blue Creek near Alpine, Ariz.[12] | 11.6 | 1958-78 | 1972 | 5.50 | 341 | 12-18-78 | 4.92 | 255 | 10 |
| 30 | 09444200 | Blue River near Clifton, Ariz. | 506 | 1870-1978 | 1972 | 22.56 | 30,000 | 11-24-78 | 17.1 | 14,700 | 12 |
| 31 | 09444400 | Chase Creek near Clifton, Ariz. | 1.37 | 1963-78 | 1964 | 13.9 | 600 | ([13]) | 7.59 | 72 | 4 |
| 32 | 09444500 | San Francisco River at Clifton, Ariz. | 2,766 | 1870-1978 | 1906 | -------- | [3]70,000 | 12-19-78 | 16.0 | 56,000 | 33 |
| 33 | 09447000 | Eagle Creek above pumping plant, near Morenci, Ariz. | 613 | 1932-78 | 1965 | 12.8 | 21,000 | 12-18-78 | 12.5 | 24,500 | 50 |
| 34 | 09448500 | Gila River at head of Safford Valley, near Solomon, Ariz. | 7,896 | 1906-78 | 1916 | [2]15.89 | 100,000 | 12-19-78 | 14.40 | 100,000 | 90 |
| 35 | 09457000 | San Simon River near Solomon, Ariz. | 2,192 | 1880-1978 | 1931 | 19.0 | 27,500 | 1-17-79 | 7.20 | 727 | 1 |
| 36 | 09458050 | Marijilda Wash near Safford, Ariz. | 10.9 | 1971-78 | 1977 | 5.10 | 883 | 12-18-78 | 6.8 | 5,770 | ------- |
| 37 | 09458200 | Deadman Creek near Safford, Ariz. | 4.78 | 1966-76 | 1972 | 3.45 | 119 | 12-18-78 | -------- | 2,760 | ------- |
| 38 | 09466500 | Gila River at Calva, Ariz. | 11,470 | 1906-78 | 1916 | -------- | 100,000 | 12-19-78 | 15.20 | 100,000 | 90 |
| 39 | 09467120 | Salt Creek near Peridot, Ariz. | 35.2 | 1964-78 | 1972 | 19.56 | 3,200 | 12-18-78 | 18.17 | 2,200 | 7 |
| 40 | 09468300 | Sevenmile Wash Tributary near Globe, Ariz. | .83 | 1933-78 | ---- | -------- | 526 | 12-18-78 | 9.47 | 640 | 25 |
| 41 | 09468500 | San Carlos River near Peridot, Ariz. | 1,027 | 1929-78 | 1941 | 11.4 | 40,600 | 11-25-78 | 13.07 | ---------- | ------- |
| | | | | | | | | 12-18-78 | -------- | 22,500 | 11 |
| 42 | 09469000 | San Carlos Reservoir at Coolidge Dam, Ariz. | 12,886 | 1928-78 | 1973 | 2,704.67 | [14]843,300 | 3-31-79 | 2,717.16 | [14]1,030,000 | ------- |
| 43 | 09469500 | Gila River below Coolidge Dam, Ariz. | 12,886 | 1914-28 | 1916 | -------- | 130,000 | 3-29-79 | 4.84 | 1,460 | ------- |
| | | | | [4]1928-78 | 1952 | 4.64 | 1,350 | | | | |
| 44 | 09470000 | Gila River at Winkelman, Ariz. | [15]13,268 | 1932-78 | 1944 | 18.4 | 55,000 | 12-18-78 | 14.30 | 9,520 | 5 |
| 45 | 09472000 | San Pedro River near Redington, Ariz. | 2,939 | 1906-78 | 1926 | 29.0 | 90,000 | 1-18-79 | 15.21 | 10,800 | 3 |

See footnotes at end of table.

Table 10.--Summary of flood stages and discharges—Continued

| Location number shown on plate 1 | Station number | Stream and place of determination | Drainage area (mi²) | Maximum previously known | | | | Maximum November 1978 to March 1979 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Period | Year | Gage height (ft) | Discharge (ft³/s) | Date | Gage height (ft) | Discharge (ft³/s) | Recurrence interval (years) |
| 46 | 09472100 | Peck Canyon Tributary near Redington, Ariz. | 8.02 | 1967-78 | 1972 | 9.25 | 4,340 | 12-19-78 | 7.07 | 46 | 1 |
| 47 | 09473000 | Aravaipa Creek near Mammoth, Ariz. | 541 | 1931-78 | 1967 | 14.25 | 15,300 | 12-18-78 | 14.4 | 16,200 | 25 |
| 48 | 09473500 | San Pedro River at Winkelman, Ariz. | 4,471 | 1906-78 | 1926 | -------- | [16]85,000 | 12-18-78 | 14.41 | 18,000 | 8 |
| 49 | 09473600 | Tam O'Shanter Wash near Hayden, Ariz. | 4.37 | 1963-78 | 1974 | 14.28 | 1,570 | 12-18-78 | 8.07 | 230 | 1 |
| 50 | 09474000 | Gila River at Kelvin, Ariz. | [15]18,011 | 1911-28 | 1916 | 19.5 | 132,000 | 12-19-78 | 25.30 | 27,000 | 8 |
| | | | | [4]1928-78 | 1930 | 12.6 | 42,800 | | | | |
| 51 | 09478600 | Queen Creek Tributary 3 at Whitlow Dam, Ariz. | 0.37 | 1966-78 | 1966 | 7.55 | 280 | 12-18-78 | 3.70 | 50 | 1 |
| 52 | 09479500 | Gila River near Laveen, Ariz. | [15]20,615 | 1940-78 | 1941 | -------- | 11,900 | 12-21-78 | 10.20 | 9,720 | 25 |
| | | | | | 1965 | 10.08 | ---------- | | | | |
| 53 | 09482000 | Santa Cruz River at Continental, Ariz. | 1,662 | 1936-78 | 1977 | 16.7 | 26,500 | 12-18-78 | 10.0 | 16,000 | 20 |
| 54 | 09482500 | Santa Cruz River at Tucson, Ariz. | 2,222 | 1892-78 | 1977 | 21.8 | 23,700 | 12-19-78 | 14.1 | 13,500 | 16 |
| 55 | 09483000 | Tucson Arroyo at Vine Avenue, Tucsón, Ariz. | 8.2 | 1940-78 | 1961 | 10.35 | 5,000 | 12-18-78 | 5.35 | 334 | 1 |
| 56 | 09483100 | Tanque Verde Creek near Tucson, Ariz. | 43.0 | 1959-78 | 1967 | 5.14 | 3,080 | 12-18-78 | 5.71 | 4,100 | 12 |
| 57 | -------- | Agua Caliente Wash near Tucson, Ariz. | 39.0 | 1978 | ---- | -------- | ---------- | 12-18-78 | -------- | 3,440 | 10 |
| 58 | 09484000 | Sabino Creek near Tucson, Ariz. | 35.5 | 1932-78 | 1970 | 10.21 | 7,730 | 12-18-78 | 11.76 | 7,400 | 37 |
| 59 | 09484200 | Bear Creek near Tucson, Ariz. | 16.3 | 1959-78 | 1965 | 4.90 | 1,150 | 12-18-78 | 5.40 | 1,400 | 11 |
| 60 | 09484500 | Tanque Verde Creek at Tucson, Ariz. | 219 | 1940-45, 1966-78 | 1965 | 7.89 | 12,200 | 12-18-78 | 7.33 | 12,700 | 75 |
| 61 | 09484510 | Ventana Canyon Wash near Tucson, Ariz. | 6.46 | 1965-78 | 1965 | 11.34 | 260 | 12-18-78 | 14.55 | 234 | 6 |
| 62 | 09485450 | Pantano Wash (at Broadway Blvd.) at Tucson, Ariz. | 599 | [17]1930-78 | 1958 | [2]7.50 | 20,000 | 12-18-78 | -------- | 1,530 | 2 |
| 63 | 09486000 | Rillito Creek near Tucson, Ariz. | 918 | 1907-78 | 1929 | 24.0 | 24,000 | 12-18-78 | -------- | 16,400 | 22 |
| 64 | 09486300 | Canada del Oro near Tucson, Ariz. | 250 | [17]1950-78 | 1959 | -------- | 17,000 | 11-25-78 | 3.90 | 1,380 | 1 |
| 65 | 09486500 | Santa Cruz River at Cortaro, Ariz. | 3,503 | 1936-78 | 1977 | 15.6 | 23,000 | 12-18-78 | 14.42 | 18,800 | 20 |
| 66 | 09489000 | Santa Cruz River near Laveen, Ariz. | 8,581 | 1940-78 | 1962 | 17.50 | 9,200 | 12-22-78 | 16.11 | 4,120 | 10 |
| 67 | 09489075 | East Fork Black River near Alpine, Ariz. | 111 | 1968-78 | 1972 | [2]8.04 | 3,720 | 12-18-78 | 4.98 | 2,270 | ------- |
| 68 | 09489076 | Burro Mountain Weir near Springerville, Ariz. | 1.14 | 1960-78 | 1972 | 1.78 | 18 | 12-18-78 | 1.23 | 7.4 | 6 |
| 69 | 09489078 | West Fork Black River near Alpine, Ariz. | 54.1 | 1968-78 | 1972 | 5.90 | 2,050 | 12-18-78 | 4.58 | 1,150 | ------- |
| 70 | 09489086 | Beaver Creek near Alpine, Ariz. | 59.1 | 1968-78 | 1972 | -------- | 2,490 | 12-18-78 | 5.36 | 1,750 | ------- |
| 71 | 09489089 | Heifer Branch near Alpine, Ariz. | 3.8 | 1967-78 | 1972 | -------- | 158 | 12-18-78 | 6.75 | 67.5 | ------- |
| 72 | 09489100 | Black River near Maverick, Ariz. | 315 | 1962-78 | 1972 | 8.99 | 11,100 | 12-18-78 | 8.74 | 10,300 | 50 |
| 73 | 09489200 | Pacheta Creek at Maverick, Ariz. | 14.8 | 1957-78 | 1973 | 4.36 | 323 | 12-18-78 | 4.23 | 224 | 9 |
| 74 | 09489500 | Black River below pumping plant, near Point of Pines, Ariz. | 560 | 1953-78 | 1972 | 18.0 | 17,900 | 12-19-78 | 14.8 | 12,400 | 25 |
| 75 | 09489700 | Big Bonito Creek near Fort Apache, Ariz. | 119 | 1957-78 | 1978 | [18]9.09 | ---------- | 12-18-78 | 9.04 | 4,510 | 75 |
| | | | | | 1978 | -------- | 2,870 | | | | |
| 76 | 09490500 | Black River near Fort Apache, Ariz. | 1,232 | 1912-78 | 1916 | -------- | [19]50,000 | 12-18-78 | 24.05 | 40,200 | 22 |
| 77 | 09491000 | North Fork White River near McNary, Ariz. | 66 | 1945-78 | 1946 | 5.36 | 1,290 | 12-18-78 | 4.82 | 1,060 | 14 |
| 78 | 09492400 | East Fork White River near Fort Apache, Ariz. | 38.8 | 1957-78 | 1967 | 3.63 | 758 | 12-18-78 | 3.62 | 751 | 20 |
| 79 | 09494000 | White River near Fort Apache, Ariz. | 632 | 1957-78 | 1971 | 13.8 | 8,670 | 12-18-78 | 15.71 | 14,600 | >100 |
| 80 | 09496500 | Carrizo Creek near Show Low, Ariz. | 439 | 1951-78 | 1965 | [2]13.0 | 23,000 | 12-18-78 | 15.1 | 19,400 | 20 |
| 81 | 09497500 | Salt River near Chrysotile, Ariz. | 2,849 | 1906-78 | 1916 | 18 | 74,000 | 12-18-78 | 17.35 | 70,400 | 45 |
| 82 | 09497800 | Cibecue Creek near Chrysotile, Ariz. | 295 | 1959-78 | 1977 | 17.3 | 22,200 | 12-18-78 | 10.20 | 7,740 | 5 |
| 83 | 09497850 | Canyon Creek near Globe, Ariz. | 316 | 1975-78 | 1978 | 18.8 | 21,100 | 12-18-78 | [3]19.4 | [3]22,700 | ------- |
| 84 | 09497980 | Cherry Creek near Globe, Ariz. | 200 | 1965-78 | 1972 | 14.0 | 8,300 | 1-17-79 | 15.2 | 15,700 | 29 |
| 85 | 09498500 | Salt River near Roosevelt, Ariz. | 4,306 | 1906-78 | 1941 | -------- | 117,000 | 12-19-78 | 29.35 | 95,800 | 25 |
| | | | | | 1978 | 28.55 | ---------- | | | | |
| 86 | 09498508 | Upper Parker Creek Watershed near Roosevelt, Ariz.[12] | 1.09 | 1934-78 | 1945 | 5.91 | 270 | 1-17-79 | 3.63 | 64 | 7 |
| 87 | 09498550 | Workman Creek near Roosevelt, Ariz.[12] | 1.70 | 1938-78 | 1972 | 6.64 | 289 | 12-18-78 | 5.78 | 204 | 15 |
| 88 | 09498870 | Rye Creek near Gisela, Ariz. | 122 | 1963-78 | 1970 | 14.1 | 44,400 | 1-17-79 | 6.15 | 5,230 | 3 |
| 89 | 09498900 | Gold Creek near Payson, Ariz. | 6.44 | 1963-78 | 1970 | 11.94 | 2,800 | Unknown | 6.72 | 1,120 | 8 |
| 90 | 09499000 | Tonto Creek above Gun Creek, near Roosevelt, Ariz. | 675 | 1940-78 | 1970 | 18.2 | 53,000 | 1-17-79 | 17.0 | 61,400 | 20 |

See footnotes at end of table.

Table 10.--Summary of flood stages and discharges—Continued

| Location number shown on plate 1 | Station number | Stream and place of determination | Drainage area (mi²) | Maximum previously known | | | | Maximum November 1978 to March 1979 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Period | Year | Gage height (ft) | Discharge (ft³/s) | Date | Gage height (ft) | Discharge (ft³/s) | Recurrence interval (years) |
| 91 | 09500100 | Three Bar D Watershed near Roosevelt, Ariz.[12] | 0.13 | 1963-78 | 1959 | 4.33 | 99 | 12-18-78 | 1.16 | 3.71 | 2 |
| 92 | 09500500 | Salt River at Roosevelt, Ariz. | 5,824 | 1888-1978 | 1978 | -------- | [20]155,000 | 12-19-78 | -------- | [21]152,000 | ------- |
| 93 | 09501000 | Reservoir system on Salt River, at and below Roosevelt Dam, Ariz. | 6,211 | 1910-78 | 1941 | -------- | [14]1,764,000 | 3-29-79 | -------- | [14]1,710,000 | ------- |
| 94 | -------- | Fish Creek above Lewis and Pranty Creek, near Tortilla Flat, Ariz. | 32.2 | 1978 | ---- | -------- | ---------- | 12-18-78 | -------- | 2,650 | 10 |
| 95 | -------- | Lewis and Pranty Creek near Tortilla Flat, Ariz. | 13.4 | 1967 | 1967 | -------- | 3,310 | 12-18-78 | -------- | 1,210 | 8 |
| 96 | 09501300 | Tortilla Creek at Tortilla Flat, Ariz. | 24.3 | 1942-78 | 1971 | 13.23 | 7,500 | 12-18-78 | 10.07 | 4,400 | 5 |
| 97 | 09502000 | Salt River below Stewart Mountain Dam, Ariz. | 6,232 | [4]1930-78 | 1966 | 22.4 | 51,600 | 1-18-79 | 23.3 | 65,000 | ------- |
| 98 | 09502800 | Williamson Valley Wash near Paulden, Ariz. | 255 | 1965-78 | 1978 | 8.22 | 7,490 | 12-18-78 | 7.28 | 4,890 | 8 |
| 99 | 09503700 | Verde River near Paulden, Ariz. | 2,530 | 1963-78 | 1978 | 9.66 | 8,080 | 12-19-78 | 8.78 | 5,700 | 6 |
| 100 | 09503720 | Hell Canyon near Williams, Ariz. | 14.9 | 1965-78 | 1965<br>1978 | 4.78 | 1,080 | 12-18-78 | 2.68 | 220 | 2 |
| 101 | 09503750 | Limestone Canyon near Paulden, Ariz. | 14.5 | 1969-78 | 1971 | 16.51 | 4,100 | 12-18-78 | 3.62 | 200 | 2 |
| 102 | 09503800 | Volunteer Wash near Bellemont, Ariz. | 131 | 1966-78 | 1978 | 6.55 | 2,300 | 12-18-78 | 3.00 | 100 | 1 |
| 103 | 09504000 | Verde River near Clarkdale, Ariz. | 3,520 | 1915-21,<br>1965-78 | 1920 | [2]19.1 | 50,600 | 12-18-78 | 14.89 | 19,900 | 14 |
| 104 | 09504400 | Munds Canyon Tributary near Sedona, Ariz. | 1.19 | 1963-78 | 1970 | 11.10 | 705 | 12-18-78 | 7.17 | 275 | 7 |
| 105 | 09504500 | Oak Creek near Cornville, Ariz. | 357 | 1885-1978<br>1940-78 | 1938<br>1970 | [2]23<br>16.48 | ----------<br>24,700 | 12-19-78 | 16.00 | 25,100 | 20 |
| 106 | 09505200 | Wet Beaver Creek near Rimrock, Ariz. | 111 | 1961-78 | 1970 | 12.41 | 7,670 | 12-18-78 | 12.38 | 7,560 | 6 |
| 107 | 09505220 | Rocky Gulch near Rimrock, Ariz.[12] | 1.40 | 1959-78 | 1970 | 4.91 | 1,550 | 12-18-78 | 2.75 | 166 | 5 |
| 108 | 09505255 | Woods Canyon near Munds Park, Ariz. | 18.9 | 1961-78 | 1970 | 7.9 | 3,990 | 12-18-78 | 7.00 | 3,200 | ------- |
| 109 | 09505260 | Bar M Canyon near Munds Park, Ariz. | 25.6 | 1961-78 | 1970 | 9.35 | 4,100 | 12-18-78 | 8.86 | 4,210 | ------- |
| 110 | 09505326 | Beaver Creek Watershed No. 15 near Munds Park, Ariz.[12] | .25 | 1962-78 | 1970 | -------- | 84 | 12-18-78 | 1.85 | 62 | ------- |
| 111 | 09505300 | Rattlesnake Canyon near Rimrock, Ariz. | 24.6 | 1957-78 | 1970 | 11.50 | 3,590 | 12-18-78 | 10.94 | 2,850 | 10 |
| 112 | 09505350 | Dry Beaver Creek near Rimrock, Ariz. | 142 | 1960-78 | 1970 | 14.35 | 26,600 | 12-18-78 | 12.20 | 17,300 | 10 |
| 113 | 09505550 | Verde River below Camp Verde, Ariz. | 4,670 | 1970-78 | 1970 | 19.5 | 43,000 | 12-19-78 | 21.27 | 55,000 | 20 |
| 114 | 09505800 | West Clear Creek near Camp Verde, Ariz. | 241 | 1964-78 | 1978 | 10.15 | 13,800 | 12-18-78 | 11.6 | 22,400 | 20 |
| 115 | 09507980 | East Verde River near Childs, Ariz. | 328 | 1961-78 | 1970 | [2]19.2 | 23,500 | 1-17-79 | 13.45 | 11,600 | 5 |
| 116 | 09508000 | Verde River below East Verde River, near Pine, Ariz. | 5,623 | 1924-78 | 1938 | 24.7 | 110,000 | 12-19-78 | 26.07 | 79,400 | ------- |
| 117 | 09508300 | Wet Bottom Creek near Childs, Ariz. | 36.4 | 1967-78 | 1978 | 15.66 | 6,660 | 12-18-78 | 15.72 | 6,680 | 6 |
| 118 | 09508500 | Verde River below Tangle Creek, above Horseshoe Dam, Ariz. | 5,872 | 1924-78 | 1938 | 19.0 | 100,000 | 12-19-78 | 21.36 | 94,000 | 22 |
| 119 | -------- | Deadman Creek near Horseshoe Dam, Ariz. | 36.3 | 1978 | 1978 | -------- | 6,620 | 12-18-78 | -------- | 3,900 | 16 |
| 120 | -------- | Lime Creek near Horseshoe Dam, near Carefree, Ariz. | 41.9 | 1978 | 1978 | -------- | 5,180 | 12-18-78 | -------- | 1,540 | 4 |
| 121 | -------- | Davenport Creek near Horseshoe Dam, Ariz. | 25.5 | 1978 | 1978 | -------- | 5,500 | 12-18-78 | -------- | 3,600 | 12 |
| 122 | -------- | Sheep Creek near Horseshoe Dam, Ariz. | 34.2 | 1978 | 1978 | -------- | 6,660 | 12-18-78 | -------- | 2,500 | 12 |
| 123 | 09509500 | Reservoir system on Verde River at and below Horseshoe Dam, Ariz. | 6,185 | 1939-78 | 1973 | -------- | [14]318,000 | 3-26-79 | -------- | [14]302,100 | ------- |
| 124 | 09510000 | Verde River below Bartlett Dam, Ariz. | 6,185 | 1888-1939<br>[4]1939-78 | 1891<br>1978 | --------<br>25.9 | [22]150,000<br>101,000 | 12-18-78 | 22.60 | 75,800 | ------- |
| 125 | 09510080 | West Fork Sycamore Creek near Sunflower, Ariz. | 9.8 | 1959-78 | 1970 | 9.50 | 3,480 | 1-17-79 | 5.60 | 463 | 5 |
| 126 | 09510100 | East Fork Sycamore Creek near Sunflower, Ariz. | 4.49 | 1959-78 | 1970 | 9.50 | 1,940 | 12-18-80 | 4.80 | 298 | 6 |
| 127 | 09510170 | Camp Creek near Sunflower, Ariz. | 2.6 | 1963-78 | 1978 | 5.05 | 402 | 12-18-78 | 2.52 | 134 | 2 |
| 128 | 09510200 | Sycamore Creek near Fort McDowell, Ariz. | 164 | 1959-78 | 1970 | 19.7 | 24,200 | 12-18-78 | 10.84 | 9,520 | 5 |
| 129 | 09511300 | Verde River near Scottsdale, Ariz. | 6,600 | 1939-78 | 1978 | 18.3 | 96,000 | 12-18-78 | -------- | 64,000 | ------- |
| 130 | 09512100 | Indian Bend Wash at Scottsdale, Ariz. | 62 | 1922-78 | 1972 | 4.90 | 21,000 | 1-17-79 | 1.62 | 252 | 1 |

See footnotes at end of table.

Table 10.--Summary of flood stages and discharges—Continued

| Location number shown on plate 1 | Station number | Stream and place of determination | Drainage area (mi²) | Maximum previously known | | | | Maximum November 1978 to March 1979 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Period | Year | Gage height (ft) | Discharge (ft³/s) | Date | Gage height (ft) | Discharge (ft³/s) | Recurrence interval (years) |
| 131 | 09512170 | Salt River at Jointhead Dam, at Phoenix, Ariz. | 13,500 | 1870-1939 | 1891 | -------- | [23]300,000 | 12-19-78 | 10.05 | 126,000 | 18 |
| | | | | [4]1939-78 | 1978 | 12.50 | 122,000 | | | | |
| 132 | 09512300 | Cave Creek near Cave Creek, Ariz. | 121 | 1958-78 | 1967 | 8.62 | 12,400 | 12-18-78 | 7.34 | 6,900 | 8 |
| 133 | 09512410 | Mingus C Watershed near Prescott, Ariz.[12] | .07 | 1958-78 | 1961 | 1.74 | 17 | 3-13-79 | 1.06 | 5.1 | 16 |
| 134 | 09512500 | Agua Fria River near Mayer, Ariz. | 588 | 1940-78 | 1970 | 14.90 | 19,800 | 12-18-78 | 14.3 | [4]26,700 | 50 |
| 135 | -------- | Agua Fria River at Black Canyon City, Ariz. | 845 | 1978 | ------ | -------- | ---------- | 12-18-78 | -------- | 32,100 | ------- |
| 136 | -------- | Black Canyon Creek near Black Canyon City, Ariz. | 238 | 1957-78 | 1970 | ([24]) | ---------- | 12-18-78 | -------- | 22,300 | ------- |
| 137 | 09512700 | Agua Fria River Tributary No. 2 near Rock Springs, Ariz. | 1.11 | 1963-78 | 1964 | 19.54 | 1,200 | 12-18-78 | 4.92 | 265 | 2 |
| 138 | 09512800 | Agua Fria River near Rock Springs, Ariz. | 1,130 | 1970-78 | 1970 | 25.3 | 40,100 | 12-18-78 | 27.2 | 52,800 | 20 |
| 139 | -------- | Castle Creek near Castle Hot Springs, Ariz. | 72.0 | 1978 | 1978 | ([25]) | ---------- | 12-18-78 | -------- | 5,780 | ------- |
| 140a | 09513000 | Agua Fria River at (above) Waddell Dam, Ariz. | 1,459 | 1891-1978 | 1916 | [2]30 | 105,000 | 12-18-78 | -------- | 79,500 | ------- |
| | | | | | 1919 | [2]33.0 | ([26]) | | | | |
| 141 | 09513500 | Lake Pleasant at Waddell Dam, Ariz. | 1,459 | 1927-78 | 1941 | -------- | [14]178,500 | 3-28-79 | 170.92 | [14]161,000 | ------- |
| | | | | | 1978 | 170.52 | ---------- | | | | |
| 140b | 09513000 | Agua Fria River at (below) Waddell Dam, Ariz. | 1,459 | [4]1927-78 | 1978 | -------- | 16,300 | 12-19-78 | -------- | 59,900 | ------- |
| 142 | 09513650 | Agua Fria River at El Mirage, Ariz. | 1,637 | 1963-78 | 1978 | 7.95 | 9,870 | 12-19-78 | 11.70 | 58,400 | ------- |
| 143 | 09513780 | New River near Rock Springs, Ariz. | 67.3 | 1960-78 | 1970 | 13.5 | 18,600 | 3-28-79 | 7.09 | 6,530 | 4 |
| 144 | 09513800 | New River at New River, Ariz. | 83.3 | 1960-78 | 1970 | [2]9.98 | 19,500 | 12-18-78 | 7.88 | 5,560 | 3 |
| | | | | 1972-78 | 1978 | 12.34 | ---------- | | | | |
| 145 | 09513820 | Deadman Wash near New River, Ariz. | 11.1 | 1959-78 | 1959 | 7.0 | 1,850 | 11-11-78 | 2.77 | 88 | 1 |
| 146 | 09513835 | New River at Bell Road, near Peoria, Ariz. | 187 | 1960-78 | 1967 | 13.5 | 14,600 | 12-19-78 | 7.61 | [3]8,410 | 6 |
| 147 | 09513860 | Skunk Creek near Phoenix, Ariz. | 64.6 | 1959-78 | 1964 | -------- | 11,500 | 1-18-79 | 6.80 | 600 | 2 |
| | | | | | 1970 | 12.24 | ---------- | | | | |
| 148 | 09513970 | Agua Fria River at Avondale, Ariz. | 2,013 | 1959-78 | 1970 | 11.21 | 20,600 | 12-19-78 | 6.48 | 29,300 | 30 |
| 149 | 09514400 | Whitespar A Watershed near Prescott, Ariz.[12] | .47 | 1957-78 | 1978 | 2.00 | 24 | 12-18-78 | 1.58 | 13.6 | 2 |
| 150 | 09515500 | Hassayampa River at Box damsite, near Wickenburg, Ariz. | 417 | 1891-1978 | 1970 | 34.6 | 58,000 | 3-28-79 | 11.50 | 9,640 | 6 |
| 151 | 09516500 | Hassayampa River near Morristown, Ariz. | 774 | 1921-78 | 1970 | 19.0 | 47,500 | 12-18-78 | 11.67 | 9,600 | 6 |
| 152 | 09517000 | Hassayampa River near Arlington, Ariz. | 1,470 | 1961-78 | 1970 | 8.40 | 39,000 | 11-11-78 | 2.83 | 3,300 | 2 |
| 153 | 09517500 | Centennial Wash near Arlington, Ariz. | 1,810 | 1961-78 | 1961 | 4.70 | 14,500 | 1-17-79 | 3.53 | 818 | 1 |
| 154 | 09519500 | Gila River below Gillespie Dam, Ariz. | [15]49,650 | 1891-1910 | 1891 | -------- | 250,000 | 12-20-78 | 17.06 | 125,000 | 20 |
| | | | | [27]1921-78 | 1966 | 16.1 | ---------- | | | | |
| | | | | | 1978 | -------- | 92,900 | | | | |
| 155 | -------- | Painted Rock Reservoir at Painted Rock Dam, Ariz. | [15]50,910 | 1959-78 | 1973 | 601.25 | [14]439,860 | 4-17-79 | 642.35 | [14]1,849,000 | ------- |
| 156 | 09519800 | Gila River below Painted Rock Dam, Ariz. | [15]50,910 | [3]1959-78 | 1973 | 10.29 | 2,860 | 2- 9-79 | 10.57 | 3,340 | ------- |
| 157 | 09520360 | Gila River near Mohawk, Ariz. | [15]55,430 | 1973-78 | 1973 | 7.44 | 1,730 | 3-21-79 | -------- | [28]2,430 | ------- |
| 158 | 09520500 | Gila River near Dome, Ariz. | [15]57,850 | 1892-1958 | 1916 | -------- | [29]200,000 | 3-25-79 | -------- | [28]2,360 | ------- |
| | | | | [27]1959-78 | 1963 | 16.20 | [30]4,820 | | | | |
| 159 | 09520700 | Gila River near mouth, near Yuma, Ariz. | [15]57,950 | 1975-78 | 1977 | -------- | 757 | 3-25-79 | -------- | [28]2,040 | ------- |

[1]At Show Low, drainage area is 87 mi².
[2]Site and datum then in use.
[3]Revised.
[4]Regulated.
[5]Includes approximately 2,100 mi² that is noncontributing of which 790 mi² is above Lyman Lake.
[6]Discharge not determined but is known to be greater than the 25,000 ft³/s that occurred in 1919.
[7]Flow of the Little Colorado River partially regulated by Lyman Reservoir since 1920.
[8]Discharge approximately equal to that at Joseph City.
[9]Flow partially regulated.
[10]No evidence of flow during flood period
[11]Discharge not determined.
[12]Part of a U.S. Forest Service watershed project. Several nearby stations are not included.
[13]Date uncertain; probably December 18, 1978.
[14]Contents in acre-feet.
[15]An area of 12,886 mi² above Coolidge Dam did not contribute to flooding downstream from the dam.
[16]Estimated on basis of records for San Pedro at Mammoth and Gila River near Kelvin.
[17]Most likely period.
[18]Result of backwater from washed-out bridge.
[19]Estimated on basis of records for Salt River near Chrysotile.
[20]Estimated on basis of flood routing.
[21]Estimated inflow to Roosevelt Lake.
[22]Estimated on basis of records for Salt River above and below Verde River.
[23]At former station near Granite Reef Dam published as Salt River near McDowell.
[24]Peak was 0.8 ft higher than peak of December 1978.
[25]Stage in March 1978 was approximately equal to that of December 1978.
[26]Probably exceeded 1916.
[27]See "Station Data" for regulation.
[28]Maximum daily, higher discharges occurred later in the calendar year.
[29]Maximum daily.
[30]From inflow below Painted Rock Dam. Maximum due to release from dam is 1,380 ft³/s in 1973.

## Data for Individual Sites

The data for each site includes a station description and may include a table of gage heights and discharges at indicated times during the rise and recession of the flood peak. The station description contains information on location, drainage area, and type and datum of gage. The method used to determine the gage height during the flood period and the definition of the stage-discharge relation are explained. The maximum stage and (or) discharge for the floods in November 1978 to March 1979 and for the highest previous flood known at each station are given. The tables of stages and discharges at indicated times contain sufficient data to define stage and discharge hydrographs, but they are less complete than the data used to compute the daily mean discharges.

Station Data

(1) 09390500 Show Low Creek near Lakeside, Ariz.

Location.--Lat 34°10'46", long 109°59'14", in SW¼NW¼ sec.14, T.9 N., R.22 E., Navajo County, Hydrologic Unit 15020005, on left bank 1 mi (2 km) upstream from pumping plant on Show Low Lake 1.9 mi (3.1 km) northwest of Lakeside, 2.2 mi (3.5 km) upstream from Jaques Dam, and 6 mi (10 km) southeast of Show Low.

Drainage area.--68.6 $mi^2$ (177.7 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Altitude of gage is 6,610 ft (2,015 m), from topographic map.

Discharge record.--Stage-discharge relation for concrete control with V-notch sharp-crested weir extended above 2,500 $ft^3/s$ or 70.8 $m^3/s$ on basis of slope-area measurement at gage height 9.53 ft (2.905 m).

Maxima.--November 1978 to March 1979: Discharge, 5,550 $ft^3/s$ (157 $m^3/s$) 1615 hours Dec. 18, gage height, 9.16 ft (2.792 m).
1953 to October 1978: Discharge, 5,450 $ft^3/s$ (154 $m^3/s$) December 26, 1971, gage height, 9.53 ft (2.905 m).

Remarks.--Record shows inflow to Show Low Lake. Flow partly regulated by several small reservoirs, largest of which are Rainbow Lake and Scott Reservoir, combined capacity, 2,400 acre-ft (2.96 $hm^3$).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 1500 | 2.27 | 19 | 1500 | 8.99 | 5,320 | 0800 | 6.57 | 2,480 |
| 1600 | 2.53 | 27 | 1615 | 9.16 | 5,550 | 1200 | 5.64 | 1,630 |
| 2200 | 3.43 | 226 | 1700 | 9.04 | 5,390 | 1800 | 4.64 | 884 |
| 2400 | 3.93 | 458 | 1800 | 8.98 | 5,310 | 2400 | 3.94 | 475 |
| Dec. 18 | | | 2400 | 6.52 | 2,430 | | | |
| 0200 | 4.55 | 828 | Dec. 19 | | | Dec. 20 | | |
| 0400 | 5.45 | 1,480 | 0200 | 6.07 | 2,010 | 0400 | 3.69 | 351 |
| 0800 | 7.95 | 4,000 | 0400 | 6.18 | 2,110 | 1200 | 3.36 | 212 |
| 1100 | 9.00 | 5,340 | 0500 | 6.17 | 2,100 | 1900 | 3.41 | 233 |
| 1400 | 9.08 | 5,440 | 0730 | 6.60 | 2,510 | 2400 | 3.24 | 167 |

(2) 09392000 Show Low Creek below Jaques Dam, near Show Low, Ariz.

Location.--Lat 34°11'47", long 110°00'13", in NW¼ sec.10, T.9 S., R.22 E., Navajo County, Hydrologic Unit 15020005, at Jaques Dam, 3.5 mi (5.6 km) northwest of Lakeside, and 4.5 mi (7.2 km) southeast of Show Low.

Drainage area.--73.0 $mi^2$ (189 $km^2$).

Gage-height record.--Crest stage only. Datum of lake gage is National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation for concrete spillway extended above 270 $ft^3/s$ on basis of weir computations.

(2) 09392000 Show Low Creek below Jaques Dam, near Show Low, Ariz.—Continued

Maxima.--November 1978-March 1979: Discharge, 4,410 $ft^3/s$ (125 $m^3/s$) revised, over spillway; lake level 6,573.7 from floodmark.

1953 to 1978: Discharge, about 2,500 $ft^3/s$ (70.8 m/s), Dec. 26, 1971.

1941 to 1953: Discharge, 6,250 $ft^3/s$ (177 $m^3/s$) Jan. 18, 1952, at site 5 mi downstream at Show Low.

Remarks.--Record shows release from Show Low Lake. Flow regulated by several reservoirs, largest of which are Show Low Lake, completed in 1953; Rainbow Lake, completed prior to 1941; and Scott Reservoir, completed in 1946 (combined capacity, 8,800 acre-ft or 10.9 $hm^3$).

Total capacity of Show Low Lake to spillway, 6,176 acre-ft (7.62 $hm^3$) consisting of 1,070 acre-ft (1.32 $hm^3$); dead storage below elevation, 6,535.0 ft (1,991.87 m), sill of outlet structure; and 5,106 acre-ft (6.30 $hm^3$) usable storage between elevation 6,535.0 and 6,570.0 ft (1,991.87 and 2,002.54 m), sill of overflow spillway.

(3) 09393500 Silver Creek near Snowflake, Ariz.

Location.--Lat 34°40'00", long 110°02'30", in SW¼NW¼ sec.29, T.15 N., R.22 E., Navajo County, Hydrologic Unit 15020005, on left bank 6 mi (10 km) upstream from mouth and 11 mi (18 km) north of Snowflake.

Drainage area.--886 $mi^2$ (2,295 $km^2$).

Gage-height record.--Crest stage only during flood period. Datum of gage is 5,204.1 ft (1,586.21 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 4,400 $ft^3/s$ (125 $m^3/s$) on basis of peak discharge for former station near Woodruff.

Maxima.--November 1978 to March 1979: Discharge, 7,700 $ft^3/s$ (218 $m^3/s$) Dec. 19, gage height, 15.33 (4.660 m) from high-water mark in gage well.

July 1929 to October 1978: Discharge, 11,000 $ft^3/s$ (286 $m^3/s$) July 26, 1940, gage height, 12.37 ft (3.760 m) at former station near Woodruff.

Remarks.--Flow regulated by several reservoirs including Lone Pine Reservoir and Show Low Lake.

(4) 09394500 Little Colorado River at Woodruff, Ariz.

Location.--Lat 34°46'58", long 110°02'37", in NE¼SW¼ sec.17, T.16 N., R.22 E., Navajo County, Hydrologic Unit 15020002, on left bank at abandoned county road bridge in Woodruff, 3.7 mi (6.0 km) downstream from Silver Creek.

Drainage area.--8,100 $mi^2$ (21,000 $km^2$), approximately. Includes approximately 2,100 $mi^2$ that is noncontributing of which 790 $mi^2$ is above Lyman Lake.

Gage-height record.--Crest stage only during flood period. Datum of gage is 5,130.3 ft (1,563.72 m) National Geodetic Vertical Datum of 1929.

(4) 09394500 Little Colorado River at Woodruff, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 9,320 $ft^3/s$ (264 $m^3/s$) Dec. 19 from slope-area measurement of peak flow. Gage height, 22.9 ft (6.98 m) from high-water mark in gage well.

1916 to 1919: Discharge (not determined) occurred Jan. 19, 1916; maximum discharge recorded, 25,000 $ft^3/s$ (708 $m^3/s$) Dec. 5, 1919.

July 1929 to October 1978: Discharge, 13,000 $ft^3/s$ (368 $m^3/s$) July 26, 1940, gage height, 13.45 ft (4.010 m) site and datum then in use.

September 1949 to October 1978: Gage height at present site and datum, 22.50 ft (6.858 m) Sept. 30, 1971, from floodmark.

Outside period of record: Large floods may have occurred in September 1923, when the maximum flood since 1879 occurred on Little Colorado River at Holbrook, and April 1929 when large floods occurred at Chevelon and Clear Creeks near Winslow.

Remarks.--Flow partially regulated by many reservoirs.

(5) 09396100 Puerco River near Chambers, Ariz.

Location.--Lat 35°10'42", long 109°27'15", in SW¼NW¼ sec.35, T.21 N., R.27 E., Apache County, Hydrologic Unit 15020007, on upstream side of right abutment of Atchison, Topeka, and Santa Fe Railway Co. bridge, 1.5 mi (2.4 km) southwest of Chambers.

Drainage area.--2,160 $mi^2$ (5,600 $km^2$), approximately.

Gage-height record.--Water-stage recorder tape 2000 hours Dec. 17 to 0300 hours Dec. 20; record estimated Dec. 21-22. Altitude of gage is 5,705 ft (1,738.9 m), from topographic map.

Discharge record.--Stage-discharge relation for concrete control extended above 8,000 $ft^3/s$ (227 $m^3/s$) on basis of critical depth computations.

Maxima.--November 1978 to March 1979: Discharge, 13,800 $ft^3/s$ (391 $m^3/s$) revised, 2300 hours Dec. 18, gage height, 7.99 ft (2.44 m) revised.

1971 to 1978: Discharge, 17,800 $ft^3/s$ (504 $m^3/s$) Sept. 30, 1971, gage height, 9.65 ft (2.941 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 2000 | 1.05 | 565 | 2400 | 7.20 | 12,000 | 0300 | 2.00 | 1,900 |
| 2400 | 1.13 | 669 | | | | 1200 | 1.64 | 1,370 |
| Dec. 18 | | | Dec. 19 | | | 2400 | 1.38 | 1,000 |
| 0300 | 1.13 | 669 | 0400 | 5.25 | 7,840 | | | |
| 0700 | 1.44 | 1,100 | 0600 | 4.20 | 5,700 | Dec. 21 | | |
| 1600 | 1.44 | 1,100 | 1200 | 3.00 | 3,510 | 1200 | 1.21 | 773 |
| 1900 | 2.70 | 3,000 | 1700 | 2.20 | 2,200 | 2400 | 1.10 | 630 |
| 2100 | 5.00 | 7,300 | 1800 | 2.40 | 2,520 | Dec.22 | | |
| 2200 | 7.00 | 11,600 | 2200 | 2.38 | 2,490 | 1200 | 1.07 | 591 |
| 2300 | 7.99 | 13,800 | 2400 | 2.24 | 2,260 | 2400 | 1.01 | 513 |

(6) 09397000 Little Colorado River at Holbrook, Ariz.

Location.--Lat 34°53'52", long 110°09'45", in SW¼SW¼ sec.6, T.17 S., R.21 E., Navajo County, Hydrologic Unit 15020007, near right bank on downstream side of bridge on U.S. Highway 180 at Holbrook, 2.3 mi (3.7 km) downstream from Puerco River.

Drainage area.--11,300 mi² (29,300 km²), approximately. Includes approximately 2,100 mi² that is noncontributing of which 790 mi² is above Lyman Lake.

Gage-height record.--Water-stage recorder graph. Datum of gage is 5,062.87 ft (1,543.163 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation during flood undefined.

Maxima.--November 1978 to March 1979: Gage height, 12.40 ft (3.780 m) 0900 hours Dec. 19. 1905-6, 1949 to October 1978: Discharge, 24,200 ft³/s (685 m³/s) Oct. 4, 1968, gage height, 15.2 ft (4.633 m) Oct. 20, 1972.

Outside period of record: A discharge of 60,000 ft³/s (17,00 m³/s) was determined for the peak of Sept. 19, 1923. U.S. Army Corps of Engineers studies indicate this is the greatest flood since at least 1870.

Remarks.--Some regulation by reservoirs above station (combined capacity about 73,000 acre-ft).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Hour | Gage height | Hour | Gage height |
|---|---|---|---|---|---|
| Dec. 18 | | Dec. 19 | | Dec.20—Con. | |
| 0430 | 8.60 | 0400 | 10.60 | 2400 | 7.65 |
| 0800 | 8.57 | 0700 | 12.16 | Dec. 21 | |
| 1030 | 9.10 | 0900 | 12.40 | 0700 | 7.45 |
| 1130 | 9.70 | 1300 | 11.65 | 1200 | 7.18 |
| 1400 | 9.57 | 1800 | 10.75 | 1800 | 6.80 |
| 1700 | 10.30 | 2400 | 10.15 | 2400 | 6.68 |
| 1830 | 10.90 | Dec. 20 | | Dec. 22 | |
| 2100 | 11.00 | 0300 | 10.40 | 0600 | 6.68 |
| 2400 | 10.70 | 0600 | 10.10 | 1200 | 6.65 |
| Dec. 19 | | 1000 | 10.07 | 1800 | 6.22 |
| 0230 | 10.95 | 1800 | 8.30 | 2400 | 6.15 |

(7) 09397300 Little Colorado River near Joseph City, Ariz.

Location.--Lat 34°54'04", long 110°15'17", in NE¼SE¼ sec.6, T.17 N., R.20 E., Navajo County, Hydrologic Unit 15020008, on right bank just upstream from diversion dam, 5.4 mi (8.7 km) west of Holbroook, 5.7 mi (9.2 km) southeast of Joseph City, and 8.5 mi (13.7 km) downstream from Puerco River.

Drainage area.--12,200 mi² (31,600 km²), approximately. Includes approximately 2,100 mi² that is noncontributing of which 790 mi² is above Lyman Lake.

Gage-height record.--Water-stage recorder graph except 2400 hours Dec. 18 to 1100 hours Dec. 20. Missing record reconstructed on basis of peak indicator reading and record for Little Colorado River at Holbrook. Datum of gage is 5,031.10 ft (1,533.479 m) National Geodetic Vertical Datum of 1929.

(7) 09397300 Little Colorado River near Joseph City, Ariz.—Continued

Discharge record.--Stage-discharge relation extended above 7,400 $ft^3/s$ (210 $m^3/s$) on basis of slope-area measurement at gage height 6.82 ft (2.079 m).

Maxima.--November 1978 to March 1979: Discharge, 25,400 $ft^3/s$ (719 $m^3/s$) 1130 hours Dec. 19, gage height, 7.64 ft (2.329 m).

1971 to October 1978: Discharge, 20,600 $ft^3/s$ (583 $m^3/s$) Oct. 29, 1974, gage height, 6.90 ft (2.103 m).

Probably 1870 to October 1978: A discharge of 60,000 $ft^3/s$ (1,700 $m^3/s$) was determined at Holbrook for peak of Sept. 19, 1923.

Remarks.--Some regulation by reservoirs above station (combined capacity about 73,000 acre-ft.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 19—Con. | | | Dec. 20—Con. | | |
| 0530 | ----- | 0 | 0800 | 7.15 | 22,100 | 0400 | 5.00 | 9,900 |
| 0730 | 3.25 | 2,850 | 0930 | 7.00 | 21,200 | 1100 | 4.88 | 9,300 |
| 1030 | 3.14 | 2,300 | 1130 | 7.64 | 25,400 | 1330 | 4.65 | 8,400 |
| 1530 | 4.20 | 6,860 | 1400 | 6.30 | 17,000 | 1930 | 3.76 | 5,360 |
| 1830 | 5.18 | 12,200 | 1600 | 6.60 | 18,800 | 2400 | 3.25 | 2,850 |
| 1930 | 5.12 | 12,000 | 1900 | 5.80 | 14,000 | | | |
| 2230 | 6.15 | 16,100 | 2400 | 5.95 | 14,900 | Dec. 21 | | |
| 2400 | 6.10 | 15,800 | | | | 0530 | 3.32 | 3,200 |
| Dec. 19 | | | Dec. 20 | | | 1200 | 2.85 | 1,180 |
| 0500 | 5.80 | 14,000 | 0100 | 4.80 | 8,900 | 2400 | 2.65 | 1,050 |

(8) 09397500 Chevelon Creek below Wildcat Canyon, near Winslow, Ariz.
(Discontinued station)

Location.--Lat 34°38'11", long 110°42'49", in SW¼ sec.36, T.15 N., R.15 E., Navajo County, Hydrologic Unit 15020010, on right bank 0.4 mi (0.6 km) downstream from Wildcat Canyon and 25 mi (40 km) south of Winslow.

Drainage area.--275 $mi^2$ (712 $km^2$).

Gage-height record.--Crest stage only. Datum of gage is 5,905.16 ft (1,799.893 m) National Geodetic Vertical Datum of 1929 (Bureau of Reclamation bench mark).

Discharge record.--Stage-discharge relation extended above 6,300 $ft^3/s$ (180 $m^3/s$) on basis of slope-area measurement at 19,800 $ft^3/s$ (561 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 19,900 $ft^3/s$ (564 $m^3/s$) Dec. 18, gage height, 18.25 ft (5.563 m) from high-water mark in gage well.

Probably 1929 to October 1978: Discharge, 19,800 $ft^3/s$ (561 $m^3/s$) Jan. 18, 1952, gage height, 18.2 ft (5.55 m).

Remarks.--Discharge partially regulated by several small reservoirs in the headwaters of the basin.

(9) 09398000 Chevelon Creek near Winslow, Ariz.
(Discontinued station)

Location.--Lat 34°55'35", long 110°31'51", in SE¼SW¼ sec.27, T.18 N., R.17 E., Navajo County, Hydrologic Unit 15020010, on right bank 3 mi (5 km) upstream from mouth and 12 mi (19 km) southeast of Winslow.

Drainage area.--794 $mi^2$ (2,056 $km^2$), excludes 200 $mi^2$ (518 $km^2$), which is noncontributing.

Gage-height record.--Crest stage only. Datum of gage is 4,899.5 ft (1,493.367 m) National Geodetic Vertical Datum of 1929.

Maxima.--November 1978 to March 1979: Discharge, 33,600 $ft^3/s$ (952 $m^3/s$) Dec. 19, gage height, 24.46 ft (7.455 m) from slope-area measurement of peak flow.
1915-19, 1929 to October 1978: Discharge, 25,300 $ft^3/s$ (716 $m^3/s$) Jan. 1952, gage height, 19.8 ft (6.04 m) from slope-area measurement of peak.

Remarks.--Discharge partially regulated by several small reservoirs in the headwaters of the basin.

(10) 09398500 Clear Creek below Willow Creek near Winslow, Ariz.

Location.--Lat 34°40'03", long 111°00'25", in SW¼SE¼ sec.19, T.15 N., R.13 E., Coconino County, Hydrologic Unit 15020008, in Sitgreaves National Forest, on right bank 2 mi (3 km) downstream from Willow Creek and 30 mi (48 km) southwest of Winslow.

Drainage area.--321 $mi^2$ (831 $km^2$).

Gage-height record.--Water-stage recorder except for periods of skipped punches, which were estimated from adjoining good record. Altitude of gage is 5,957 ft (1,815.7), from Topographic Division by photogrammetry.

Discharge record.--Stage-discharge relation extended above 6,000 $ft^3/s$ (170 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 19,700 $ft^3/s$ (558 $m^3/s$) 2115 hours Dec. 18, gage height, 22.32 ft (6.803 m).
1947 to October 1978: Discharge, 16,400 $ft^3/s$ (464 $m^3/s$) Jan. 18, 1952, gage height, 21.5 ft (6.55 m).

Remarks.--Discharge partially regulated by Blue Ridge Reservoir (capacity, 19,500 acre-ft or 24.0 $hm^3$), which was completed in 1964.

(10) 09398500 Clear Creek below Willow Creek near Winslow, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 19 | | | Dec. 20—Con. | | |
| 0800 | 4.02 | 52 | 0100 | 19.80 | 14,200 | 2400 | 8.51 | 1,200 |
| 0900 | 12.65 | 4,100 | 0300 | 18.94 | 14,400 | Dec. 21 | | |
| 1000 | 16.02 | 8,190 | 0500 | 18.71 | 12,500 | 0600 | 7.82 | 898 |
| 1100 | 17.75 | 10,900 | 0800 | 16.49 | 8,890 | 1200 | 7.47 | 758 |
| 1200 | 19.00 | 13,000 | 1200 | 14.15 | 5,740 | 1800 | 7.30 | 695 |
| 1600 | 20.63 | 15,700 | 1800 | 12.18 | 3,710 | 2400 | 7.40 | 731 |
| 1730 | 20.67 | 15,800 | 2400 | 10.90 | 2,660 | | | |
| 1900 | 20.75 | 16,000 | | | | Dec. 22 | | |
| 2030 | 21.96 | 18,300 | Dec. 20 | | | 0600 | 6.97 | 582 |
| 2115 | 22.37 | 19,700 | 0600 | 10.06 | 2,070 | 1200 | 6.60 | 471 |
| 2300 | 21.67 | 17,700 | 1300 | 9.20 | 1,550 | 1800 | 6.40 | 417 |
| 2400 | 20.84 | 16,100 | 1800 | 8.51 | 1,200 | 2400 | 6.51 | 446 |

(11) 09399000 Clear Creek near Winslow, Ariz.

Location.--Lat 34°58'10", long 110°38'40", in SE¼SE¼ sec.9, T.18 N., R.16 E., Navajo County, Hydrologic Unit 15020008, on right bank 10 ft (3.0 m) downstream from bridge on State Highway 99, 1.5 mi (2.4 km) upstream from mouth, and 5 mi (8 km) southeast of Winslow.

Drainage area.--607 $mi^2$ (1,572 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Datum of gage is 4,861.32 ft (1,481.730 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation for concrete diversion dam extended above 13,500 $ft^3/s$ (582 $m^3/s$ on basis of velocity area studies and verified by slope-area measurement at gage height, 13.4 ft (4.08 m).

Maxima.--November 1978 to March 1979: Discharge, 36,300 $ft^3/s$ (1,030 $m^3/s$) 0430 hours Dec. 19, gage height, 16.67 ft (5.081 m).

March 1929 to October 1978: Discharge, 50,000 $ft^3/s$ (1,420 $m^3/s$) Apr. 4, 1929, gage height, 18.1 ft (5.52 m), present datum.

Prior to March 1929: Floodmarks 3 ft (0.9 m) higher than stage of flood of Apr. 4, 1929, were found 1,850 ft (564 m) downstream from gage in 1929.

Remarks.--Discharge partially regulated by Blue Ridge Reservoir (capacity, 19,500 acre-ft or 24.0 $hm^3$), which was completed in 1964. Discharge during December 1978 may have been affected by storage above large debris dam a short distance upstream from gage.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 19—Con. | | | Dec. 20—Con. | | |
| 2000 | 5.91 | 34 | 0600 | 16.02 | 32,300 | 1800 | 8.29 | 2,670 |

(11) 09399000 Clear Creek near Winslow, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Dec. 19—Con. | | | Dec. 20—Con. | | |
| 2100 | 13.58 | 19,300 | 1000 | 14.30 | 22,800 | 2400 | 7.95 | 2,110 |
| 2200 | 14.88 | 25,900 | 1200 | 14.10 | 21,800 | Dec. 21 | | |
| 2300 | 15.15 | 27,300 | 2100 | 11.01 | 9,390 | 0600 | 7.68 | 1,710 |
| 2400 | 15.88 | 29,800 | 2400 | 10.35 | 7,410 | 1200 | 7.49 | 1,450 |
| Dec. 19 | | | Dec. 20 | | | 2400 | 7.12 | 1,020 |
| 0100 | 15.73 | 30,600 | 0300 | 9.85 | 6,100 | Dec. 22 | | |
| 0200 | 16.33 | 34,200 | 0600 | 9.40 | 4,980 | 1200 | 6.88 | 772 |
| 0430 | 16.67 | 36,300 | 1200 | 8.79 | 3,610 | 2400 | 6.82 | 716 |

(12) 09399400 Jacks Canyon Creek near Winslow, Ariz.
(Discontinued station)

Location.--Lat 34°55'17", long 110°47'49", in NW¼NW¼ sec.31, T.18 N., R.15 E., Coconino County, on left bank 9 mi (14 km) northeast of Sunset Pass and 9.5 mi (15.3 km) southwest of Winslow.

Drainage area.--280 $mi^2$ (725 $km^2$).

Gage-height record.--Crest stage only from high-water mark in well. Altitude of gage is 5,220 ft (1.591 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 140 $ft^3/s$ (3.96 $m^3/s$) on basis of culvert and road-overflow measurement at 12.0 ft (3.66 m).

Maxima.--November 1978 to March 1979: Discharge, 4,600 $ft^3/s$ (130 $m^3/s$) Dec. 18, gage height, 16.98 ft (5.176 m).
1970 to 1975: Discharge, 2,600 $ft^3/s$ (73.6 $m^3/s$), Nov. 20, 1972, gage height, 13.50 ft (4.115 m).

(13) 09400000 Little Colorado River near Winslow, Ariz.
(Miscellaneous site)

Location.--Lat 35°00'00", long 110°39'00", in SE¼NW¼ sec.33, T.19 S., R.16 E., Navajo County, Hydrologic Unit 15020008, at U.S. Highway 66, 2 mi (3.2 km) downstream from Clear Creek 1,500 ft (460 m) downstream from Jacks Canyon and 2.75 mi (4.4 km) southeast of Winslow.

Drainage area.--16,100 $mi^2$ (41,700 $km^2$). Includes approximately 2,100 $mi^2$ (5,349 $km^2$) that is noncontributing of which 790 $mi^2$ (2,046 $km^3$) is above Lyman Lake.

Maxima.--November 1978 to March 1979: Discharge, 57,600 $ft^3/s$ (1,630 $m^3/s$) Dec. 20, 1978, from slope-area measurement of peak flow.

Remarks.--Low-water station operated at site 700 ft (210 m) upstream 1954-56. Discharge partially regulated by many reservoirs on the Little Colorado River and tributaries.

(14) 09402000 Little Colorado River near Cameron, Ariz.

Location.--Lat 35°55'35", long 111°34'00", in NW¼ sec.5, T.29 N., R.8 E. (unsurveyed), Coconino County, Hydrologic Unit 15020016, in Navajo Indian Reservation, on left bank 3 mi (5 km) downstream from Coconino damsite, 9.5 mi (15.3 km) downstream from Moenkopi Wash, 9.5 mi (15.3 km) northwest of Cameron, and 45 mi (72 km) upstream from mouth.

Drainage area.--26,500 mi² (68,600 km²), approximately. Includes approximately 2,100 mi² (5,349 km²) that is noncontributing of which 790 mi² (2,046 km²) is above Lyman Lake.

Gage-height record.--Water-stage recorder graph. Datum of gage is 3,979.2 ft (1,212.86 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 17,800 ft³/s (504 m³/s) 0200 hours Dec. 23, gage height, 17.36 ft (5.291 m).

1947 to October 1978: Discharge, 24,900 ft³/s (705 m³/s) Jan. 21, 1952, gage height, 20.7 ft (6.31 m).

Probably 1870 to October 1978: A discharge of about 120,000 ft³/s (3,400 m³/s) occurred on Sept. 19 or 20, 1923, based on discharge at Grand Falls.

Remarks.--Discharge partially regulated by many reservoirs on the Little Colorado River and tributaries.

(15) 09430500 Gila River near Gila, N. Mex.

Location.--Lat 33°03'40", long 108°32'12", in NE¼NW¼ sec.30, T.14 S., R.16 W., Grant County, Hydrologic Unit 15040001, on left bank at Hooker damsite, 1.6 mi (2.6 km) upstream from Mogollon Creek, and 7 mi (11 km) northeast of Gila, at mile 572.5.

Drainage area.--1,864 mi² (4,828 km²).

Gage-height record.--Digital water-stage recorder tape except 0200 hours Dec. 19 to 1200 hours Dec. 20, which was reconstructed. Datum of gage is 4,655.8 ft (1,419.09 m) National Geodetic Vertical Datum of 1929 (river-profile survey).

Discharge record.--Stage-discharge relation extended above 7,000 ft³/s (200 m³/s) on basis of slope-area measurement of peak flow.

Maxima.--November 1978 to March 1979: Discharge, 32,400 ft³/s (918 m³/s) 2330 hours Dec. 18, gage height, 12.5 ft (3.810 m) from floodmark.

1927 to October 1978: Discharge, 25,400 ft³/s (719 m³/s) Sept. 29, 1941, gage height, 17.2 ft (5.24 m) from floodmark from rating curve extended above 3,900 ft³/s (110 m³/s) on basis of velocity-area studies.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 23 | | | Nov. 28 | | | Dec. 22 | | |
| 2400 | 2.19 | 114 | 0600 | 3.10 | 1,040 | 1200 | 3.39 | 2,160 |
| Nov. 24 | | | 1200 | 3.04 | 998 | 2400 | 3.10 | 1,830 |
| 0600 | 2.23 | 124 | 2400 | 2.81 | 837 | Jan. 17 | | |
| 1200 | 2.83 | 365 | Dec. 17 | | | 0600 | 1.40 | 480 |
| 1800 | 3.26 | 648 | 2400 | 1.53 | 166 | 1200 | 1.45 | 510 |

(15) 09430500 Gila River near Gila, N. Mex.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24—Con. | | | Dec. 18 | | | Jan. 17—Con. | | |
| 2100 | 4.75 | 2,200 | 0600 | 1.66 | 214 | 1800 | 1.57 | 582 |
| 2400 | 6.22 | 3,990 | 1000 | 3.27 | 1,420 | 2400 | 2.53 | 1,270 |
| Nov. 25 | | | 1200 | 3.82 | 2,120 | Jan. 18 | | |
| 0300 | 7.32 | 5,630 | 1500 | 4.41 | 2,990 | 0300 | 3.96 | 2,570 |
| 0700 | 9.21 | 8,590 | 1800 | 8.87 | 14,300 | 0600 | 4.52 | 3,520 |
| 0800 | 9.07 | 8,360 | 2100 | 10.97 | 23,800 | 0900 | 5.41 | 5,370 |
| 1215 | 9.74 | 9,430 | 2330 | 12.5 | 32,400 | 1045 | 5.51 | 5,600 |
| 1300 | 9.21 | 8,590 | 2400 | 12.06 | 30,000 | 1200 | 5.35 | 5,240 |
| 1400 | 9.29 | 8,710 | | | | 1800 | 4.85 | 4,160 |
| 1800 | 8.47 | 7,400 | Dec. 19 | | | 2400 | 4.46 | 3,410 |
| 2400 | 7.09 | 5,280 | 0600 | 10.85 | 23,600 | Jan. 19 | | |
| | | | 1200 | 9.95 | 19,400 | 0600 | 4.32 | 3,200 |
| Nov. 26 | | | 1800 | 9.08 | 15,700 | 1200 | 3.84 | 2,430 |
| 0600 | 5.94 | 3,920 | 2400 | 8.20 | 12,600 | 1800 | 3.67 | 2,190 |
| 1200 | 5.42 | 3,360 | Dec. 20 | | | 2400 | 3.35 | 1,780 |
| 1800 | 4.84 | 2,670 | 0600 | 7.32 | 9,810 | Jan. 20 | | |
| 2400 | 4.49 | 2,290 | 1200 | 6.46 | 7,530 | 0600 | 3.26 | 1,680 |
| Nov. 27 | | | 1800 | 5.56 | 5,520 | 1200 | 3.05 | 1,420 |
| 0600 | 4.15 | 1,950 | 2400 | 4.90 | 4,310 | 2400 | 2.74 | 1,130 |
| 1200 | 3.84 | 1,640 | Dec. 21 | | | Jan. 21 | | |
| 1800 | 3.56 | 1,410 | 1200 | 4.35 | 3,420 | 1200 | 2.55 | 969 |
| 2400 | 3.26 | 1,170 | 2400 | 3.81 | 2,660 | 2400 | 2.30 | 792 |

(16) 09430600 Mogollon Creek near Cliff, N. Mex.

Location.--Lat 33°10'01", long 108°38'58", in SE¼SE¼ sec.13, T.13 S., R.18 W., Grant County, Hydrologic Unit 15040001, on right bank 0.3 mi (0.5 km) downstream from Gila Wilderness Boundary, 12 mi (19 km) upstream from mouth, and 14 mi (23 km) north of Cliff.

Drainage area.--69 $mi^2$ (179 $km^2$).

Gage-height record.--Water-stage recorder except 1030 hours Dec. 18 to 0500 hours Dec. 20. Altitude of gage is 5,440 ft (1,658 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 270 $ft^3/s$ (7.65 $m^3/s$) on basis of slope-area measurement of peak flow at 13.7 ft (4.18 m).

Maxima.--November 1978 to March 1979: Discharge, 10,100 $ft^3/s$ (286 $m^3/s$) Dec. 18, gage height, 12.4 ft (3.78 m) from high-water mark in well.

1967 to October 1978: Discharge, 10,800 $ft^3/s$ (306 $m^3/s$) Aug. 12, 1967, gage height, 13.7 ft (4.18 m) from floodmarks.

(16) 09430600 Mogollon Creek near Cliff, N. Mex.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Nov. 24—Con. | | | Nov. 25—Con. | | |
| 0100 | 2.16 | 14 | 2300 | 9.42 | 4,770 | 1900 | 5.34 | 1,020 |
| 0300 | 2.30 | 22 | 2400 | 8.71 | 3,950 | 2100 | 4.87 | 755 |
| 0400 | 3.17 | 143 | Nov. 25 | | | 2400 | 4.71 | 675 |
| 0500 | 3.88 | 335 | 0100 | 9.38 | 4,730 | | | |
| 0600 | 4.46 | 552 | 0200 | 9.34 | 4,680 | Nov. 26 | | |
| 0700 | 4.94 | 785 | 0500 | 8.17 | 3,360 | 0500 | 4.19 | 448 |
| 0900 | 6.26 | 1,640 | 0600 | 8.42 | 3,640 | 0600 | 4.27 | 480 |
| 1100 | 6.92 | 2,160 | 0800 | 7.00 | 2,230 | 0900 | 4.06 | 396 |
| 1300 | 6.49 | 1,820 | 0900 | 7.31 | 2,510 | 1200 | 3.86 | 332 |
| 1700 | 6.35 | 1,710 | 1000 | 7.37 | 2,560 | 1800 | 3.62 | 260 |
| 1800 | 6.68 | 1,990 | 1200 | 6.45 | 1,790 | 2400 | 3.41 | 198 |
| 1900 | 6.76 | 2,030 | 1400 | 5.95 | 1,420 | | | |
| 2000 | 7.72 | 2,890 | 1500 | 5.90 | 1,390 | Nov. 27 | | |
| 2100 | 8.06 | 3,230 | 1700 | 5.40 | 1,060 | 1200 | 3.09 | 130 |
| 2215 | 9.80 | 5,220 | 1800 | 5.47 | 1,100 | 2400 | 3.06 | 123 |

(17) 09430900 Duck Creek at Cliff, N. Mex.

Location.--Lat 32°58'03", long 108°36'36", in SW¼SW¼ sec.28, T.15 S., R.17 W., Grant County, Hydrologic Unit 15040002, on right bank at Cliff 300 ft (91.4) downstream from State Highway 211, and 0.6 mi (0.9 km) above mouth.

Drainage area.--228 $mi^2$ (591 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 4,500 ft (1,372 m).

Discharge record.--Stage-discharge relation extended above 1,200 $ft^3/s$ (34.0 $m^3/s$) on basis of slope-area measurements at gage heights 5.90 ft (1.798 m), 8.60 ft (2.621 m), 9.50 ft (2.896 m) and 10.24 ft (3.121 m).

Maxima.--November 1978 to March 1979: Discharge, 5,800 $ft^3/s$ (164 $m^3/s$) Dec. 18, gage height, 9.36 ft (2.853 m).

1957 to October 1978: Discharge, 6,900 $ft^3/s$ (195 $m^3/s$) Aug. 4, 1967, gage height, 11.09 ft (3.380 m).

Outside period of record: Olmstead (1919, facing page 71, site 2) gives a discharge of 10,600 $ft^3/s$ (300 $m^3/s$) for the flood of Oct. 16, 1916 and 41,800 $ft^3/s$ (1,180 $m^3/s$) for an earlier flood. Accuracy of estimates is unknown.

(18) 09431500 Gila River near Redrock, N. Mex.

Location.--Lat 32°43'37", long 108°40'30", in W¼ sec.23, T.18 S., R.18 W., Grant County Hydrologic Unit 15040002, on left bank 0.2 mi (0.3 km) downstream from Copper Canyon, 0.2 mi (0.3 km) upstream from lower end of box canyon, 4.7 mi (7.6 km) northeast of Redrock, and 14 mi (23 km) downstream from Mangas Creek, at mile 539.2.

Drainage area.--2,829 $mi^2$ (7,327 $km^2$).

(18) 09431500 Gila River near Redrock, N. Mex.—Continued

Gage-height record.--Digital water-stage recorder tape except Dec. 19. Altitude of gage is 4,090 ft (1,247 m) from plane-table survey.

Discharge record.--Stage-discharge relation extended above 9,500 $ft^3/s$ (269 $m^3/s$) and on basis of slope-area measurement of peak flow. Discharge for Dec. 19-20 estimated from reconstructed gage-height record, discharge measurements, and hydrographic comparison with stations on the Gila River near Gila and below Blue Creek, near Virden, N. Mex.

Maxima.--November 1978 to March 1979: Discharge, 48,800 $ft^3/s$ (1,380 $m^3/s$) at 0600 hours, Dec. 19, gage height, 29.8 ft (9.08 m) in gage well, outside stage, 34.1 ft (10.4 m) from floodmarks.

1912 to October 1978: Discharge, 40,000 $ft^3/s$ (1,130 $m^3/s$) Sept. 29, 1941, gage height, 31 ft (9.4 m) from floodmarks computed on basis of peak flow of Gila River below Blue Creek, near Virden, N. Mex.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 27 | | | Dec. 18 | | | Dec. 19—Con. | | |
| 1600 | 9.01 | 1,980 | 0600 | 6.32 | 198 | 1800 | ----- | 27,000 |
| 2400 | 8.97 | 1,930 | 1200 | 6.52 | 279 | 2400 | ----- | 18,000 |
| Nov. 28 | | | 1800 | 12.46 | 8,720 | Dec. 20 | | |
| 1200 | 8.59 | 1,460 | 2400 | 18.87 | 23,000 | 0600 | ----- | 14,000 |
| 2400 | 8.41 | 1,270 | Dec. 19 | | | 1200 | ----- | 11,000 |
| Dec. 17 | | | 0600 | 29.8 | 48,000 | 1800 | ----- | 8,000 |
| 2400 | 6.29 | 186 | 1200 | ----- | 36,000 | 2400 | ----- | 6,000 |

(19) 09432000 Gila River below Blue Creek, near Virden, N. Mex.

Location.--Lat 32°38'53", long 108°50'43", in SE¼SW¼ sec.18, T.19 S., R.19 W., Grant County, Hydrologic Unit 15040002, on left bank at head of canyon, 1.4 mi (2.3 km) downstream from Blue Creek, 10 mi (16 km) east of Virden, and 16 mi (26 km) upstream from Mexico-Arizona State line at mile 523.

Drainage area.--3,203 $mi^2$ (8,296 $km^2$), excluding Animas River basin.

Gage-height record.--Water-stage recorder graph. Altitude of gage is 3,875 ft (1,181.1 m), from river-profile map.

Discharge record.--Stage-discharge relation prior to peak of Dec. 19 extended above 14,000 $ft^3/s$ (396 $m^3/s$) on basis and slope-area measurement of peak flow. Large positive shift adjustments following the peak are based on current-meter measurements below 13,000 $ft^3/s$ (368 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 58,700 $ft^3/s$ (1,660 $m^3/s$) 0930 hours Dec. 19, 1978, gage height, 29.00 ft (8.839 m).

Probably 1892 to October 1978: Discharge, 41,700 $ft^3/s$ (1,180 $m^3/s$) Sept. 29, 1941, gage height, 25.78 ft (7.858 m).

(19) 09432000 Gila River below Blue Creek, near Virden, N. Mex.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 2400 | 5.71 | 172 | 1530 | 8.50 | 900 | 0600 | 16.00 | 18,200 |
| Nov. 25 | | | 1730 | 8.60 | 980 | 0830 | 15.00 | 16,000 |
| 0100 | 6.78 | 611 | 1830 | 10.10 | 2,500 | 1200 | 14.00 | 14,000 |
| 0200 | 7.45 | 925 | 1900 | 11.75 | 4,550 | 1500 | 13.14 | 13,000 |
| 0600 | 8.55 | 1,560 | 2000 | 13.20 | 6,280 | 2400 | 12.05 | 8,100 |
| 0630 | 9.30 | 2,140 | 2200 | 14.28 | 7,848 | Dec. 21 | | |
| 0730 | 10.30 | 3,100 | 2400 | 15.30 | 9,640 | 0600 | 11.40 | 6,640 |
| 0900 | 11.16 | 3,960 | Dec. 19 | | | 1200 | 10.65 | 5,290 |
| 1100 | 11.85 | 4,650 | 0100 | 16.25 | 11,500 | 1530 | 10.60 | 5,210 |
| 1500 | 13.00 | 6,000 | 0300 | 17.15 | 13,300 | 2400 | 10.10 | 4,480 |
| 1800 | 14.00 | 7,400 | 0330 | 17.05 | 13,100 | Dec. 22 | | |
| 2030 | 15.00 | 9,100 | 0500 | 17.65 | 14,450 | 1200 | 9.73 | 3,950 |
| 2200 | 16.10 | 11,200 | 0600 | 18.90 | 18,200 | 2400 | 9.16 | 3,190 |
| 2400 | 16.95 | 12,900 | 0700 | 21.60 | 26,300 | Jan. 18 | | |
| Nov. 26 | | | 0800 | 26.80 | 43,000 | 0030 | 6.48 | 795 |
| 0200 | 17.20 | 13,400 | 0830 | 27.60 | 51,000 | 0100 | 8.40 | 2,180 |
| 0430 | 16.80 | 12,600 | 0930 | 29.00 | 58,700 | 0200 | 9.55 | 3,700 |
| 0600 | 16.00 | 11,000 | 1100 | 28.20 | 54,900 | 0330 | 10.25 | 4,600 |
| 0700 | 15.25 | 9,550 | 1230 | 27.00 | 50,600 | 0630 | 9.72 | 2,170 |
| 0900 | 14.15 | 7,640 | 1400 | 25.85 | 45,300 | 0800 | 11.70 | 7,120 |
| 1100 | 13.45 | 6,630 | 1600 | 24.70 | 40,700 | 1000 | 13.35 | 10,700 |
| 1730 | 12.10 | 4,920 | 1800 | 23.40 | 36,200 | 1300 | 13.30 | 10,600 |
| 2400 | 11.00 | 3,800 | 1930 | 22.14 | 33,500 | 1400 | 12.90 | 9,520 |
| Nov. 27 | | | 2100 | 21.10 | 29,700 | 1500 | 13.00 | 10,000 |
| 0800 | 10.20 | 2,700 | 2230 | 20.50 | 28,300 | 1800 | 12.95 | 9,730 |
| 2400 | 9.75 | 2,100 | 2400 | 19.20 | 25,300 | 2400 | 11.95 | 6,350 |
| Dec. 18 | | | Dec. 20 | | | Jan. 19 | | |
| 1400 | 6.86 | 205 | 0200 | 18.10 | 22,800 | 1200 | 10.75 | 3,550 |
| 1430 | 7.82 | 542 | 0400 | 17.00 | 20,300 | 2400 | 9.78 | 1,960 |

(20) 09437200 Mexican Canyon at Virden, N. Mex.
(Crest-stage station)

Location.--Lat 32°41'03", long 108°59'00", in SE¼NW¼ sec.2, T.19 S., R.21 W, Hidalgo County, Hydrologic Unit 15040002, upstream from dip in State Road 82, and about 0.8 mi (1.3 km) east of Virden.

Drainage area.--3.40 $mi^2$ (8.8 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 3,760 ft (1,146 m) from topographic map.

Maxima.--November 1978 to March 1979: No evidence of flow.

## (21) 09442000 Gila River near Clifton, Ariz.

Location.--Lat 32°57'57", long 109°18'35", in NE¼SE¼ sec.25, T.5 S., R.29 E., Greenlee County, Hydrologic Unit 15040002, on right bank 500 ft (150 m) downstream from bridge on county road, 6 mi (10 km) upstream from San Francisco River, and 6 mi (10 km) south of Clifton at mile 471.

Drainage area.--4,010 mi² (10,386 km²).

Gage-height record.--Water-stage recorder graph. Datum of gage is 3,336.82 ft (1,017.063 m) National Geodetic Vertical Datum of 1929 (adjusted).

Discharge record.--Base stage-discharge relation defined by current-meter measurements below 25,000 ft³/s (708 m³/s). Large positive shift adjustments required after the peak of Dec. 19 are based on discharge measurements below 28,000 ft³/s (793 m³/s).

Maxima.--November 1978 to March 1979: Discharge, 57,000 ft³/s (1,610 m³/s) 2030 hours, Dec. 19, 1978, gage height, 23.80 ft (7.254 m).

Probably 1892 to November 1978: Discharge, 33,000 ft³/s (935 m³/s) Oct. 21, 1972, gage height, 18.7 ft (5.70 m), from high-water mark in gage well.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Dec. 18—Con. | | | Dec. 21—Con. | | |
| 2400 | 1.20 | 70 | 2100 | 3.40 | 615 | 2400 | 6.45 | 5,010 |
| Nov. 25 | | | 2300 | 3.45 | 645 | Dec. 22 | | |
| 0200 | 1.18 | 66 | 2400 | 3.83 | 877 | 1200 | 5.70 | 3,980 |
| 0330 | 2.28 | 308 | Dec. 19 | | | 2400 | 5.25 | 3,440 |
| 0800 | 1.60 | 130 | 0100 | 4.16 | 1,130 | Jan. 17 | | |
| 1100 | 1.50 | 108 | 0330 | 4.26 | 1,210 | 1800 | 1.95 | 603 |
| 1300 | 1.58 | 126 | 0430 | 4.70 | 1,640 | 2400 | 3.10 | 1,290 |
| 1515 | 1.50 | 108 | 0800 | 6.10 | 3,400 | Jan. 18 | | |
| 1530 | 3.00 | 645 | 1300 | 7.55 | 5,440 | 0200 | 3.80 | 1,850 |
| 1600 | 4.15 | 1,460 | 1500 | 8.55 | 7,070 | 0300 | 4.10 | 2,120 |
| 1700 | 4.80 | 2,040 | 1700 | 10.0 | 9,680 | 0700 | 3.52 | 1,620 |
| 2400 | 5.85 | 3,200 | 1800 | 13.0 | 16,200 | 0830 | 3.65 | 1,720 |
| Nov. 26 | | | 1900 | 21.0 | 42,200 | 1000 | 3.50 | 1,600 |
| 0600 | 6.20 | 3,620 | 1930 | 23.0 | 52,200 | 1200 | 4.40 | 2,420 |
| 1200 | 7.50 | 5,360 | 2030 | 23.8 | 57,000 | 1400 | 4.62 | 2,660 |
| 1500 | 8.75 | 7,430 | 2200 | 23.0 | 53,400 | 1430 | 4.58 | 2,620 |
| 1830 | 10.70 | 11,000 | 2400 | 21.70 | 49,800 | 1700 | 5.35 | 3,540 |
| 2200 | 9.55 | 8,870 | Dec.20 | | | 1830 | 6.20 | 4,620 |
| 2400 | 8.65 | 7,250 | 0200 | 20.60 | 46,200 | 1930 | 7.00 | 5,790 |
| Nov. 27 | | | 0430 | 18.90 | 40,600 | 2130 | 7.62 | 6,870 |
| 0600 | 7.04 | 4,720 | 0800 | 16.85 | 32,800 | 2400 | 7.70 | 7,050 |
| 1200 | 6.26 | 3,630 | 1200 | 14.50 | 25,800 | Jan. 19 | | |
| 1800 | 5.55 | 2,660 | 1400 | 13.10 | 21,000 | 0100 | 7.78 | 7,200 |
| 2400 | 5.20 | 2,190 | 1630 | 12.0 | 17,800 | 0230 | 7.56 | 6,750 |
| Nov.28 | | | 1900 | 11.05 | 14,900 | 0300 | 7.64 | 6,830 |
| 1200 | 4.68 | 1,640 | 2400 | 9.75 | 11,400 | 0930 | 6.85 | 5,580 |
| 2400 | 4.60 | 1,520 | Dec. 21 | | | 1100 | 6.85 | 5,580 |
| Dec. 17 | | | 0400 | 8.90 | 9,500 | 1500 | 6.32 | 4,910 |
| 2400 | 2.20 | 119 | 0800 | 8.10 | 7,880 | 2400 | 5.54 | 3,970 |
| Dec. 18 | | | 1300 | 7.45 | 6,560 | Jan. 20 | | |
| 1200 | 2.20 | 119 | 1530 | 7.40 | 6,480 | 1200 | 4.69 | 3,080 |
| 1830 | 2.40 | 170 | 1900 | 6.90 | 5,680 | 2400 | 4.08 | 2,380 |

(22) 09442630 Mail Hollow near Luna, N. Mex.
(Crest-stage station)

Location.--Lat 33°47'38", long 108°56'59", in NW¼SW¼ sec.7, T.6 S., R.20 W., Catron County, Hydrologic Unit 15040004, 450 ft (137.2 m) upstream from U.S. Highway 180, and 2.3 mi (3.7 km) south of Luna.

Drainage area.--4.20 $mi^2$ (10.9 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 7,100 ft (2,164.1 m) from topographic map

Discharge record.--Stage-discharge relation extended above 6.0 $ft^3/s$ (0.17 $m^3/s$) on basis of slope-area measurement at gage height 3.30 ft (1.006 m).

Maxima.--November 1978 to March 1979: Discharge, 66 $ft^3/s$ (1.87 $m^3/s$) Nov. 24, gage height, 3.05 ft (0.930 m).
1970 to October 1978: Discharge not determined, gage height, 3.90 ft (1.189 m) Oct. 20, 1972.

(23) 09442660 Trout Creek at Luna, N. Mex.
(Crest-stage station)

Location.--Lat 33°50'50", long 108°59'38", in NE¼NW¼ sec.29, T.5 S., R.20 W., Catron County, Hydrologic Unit 15040004, 500 ft downstream from Luna-Red Hill Road and 2.6 mi (4.2 km) north of Luna.

Drainage area.--31.9 $mi^2$ (82.9 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 7,300 ft (2,225.0 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 70 $ft^3/s$ (1.98 $m^3/s$) on basis of slope-area measurements at gage heights 1.82 ft (0.555 m), 2.00 ft (0.610 m) and 4.20 ft (1.280 m).

Maxima.--November 1978 to March 1979: Discharge, 720 $ft^3/s$ (20.4 $m^3/s$) Nov. 24, gage height, 3.07 ft (0.936 m).
1954 to October 1978: Discharge, 2,250 $ft^3/s$ (63.7 $m^3/s$) Oct. 19, 1972, gage height, 4.47 ft (1.362 m).

(24) 09442680 San Francisco River near Reserve, N. Mex.

Location.--Lat 33°44'12", long 108°46'14", in NE¼NW¼SE¼ sec.35, T.6 S., R.19 W., Catron County, Hydrologic Unit 15040004, on left bank 1,300 ft (400 m) downstream from Rainbow Bridge Canyon, 1.7 mi (2.7 km) northwest of Reserve, and at mile 563.1 (906.0 km).

Drainage area.--350 $mi^2$ (907 $km^2$), approximately.

Gage-height record.--Digital water-stage recorder tape except Nov. 25. Altitude of gage, 5,820 ft (1,774 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 1,400 $ft^3/s$ (39.6 $m^3/s$).

(24) 09442680 San Francisco River near Reserve, N. Mex.—Continued

Maxima.--November 1978 to March 1979: Discharge, 11,800 $ft^3/s$ (334 $m^3/s$) Nov. 25, gage height, 9.40 ft (2.865 m) from high-water mark in well.

1959 to October 1978: Discharge, 11,900 $ft^3/s$ (337 $m^3/s$) Oct. 20, 1972, gage height, 7.47 ft (2.277 m) in gage well; 8.05 ft (2.454 m) from outside floodmarks site and datum then in use, and from rating curve extended above 9,000 $ft^3/s$ (255 $m^3/s$) on basis of velocity-area study.

Outside period of record: Stage, about 15 ft (4.6 m), as determined in 1962 from old floodmarks.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 19—Con. | | | Dec. 20 | | |
| 0100 | 1.28 | 38 | 0400 | 5.28 | 2,590 | 0600 | 3.25 | 620 |
| 0900 | 1.60 | 74 | 0630 | 5.85 | 3,390 | 1200 | 2.88 | 440 |
| 1200 | 2.67 | 330 | 0800 | 4.51 | 1,650 | 1800 | 2.63 | 340 |
| 1800 | 4.64 | 1,640 | 1200 | 3.25 | 655 | 2400 | 2.63 | 340 |
| 2400 | 5.51 | 2,710 | 1400 | 4.21 | 1,350 | Dec. 21 | | |
| Dec. 19 | | | 1800 | 4.01 | 1,180 | 1200 | 2.20 | 185 |
| 0300 | 5.47 | 2,850 | 2400 | 3.60 | 864 | 2400 | 2.27 | 202 |

(25) 09442695 Negro Canyon at Aragon, N. Mex.
(Crest-stage station)

Location.--Lat 33°52'47", long 108°33'08", in NW¼NW¼ sec.18, T.5 S., R.16 W., Catron County, Hydrologic Unit 15040004, above culvert on State Highway 12, at west edge of Aragon.

Drainage area.--9.62 $mi^2$ (24.9 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 6,880 ft (2,097.0 m)

Discharge record.--Stage-discharge relation defined by computation of flow through culvert.

Maxima.--November 1978 to March 1979: Discharge, 230 $ft^3/s$ (6.51 $m^3/s$) Nov. 24, gage height, 1.48 ft (0.451 m).

1958 to October 1978: Discharge, 5,200 $ft^3/s$ (147 $m^3/s$) July 28, 1959, gage height, 11.60 ft (3.536 m).

(26) 09442740 Tularosa River near Reserve, N. Mex.
(Crest-stage station)

Location.--Lat 33°44'00", long 108°42'10", in SE¼ sec.33, T.6 S., R.18 W., Catron County, Hydrologic Unit 15040004, 150 ft (46 m) west of Eagle Peak Lookout Road and 3.3 mi (5.3 km) northeast of Reserve.

Drainage area.--426 $mi^2$ (1,103 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 5,950 ft (1,813.6 m)

Discharge record.--Stage-discharge relation extended above 16 $ft^3/s$ (0.45 $m^3/s$) on basis of slope-area measurement at gage heights 4.35 ft (1.326 m) and 5.76 ft (1.756 m).

(26) 09442740 Tularosa River near Reserve, N. Mex.—Continued

Maxima.--November 1978 to March 1979: Discharge, 850 $ft^3/s$ (24.1 $m^3/s$) Nov. 24, gage height, 6.22 ft (1.896 m).

1956 to October 1978: Discharge, 2,280 $ft^3/s$ (64.6 $m^3/s$) July 28, 1956.

Outside period of record: Olmstead (1919, facing p. 64, site 45) shows a discharge of 16,420 $ft^3/s$ (465 $m^3/s$) at site 2 mi (3.2 km) downstream for flood of Oct. 16, 1916 and indicates that it was the maximum known prior to 1919. Accuracy of estimate is unknown.

(27) 09443000 San Francisco River near Alma, N. Mex.

Location.--Lat 33°22'05", long 108°54'35", in SW¼SE¼ sec.4, T.11 S., R.20 E., Catron County, Hydrologic Unit 15040004, on right bank 1.2 mi (1.9 km) downstream from Alma, 4 mi (6 km) northwest of Glenwood, and 6 mi (10 km) upstream from Whitewater Creek, at at mile 523.5.

Drainage area.--1,546 $mi^2$ (4,004 $km^2$).

Gage-height record.--Water-stage recorder graph. Altitude of gage is 4,842 ft (1,476 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 8,700 $ft^3/s$ (246 $m^3/s$) on basis of slope-area measurment at gage height 18.16 ft (5.535 m).

Maxima.--November 1978 to March 1979: Discharge, 24,500 $ft^3/s$ (694 $m^3/s$) 2100 hours, Dec. 18, 1978, gage height, 15.84 ft (4.828 m).

1904-14, 1927 to October 1978: Discharge, 30,600 $ft^3/s$ (867 $m^3/s$) Oct. 20, 1972, gage height, 18.16 ft (5.535 m) present datum, from floodmarks in well, and from rating curve extended above 3,500 $ft^3/s$ (99.1 $m^3/s$) on basis of slope-area measurement of peak flow.

Outside period of record: Olmstead (1919, facing page 64, site 27) gives a peak discharge of 31,800 $ft^3/s$ (901 $m^3/s$) for the flood of October 16, 1916, and 49,400 $ft^3/s$ (1,400 $m^3/s$) for an earlier flood (probably 1891). Accuracy of data is unknown.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Dec. 18—Con. | | | Jan. 17 | | |
| 0100 | 3.18 | 67 | 0400 | 3.46 | 58 | 0100 | 3.48 | 204 |
| 0800 | 3.30 | 79 | 0600 | 3.79 | 130 | 0600 | 3.50 | 212 |
| 1200 | 5.70 | 1,010 | 0900 | 5.80 | 2,060 | 0900 | 3.80 | 338 |
| 1400 | 7.45 | 3,030 | 1200 | 8.50 | 6,400 | 1200 | 3.93 | 404 |
| 1500 | 6.80 | 2,160 | 1500 | 12.30 | 15,200 | 1500 | 4.20 | 562 |
| 1800 | 9.20 | 6,120 | 1800 | 14.50 | 20,800 | 1800 | 5.00 | 1,140 |
| 2100 | 10.50 | 9,000 | 2100 | 15.84 | 24,500 | 2100 | 9.40 | 8,620 |
| 2400 | 12.30 | 13,700 | 2400 | 15.25 | 22,800 | 2330 | 11.10 | 13,500 |
| Nov. 25 | | | Dec. 19 | | | 2400 | 10.50 | 11,600 |
| 0130 | 14.38 | 19,400 | 0300 | 13,90 | 19,200 | Jan. 18 | | |
| 0300 | 12.35 | 13,800 | 0600 | 13.00 | 17,000 | 0300 | 9.05 | 7,750 |
| 0600 | 11.35 | 11,100 | 0900 | 11.80 | 14,000 | 0600 | 8.35 | 6,180 |
| 0900 | 10.50 | 9,000 | 1200 | 10.60 | 11,000 | 0900 | 7.20 | 3,990 |
| 1200 | 9.60 | 6,960 | 1500 | 9.90 | 9,280 | 1200 | 6.35 | 2,690 |
| 1500 | 8.25 | 4,350 | 1800 | 9.10 | 7,600 | 1500 | 6.00 | 2,150 |
| 1800 | 7.15 | 2,610 | 2100 | 8.10 | 5,680 | 1800 | 5.75 | 1,800 |

(27) 09443000 San Francisco River near Alma, N. Mex.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 25—Con. | | | Dec. 19—Con. | | | Jan. 18—Con. | | |
| 2100 | 6.50 | 1,800 | 2400 | 7.60 | 4,780 | 2100 | 5.55 | 1,520 |
| 2400 | 6.00 | 1,300 | Dec. 20 | | | 2400 | 5.37 | 1,350 |
| Nov. 26 | | | 0600 | 6.70 | 3,640 | Jan. 19 | | |
| 0600 | 5.55 | 1,050 | 1200 | 6.00 | 2,860 | 0600 | 5.12 | 1,030 |
| 1200 | 5.35 | 890 | 1800 | 5.35 | 1,820 | 1200 | 5.00 | 938 |
| 1800 | 5.20 | 780 | 2400 | 5.15 | 1,520 | 1800 | 4.95 | 862 |
| 2400 | 5.00 | 660 | | | | 2400 | 4.89 | 816 |
| Nov. 27 | | | Dec. 21 | | | Jan. 20 | | |
| 0600 | 4.86 | 578 | 0600 | 5.20 | 1,470 | 0600 | 4.83 | 733 |
| 1200 | 4,64 | 572 | 1200 | 5.20 | 1,470 | 1200 | 4.75 | 680 |
| 1800 | 4.53 | 515 | 1800 | 5.05 | 1,320 | 1800 | 4.66 | 627 |
| 2400 | 4.38 | 446 | 2400 | 4.85 | 1,140 | 2400 | 4.44 | 498 |
| Nov. 28 | | | Dec. 22 | | | Jan. 21 | | |
| 1200 | 4.24 | 346 | 0600 | 4.65 | 919 | 0600 | 4.40 | 444 |
| 2400 | 4.05 | 282 | 1200 | 4.50 | 798 | 1200 | 4.30 | 388 |
| Dec. 18 | | | 1800 | 4.34 | 680 | 1800 | 4.25 | 360 |
| 0100 | 3.44 | 54 | 2400 | 4.30 | 652 | 2400 | 4.22 | 346 |

(28) 09444000 San Francisco River near Glenwood, N. Mex.

Location.--Lat 33°14'48", long 108°52'47", in NE¼NW¼ sec.23, T.12 S., R.20 W., Catron County, Hydrologic Unit 15040004, on left bank 0.2 mi (0.3 km) upstream from hot springs, 5 mi (8 km) south of Glenwood, and 6 mi (10 km) downstream from Whitewater Creek, at mile 511.5.

Drainage area.--1,653 $mi^2$ (4,281 $km^2$).

Gage-height record.--Water-stage recorder graph except 2000 hours Dec. 18 to 1200 hours Dec. 20, which was reconstructed. Altitude of gage is 4,560 ft (1,290 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 6,500 $ft^3/s$ (184 $m^3/s$) on basis of slope-area measurement at gage heights 10.74 ft (3.274 m) and 15.6 ft (4.75 m).

Maxima.--November 1978 to March 1979: Discharge, 20,500 $ft^3/s$ (581 $m^3/s$) Dec. 18, gage height, 15.60 ft (4.755 m).

1927 to October 1978: Discharge, 24,000 $ft^3/s$ (680 $m^3/s$) Oct. 20, 1972, gage height, 16.61 ft (5.063 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Nov. 28 | | | Jan. 17—Con. | | |
| 0100 | 1.39 | 24 | 0600 | 3.67 | 500 | 1200 | 2.76 | 342 |
| 0600 | 1.56 | 32 | 1200 | 3.52 | 448 | 1500 | 3.16 | 541 |
| 0900 | 2.59 | 137 | 1800 | 3.37 | 400 | 1800 | 3.47 | 720 |

(28) 09444000 San Francisco River near Glenwood, N. Mex.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24—Con. | | | Nov. 28—Con. | | | Jan. 17—Con. | | |
| 1200 | 4.45 | 614 | 2400 | 3.27 | 370 | 2100 | 4.89 | 1,010 |
| 1500 | 6.37 | 1,630 | Dec. 18 | | | 2400 | 10.01 | 9,260 |
| 1800 | 8.18 | 3,210 | 0600 | 1.92 | 83 | Jan. 18 | | |
| 2100 | 9.41 | 4,640 | 0900 | 2.92 | 249 | 0200 | 10.92 | 10,900 |
| 2400 | 11.36 | 7,800 | 1200 | 5.67 | 1,430 | 0600 | 8.50 | 6,760 |
| Nov. 25 | | | 1500 | 11.20 | 8,640 | 0900 | 8.22 | 6,370 |
| 0300 | 13.41 | 11,700 | 1800 | 14.20 | 16,000 | 1200 | 6.72 | 4,080 |
| 0430 | 13.80 | 12,600 | 2000 | 15.16 | 19,000 | 1500 | 5.68 | 2,750 |
| 0600 | 13.29 | 11,400 | ---- | 15.6 | 20,500 | 1800 | 6.16 | 3,330 |
| 0900 | 12.66 | 9,980 | Dec. 20 | | | 2100 | 5.94 | 3,060 |
| 1200 | 11.90 | 8,310 | 1200 | 6.96 | 3,640 | 2400 | 5.76 | 2,840 |
| 1500 | 10.89 | 6,470 | 1800 | 6.16 | 2,770 | Jan. 19 | | |
| 1800 | 9.60 | 4,450 | 2400 | 5.51 | 2,140 | 0600 | 4.98 | 1,960 |
| 2100 | 8.93 | 3,650 | Dec. 21 | | | 1200 | 4.59 | 1,570 |
| 2400 | 8.38 | 3,120 | 0600 | 5.13 | 1,790 | 1800 | 4.24 | 1,270 |
| Nov. 26 | | | 1200 | 4.84 | 1,560 | 2400 | 4.03 | 1,100 |
| 0600 | 7.26 | 3,110 | 1800 | 4.52 | 1,330 | Jan. 20 | | |
| 1200 | 6.31 | 2,190 | 2400 | 4.32 | 1,210 | 0600 | 3.82 | 941 |
| 1800 | 5.49 | 1,540 | Dec. 22 | | | 1200 | 3.61 | 790 |
| 2400 | 4.87 | 1,170 | 0600 | 4.21 | 1,190 | 1800 | 3.38 | 657 |
| | | | 1200 | 4.07 | 1,110 | 2400 | 3.31 | 616 |
| Nov. 27 | | | 1800 | 3.97 | 1,050 | Jan. 21 | | |
| 0600 | 4.60 | 860 | 2400 | 3.81 | 954 | 0600 | 3.20 | 564 |
| 1200 | 4.30 | 714 | Jan. 17 | | | 1200 | 3.15 | 535 |
| 1800 | 4.05 | 614 | 0100 | 2.39 | 218 | 1800 | 3.06 | 485 |
| 2400 | 3.84 | 535 | 0600 | 2.49 | 250 | 2400 | 2.99 | 450 |

(29) 09444100 Campbell Blue Creek near Alpine, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°44'46", long 109°12'17", in SE¼SE¼ sec.26, T.4 N., R.30 E., Greenlee County Hydrologic Unit 15040004, Apache National Forest, 2.5 mi (4.0 km) upstream from Coleman Creek, and 8 mi (13 km) southwest of Alpine.

Drainage area.--11.6 $mi^2$ (30.1 $km^2$).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 7,700 ft (2,350 m) from topographic map.

Discharge record.--Stage-discharge relation for Villemonte weir defined by model studies.

Maxima.--November 1978 to March 1979: Discharge, 255 $ft^3/s$ (7.22 $m^3/s$) 1625 hours Dec. 18, gage height, 4.92 ft (1.500 m).
1958 to October 1978: Discharge, 341 $ft^3/s$ (9.66 $m^3/s$) Oct. 20, 1972, gage height, 5.50 ft (1.676 m).

Remarks.--Discharges furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station and rounded to U.S. Geological Survey standards. Watershed is one of several small watersheds in this area.

(29) 09444100 Campbell Blue Creek near Alpine, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 2400 | 0.58 | 1.38 | 2400 | 2.95 | 67 | 1125 | 2.42 | 40 |
| Dec. 17 | | | | | | 2400 | 2.06 | 26 |
| 2125 | .90 | 3.5 | Dec. 19 | | | Dec. 21 | | |
| 2400 | 1.02 | 4.6 | 0335 | 2.76 | 56 | 0815 | 1.95 | 22 |
| | | | 0730 | 2.98 | 68 | 1300 | 2.13 | 28 |
| Dec. 18 | | | 1030 | 2.88 | 62 | 1620 | 2.18 | 30 |
| 0325 | 1.52 | 12 | 1335 | 3.06 | 73 | 1955 | 2.07 | 26 |
| 0500 | 1.72 | 16 | 1558 | 2.83 | 60 | 2400 | 1.93 | 22 |
| 1245 | 3.00 | 70 | 1630 | 2.86 | 62 | Dec. 22 | | |
| 1500 | 4.20 | 169 | 1930 | 2.66 | 51 | 0900 | 1.78 | 18 |
| 1625 | 4.92 | 255 | 2400 | 2.45 | 42 | 1155 | 2.00 | 24 |
| 1700 | 4.58 | 211 | Dec. 20 | | | 1300 | 2.06 | 26 |
| 1800 | 3.60 | 112 | 0900 | 2.23 | 32 | 2400 | 1.78 | 18 |

(30) 09444200 Blue River near Clifton, Ariz.

Location.--Lat 33°17'27", long 109°11'44", in sec.6, T.2 S., R.31 E. (unsurveyed), Greenlee County, Hydrologic Unit 15040004, in Apache National Forest, on right bank 0.1 mi (0.2 km) downstream from county road crossing, 0.9 mi (1.4 km) upstream from Clear Creek, 8 mi (13 km) upstream from mouth, and 17 mi (27 km) northeast of Clifton.

Drainage area.--506 $mi^2$ (1,311 $km^2$).

Gage-height record.--Digital water-stage recorder tape except 1000 hours Nov. 25 to 1200 hours Nov. 26, 1300 hours Dec. 18 to 1500 hours Dec. 22, and 2200 hours Jan. 17 to 1200 hours Jan. 20 when recorder float rested on a plug of trash in the gage well during recessions. Gage-height record estimated for missing periods. Altitude of gage is 4,160 ft (1,268 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 1,900 $ft^3/s$ (53.8 $m^3/s$) on basis of slope-area measurement at gage height 22.56 ft (6.876 m).

Maxima.--November 1978 to March 1979: Discharge, 14,700 $ft^3/s$ (416 $m^3/s$) 2400 hours Nov. 24, gage height, 17.1 ft (5.21 m).

1965 to October 1978: Discharge, 30,000 $ft^3/s$ (850 $m^3/s$) Oct. 10, 1972, gage height, 22.56 ft (6.876 m). Flood of Oct. 20, 1972 appears to be the highest since at least 1885.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 23 | | | Dec. 18—Con. | | | Jan. 16—Con. | | |
| 2400 | 4.68 | 34 | 0400 | 5.93 | 260 | 1800 | 6.09 | 473 |
| Nov. 24 | | | 0600 | 6.89 | 609 | 2400 | 6.18 | 503 |
| 0300 | 5.51 | 150 | 0800 | 7.65 | 995 | Jan. 17 | | |
| 0600 | 6.68 | 518 | 1000 | 9.84 | 2,810 | 0200 | 6.18 | 516 |
| 0900 | 8.12 | 1,320 | 1200 | 12.36 | 5,990 | 0600 | 6.21 | 633 |

(30) 09444200 Blue River near Clifton, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24—Con. | | | Dec. 18—Con. | | | Jan. 17—Con. | | |
| 1200 | 9.32 | 2,290 | 1300 | 15.66 | 11,800 | 1300 | 7.18 | 948 |
| 1500 | 10.93 | 4,050 | 1400 | 16.3 | 13,100 | 1600 | 7.80 | 1,300 |
| 1700 | 11.63 | 4,900 | 2000 | 13.7 | 8,000 | 1700 | 8.83 | 1,470 |
| 1800 | 13.44 | 7,600 | 2400 | 12.5 | 6,200 | 1800 | 10.08 | 3,050 |
| 2000 | 14.34 | 9,200 | Dec. 19 | | | 1900 | 12.28 | 5,870 |
| 2100 | 14.45 | 9,400 | 0600 | 11.4 | 4,600 | 2015 | 13.6 | 7,850 |
| 2200 | 15.20 | 10,900 | 1200 | 10.5 | 3,500 | 2200 | 12.9 | 6,800 |
| 2400 | 17.1 | 14,700 | 1800 | 9.9 | 2,900 | 2400 | 12.0 | 5,450 |
| Nov. 25 | | | 2400 | 9.4 | 2,400 | Jan. 18 | | |
| 0600 | 14.0 | 8,500 | Dec. 20 | | | 0600 | 10.1 | 3,200 |
| 1200 | 10.8 | 3,600 | 1200 | 8.5 | 1,700 | 1200 | 9.0 | 2,200 |
| 1800 | 8.8 | 1,500 | 2400 | 8.0 | 1,400 | 1800 | 8.4 | 1,800 |
| 2400 | 8.0 | 900 | Dec. 21 | | | 2400 | 7.9 | 1,400 |
| Nov. 26 | | | 1200 | 7.5 | 1,100 | | | |
| 0600 | 7.6 | 700 | 2400 | 7.2 | 900 | Jan. 19 | | |
| 1200 | 7.53 | 628 | Jan. 15 | | | 1200 | 7.1 | 1,100 |
| 1800 | 7.43 | 604 | 2400 | 5.61 | 345 | 2400 | 6.5 | 800 |
| 2400 | 7.35 | 580 | Jan. 16 | | | Jan. 20 | | |
| Dec. 18 | | | 0800 | 5.76 | 381 | 1300 | 6.18 | 724 |
| 0200 | 5.53 | 179 | 1200 | 6.08 | 469 | 2400 | 6.09 | 681 |

(31) 09444400 Chase Creek near Clifton, Ariz.
(Crest-stage station)

Location.--Lat 33°10'20", long 109°22'10", in NW¼ sec.16, T.3 S., R.29 E., Greenlee County, Hydrologic Unit 15040004, at U.S. Highway 666, 9 mi (14.4 km) northwest of Clifton.

Drainage area.--1.37 $mi^2$ (3.55 $km^2$).

Gage-height record.--Crest stages only. Altitude of gage is 6,050 ft from topographic map.

Discharge record.--Stage-discharge relation defined by computations of flow through culvert.

Maxima.--November 1978 to March 1979: Discharge, 72 $ft^3/s$ (2.03 $m^3/s$) probably Dec. 18, gage height, 7.59 ft (2.313 m).
1963 to October 1978: Discharge, 600 $ft^3/s$ (17.0 $m^3/s$) July 25, 1964, gage height, 13.9 ft (4.24 m), from computation of flow through culvert and over roadway.

(32) 09444500 San Francisco River at Clifton, Ariz.

Location.--Lat 33°02'58", long 109°17'43", in SW¼SE¼ sec.30, T.4 S., R.30 E., Greenlee County, Hydrologic Unit 15040004, on downstream side of right pier at Railroad Boulevard Bridge (U.S. Highway 666), at Clifton, 9.9 mi (15.9 km) upstream from mouth.

Drainage area.--2,766 $mi^2$ (7,164 $km^2$).

(32) 09444500 San Francisco River at Clifton, Ariz.—Continued

Gage-height record.--Water-stage recorder except 2000 hours Dec. 19 to 1030 hours Dec. 20 when recorder was underwater. Gage-height record reconstructed on basis of high-water mark and stage measurements by Clifton Police Department. Datum of gage is 3,436.16 ft (1,047,342 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 26,000 $ft^3/s$ (736 $m^3/s$) on basis of slope-area measurment at gage height 17.0 ft (5.18 m).

Maxima.--November 1978 to March 1979: Discharge, 56,000 $ft^3/s$ (1,590 $m^3/s$) about 0030 hours Dec. 19, 1978, gage height, 16.0 ft (4.88 m) from high-water mark in gage house adjusted for surge.

1870 to October 1978: Discharge, 70,000 $ft^3/s$ or 1980 $m^3/s$ (revised) Dec. 3, 1906.

Remarks.--Discharges for the 1906 peak and several other historic peaks are either previously unpublished or were published in error. Discharges below are from Aldridge and Moosburner (written commun., 1978) and superseded those published by Olmstead (1919) and several subsequent authors.

| Date | Approximate discharge | |
|---|---|---|
| | Cubic feet per second | Cubic meters per second |
| February 21, 1981 | 65,000 | 1,840 |
| January 10, 1905 | 60,000 | 1,700 |
| February 17, 1905 | 50,000 | 1,420 |
| November 27, 1905 | 65,000 | 1,840 |
| January 16, 1916 | [1]59,000 (revised) | 1,670 |
| October 13, 1916 | 60,000 (revised) | 17,00 |

[1]From slope-area computation of peak flow.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Dec. 18 | | | Jan. 16 | | |
| 0600 | 3.50 | 340 | 0600 | 2.56 | 202 | 1200 | 3.80 | 443 |
| 0930 | 4.60 | 1,220 | 1000 | 3.10 | 320 | 1600 | 3.95 | 556 |
| 1330 | 5.90 | 3,750 | 1200 | 5.32 | 2,940 | 1800 | 4.15 | 687 |
| 1830 | 6.70 | 6,200 | 1400 | 8.00 | 10,700 | 2400 | 4.31 | 782 |
| 2000 | 8.00 | 10,700 | 1500 | 9.52 | 17,600 | Jan. 17 | | |
| 2100 | 9.00 | 15,000 | 1600 | 10.85 | 24,200 | 1200 | 4.48 | 919 |
| 2130 | 9.75 | 18,350 | 2000 | 13.10 | 35,600 | 1800 | 4.78 | 1,220 |
| 2400 | 11.40 | 27,000 | 2200 | 15.0 | 48,000 | 2000 | 5.72 | 2,740 |
| | | | 2400 | 15.9 | 55,200 | 2100 | 7.30 | 6,740 |
| Nov. 25 | | | Dec. 19 | | | 2200 | 8.90 | 12,700 |
| 0200 | 12.20 | 31,000 | 0030 | 16.0 | 56,000 | 2400 | 10.54 | 22,000 |
| 0530 | 11.40 | 27,000 | 0600 | 13.6 | 38,600 | Jan. 18 | | |
| 0830 | 11.70 | 28,500 | 1200 | 11.1 | 25,500 | 0200 | 9.60 | 18,000 |
| 1030 | 11.60 | 28,000 | 1800 | 10.1 | 20,500 | 0500 | 11.05 | 25,200 |
| 1200 | 10.20 | 21,000 | 2400 | 9.1 | 15,500 | 0800 | 11.30 | 26,500 |
| 1600 | 9.10 | 15,500 | Dec. 20 | | | 0830 | 11.25 | 26,200 |
| 2000 | 8.15 | 11,300 | 0500 | 8.2 | 12,300 | 1100 | 10.40 | 22,000 |

(32) 09444500 San Francisco River at Clifton, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 25—Con. | | | Dec. 20—Con. | | | Jan. 18—Con. | | |
| 2400 | 7.25 | 7,850 | 1030 | 7.20 | 8,820 | 1300 | 9.40 | 16,000 |
| | | | 1800 | 6.50 | 6,500 | 1800 | 8.20 | 11,500 |
| Nov. 26 | | | 2400 | 6.10 | 5,280 | 2400 | 6.90 | 7,800 |
| 0600 | 6.60 | 5,900 | Dec. 21 | | | Jan. 19 | | |
| 1200 | 6.10 | 4,600 | 1200 | 5.60 | 3,650 | 1200 | 6.20 | 4,850 |
| 2400 | 5.50 | 3,300 | 2400 | 5.15 | 2,680 | 2400 | 5.60 | 3,400 |

(33) 09447000 Eagle Creek above Pumping Plant, near Morenci, Ariz.

Location.--Lat 33°04'12", long 109°27'05", in SE¼NE¼ sec.22, T.4 S., R.28 E., Greenlee County, Hydrologic Unit 15040005, 3 mi (5 km) upstream from Phelps Dodge Corp. pumping plant, 5 mi (8 km) west of Morenci, and 13 mi (21 km) upstream from mouth.

Drainage area.--613 mi² (1,588 km²).

Gage-height record.--Water-stage recorder graphs from main gage at flume and from supplemental gage 90 ft (27 m) upstream. Datum of gage is 3,695 ft (1,126 m) unadjusted.

Discharge record.--Discharges of less than 700 ft³/s (19.8 m³/s) are from stage-discharge relation for flume, which is defined by current-meter measurements; larger discharges are from stage-discharge relation for supplemental gage, which was extended above 3,500 ft³/s (99.1 m³/s) on basis of slope-area measurement of peak flow.

Maxima.--November 1978 to March 1979: Discharge, 24,500 ft³/s (694 m³/s) 2200 hours Dec. 18, gage height, 12.5 ft (3.81 m) at supplemental gage.
1944 to October 1978: Discharge, 21,000 ft³/s (595 m³/s) Dec. 30, 1965, gage height, 12.8 ft (3.90 m) at supplemental gage.
Peak of December 18, 1978, is probably the highest since at least 1916.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec.18 | | | Dec. 20 | | | Jan. 17—Con. | | |
| 0800 | 2.25 | 751 | 1400 | 4.57 | 3,080 | 1730 | 7.35 | 12,900 |
| 0930 | 2.32 | 188 | 2400 | 4.23 | 1,950 | 1800 | 7.20 | 12,400 |
| 1400 | 3.45 | 1,550 | Jan. 16 | | | 1830 | 9.15 | 20,400 |
| 1430 | 6.50 | 6,150 | 1200 | 3.80 | 374 | 2000 | 6.30 | 9,600 |
| 1500 | 6.70 | 6,650 | 1530 | 4.1 | 405 | 2030 | 7.10 | 12,000 |
| 1700 | 9.20 | 12,700 | 1700 | 5.15 | 510 | 2100 | 7.55 | 14,800 |
| 1930 | 11.66 | 21,460 | 1900 | 5.40 | 567 | 2300 | 9.20 | 20,600 |
| 2200 | 12.5 | 24,500 | 2400 | 5.80 | 665 | 2400 | 9.15 | 20,400 |
| 2400 | 11.56 | 21,000 | | | | Jan. 18 | | |
| | | | Jan. 17 | | | 0200 | 7.65 | 14,000 |
| Dec. 19 | | | 0500 | 5.93 | 8,220 | 1200 | 4.85 | 5,200 |
| 0300 | 10.45 | 17,100 | 0800 | 5.65 | 7,520 | 1530 | 4.67 | 4,800 |
| 0400 | 8.85 | 11,700 | 0900 | 5.70 | 7,650 | 2000 | 5.14 | 6,000 |

(33) 09447000 Eagle Creek above Pumping Plant, near Morenci, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 19—Con. | | | Jan. 17—Con. | | | Jan. 18—Con. | | |
| 0500 | 7.20 | 7,400 | 1130 | 5.53 | 7,220 | 2400 | 4.83 | 6,160 |
| 0730 | 6.50 | 6,150 | 1300 | 5.60 | 7,400 | Jan. 19 | | |
| 1400 | 5.85 | 5,000 | 1430 | 5.56 | 7,300 | 0600 | 4.10 | 3,600 |
| 2000 | 5.20 | 3,900 | 1600 | 5.96 | 8,300 | 1200 | 3.75 | 2,130 |
| 2400 | 5.00 | 3,600 | 1700 | 6.80 | 11,100 | 2400 | 3.64 | 2,000 |

(34) 09448500 Gila River at head of Safford Valley, near Solomon, Ariz.

Location.--Lat 32°52'06", long 109°30'38", in SE¼NE¼ sec.31, T.6 S., R.28 E., Graham County, Hydrologic Unit 15040005, on left bank 0.6 mi (1.0 km) downstream from intake of Brown Canal, 8 mi (13 km) northeast of Solomon, and 17 mi (27 km) downstream from San Francisco River.

Drainage area.--7,896 $mi^2$ (20,451 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 3,064.88 ft (934.175 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Base stage-discharge relation extended above 35,000 $ft^3/s$ (990 $m^3/s$) on basis of slope-area measurement at 15.6 ft, and area-velocity study at 15.89 ft (4.842 m). Large positive shift adjustments required during the flood period were estimated on basis of current-meter measurements below 52,000 $ft^3/s$ and a slope-area measurement of the peak flow.

Maxima.--November 1978 to March 1979: Discharge, 100,000 $ft^3/s$ (2,830 $m^3/s$) 0300 hours Dec. 19, gage height, 14.40 ft (4,389 m).

1914 to October 1978: Discharge about 100,000 $ft^3/s$ (2,830 $m^3/s$) Jan. 19, 1916, gage height, 15.89 ft or 4.843 present datum.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Dec. 18—Con. | | | Dec. 21 | | |
| 0600 | 4.02 | 229 | 1600 | 5.80 | 3,100 | 1200 | 7.20 | 13,250 |
| 1600 | 4.20 | 343 | 1630 | 7.30 | 7,700 | 2400 | 6.50 | 19,700 |
| 1630 | 5.56 | 1,910 | 1700 | 8.30 | 12,300 | Dec. 22 | | |
| 2000 | 6.70 | 5,050 | 1830 | 10.70 | 30,000 | 1200 | 6.00 | 7,380 |
| 2030 | 6.53 | 4,650 | 2000 | 12.00 | 45,200 | 2400 | 5.55 | 5,550 |
| 2300 | 7.29 | 7,660 | 2100 | 12.70 | 55,800 | Jan. 17 | | |
| 2400 | 8.21 | 12,100 | 2400 | 13.65 | 76,800 | 0100 | 4.05 | 1,660 |
| | | | Dec. 19 | | | 2000 | 4.40 | 2,380 |
| Nov. 25 | | | 0300 | 14.40 | 100,000 | 2400 | 5.65 | 5,950 |
| 0200 | 9.40 | 19,580 | 0600 | 13.50 | 76,800 | | | |
| 0430 | 10.70 | 30,000 | 1100 | 12.50 | 58,300 | Jan. 18 | | |
| 0630 | 11.75 | 41,000 | 1400 | 11.40 | 45,200 | 0100 | 7.30 | 14,000 |
| 0830 | 11.20 | 35,000 | 1700 | 10.75 | 38,000 | 0200 | 8.65 | 23,600 |

(34) 09448500 Gila River at head of Safford Valley, near Solomon, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 25—Con. | | | Dec. 19—Con. | | | Jan. 18—Con. | | |
| 1130 | 9.80 | 22,400 | 1800 | 10.40 | 35,000 | 0300 | 9.40 | 31,000 |
| 1330 | 10.05 | 28,000 | 2030 | 10.85 | 39,200 | 0500 | 10.00 | 38,000 |
| 1800 | 9.32 | 18,900 | 2130 | 12.00 | 51,400 | 0600 | 9.80 | 35,000 |
| 2400 | 8.59 | 14,300 | 2330 | 13.90 | 88,000 | 0700 | 10.10 | 39,200 |
| Nov.26 | | | 2400 | 13.80 | 85,200 | 1000 | 9.70 | 34,000 |
| 1300 | 7.86 | 10,300 | | | | 1200 | 9.20 | 26,400 |
| 2230 | 8.72 | 15,100 | Dec. 20 | | | 1400 | 8.50 | 19,600 |
| 2400 | 8.60 | 14,400 | 0400 | 13.00 | 73,000 | 1700 | 8.15 | 16,300 |
| Nov. 27 | | | 0600 | 12.10 | 61,000 | 2000 | 8.00 | 15,200 |
| 0600 | 7.76 | 9,780 | 0900 | 11.00 | 52,200 | 2400 | 8.30 | 17,500 |
| 1100 | 7.35 | 7,660 | 1200 | 10.40 | 43,400 | | | |
| 1800 | 6.70 | 5,300 | 1500 | 9.60 | 33,000 | Jan. 19 | | |
| 2400 | 6.30 | 4,100 | 1900 | 8.50 | 22,000 | 0200 | 8.40 | 18,000 |
| Dec. 18 | | | 2000 | 8.00 | 18,400 | 1200 | 7.80 | 13,500 |
| 1530 | 4.10 | 468 | 2400 | 7.95 | 17,800 | 2400 | 7.05 | 9,100 |

(35) 09457000 San Simon River near Solomon, Ariz.

Location.--Lat 32°48'06", long 109°38'19", in NW¼NE¼ sec.25, T.7 S., R.26 E., Graham County, Hydrologic Unit 15040006, 1.0 mi (1.6 km) southwest of Solomon and 2.2 mi (3.5 km) upstream from mouth.

Drainage area.--2,192 mi² (5,677 km²).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,960.15 ft (902.25 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 727 ft³/s (21.2 m³/s) 1800 hours Jan. 17, gage height, 7.20 ft (2.195 m). Maximum during December flood is 56 ft³/s or 1.6 m³/s.

1931 to October 1978: Discharge, 27,500 ft³/s (779 m³/s) Aug. 9, 1931, from slope-area measurement of peak flow, gage height, 19.0 ft (5.79 m).

Flood of Aug. 9, 1931, is the maximum since at least the early 1880's. Olmstead (1919) gives a peak discharge of 11,960 ft³/s (338 m³/s) for the maximum flood known prior to 1919. Date of flood unknown.

(36) 09458050 Marijilda Wash near Safford, Ariz.
(Discontinued station)

Location.--Lat 32°41'43", long 109°47'"28, in NE¼ sec.33, T.8 S., R.25 E. (unsurveyed), Graham County, Hydrologic Unit 15040005, on right bank, in Coronado National Forest, 10 mi (16 km) southwest of Safford

Drainage area.--10.9 mi² (28.2 km²).

Gage-height record.--Crest stage only. Altitude of gage is 4,500 ft (1,370 m) from topographic map.

Maxima.--November 1978 to March 1979: Discharge, 5,770 ft³/s (163.4 m³/s) Dec. 18 from slope-area measurement of peak flow; gage height, 6.8 ft (2.07 m) from floodmarks at gage.

1971 to October 1978: Discharge, 883 ft³/s (25.0 m³/s) Sept. 13, 1977, gage height, 5.10 ft (1.554 m) from rating curve extended above 668 ft³/s (18.9 m³/s).

## (37) 09458200 Deadman Creek near Safford, Ariz.
(Discontinued station)

Location.--Lat 32°43'59", long 109°48'57", in SW¼ sec.17, T.8 S., R.25 E. (unsurveyed), Graham County, Hydrologic Unit 15040005, in Coronado National Forest, on left bank, 9 mi (14 km) southwest of Safford

Drainage area.--4.78 $mi^2$ (12.38 $km^2$).

Gage-height record.--None. Altitude of gage is 4,950 ft (1,509 m) from topographic map.

Maxima.--November 1978 to March 1979: Discharge, 2,760 $ft^3/s$ (78.2 $m^3/s$) from slope-area measurement of peak flow.

1966 to September 1976: Discharge, 119 $ft^3/s$ (3.37 $m^3/s$) Oct. 19, 1972, gage height, 3.45 ft (1.052 m) from rating curve extended above 18 $ft^3/s$ (0.51 $m^3/s$) on basis of computation of flow over weir at gage height 3.25 ft (0.991 m).

## (38) 09466500 Gila River at Calva, Ariz.

Location.--Lat 33°11'08", long 110°13'10", in SW¼ sec.8, T.3 S., R.21 E. (unsurveyed), Graham County, Hydrologic Unit 15040005, in San Carlos Indian Reservation, on right upstream abutment of Southern Pacific Railroad bridge at head of San Carlos Reservoir, 2.0 mi (3.2 km) west of Calva. Supplemental gage at downstream side of bridge.

Drainage area.--11,470 $mi^2$ (29,710 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,517.29 ft (767.270 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements. Large positive shift adjustments required after the peak of December 20 were estimated on basis of current-meter measurements below 29,000 $ft^3/s$ (820 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 100,000 $ft^3/s$ (2,830 $m^3/s$) 2130 hours Dec. 19, gage height, 15.20 ft (4,633 m).

1929 to October 1978: Discharge, 80,000 $ft^3/s$ (2,270 $m^3/s$) Oct. 20, 1972, gage height, 15.88 ft (4.840 m) at supplemental gage, from rating curve extended above 44,000 $ft^3/s$ (1,250 $m^3/s$).

Floods of February 1891, November 1905, and January 1916 probably exceeded 100,000 $ft^3/s$ (2,830 $m^3/s$).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Dec. 18 | | | Dec. 22—Con. | | |
| 1700 | 1.51 | 102 | 0500 | 1.80 | 294 | 1200 | 5.95 | 9,100 |
| 2400 | 2.65 | 406 | 0900 | 2.10 | 399 | 1600 | 5.75 | 8,500 |
| Nov. 25 | | | 1030 | 2.81 | 692 | 1700 | 5.95 | 9,100 |
| 0300 | 3.40 | 770 | 1100 | 2.76 | 674 | 2400 | 5.40 | 7,480 |
| 0900 | 4.55 | 1,760 | 1200 | 2.85 | 722 | Dec. 23 | | |
| 1500 | 5.65 | 3,380 | 1500 | 2.50 | 555 | 1000 | 4.75 | 5,940 |

(38) 09466500 Gila River at Calva, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 25—Con. | | | Dec. 18—Con. | | | Dec. 23—Con. | | |
| 2100 | 6.43 | 4,810 | 1700 | 3.66 | 1,270 | 2400 | 4.40 | 5,040 |
| 2400 | 6.75 | 5,340 | 2000 | 4.66 | 2,170 | Jan. 17 | | |
| Nov. 26 | | | 2200 | 5.45 | 3,100 | 2400 | 3.17 | 2,470 |
| 0300 | 7.08 | 6,030 | 2400 | 6.25 | 4,020 | Jan. 18 | | |
| 0700 | 7.68 | 7,410 | Dec. 19 | | | 0600 | 3.90 | 3,820 |
| 0830 | 8.55 | 9,580 | 0530 | 7.40 | 5,940 | 1200 | 4.80 | 6,240 |
| 0930 | 9.49 | 12,100 | 0800 | 7.30 | 5,640 | 1400 | 6.20 | 12,500 |
| 1100 | 10.92 | 17,600 | 1200 | 7.75 | 6,840 | 1600 | 7.70 | 18,800 |
| 1400 | 12.00 | 22,400 | 1600 | 8.62 | 9,380 | 1800 | 8.90 | 23,200 |
| 1800 | 11.70 | 21,000 | 1730 | 9.80 | 15,200 | 2000 | 9.75 | 26,900 |
| 2100 | 11.20 | 18,500 | 1800 | 11.00 | 22,400 | 2200 | 9.85 | 27,400 |
| 2400 | 10.65 | 16,100 | 1900 | 14.00 | 61,900 | 2300 | 9.90 | 27,900 |
| Nov. 27 | | | 2000 | 15.10 | 96,200 | 2400 | 9.80 | 26,900 |
| 0600 | 9.75 | 12,600 | 2100 | 15.20 | 100,000 | Jan. 19 | | |
| 0900 | 9.25 | 13,600 | 2400 | 14.60 | 85,100 | 0300 | 9.25 | 26,000 |
| 1200 | 9.05 | 11,200 | Dec. 20 | | | 0600 | 8.15 | 23,600 |
| 1500 | 9.05 | 11,200 | 0500 | 13.50 | 61,900 | 0800 | 7.45 | 22,100 |
| 1800 | 9.10 | 11,400 | 0930 | 12.80 | 54,300 | 1400 | 6.95 | 21,200 |
| 2200 | 9.30 | 12,100 | 1300 | 13.75 | 67,850 | 1900 | 6.25 | 19,400 |
| 2400 | 9.30 | 12,100 | 1500 | 14.40 | 81,600 | 2400 | 5.30 | 15,800 |
| Nov. 28 | | | 1600 | 14.40 | 81,600 | Jan. 20 | | |
| 0400 | 8.75 | 10,200 | 2400 | 12.85 | 54,300 | 0300 | 4.76 | 14,400 |
| 1100 | 7.50 | 6,930 | Dec. 21 | | | 0700 | 4.22 | 13,100 |
| 1800 | 6.38 | 4,570 | 0600 | 11.35 | 38,100 | 1700 | 3.80 | 8,900 |
| 2400 | 5.75 | 3,490 | 1400 | 9.90 | 27,400 | 2400 | 3.60 | 6,840 |
| Nov. 29 | | | 2400 | 7.80 | 16,100 | Jan. 21 | | |
| 1200 | 5.30 | 2,890 | Dec. 22 | | | 1200 | 3.65 | 6,690 |
| 2400 | 4.80 | 2,330 | 0600 | 6.95 | 12,500 | 2400 | 3.50 | 5,940 |

(39) 09467120 Salt Creek near Peridot, Ariz.
(Crest-stage station)

Location.--Lat 33°16'15", long 110°18'15", Graham County, Hydrologic Unit 15040005, at U.S. Highway 70, 4 mi (6.4 km) above mouth, and 9.5 mi (15.3 km) southeast of Peridot.

Drainage area.--35.2 $mi^2$ (91.2 $km^2$). Contributing drainage area 30.3 $mi^2$ (48.6 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 2,800 ft (853 m) from topographic map.

Discharge record.--Stage-discharge relation defined on basis of culvert computations.

Maxima.--November 1978 to March 1979: Discharge, 2,200 $ft^3/s$ (62.3 $m^3/s$) Dec. 18, gage height, 18.17 ft (5.538 m).

1964 to October 1978: Discharge, 3,200 $ft^3/s$ (90.6 $m^3/s$) Oct. 19, 1972, gage height, 19.56 ft (5.962 m).

(40) 09468300 Sevenmile Wash Tributary near Globe, Ariz.
(Crest-stage station)

Location.--Lat 33°35'10", long 110°39'00", Gila County, Hydrologic Unit 15040007, at U.S. Highway 60, 0.2 mi (0.32 km) south of Sevenmile Wash and 15 mi (24 km) northwest of Globe.

Drainage area.--0.83 $mi^2$ (2.15 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 4,072 ft (1,241.15 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined on basis of culvert computations.

Maxima.--November 1978 to March 1979: Discharge, 640 $ft^3/s$ (18.1 $m^3/s$) Dec. 18, gage height, 9.47 ft (2.886 m).
1933 to October 1978: Discharge, 526 $ft^3/s$ (14.9 $m^3/s$) from slope-area measurement in culvert. Date and gage height unknown.

(41) 09468500 San Carlos River near Peridot, Ariz.

Location.--Lat 33°19'16", long 110°26'54", in NW¼ sec. 30, T.1 S., R.19 E. (unsurveyed), Gila County, Hydrologic Unit 15040007, in San Carlos Indian Reservation, on right bank 750 ft (229 m) downstream from highway crossing, 0.8 mi (1.3 km) north of Peridot, and 2.4 mi (3.9 km) south of San Carlos. Gage moved 1.8 mi (2.9 km) downstream to U.S. Highway 70 on Jan. 31, 1979.

Drainage area.--1,027 $mi^2$ (2,660 $km^2$).

Gage-height record.--Water-stage recorder graph except during short periods on Jan. 16 and 18, which were reconsturcted. Datum of gage is 2,578.90 ft (786.049 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Base rating extended above 2,200 $ft^3/s$ (62.3 $m^3/s$) on basis of contracted-opening measurement of peak flow of Dec. 22, 1965 at gage height 14.8 ft (3.99 m). Large negative shift adjustments prior to development of a new channel during flood of Dec. 18 were estimated from current-meter measurements below 340 $ft^3/s$ (9.63 $m^3/s$) during the flood period and from measurements to 17,000 $ft^3/s$ (637 $m^3/s$) made in March 1978. Large positive shifts, after development of the channel, estimated from current-meter measurements below 11,000 $ft^3/s$ (312 $m^3/s$) and contracted opening measurement of peak flow. Records poor.

Maxima.--November 1978 to March 1979: Discharge, 22,500 $ft^3/s$ (637 $m^3/s$) 1130 hours Dec. 18, from contracted opening measurement of peak flow at site 4 mi (6.4 $km^2$) downstream. Gage height, 13.07 ft (3.973 m) 0100 hours Nov. 25, result of failure of partially completed dam forming Talkalai Reservoir (discharge 22,400 $ft^3/s$ or 634 $m^3/s$).
1928 to October 1978: Discharge, 40,600 $ft^3/s$ (1,150 $m^3/s$) Mar. 14, 1941, gage height, 11.4 ft (3.47 m) site and datum then in use from rating curve extended above 23,000 $ft^3/s$ (650 $m^3/s$) on basis of rate of change in storage in San Carlos Reservoir.

(41) 09468500 San Carlos River near Peridot, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Nov. 26—Con. | | | Dec. 19—Con. | | |
| 1030 | 1.20 | 20.0 | 1200 | 1.66 | 326 | 0600 | 6.38 | 11,900 |
| 1300 | 1.58 | 58.5 | 2400 | 1.40 | 218 | 0730 | 5.69 | 10,600 |
| 1400 | 1.46 | 44.0 | Dec. 17 | | | 1000 | 5.12 | 7,740 |
| 1430 | 2.90 | 485 | 2330 | .80 | 38 | 1600 | 4.34 | 3,400 |
| 1600 | 4.00 | 1,440 | 2400 | 3.36 | 2,160 | 2400 | 3.75 | 1,260 |
| 1630 | 5.00 | 2,540 | Dec. 18 | | | Dec. 20 | | |
| 1730 | 6.50 | 4,900 | 0100 | 3.00 | 1,580 | 1200 | 3.66 | 1,100 |
| 2100 | 5.16 | 2,640 | 0130 | 4.00 | 3,310 | 2400 | 3.48 | 805 |
| 2130 | 6.40 | 4,700 | 0200 | 5.29 | 6,060 | Jan. 16 | | |
| 2200 | 8.70 | 8,900 | 0330 | 6.40 | 8,700 | 1830 | 3.38 | 475 |
| 2300 | 9.84 | 11,500 | 0500 | 7.76 | 12,700 | 2000 | 3.58 | 583 |
| 2400 | 9.34 | 10,200 | 0600 | 7.60 | 12,200 | 2400 | 3.61 | 814 |
| Nov. 25 | | | 0730 | 7.90 | 13,200 | Jan. 17 | | |
| 0030 | 10.34 | 12,700 | 1000 | 9.40 | 19,800 | 1000 | 3.62 | 822 |
| 0045 | 11.94 | 17,800 | 1130 | 10.00 | 22,500 | 1100 | 3.80 | 1,560 |
| 0100 | 13.07 | 22,400 | 1330 | 9.48 | 20,200 | 1230 | 6.50 | 12,300 |
| 0130 | 11.34 | 15,600 | 1500 | 9.90 | 21,800 | 1500 | 7.20 | 14,100 |
| 0200 | 8.40 | 8,150 | 1730 | 9.50 | 20,600 | 1630 | 8.15 | 16,400 |
| 0215 | 6.70 | 5,200 | 1900 | 9.70 | 21,400 | 1900 | 7.20 | 10,900 |
| 0315 | 5.30 | 3,260 | 2100 | 8.70 | 17,800 | 2230 | 6.33 | 6,760 |
| 0730 | 3.80 | 1,560 | 2200 | 7.59 | 14,600 | 2400 | 6.74 | 8,500 |
| 0930 | 3.80 | 1,560 | 2400 | 6.49 | 12,200 | Jan. 18 | | |
| 1400 | 2.84 | 693 | | | | 0600 | 5.66 | 4,080 |
| 2400 | 2.20 | 435 | Dec. 19 | | | 1000 | 5.19 | 2,370 |
| | | | 0130 | 5.74 | 10,700 | 1100 | 5.24 | 2,440 |
| Nov. 26 | | | 0300 | 5.72 | 10,600 | 1800 | 4.98 | 1,790 |
| 0600 | 1.80 | 400 | 0400 | 6.59 | 12,300 | 2400 | 4.70 | 890 |

(42) 09469000 San Carlos Reservoir at Coolidge Dam, Ariz.

Location.--Lat 33°10'32", long 110°31'38", in NW¼ sec.17, T.3 S., R.18 E. (unsurveyed), Gila County, Hydrologic Unit 15040005, in San Carlos Indian Reservation, at right intake tower of Coolidge Dam on Gila River.

Drainage area.--12,886 mi² (33,375 km²).

Gage-height record.--Water-stage recorder graph. Datum of gage is National Geodetic Vertical Datum of 1929.

Contents.--Contents computed from capacity tables developed by San Carlos Irrigation District.

Maxima.--November 1978 to March 1979: Contents, 1,030,000 acre-ft (1,270 hm³) 2400 hours Mar. 31; elevation, 2,717.16 ft (767.230 mi)

1928 to October 1978: Contents, 843,300 acre-ft (1,040 hm³) June 1, 1973; elevation, 2,704.67 ft (763.423 m).

Remarks.--Reservoir is formed by concrete multiple-dome dam completed Oct. 25, 1928; storage began Nov. 15, 1928. Usable capacity, 1,070,000 acre-ft (1,320 hm³), from table put in use Jan. 1, 1979, between elevations 2,382.63 ft (726.226 m)—sill of lowest outlet gate—and 2,519.0 ft (767.79 m)—crest of spillway. Reservoir is used to store water for irrigation of San Carlos project and for power development. Contents reached 1,070,000 acre-ft (1,320 hm³) April 22, 1979; flow over spillway from Apr. 22, 1979, to about May 5, 1979.

(43) 09469500 Gila River below Coolidge Dam, Ariz.

Location.--Lat 33°10'10", long 110°31'50", in SW¼ sec.17, T.3 S., R.18 E. (unsurveyed), Pinal County, Hydrologic Unit 15050100, on left bank 2,200 ft (670 m) downstream from Coolidge Dam.

Drainage area.--12,886 $mi^2$ (33,375 $km^2$).

Gage-height record.--Water-stage recorder chart. Datum of gage is 2,309.33 ft (703.884 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation for concrete flume defined by discharge measurements.

Maxima.--November 1978 to March 1979: Daily discharge 1,460 $ft^3/s$ (41.3 $m^3/s$) Mar. 29, gage height, 4.84 ft (1.475 m). Maximum during December flood period, 64 $ft^3/s$ (1.81 $m^3/s$).

1928 to October 1978: Discharge, 1,350 $ft^3/s$ (38.2 $m^3/s$) July 28, 1952, gage height, 4.64 ft (1.414 m).

1914 to 1928: Discharge, 130,000 $ft^3/s$ (3,680 $m^3/s$) Jan. 20, 1916, estimated on basis of peak discharge near Solomon and at Kelvin.

Remarks.--Flow regulated by San Carlos Reservoir since Nov. 15, 1928. (See sta 09469000.) Record includes flow of Warm Springs, which enters between dam and gage.

(44) 09470000 Gila River at Winkelman, Ariz.

Location.--Lat 33°00'06", long 110°45'55", in NW¼NE¼ sec.13, T.5 S., R.15 E., Gila County, Hydrologic Unit 15050100, on right bank 1 mi (1.6 km) north of Winkelman, 2.2 mi (3.5 km) upstream from San Pedro River, and 29 mi (47 km) downstream from Coolidge Dam.

Drainage area.--13,268 $mi^2$ (34,364 $km^2$), of which 382 $mi^2$ (989 $km^2$) is below Coolidge Dam.

Gage-height record.--Digital water-stage recorder tape. Datum of gage is 1,921.76 ft (585.752 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 9,520 $ft^3/s$ (270 $m^3/s$) 1430 hours Dec. 18, gage height, 14.30 ft (4,359 m).

1941 to October 1978: Discharge, 55,000 $ft^3/s$ (1,560 $m^3/s$) Aug. 9, 1944, gage height, 18.40 ft (5.608 m) from rating curve extended above 2,900 $ft^3/s$ (82 $m^3/s$) on basis of slope-area measurement of peak flow.

Peak discharge, Aug. 9, 1944, is probably the highest to originate downstream from Coolidge Dam since at least 1913, but it could have been exceeded on Aug. 4, 1930, or Aug. 30, 1931.

Remarks.--Flow regulated by San Carlos Reservoir since 1928. Records of peak flow show discharge from drainage area below Coolidge Dam.

(44) 09470000 Gila River at Winkelman, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 0100 | 2.05 | 97 | 1430 | 14.30 | 9,520 | 0600 | 12.16 | 6,110 |
| 0300 | 3.53 | 574 | 1500 | 14.10 | 8,920 | 0800 | 11.63 | 5,532 |
| 0500 | 4.15 | 862 | 1600 | 13.84 | 8,470 | 1200 | 9.29 | 3,770 |
| 0700 | 5.61 | 1,570 | 2100 | 13.55 | 8,030 | 1800 | 5.83 | 1,680 |
| 0900 | 7.67 | 2,750 | 2400 | 13.28 | 7,630 | 2400 | 4.91 | 1,220 |
| 1100 | 10.22 | 4,410 | | | | | | |
| 1200 | 11.76 | 5,640 | Dec. 19 | | | Dec.20 | | |
| 1300 | 13.40 | 7,810 | 0200 | 13.11 | 7,390 | 0400 | 4.93 | 1,230 |
| 1400 | 14.10 | 8,920 | 0400 | 12.69 | 6,810 | ---- | 3.53 | 581 |

(45) 09472000 San Pedro River near Redington, Ariz.

Location.--Lat 32°22'50", long 110°26'45", in NE¼NW¼ sec.19, T.12 S., R.19 E., Cochise County, Hydrologic Unit 15050203, on left bank 0.3 mi (0.5 km) upstream from Cochise-Pima County line, 4.3 mi (6.9 km) southeast of Redington, and 30 mi (48 km) north of Benson.

Drainage area.--2,939 mi² (7,612 km²), of which 696 mi² (1,803 km²) is in Mexico.

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,930.04 ft (893.076 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 3,300 ft³/s (93 m³/s) on the basis of slope-area measurement at 15.21 ft (6.523 m).

Maxima.--November 1978 to March 1979: Discharge, 10,800 ft³/s (306 m³/s) 2000 hours Jan. 18, gage height, 15.21 ft (4.636 m).

1906 to October 1978: Discharge, about 90,000 ft³/s (2,550 m³/s) Sept. 28, 1926, gage height, 29.0 ft (8.84 m) present site and datum from floodmark. Discharge computed on basis of peak discharges of San Pedro River at Charleston and Gila River at Kelvin.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19—Con. | | | Jan. 17—Con. | | |
| 2400 | 6.2 | 10 | 2400 | 14.57 | 9,670 | 2300 | 10.35 | 3,190 |
| Dec. 18 | | | Dec. 20 | | | 2400 | 11.55 | 5,210 |
| 0400 | 6.2 | 10 | 0200 | 14.92 | 10,200 | Jan. 18 | | |
| 0600 | 7.85 | 163 | 0600 | 14.0 | 8,900 | 0500 | 10.38 | 3,220 |
| 0800 | 8.25 | 348 | 0800 | 12.85 | 7,270 | 0700 | 9.97 | 2,370 |
| 1000 | 8.80 | 760 | 0900 | 12.0 | 6,020 | 1300 | 9.47 | 1,530 |
| 1300 | 9.85 | 2,190 | 1100 | 11.25 | 4,790 | 1400 | 12.3 | 6,500 |
| 1500 | 11.00 | 4,300 | 1300 | 10.75 | 3,880 | 1600 | 14.36 | 9,020 |
| 1800 | 13.2 | 7,720 | 1500 | 10.55 | 3,520 | 2000 | 15.21 | 10,800 |

(45) 09472000 San Pedro River near Redington, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Dec. 20—Con. | | | Jan. 18—Con. | | |
| 2000 | 14.4 | 9,100 | 1900 | 10.00 | 2,390 | 2400 | 13.25 | 7,810 |
| 2200 | 12.8 | 7,180 | 2400 | 9.75 | 2,030 | Jan. 19 | | |
| 2400 | 11.5 | 5,140 | Dec. 21 | | | 0200 | 12.0 | 6,020 |
| Dec. 19 | | | 1200 | 9.30 | 1,300 | 0400 | 11.00 | 4,300 |
| 2000 | 14.4 | 9,100 | 1900 | 10.00 | 2,390 | 2400 | 13.25 | 7,810 |
| 2200 | 12.8 | 7,180 | 2400 | 9.75 | 2,030 | Jan. 19 | | |
| 2400 | 11.5 | 5,140 | Dec. 21 | | | 0200 | 12.0 | 6,020 |
| Dec. 19 | | | 1200 | 9.30 | 1,300 | 0400 | 11.00 | 4,300 |
| 0200 | 10.0 | 2,480 | 2400 | 8.85 | 620 | 0800 | 10.43 | 3,270 |
| 0400 | 9.65 | 1,800 | Jan. 16 | | | 1000 | 10.60 | 3,700 |
| 0700 | 9.12 | 1,090 | 2400 | ----- | 40 | 1200 | 9.95 | 2,190 |
| 1000 | 9.19 | 1,120 | Jan. 17 | | | 1400 | 9.75 | 1,800 |
| 1200 | 9.10 | 1,030 | 1700 | ----- | 40 | 1800 | 10.05 | 2,440 |
| 1300 | 10.45 | 3,400 | 1800 | 7.83 | 160 | 2000 | 9.80 | 1,910 |
| 1400 | 11.30 | 4,860 | 1900 | 8.16 | 275 | 2400 | 9.55 | 1,450 |
| 1600 | 12.1 | 6,180 | 2000 | 8.30 | 385 | Jan. 20 | | |
| 1800 | 13.0 | 7,540 | 2100 | 9.15 | 1,100 | 1200 | 9.25 | 1,030 |
| 2100 | 14.37 | 9,340 | 2200 | 9.72 | 1,930 | 2400 | 9.10 | 840 |

(46) 09472100 Peck Canyon Tributary near Redington, Ariz.
(Crest-stage station)

Location.--Lat 32°29'12", long 110°30'00", in SW¼SW¼ sec.10, T.11 S., R.18 E., Pima County, Hydrologic Unit 15050203, on left bank 0.2 mi (0.32 km) upstream from mouth and 4 mi (6.4 km) north of Redington.

Drainage area.--8.02 $mi^2$ (20.8 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 2,850 ft (869 m) from topographic map.

Discharge record.--Stage-discharge relation defined by step-backwater analysis.

Maxima.--November 1978 to March 1979: Discharge, 46 $ft^3/s$ (1.30 $m^3/s$) Dec. 19, 1978, gage height, 7.07 ft (2.15 m) from high-water mark in well of former gaging station.

1967 to October 1978: Discharge, 4,340 $ft^3/s$ (123 $m^3/s$) Aug. 12, 1972, gage height, 9.25 ft (2.819 m) from inside high-water mark and 10.9 ft (3.322 m) from outside high-water mark from slope-area measurement of peak flow.

(47) 09473000 Aravaipa Creek near Mammoth, Ariz.

Location.--Lat 32°50'37", long 110°37'07", in NW¼NW¼ sec.9, T.7 S., R.17 E., Pinal County, Hydrologic Unit 15050203, on right bank 6 mi (10 km) upstream from mouth, and 9 mi (14 km) north of Mammoth.

(47) 09473000 Aravaipa Creek near Mammoth, Ariz.—Continued

Drainage area.--541 mi² (1,401 km²).

Gage-height record.--Crest stages only during flood periods because well was damaged. Altitude of gage is 2,350 ft (716 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 1,300 ft³/s (36.8 m³/s) on basis of step-backwater computations and slope-area measurements at 8.09 and 13.71 ft (2.465 and 4.179 m).

Maxima.--November 1978 to March 1979: Discharge, 16,200 ft³/s (459 m³/s) about 1200 hours Dec. 8, gage height, 13.71 ft (4.179 m) from profile of outside floodmarks.

1931 to October 1978: Discharge, 15,300 ft³/s (433 m³/s) revised Dec. 19, 1967, gage height, 11.86 ft (3.615 m) in gage well, and 14.25 ft (4.343 m) from profile past gage.

Outside period of record: A discharge of 20,000 ft³/s (566 m³/s) occurred Aug. 2, 1919, at former gaging station 6 mi (10 km) downstream, from rating curve extended above 5,100 ft³/s (140 m³/s) on basis of velocity-area study.

(48) 09473500 San Pedro River at Winkelman, Ariz.

Location.--Lat 32°58'38", long 110°46'11", in SE¼SW¼ sec.24, T.5 S., R.15 E., Pinal County, Hydrologic Unit 15050203, on right bank 0.7 mi (1.1 km) south of Winkelman, and 1.0 mi (1.6 km) upstream from mouth.

Drainage area.--4,471 mi² (11,580 km²), of which 696 mi² (1,803 km²) is in Mexico.

Gage-height record.--Water-stage recorder graph from manometer gage. Altitude of gage is 1,925 ft (587 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 4,200 ft³/s (119 m³/s) on basis of slope-area measurement for flood of Dec. 22-23, 1965, at site 3.5 mi (5.6 km) upstream; discharge, 16,800 ft³/s (476 m³/s). Stage-discharge relation for the recession estimated because a secondary channel, which bypassed gage, was formed during the flood.

Maxima.--November 1978 to March 1979: Discharge, 18,000 ft³/s (510 m³/s) about 2045 hours Dec. 18, gage height, 14.41 ft (4.392 m).

1906 to October 1978: Discharge, about 85,000 ft³/s (2,410 m³/s) Sept. 28, 1926, on basis of interpolation between discharges of San Pedro River at Mammoth and Gila River near Kelvin.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 2400 | 5.93 | 48 | 2400 | 14.22 | 17,100 | 0200 | 10.77 | 5,260 |
| Dec. 18 | | | Dec. 19 | | | 0500 | 11.63 | 7,360 |
| 1000 | 6.06 | 82 | 0200 | 14.28 | 17,400 | 0730 | 12.04 | 8,510 |
| 1030 | 7.32 | 651 | 0415 | 14.37 | 17,900 | 1200 | 11.84 | 7,940 |
| 1100 | 7.54 | 772 | 0515 | 14.26 | 17,300 | 1500 | 10.44 | 4,570 |
| 1400 | 11.45 | 6,880 | 0700 | 12.94 | 11,600 | 1800 | 10.06 | 3,840 |
| 1700 | 12.91 | 11,500 | 1000 | 11.53 | 7,090 | 2200 | 9.14 | 2,520 |
| 1900 | 13.52 | 14,000 | 1500 | 10.61 | 4,910 | 2400 | 9.34 | 2,720 |
| 2000 | 14.08 | 16,500 | 1800 | 10.11 | 3,930 | | | |
| 2045 | 14.41 | 18,000 | 2000 | 9.48 | 2,880 | Dec. 21 | | |
| 2130 | 14.30 | 17,500 | 2200 | 9.93 | 3,600 | 1200 | 7.88 | 1,390 |
| 2200 | 14.31 | 17,600 | 2400 | 10.98 | 5,730 | 2400 | 7.14 | 903 |

(49) 09473600 Tam O'Shanter Wash near Hayden, Ariz.
(Discontinued crest-stage station)

Location.--Lat 33°01'46", long 110°52'22", in SE¼NW¼ sec.1, T.5 S., R.14 E., Pinal County, Hydrologic Unit 15050100, at State Highway 177, 6 mi (9.6 km) west of Hayden.

Drainage area.--4.37 $mi^2$ (11.3 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 1,900 ft (519 m) from topographic map.

Discharge record.--Stage-discharge relation defined by computations of flow through culvert.

Maxima.--November 1978 to March 1979: Discharge, 230 $ft^3/s$ (6.51 $m^3/s$) Dec. 18, gage height, 8.07 ft (2.460 m).
1963 to October 1978: Discharge, 1,570 $ft^3/s$ (44.5 $m^3/s$) Aug. 2, 1974, gage height, 14.28 ft (4.353 m).

(50) 09474000 Gila River at Kelvin, Ariz.

Location.--Lat 33°06'10", long 110°58'33", in NE¼NW¼ sec.12, T.4 S., R.13 E., Pinal County, Hydrologic Unit 15050100, on left bank at Kelvin, 500 ft (152 m) downstream from Mineral Creek, 18 mi (29 km) downstream from San Pedro River, and 19 mi (31 km) upstream from Ashurst-Hayden Dam.

Drainage area.--18,011 $mi^2$ (46,648 $km^2$), of which 5,125 $mi^2$ (13,274 $km^2$) is below Coolidge Dam.

Gage-height record.--Water-stage recorder graph except 0600 hours Dec. 19 to 0940 hours Dec. 20, which was estimated on basis of high-water mark and information from local residents, and 2400 hours Dec. 20 to 0930 hours Dec. 21, which was estimated on basis of adjacent good record. Datum of gage is 1,745.02 ft (531.882 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 12,000 $ft^3/s$ (3,400 $m^3/s$) on basis of step-backwater study and high-water mark at Hayden, 17 mi upstream.

Maxima.--November 1978 to March 1979: Discharge, 27,000 $ft^3/s$ (765 $m^3/s$) 1500 hours Dec. 19, gage height, 25.30 ft (7.711 m).
1928 to October 1978: Discharge, 42,800 $ft^3/s$ (1,210 $m^3/s$) Aug. 8, 1930, gage height, 12.6 ft (3.84 m).
1911 to October 1978: Discharge, about 132,000 $ft^3/s$ (3,740 $m^3/s$) Jan. 20, 1916, gage height, 19.5 ft (5.94 m) from rating curve extended above slope-area measurement of peak discharge of Sept. 28, 1926, at gage height 16.2 ft (4.94 m).

Remarks.--Flow partially regulated by San Carlos Reservoir 49 mi (79 km) upstream since Nov. 15, 1928. Records of peak flow show discharge from drainage area below Coolidge Dam.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 21—Con. | | | Jan. 18 | | |
| 0330 | 4.93 | 90 | 1200 | 11.75 | 5,370 | 0230 | 11.27 | 4,970 |
| 1030 | 5.09 | 108 | 1700 | 9.25 | 2,650 | 0430 | 11.11 | 4,810 |

(50) 09474000 Gila River at Kelvin, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 21—Con. | | | Jan. 18—Con. | | |
| 1700 | 5.33 | 139 | 2400 | 8.70 | 2,100 | 0800 | 11.45 | 5,150 |
| 2200 | 5.53 | 168 | | | | 1000 | 11.58 | 5,280 |
| 2400 | 5.62 | 182 | Dec. 22 | | | 1300 | 12.29 | 5,990 |
| Dec. 18 | | | 0300 | 8.50 | 1,920 | 1600 | 13.98 | 7,940 |
| 0200 | 6.69 | 470 | 0900 | 8.20 | 1,650 | 1800 | 15.22 | 9,420 |
| 0400 | 8.37 | 1,803 | 1500 | 7.97 | 1,470 | 2030 | 15.86 | 10,200 |
| 0630 | 9.37 | 2,770 | 2100 | 7.75 | 1,300 | 2400 | 15.54 | 9,920 |
| 1000 | 11.05 | 4,450 | 2400 | 7.60 | 1,190 | | | |
| 1500 | 13.16 | 6,592 | Dec. 23 | | | Jan. 19 | | |
| 2400 | 13.60 | 7,120 | 0600 | 7.45 | 1,080 | 0200 | 14.96 | 9,220 |
| Dec. 19 | | | 1800 | 7.18 | 918 | 0530 | 13.99 | 8,060 |
| 0200 | 14.00 | 7,600 | | | | 0900 | 13.25 | 7,170 |
| 0500 | 20.05 | 16,900 | Jan. 16 | | | 1000 | 13.28 | 7,200 |
| 0700 | 24.40 | 25,200 | 0430 | 5.80 | 350 | 1130 | 13.99 | 8,060 |
| 0900 | 25.20 | 26,800 | 1230 | 5.93 | 390 | 1400 | 14.79 | 9,020 |
| 1500 | 25.30 | 27,000 | 1930 | 6.12 | 458 | 1700 | 15.34 | 9,680 |
| 1900 | 22.00 | 20,300 | 2400 | 6.20 | 530 | 2400 | 14.14 | 8,250 |
| 2400 | 18.50 | 14,500 | | | | Jan. 20 | | |
| | | | Jan. 17 | | | 0100 | 13.96 | 8,030 |
| Dec. 20 | | | 0700 | 6.20 | 615 | 0500 | 12.55 | 6,350 |
| 0200 | 16.0 | 11,000 | 0930 | 6.41 | 790 | 0900 | 11.40 | 5,200 |
| 0900 | 14.0 | 8,550 | 1130 | 6.81 | 836 | 1300 | 9.92 | 3,720 |
| 1300 | 13.44 | 7,770 | 1200 | 7.53 | 1,280 | 1630 | 9.49 | 3,290 |
| 1700 | 14.30 | 8,860 | 1300 | 8.74 | 2,340 | 2200 | 9.02 | 2,820 |
| 1900 | 14.75 | 9,460 | 1430 | 9.30 | 2,900 | Jan. 21 | | |
| 2200 | 15.06 | 9,830 | 1730 | 10.07 | 3,670 | 0300 | 8.86 | 2,680 |
| 2400 | 15.08 | 9,860 | 2000 | 10.89 | 4,490 | 1000 | 8.50 | 2,320 |
| Dec. 21 | | | 2300 | 11.08 | 4,680 | 1700 | 8.18 | 2,010 |
| 0800 | 13.0 | 7,000 | 2400 | 11.08 | 4,780 | 2200 | 8.00 | 1,850 |

(51) 09478600 Queen Creek Tributary No. 3 at Whitlow Dam, Ariz.
(Crest-stage station)

Location.--Lat 33°17'30", long 111°16'50", in N½ sec.1, T.2 S., R.10 E., Pinal County, Hydrologic Unit 15050100, 0.5 mi (0.8 km) south of Whitlow Dam, and 4.5 mi (7.2 mi) northeast of Florence Junction.

Drainage area.--0.37 $mi^2$ (0.958 $km^2$).

Gage-height record.--Crest stages only. Altitude of gage is 2,110 ft (643 m) from topographic map.

Discharge record.--Stage-discharge relation defined by culvert computations.

Maxima.--November 1978 to March 1979: Discharge, 5.0 $ft^3/s$ (0.14 $m^3/s$) probably Dec. 18, gage height, 3.70 ft (1.13 m).

1966 to October 1978: Discharge, 280 $ft^3/s$ (7.93 $m^3/s$) Sept. 13, 1966, gage height, 7.55 ft (2.30 m).

## (52) 09479500 Gila River near Laveen, Ariz.

Location.--Lat 33°15'25", long 112°09'59", in SW¼NW¼ sec.16, T.2 S., R.2 E., Pinal County, Hydrologic Unit 15050100, in Gila River Indian Reservation, on left abutment of highway bridge, 2.1 mi (3.4 km) upstream from Santa Cruz River, 2.6 mi (4.2 km) south of Komatke, and 7.3 mi (11.7 km) south of Laveen. Supplementary water-stage recorder on overflow channel at highway bridge 0.2 mi (0.3 km) south.

Drainage area.--20,615 mi² (53,393 km²), of which 696 mi² (1,803 km²) is in Mexico and 7,729 mi² (20,018 km²) is below Coolidge Dam.

Gage-height record.--From two water-stage recorders. Datum of both gages is 1,018.90 ft (310.561 m) National Geodetic Vertical Datum of 1929. Gage heights given are for base gage.

Discharge record.--Both stage-discharge relations defined by current-meter measurements. Records include flow in main and overflow channels.

Maxima.--November 1978 to March 1979: Discharge, 9,720 ft³/s (275 m³/s) 1900 hours Dec. 21, gage height, 10.20 ft (3.109 m) at base gage.

1940 to October 1978: Discharge, 11,900 ft³/s (337 m³/s) Jan. 2, 1941, gage height, 10.08 ft (3.072 m) Dec. 26, 1965, result of backwater.

Remarks.--Flow partly regulated by storage in San Carlos Reservoir since 1928; discharge represents runoff from area below the reservoir.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | [1]Gage height | [2]Discharge | Hour | [1]Gage height | [2]Discharge | Hour | [1]Gage height | [1]Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 20 | | | Dec. 23—Con. | | | Jan. 20—Con. | | |
| 0400 | 3.90 | 5.8 | 2400 | 8.43 | 2,530 | 2200 | 8.74 | 3,870 |
| 0500 | 3.98 | 21 | Dec. 24 | | | 2400 | 8.80 | 3,990 |
| 0600 | 4.16 | 110 | 2400 | 7.79 | 1,000 | Jan. 21 | | |
| 0900 | 6.18 | 336 | Dec. 25 | | | 0530 | 9.41 | 6,170 |
| 1200 | 6.85 | 381 | 1500 | 7.63 | 760 | 0700 | 9.48 | 6,520 |
| 2400 | 7.15 | 453 | 2000 | 7.52 | 623 | 1100 | 9.50 | 6,560 |
| Dec. 21 | | | 2400 | 6.91 | 493 | 1730 | 9.43 | 6,330 |
| 1600 | 7.28 | 494 | Dec. 26 | | | 2400 | 9.57 | 6,750 |
| 1700 | 8.62 | 2,520 | 0200 | 6.21 | 338 | Jan. 22 | | |
| 1800 | 9.96 | 8,480 | 0400 | 5.73 | 314 | 0045 | 9.59 | 6,780 |
| 1900 | 10.20 | 9,720 | 1200 | 6.22 | 338 | 0200 | 9.56 | 6,710 |
| 2400 | 9.99 | 8,610 | 2400 | 5.60 | 305 | 0800 | 9.27 | 5,610 |
| Dec. 22 | | | Jan. 19 | | | 1400 | 8.85 | 4,150 |
| 0600 | 9.45 | 6,900 | 0600 | ----- | ------ | 2000 | 8.54 | 3,100 |
| 1200 | 9.10 | 5,840 | 1200 | ----- | ------ | 2400 | 8.42 | 2,650 |
| 1800 | 8.91 | 5,130 | 1800 | ----- | ------ | Jan. 23 | | |
| 2400 | 8.84 | 4,670 | 2400 | 7.97 | 1,400 | 1200 | 8.16 | 1,870 |
| Dec. 23 | | | Jan. 20 | | | 2400 | 8.02 | 1,540 |
| 0600 | 8.94 | 4,680 | 0700 | 8.29 | 2,300 | Jan. 24 | | |
| 1200 | 8.89 | 4,170 | 1300 | 8.56 | 3,200 | 1200 | 7.89 | 1,250 |
| 1800 | 8.64 | 3,280 | 1900 | 8.66 | 3,630 | 2400 | 7.80 | 1,040 |

[1]At main channel gage.
[2]Total of two channels.

(53) 09482000 Santa Cruz River at Continental, Ariz.

Location.--Lat 31°51'12", long 110°58'40", in NE¼NE¼ sec.23, T.18 S., R.13 E. (unsurveyed), Pima County, Hydrologic Unit 15050301, in Spanish land grant of San Ignacio de la Canoa, near left bank on downstream side of pier of highway bridge at Continental.

Drainage area.--1,662 mi² (4,305 km²), of which 395 mi² (1,023 km²) is in Mexico.

Gage-height record.--Water-stage recorder graph except 1800 hours Dec. 18 to 1500 hours Dec. 19. Datum of gage is 2,832.28 ft (863.279 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Average stage-discharge curve defined below 7,000 ft³/s (198 m³/s) by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 16,000 ft³/s (453 m³/s), about 2300 hours Dec. 18, gage height, 10.0 ft (3.05 m) from high-water mark in well.

1936 to October 1978: Discharge, 26,500 ft³/s (750 m³/s) Oct. 10, 1977, gage height, 16.70 ft (5.090 m), from rating curve extended above 16,000 ft³/s (453 m³/s) on basis of flood-routing studies.

(54) 09482500 Santa Cruz River at Tucson, Ariz.

Location.--Lat 32°13'16", long 110°58'52", in NE¼NE¼ sec.14, T.14 S., R.13 E., Pima County, Hydrologic Unit 15050301, on downstream side of center pier of Congress Street Bridge in Tucson.

Drainage area.--2,222 mi² (5,755 km²), of which 395 mi² (1,023 km²) is in Mexico.

Gage-height record.--Water-stage recorder graph except Dec. 19-23. Record affected by drawdown on manometer orifice. Datum of gage is 2,317.82 ft (706.472 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Discharge estimated on basis of flood-routing studies.

Maxima.--November 1978 to March 1979: Discharge, 13,500 ft³/s (382 m³/s) about 1000 hours Dec. 19, gage height, recorded, 9.50 ft (2.896 m), outside, 14.1 ft (4.30 m) from floodmark on bank.

1892 to October 1978: Discharge, 23,700 ft³/s (671 m³/s) Oct. 10, 1977, from slope-area measurement of peak flow, gage height, 21.8 ft (6.64 m) from floodmark on the bank.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 19—Con. | | | Dec. 20—Con. | | |
| 0900 | 3.4 | 0 | 0900 | 9.0 | 11,000 | 1800 | ----- | 1,680 |
| 1000 | 4.37 | 108 | 1000 | 9.50 | 13,500 | 2400 | ----- | 1,450 |
| 1200 | 4.17 | 61 | 1200 | 9.25 | 12,200 | Dec. 21 | | |
| 1400 | 4.70 | 238 | 1500 | 9.35 | 12,700 | 0800 | ----- | 1,180 |

(54) 09482500 Santa Cruz River at Tucson, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Dec. 19—Con. | | | Dec. 21—Con. | | |
| 1500 | 4.32 | 97 | 1600 | ----- | 12,000 | 1600 | ----- | 940 |
| 1600 | 4.65 | 216 | 1800 | ----- | 11,200 | 2400 | ----- | 800 |
| 2000 | 3.93 | 26 | 2000 | ----- | 9,800 | | | |
| 2200 | 7.4 | 4,880 | 2200 | ----- | 7,000 | Dec. 22 | | |
| 2400 | 7.9 | 6,530 | 2400 | ----- | 5,800 | 1200 | ----- | 570 |
| Dec. 19 | | | Dec. 20 | | | 2400 | ----- | 415 |
| 0200 | 8.1 | 7,230 | 0400 | ----- | 3,700 | Dec. 23 | | |
| 0400 | 8.3 | 8,030 | 0800 | ----- | 2,750 | 1200 | ----- | 300 |
| 0700 | 8.7 | 9,730 | 1200 | ----- | 2,150 | 2400 | ----- | 220 |

(55) 09483000 Tucson Arroyo at Vine Avenue, Tucson, Ariz.

Location.--Lat 32°13'00", long 110°56'54", in SW¼NE¼ sec.18, T.14 S., R.14 E., Pima County, Hydrologic Unit 15050301, on right bank at Vine Avenue in Tucson, 0.2 mi (0.3 km) downstream from confluence of Railroad Wash and Arroyo Chico.

Drainage area.--8.2 $mi^2$ (21.2 $km^2$) since June 1956.

Gage-height record.--Water-stage recorder tape. Datum of gage is 2,411.9 ft (735.15 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation for concrete control extended above 2,100 $ft^3/s$ (60 $m^3/s$) on basis of slope-area measurements at gage heights 10.13 and 10.35 ft (3.088 and 3.155 m).

Maxima.--November 1978-March 1979: Discharge, 334 $ft^3/s$ (9.46 $m^3/s$) 1315 hours Dec. 18, gage height, 5.35 ft (1.631 m).
1940 to October 1978: Discharge, 5,000 $ft^3/s$ (142 $m^3/s$) Aug. 22, 1961, gage height, 10, 35 ft (3.155 m).

(56) 09483100 Tanque Verde Creek near Tucson, Ariz.
(Crest-stage station)

Location.--Lat 32°14'48", long 110°40'46", in NE¼NW¼ sec.2, T.14 S., R.16 E., Pima County, Hydrologic Unit 15050302, 4.4 mi (7.1 km) east of Tanque Verde School, 7.4 mi (11.9 km) upstream from Agua Caliente Wash, and 17.5 mi (28.2 km) east of Tucson city hall.

Drainage area.--43.0 $mi^2$ (111 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 2,720 ft (829 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 600 $ft^3/s$ (17.0 $m^3/s$) on basis of slope-area measurements at 3.85, 4.86, and 5.14 ft (1.173, 1.481, and 1.566 m).

Maxima.--November 1978 to March 1979: Discharge, 4,100 $ft^3/s$ (116 $m^3/s$) Dec. 18, gage height, 5.71 ft (1.74 m).
1959 to October 1978: Discharge, 3,080 $ft^3/s$ (87.2 $m^3/s$) Dec. 20, 1967, gage height, 5.14 ft (1.566 m).

(57) Agua Caliente Wash near Tucson, Ariz.
(Miscellaneous site)

Location.--Lat 32°15'30", long 110°45'34", in SW¼NE¼ sec.36, T.13 S., R.15 E., Pima County, Hydrologic Unit 15050302, atGlenn Street, 0.7 mi (1.1 km) upstream from Tanque Verde Road and 13.5 mi (21.7 km) northeast of Tucson city hall.

Drainage area.--39.0 $mi^2$ (101 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 3,440 $ft^3/s$ (97.4 $m^3/s$) Dec. 18, 1978, from slope-area measurement of peak discharge. Record poor.

Remarks.--Tributary to Tanque Verde Creek.

(58) 09484000 Sabino Creek near Tucson, Ariz.
(Crest-stage station)

Location.--Lat 32°19'00", long 110°48'35", in SE¼NE¼ sec.9, T.13 S., R.15 E., Pima County, Hydrologic Unit 15050302, 1,000 ft (304.8 m) upstream from Lower Sabino Dam, 0.5 mi (0.8 km) north of Coronado National Forest boundary, and 12 mi (19.3 km) northeast of Tucson city hall.

Drainage area.--35.5 $mi^2$ (92 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 2,720 ft (829 m) from topographic map.

Maxima.--November 1978 to March 1979: Discharge, 7,400 $ft^3/s$ (210 $m^3/s$) Dec. 18, gage height, 11.76 ft (3.584 m) from computation of flow over dam.
1932 to October 1978: Discharge, 7,730 $ft^3/s$ (219 $m^3/s$) Sept. 6, 1970, gage height, 10.21 ft (3.112 m) from rating extended above 3,000 $ft^3/s$ (85.0 $m^3/s$) on basis of slope-area measurement at gage height 9.65 ft (2.941 m).

(59) 09484200 Bear Creek near Tucson, Ariz.
(Discontinued station)

Location.--Lat 32°18'20", long 110°48'03", in NW¼ sec.15, T.13 S., R.15 E., Pima County, Hydrologic Unit 15050302, on left bank 0.8 mi (1.3 km) upstream from mouth, and 12.5 mi (20.1 km) northeast of Tucson city hall..

Drainage area.--16.3 $mi^2$ (42.2 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 2,670 ft (8.13 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 300 $ft^3/s$ (8.50 $m^3/s$) on basis of computation of peak flow over dam at 4.90 ft (1.493 m).

Maxima.--November 1978 to March 1979: Discharge, 1,400 $ft^3/s$ (39.6 $m^3/s$) Dec. 18, gage height, 5.40 ft (1.650 m) from crest-stage gage.
1959 to October 1978: Discharge, 1,150 $ft^3/s$ (32.6 $m^3/s$) Dec. 22, 1965, gage height recorded 4.1 ft (1.25 m) affected by drawdown; 4.90 ft (1.493 m) outside from floodmark.

(60) 09484500 Tanque Verde Creek at Tucson, Ariz.
(Crest-stage station)

Location.--Lat 32°15'57", long 110°50'27", in SE¼SE¼ sec.30, T.13 S., R.15 E., Pima County, Hydrologic Unit 15050302, at Sabino Canyon Road, 1.0 mi (1.609 km) downstream from Sabino Creek and 8.25 mi (13.3 km) northeast of Tucson city hall.

Drainage area.--219 $mi^2$ (567 $km^2$).

Gage-height record.--Crest-stage gage only. Datum of gage is 2,464.33 ft (751.128 m) National Geodetic Vertical Datum of 1929.

Maxima.--November 1978 to March 1979: Discharge, 12,700 $ft^3/s$ (360 $m^3/s$) Dec. 18, gage height, 7.33 ft (2.234 m) from slope-area measurement of peak flow.
Probably 1940 to October 1978: Discharge, 12,200 $ft^3/s$ (346 $m^3/s$) Dec. 22, 1965, gage height, 7.89 ft (2.405 m) from rating curve defined by current-meter measurement

(61) 09484510 Ventana Canyon Wash near Tucson, Ariz.
(Crest-stage station)

Location.--Lat 32°18'33", long 110°50'20", in SW¼SW¼ sec.8, T.13 S., R.15 E., Pima County, Hydrologic Unit 15050302, at Sunrise Drive, 0.5 mi (0.8 km) upstream from Esperero Wash, and 4 mi (6.4 km) northeast of Tucson city limits and 12 mi (19.3 km) northeast of Tucson city hall.

Drainage area.--6.46 $mi^2$ (16.7 $km^2$).

Gage-height record.--Crest stages only. Altitude of gage is 2,720 ft (829 m) from topographic map.

Discharge record.--Stage-discharge relation defined by computations of flow through culvert and over roadway.

Maxima.--November 1978 to March 1979: Discharge, 234 $ft^3/s$ (6.63 $m^3/s$) Dec. 18, gage height, 14.55 ft (4.43 m).
1965 to October 1978: Discharge, 260 $ft^3/s$ (7.36 $m^3/s$) Dec. 22, 1965, gage height, 11.34 ft (3.456 m).

(62) 09485450 Pantano Wash (at Broadway Blvd.) at Tucson, Ariz.

Location.--Lat 32°13'14", long 110°49'44", in NW¼NE¼ sec.17, T.14 S., R.15 E., Pima County, Hydrologic Unit 15050302, near right bank at bridge on Broadway Blvd., 4.6 mi (7.4 km) upstream from mouth, and 8.5 mi (13.7 km) east of Tucson city hall.

Drainage area.--599 $mi^2$ (1,550 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 1,530 $ft^3/s$ (43.3 $m^3/s$) Dec. 18, from slope-area measurement of peak flow.
Probably 1930 to October 1978: Discharge, 20,000 $ft^3/s$ (566 $m^3/s$) Aug. 12, 1958, from slope-area measurement of peak flow at site 1 mi (1.6 km) downstream at Speedway Blvd.

(63) 09486000 Rillito Creek near Tucson, Ariz.
(Flood-hydrograph station)

Location.--Lat 32°17'41", long 110°59'00", in SW¼SE¼ sec.14, T.13 S., R.13 E., Pima County, Hydrologic Unit 15050302, on right bank 600 ft (183 m) downstream from Pima Wash, 1,800 ft (549 m) downstream from U.S. Highway 89, 5 mi (8 km) above mouth, and 5.4 mi (8.6 km) north of Tucson city hall.

Drainage area.--918 mi² (2,378 km²).

Gage-height record.--Water-stage recorder graph prior to 1000 hours Dec. 18 when station was washed out. Datum of gage is 2,280.16 ft (694.993 m) National Geodetic Vertical Datum of 1929, supplementary adjustment of 1954.

Discharge record.--Stage-discharge relation for period of gage-height record defined by current-meter measurements. Discharge during period of missing gage-height record estimated by subtracting Santa Cruz River at Tucson and minor tributaries from Santa Cruz River at Cortaro.

Maxima.--November to March 1979: Discharge, 16,400 ft³/s (464 m³/s) about 1300 hours Dec. 18, from slope-area measurement of peak flow at site 5 mi (8.1 km) upstream at Swan Road.

1908 to October 1978: Discharge, 24,000 ft³/s (680 m³/s) Sept. 23, 1929, gage height, 24 ft (7.31 m) from floodmarks at site 800 ft (244 m) upstream at different datum from rating extended above 12,000 ft³/s (339 km³/s) on basis of velocity-area studies.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 18—Con. | | |
| 2330 | 1.03 | ----- | 0700 | 5.90 | ----- | 2400 | ----- | 6,000 |
| 2400 | 4.15 | ----- | 0800 | 5.93 | ----- | Dec. 19 | | |
| Dec. 18 | | | 0900 | 7.20 | ----- | 0600 | ----- | 4,000 |
| 0200 | 4.73 | ----- | 1000 | 8.34 | 7,170 | 0900 | ----- | 6,000 |
| 0300 | 4.75 | ----- | 1200 | ----- | 14,000 | 1400 | ----- | 4,000 |
| 0330 | 5.50 | ----- | 1400 | ----- | 16,400 | 1800 | ----- | 1,000 |
| 0530 | 6.65 | ----- | 1800 | ----- | 12,000 | 2400 | ----- | 500 |

(64) 09486300 Canada del Oro near Tucson, Ariz.
(Crest-stage station)

Location.--Lat 32°22'27", long 111°00'31", in SW¼NW¼ sec.22, T.12 S., R.13 E., Pima County, Hydrologic Unit 15050301, on right bank at upstream side of Overton Road, 4.7 mi (7.6 km) upstream from mouth, and 10.5 mi (16.9 km) north of Tucson city hall.

Drainage area.--250 mi² (648 km²).

Gage-height record.--Water-stage recorder chart. Datum of gage is 2,374.39 ft (723.714 m) National Geodetic Vertical Datum of 1929 from project bench mark.

Discharge record.--Stage-discharge relation extended above 600 ft³/s (17 m³/s) on basis of slope-area measurements at gage heights 4.5 and 7.5 ft (1.37 and 2.29 m).

(64) 09486300 Canada del Oro near Tucson, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 1,380 $ft^3/s$ (39.1 $m^3/s$) 0030 hours Nov. 25, gage height, 3.90 ft (1.19 m).

About 1955 to October 1978: Discharge, 17,000 $ft^3/s$ (481 $m^3/s$) July 21, 1959, from slope-area measurement at Tangerine Road, 4 mi (6.4 km) upstream.

(65) 09486500 Santa Cruz River at Cortaro, Ariz.

Location.--Lat 32°21'04", long 111°05'38", in NW¼NW¼ sec.35, T.12 S., R.12 E., Pima County, Hydrologic Unit 15050302, on downstream side of right bridge pier 0.5 mi (0.8 km) southwest of Cortaro, 2.6 mi (4.2 km) downstream from Canada del Oro, and 3.7 mi (6.0 km) downstream from Rillito Creek.

Drainage area.--3,503 $mi^2$ (9,073 $km^2$), of which 395 $mi^2$ (1,023 $km^2$) is in Mexico.

Gage-height record.--Water-stage recorder graph from 0600 hours, Dec. 18 to 2000 hours, Dec. 20. Gage height for Dec. 21 estimated. Datum of gage is 2,133.13 ft (650.178 m) National Geodetic Vertical Datum of 1929 (State Highway Department bench mark).

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978-March 1979: Discharge, 18,800 $ft^3/s$ (532 $m^3/s$) 1930 hours, Dec. 18, gage height, 14.42 ft (4,395 m).

1936 to October 1978: Discharge, 23,000 $ft^3/s$ (651 $m^3/s$) Oct. 10, 1977, gage height, 15.6 ft (4.75 m).

Remarks.--Flow of less than about 50 $ft^3/s$ (1.4 $m^3/s$) is waste water from sewage-disposal plant. Rapid drop in discharge from 0500 hours to 0600 hours is not due to natural causes. The most likely cause of the drop is overflow into a large gravel pit upstream from station.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 2400 | 5.0 | 33 | 2400 | 13.89 | 16,000 | 0200 | 9.65 | 4,910 |
| Dec. 18 | | | Dec. 19 | | | 0400 | 9.25 | 4,110 |
| 0400 | 5.3 | 70 | 0500 | 13.22 | 13,700 | 0800 | 9.00 | 3,680 |
| 0530 | 6.0 | 200 | 0530 | 12.04 | 11,000 | 1000 | 8.79 | 3,340 |
| 0600 | 7.36 | 900 | 0630 | 9.73 | 5,090 | 1200 | 8.58 | 2,850 |
| 0800 | 8.43 | 1,800 | 0700 | 12.04 | 12,000 | 1400 | 8.45 | 2,670 |
| 0930 | 8.28 | 1,700 | 0800 | 13.07 | 16,400 | 1500 | 8.52 | 2,770 |
| 1100 | 9.92 | 4,000 | 1100 | 13.23 | 17,400 | 1700 | 8.49 | 2,730 |
| 1200 | 11.41 | 7,500 | 1200 | 13.20 | 17,400 | 1800 | 8.30 | 2,460 |
| 1400 | 13.60 | 15,400 | 1330 | 13.38 | 18,200 | 2200 | 8.1 | 2,000 |
| 1600 | 13.99 | 17,000 | 1700 | 12.89 | 16,100 | 2400 | 8.0 | 1,940 |
| 1930 | 14.42 | 18,800 | 1930 | 12.40 | 14,000 | Dec. 21 | | |
| 2130 | 13.71 | 16,000 | 2100 | 11.45 | 10,350 | 1200 | 7.5 | 1,310 |
| 2300 | 13.99 | 17,000 | 2400 | 10.16 | 6,550 | 2400 | 7.2 | 970 |

(66) 09489000 Santa Cruz River near Laveen, Ariz.

Location.--Lat 33°13'56", long 112°10'08", in NE¼NE¼ sec.29, T.2 S., R.2 E., Pinal County, Hydrologic Unit 15050303, in Gila River Indian Reservation, on downstream side of highway bridge, 3.4 mi (5.5 km) upstream from mouth, 4.3 mi (6.9 km) south of Komatke, and 9 mi (14 km) south of Laveen.

Drainage area.--8,581 mi² (22,225 km²).

Gage-height record.--Digital water-stage recorder tape. Datum of gage is 1,020.86 ft (311.158 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 4,120 ft³/s (117 m³/s) 1045 hours Dec. 22, gage height, 16.11 ft (4.910 m).
1940 to October 1978: Discharge, 9,200 ft³/s (261 m³/s) Sept. 29, 1962, gage height, 17.50 ft (5.334 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 20 | | | Dec. 21—Con. | | | Dec. 22—Con. | | |
| 1200 | 7.58 | 5.8 | 1800 | 13.87 | 1,530 | 2400 | 15.82 | 3,570 |
| 1800 | 7.45 | 3.9 | 2400 | 14.64 | 2,050 | Dec.23 | | |
| 2400 | 11.14 | 460 | | | | 1200 | 14.70 | 2,060 |
| | | | Dec. 22 | | | 2400 | 12.83 | 984 |
| Dec. 21 | | | 0300 | 15.08 | 2,480 | Dec. 24 | | |
| 0600 | 12.47 | 888 | 0700 | 15.99 | 3,880 | 1200 | 11.01 | 428 |
| 1200 | 13.15 | 1,160 | 1045 | 16.11 | 4,120 | 2400 | 9.77 | 174 |

(67) 09489075 East Fork Black River near Alpine, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°45'33", long 109°21'26", in SE¼NW¼ sec.12, T.4 S., R.28 E., Greenlee County, Hydrologic Unit 15060101162, on left bank 0.5 mi (0.8 km) upstream from confluence with West Fork Black River, 28 mi (45 km) southwest of Alpine, Ariz.

Drainage area.--111 mi² (288.0 km²).

Gage-height record.--Water-stage recorder tape and chart. Altitude of gage is 7,515 ft (2,291 m) from topographic map.

Discharge record.--Stage-discharge relation for modified Woods Canyon flume defined by discharge measurements.

Maxima.--November 1978 to March 1979: Discharge, 2,270 ft³/s (64.3 m³/s) 1140 hours Dec. 18, gage height, 4.98 ft (1.518 m).
1968 to October 1978: Discharge, 3,720 ft³/s (105 m³/s) Oct. 20, 1972, gage height 8.04 ft (2.451 m) at site and datum then in use from slope-area measurement of peak discharge.

Remarks.--Gage-height record and stage-discharge relation furnished by U.S. Forest Service, Apache-Sitgreaves National Forest.

(67) 09489075 East Fork Black River near Alpine, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 2400 | 0.62 | 31.3 | 1945 | 4.30 | 1,680 | 1900 | 2.70 | 641 |
| Dec. 17 | | | 2200 | 4.00 | 1,440 | 2400 | 2.42 | 514 |
| 1045 | .63 | 32.2 | 2400 | 3.90 | 1,370 | Dec. 21 | | |
| 1915 | .78 | 50.0 | Dec. 19 | | | 1045 | 2.16 | 408 |
| 2215 | 1.00 | 83.3 | 0200 | 3.80 | 1,300 | 1245 | 2.22 | 430 |
| 2400 | 1.12 | 104 | 0500 | 3.94 | 1,400 | 1600 | 2.44 | 520 |
| Dec. 18 | | | 0900 | 3.50 | 1,100 | 1800 | 2.44 | 522 |
| 0315 | 1.74 | 259 | 1300 | 3.60 | 1,160 | 2400 | 2.26 | 444 |
| 0610 | 3.00 | 799 | 1545 | 3.56 | 1,140 | Dec. 22 | | |
| 0730 | 3.70 | 1,230 | 2400 | 3.10 | 855 | 0845 | 2.00 | 347 |
| 0945 | 4.30 | 1,680 | Dec. 20 | | | 1045 | 2.04 | 361 |
| 1140 | 4.98 | 2,270 | 0815 | 2.55 | 572 | 1345 | 1.96 | 333 |
| 1400 | 4.56 | 1,890 | 1215 | 2.52 | 560 | 1630 | 1.83 | 288 |
| 1700 | 4.80 | 2,100 | 1730 | 2.70 | 643 | 2400 | 2.00 | 347 |

(68) 09489076 Burro Mountain Weir near Springerville, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°53'55", long 109°28'35", in SE¼ sec.22, T.6 N., R.27 E., Apache County, Hydrologic Unit 15060101, Apache National Forest, 1 mi (1.6 km) upstream from mouth, and 19 mi (31 km) southwest of Springerville.

Drainage area.--1.14 $mi^2$ (2.95 $km^2$).

Gage-height record.--Water-stage recorder tape and chart. Altitude of gage is 9,000 ft (2,743 m) from topographic map.

Discharge record.--Stage-discharge relation defined by computations of discharge over 120° v-notch weir.

Maxima.--November 1978 to March 1979: Discharge, 7.4 $ft^3/s$ (0.210 $m^3/s$) 1515 hours Dec. 18, gage height, 1.23 ft (0.375 m).
1960 to October 1978: Discharge, 18.1 $ft^3/s$ (0.51 $m^3/s$) Oct. 19, 1972, gage height, 1.78 ft (0.543 m).

Remarks.--Gage-height record and stage-discharge relation furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station. Data for other small research watersheds in the area are available from the experiment station.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 0900 | 0.26 | 0.2 | 1800 | 1.19 | 6.8 | 0900 | 0.79 | 2.5 |
| 1800 | .29 | .2 | 2000 | 1.15 | 6.2 | 1200 | .78 | 2.4 |

(68) 09489076 Burro Mountain Weir near Springerville, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 2400 | 0.58 | 1.2 | 2400 | 1.11 | 5.7 | 2400 | 0.71 | 1.9 |
| Dec. 18 | | | Dec. 19 | | | | | |
| 0300 | .87 | 3.2 | 0600 | 1.04 | 4.9 | Dec. 21 | | |
| 0500 | .99 | 4.3 | 0700 | 1.04 | 4.9 | 0800 | .67 | 1.7 |
| 0600 | 1.09 | 5.5 | 0800 | 1.01 | 4.5 | 2400 | .61 | 1.3 |
| 0800 | 1.19 | 6.8 | 1200 | .97 | 4.1 | | | |
| 1000 | 1.21 | 7.1 | 1400 | .95 | 3.9 | Dec. 22 | | |
| 1200 | 1.21 | 7.1 | 1500 | .97 | 4.1 | 0800 | .59 | 1.2 |
| 1300 | 1.20 | 6.9 | 2000 | .90 | 3.4 | 2300 | .58 | 1.2 |
| 1515 | 1.23 | 7.4 | 2400 | .85 | 3.0 | 2400 | .52 | .9 |

(69) 09489078 West Fork Black River near Alpine, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°45'36", long 109°22'30", in SE¼NW¼ sec.11, T.4 N., R.28 E., Apache County, Hydrologic Unit 15060101162, on right bank, 1 mi (1.6 km) upstream from confluence with East Fork Black River, and 15 mi (24 km) southwest of Alpine.

Drainage area.--54.1 mi² (140.1 km²).

Gage-height record.--Water-stage recorder tape and chart. Altitude of gage is 7,550 ft (2,300 m) from topographic map.

Discharge record.--Stage-discharge relation for modified Woods Canyon flume defined by discharge measurements.

Maxima.--November 1978 to March 1979: Discharge, 1,150 ft³/s (32.6 m³/s) 1730 hours Dec. 18, gage height, 4.58 ft (1.396 m).
1968 to October 1978: Discharge, 2,050 ft³/s (58.1 m³/s) Oct. 20, 1972, gage height 5.90 ft (1.798 m), from slope-area measurement of peak flow.

Remarks.--Gage-height record and stage-discharge relation furnished by U.S. Forest Service, Apache-Sitgreaves National Forest.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 0915 | 0.98 | 15.7 | 1345 | 4.31 | 976 | 0630 | 2.80 | 293 |
| 1045 | 1.01 | 17.1 | 1515 | 4.32 | 982 | 0900 | 2.62 | 244 |
| 1630 | 1.40 | 42.5 | 1730 | 4.58 | 1,150 | 1000 | 2.70 | 265 |
| 1750 | 1.45 | 46.9 | 1810 | 4.41 | 1,040 | 1230 | 2.66 | 254 |
| 2315 | 1.83 | 89.7 | 1945 | 4.11 | 855 | 1815 | 2.77 | 285 |
| 2400 | 2.00 | 115 | 2400 | 3.92 | 749 | 2400 | 2.39 | 189 |
| Dec. 18 | | | Dec. 19 | | | Dec. 21 | | |
| 0100 | 1.95 | 107 | 0045 | 3.95 | 744 | 0400 | 2.33 | 176 |
| 0345 | 2.21 | 152 | 0245 | 4.01 | 798 | 1215 | 2.36 | 182 |

(69) 09489078 West Fork Black River near Alpine, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Dec. 19—Con. | | | Dec. 21—Con. | | |
| 0500 | 2.41 | 193 | 0400 | 4.12 | 861 | 1630 | 2.55 | 226 |
| 0605 | 2.61 | 241 | 0815 | 3.81 | 692 | 2400 | 2.33 | 176 |
| 0830 | 3.21 | 429 | 1145 | 3.61 | 596 | Dec. 22 | | |
| 1000 | 3.71 | 643 | 1504 | 3.46 | 529 | 1230 | 1.93 | 104 |
| 1245 | 4.21 | 914 | 2400 | 3.02 | 362 | 2400 | 1.92 | 103 |

(70) 09489086 Beaver Creek near Alpine, Ariz.

Location.--Lat 33°44'17", long 109°20'28", in SW¼SW¼ sec.34, T.4½ N., R.29 E., Greenlee County, Hydrologic Unit 15060101162, on right bank, on Forest Road 565, 1 mi (1.6 km) upstream from mouth, and 25 mi (40 km) southwest of Alpine.

Drainage area.--59.1 mi² (153 km²).

Gage-height record.--Water-stage recorder tape and chart. Altitude of gage is 7,500 ft (2,290 m) from topographic map.

Discharge record.--Stage-discharge relation for modified Woods Canyon flume defined by discharge measurement.

Maxima.--November 1978 to March 1979: Discharge, 1,750 ft³/s (49.3 m³/s) 1800 hours Dec. 18, gage height, 5.36 ft (1.634 m).
1968 to October 1978: Discharge, 2,490 ft³/s (70.5 m³/s) Oct. 20, 1972, from computation of peak flow through culvert.

Remarks.--Gage-height record and stage-discharge relation furnished by U.S. Forest Service, Apache-Sitgreaves National Forest.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 2400 | 0.83 | 9.4 | 1130 | 3.99 | 762 | 1045 | 2.50 | 206 |
| Dec. 17 | | | 1800 | 5.36 | 1,750 | 1230 | 2.50 | 206 |
| 1030 | .77 | 7.6 | 2400 | 4.21 | 886 | 2400 | 2.11 | 128 |
| 1230 | .80 | 8.5 | Dec. 19 | | | Dec. 21 | | |
| 1600 | 1.32 | 34 | 0500 | 4.15 | 851 | 0630 | 2.02 | 114 |
| 1800 | 1.53 | 52 | 1220 | 3.66 | 599 | 1600 | 2.10 | 126 |
| 2145 | 1.56 | 55 | 1500 | 3.49 | 524 | 2100 | 2.00 | 110 |
| 2400 | 1.73 | 74 | 1630 | 3.53 | 541 | 2400 | 1.92 | 98 |
| | | | 1745 | 3.50 | 528 | Dec. 22 | | |
| Dec. 18 | | | 2400 | 3.00 | 343 | 0730 | 1.80 | 82 |
| 0400 | 1.96 | 104 | Dec. 20 | | | 1800 | 1.85 | 89 |
| 0800 | 2.98 | 337 | 0445 | 2.66 | 245 | 2400 | 1.75 | 76 |

(71) 09489089 Heifer Branch near Alpine, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°44'21", long 109°20'30", in SW¼NW¼ sec.34, T.4½ N., R.29 E., Greenlee County, Hydrologic Unit 15060101162, on left bank at mouth, and 25 mi (40 km) southwest of Alpine.

Drainage area.--3.8 $mi^2$ (9.8 $km^2$).

Gage-height record.--Water-stage recorder tape and chart except 2100 hours, Dec. 20 to 1100 hours Dec. 21, which was estimated. Altitude of gage is 7,550 ft (2,300 m) from topographic map.

Discharge record.--Computed from formula for flow over 120° v-notch weir.

Maxima.--November 1978 to March 1979: Discharge, 67.5 $ft^3/s$ (1.91 $m^3/s$) 1800 hours Dec. 18, gage height, 3.04 ft (0.927 m).
1967 to October 1978: Discharge, 158 $ft^3/s$ (4.47 $m^3/s$) Oct. 20, 1972.

Remarks.--Gage-height record and discharge formula furnished by U.S. Forest Service, Apache-Sitgreaves National Forest.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19 | | | Dec. 21 | | |
| 1030 | 0.35 | 0.3 | 0215 | 2.70 | 50.4 | 0300 | 1.30 | 8.4 |
| 1715 | .73 | 2.0 | 0415 | 2.80 | 55.1 | 0600 | 1.32 | 8.7 |
| 2400 | 1.02 | 4.6 | 0545 | 2.78 | 54.2 | 1500 | 1.59 | 13.8 |
| Dec. 18 | | | 1630 | 2.34 | 35.5 | 1900 | 1.42 | 10.5 |
| 0830 | 1.66 | 15.3 | 2300 | 2.00 | 24.2 | 2400 | 1.31 | 8.6 |
| 1245 | 2.43 | 39.0 | 2400 | 1.96 | 23.0 | Dec. 22 | | |
| 1430 | 2.52 | 42.6 | | | | 0800 | 1.13 | 6.0 |
| 1600 | 2.79 | 54.7 | Dec. 20 | | | 1115 | 1.29 | 8.3 |
| 1800 | 3.04 | 67.5 | 0930 | 1.90 | 21.3 | 1215 | 1.29 | 8.3 |
| 1945 | 2.66 | 48.6 | 1245 | 1.78 | 18.2 | 1515 | 1.34 | 9.1 |
| 2330 | 2.77 | 53.7 | 1615 | 1.73 | 17.0 | 2115 | 1.19 | 6.8 |
| 2400 | 2.76 | 53.2 | 2400 | 1.38 | 9.8 | 2400 | 1.11 | 5.7 |

(72) 09489100 Black River near Maverick, Ariz.

Location.--Lat 33°42'27", long 109°26'48", in SW¼ sec.30, T.4 N., R.28 E., Apache County, Hydrologic Unit 15060101, in Apache National Forest, on right bank 1.0 mi (1.6 km) downstream from Fish Creek, 1.1 mi (1.8 km) upstream from Conklin Creek, and 6 mi (10 km) southeast of Maverick.

Drainage area.--315 $mi^2$ (816 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Altitude of gage is 6,850 ft (2,088 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 2,100 $ft^3/s$ (59 $m^3/s$) on basis of slope-area measurement at gage height, 8.99 ft (2.740 m).

(72) 09489100 Black River near Maverick, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 10,300 $ft^3/s$ (292 $m^3/s$) 1315 hours Dec. 18, gage height, 8.74 ft (2.664 m).

1962 to October 1978: Discharge, 11,100 $ft^3/s$ (314 $m^3/s$) Oct. 20, 1972, gage height, 8.99 ft (2.740 m) present datum.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 1200 | 1.68 | 115 | 1400 | 8.32 | 9,060 | 1000 | 6.49 | 4,740 |
| 1800 | 1.99 | 186 | 1500 | 8.05 | 8,390 | 1400 | 6.08 | 3,990 |
| 2400 | 2.82 | 496 | 1600 | 8.27 | 8,920 | 1600 | 6.00 | 3,860 |
| Dec. 18 | | | 1800 | 8.63 | 9,960 | 2000 | 5.57 | 3,170 |
| 0200 | 3.08 | 635 | 1900 | 8.31 | 9,030 | 2400 | 5.08 | 2,480 |
| 0400 | 3.51 | 912 | 2000 | 7.89 | 7,890 | Dec. 20 | | |
| 0600 | 4.23 | 1,520 | 2100 | 7.57 | 7,080 | 0600 | 4.62 | 1,940 |
| 0700 | 4.58 | 1,890 | 2200 | 7.43 | 6,750 | 1200 | 4.31 | 1,600 |
| 0800 | 5.28 | 2,750 | 2400 | 7.26 | 6,350 | 1800 | 4.24 | 1,530 |
| 0900 | 6.03 | 3,910 | Dec. 19 | | | 2400 | 4.02 | 1,330 |
| 1000 | 6.99 | 5,750 | 0200 | 7.05 | 5,880 | Dec. 21 | | |
| 1200 | 8.22 | 8,780 | 0400 | 7.26 | 6,350 | 1200 | 3.50 | 905 |
| 1300 | 8.67 | 10,100 | 0530 | 7.37 | 6,610 | 1900 | 3.76 | 1,100 |
| 1315 | 8.74 | 10,300 | 0600 | 7.30 | 6,440 | 2400 | 3.58 | 963 |

(73) 09489200 Pacheta Creek at Maverick, Ariz.

Location.--Lat 33°44'23", long 109°32'24", at corner of secs.28, 29, 32, 33, T.4½ N., R.27 E. (unsurveyed), Apache County, Hydrologic Unit 15060101, in Fort Apache Indian Reservation, on left bank 0.5 mi (0.8 km) southeast of Maverick.

Drainage area.--14.8 $mi^2$ (38.3 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Altitude of gage is 7,850 ft (2,393 m), by barometer.

Discharge record.--Stage-discharge relation for concrete control extended above 98 $ft^3/s$ (2.78 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 224 $ft^3/s$ (6.34 $m^3/s$) 1545 hours Dec. 18, gage height, 4.23 ft (1.289 m).

1957 to October 1978: Discharge, 323 $ft^3/s$ (9.15 $m^3/s$) May 13, 1973, gage height, 4.36 ft (1.329 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19 | | |
| 0900 | 2.62 | 2.8 | 1100 | 3.91 | 152 | 0400 | 3.93 | 156 |
| 1200 | 2.68 | 4.1 | 1300 | 4.07 | 192 | 1200 | 3.75 | 119 |
| 1800 | 2.90 | 12 | 1545 | 4.23 | 224 | 2400 | 3.49 | 76 |
| 2400 | 3.13 | 27 | 1700 | 4.11 | 203 | | | |
| Dec. 18 | | | 2000 | 3.83 | 134 | Dec. 20 | | |
| 0600 | 3.61 | 86 | 2200 | 3.80 | 128 | 1500 | 3.67 | 104 |
| 0900 | 3.94 | 147 | 2400 | 3.84 | 136 | 2400 | 3.50 | 78 |

(74) 09489500 Black River below pumping plant, near Point of Pines, Ariz.

Location.--Lat 33°28'36", long 109°45'48", in W½ sec.32, T.2 N., R.25 E. (unsurveyed), Graham County, Hydrologic Unit 15060101, in San Carlos Indian Reservation on left bank 0.9 mi (1.4 km) downstream from Phelps Dodge Corp. pumping plant, 1.3 mi (2.1 km) downstream from Freezeout Creek, 8 mi (13 km) northwest of Point of Pines.

Drainage area.--560 $mi^2$ (1,450 $km^2$).

Gage-height record.--Digital water-stage recorder tape , record partially reconstructed because of erroneous punches. Altitude of gage is 5,725 ft (1,745.0 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 4,000 $ft^3/s$ (113 $m^3/s$) on basis of a slope-area measurement at 9.5 ft (2.895 m).

Maxima.--November 1978 to March 1979: Discharge, 12,400 $ft^3/s$ (351 $m^3/s$) 0015 hours Dec. 19, gage height, 14.8 ft (4.51 m).
1953 to January 1978: Discharge, 17,900 $ft^3/s$ (507 $m^3/s$) Oct. 19, 1972, gage height, 18.0 ft (5.49 m), from floodmarks.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 2.72 | 75 | 1400 | 9.50 | 5,170 | 0400 | 12.7 | 9,140 |
| Dec. 17 | | | 1600 | 10.40 | 6,100 | 0600 | 11.7 | 7,740 |
| 0900 | 2.72 | 75 | 1800 | 12.90 | 9,420 | 0800 | 11.3 | 7,220 |
| 1200 | 2.87 | 107 | 1900 | 13.6 | 10,500 | 1100 | 11.7 | 7,740 |
| 2000 | 2.89 | 112 | 2000 | 13.0 | 9,560 | 1500 | 10.6 | 6,340 |
| 2400 | 2.94 | 124 | 2100 | 14.7 | 12,200 | 2400 | 9.2 | 4,730 |
| Dec. 18 | | | 2200 | 13.4 | 10,100 | Dec. 20 | | |
| 0700 | 3.77 | 423 | 2400 | 13.7 | 10,600 | 1200 | 7.7 | 3,210 |
| 0900 | 4.93 | 1,060 | Dec. 19 | | | 2400 | 6.8 | 2,400 |
| 1000 | 5.60 | 1,480 | 0015 | 14.8 | 12,400 | Dec. 21 | | |
| 1100 | 6.50 | 2,160 | 0100 | 13.5 | 10,300 | 1200 | 6.2 | 1,920 |
| 1200 | 7.95 | 3,460 | 0200 | 13.3 | 9,980 | 2400 | 5.9 | 1,690 |

(75) 09489700 Big Bonito Creek near Fort Apache, Ariz.

Location.--Lat 33°40'02", long 109°50'46", in NE¼ sec.28, T.4 N., R.24 E. (unsurveyed), Apache County, Hydrologic Unit 15060101, in Fort Apache Indian Reservation, at downstream side of bridge, 1.9 mi (3.1 km) upstream from Tonto Creek, 3.7 mi (6.0 km) southeast of Chino Springs, and 12 mi (19 km) southeast of Fort Apache.

Drainage area.--119 $mi^2$ (308 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Altitude of gage is 5,910 ft (1,801 m), by barometer.

Discharge record.--Stage-discharge relation extended above 600 $ft^3/s$ (17.0 $m^3/s$) on basis of slope-area measurements at gage heights 7.11 and 7.77 ft (2.167 and 2.368 m).

Maxima.--November 1978 to March 1979: Discharge, 4,510 $ft^3/s$ (128 $m^3/s$) 1915 hours Dec. 18, gage height, 9.04 ft (2.755 m).
1957 to January 1978: Discharge, 2,870 $ft^3/s$ (81.3 $m^3/s$) Mar. 3, 1978. Gage height, 9.09 ft (2.77 m) Mar. 1, 1978, result of backwater.

(75) 09489700 Big Bonito Creek near Fort Apache, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Nov. 24 | | | Nov. 26 | | | Dec. 18—Con. | | |
| 0700 | 2.16 | 37.9 | 1200 | 3.18 | 166 | 1800 | 8.64 | 3,910 |
| 0900 | 2.31 | 50 | 2400 | 2.96 | 129 | 1900 | 8.62 | 3,880 |
| 1200 | 3.01 | 137 | Dec. 17 | | | 1915 | 9.04 | 4,510 |
| 1700 | 4.64 | 585 | 1200 | 2.01 | 34 | 2000 | 8.78 | 4,120 |
| 1800 | 4.62 | 577 | 2400 | 2.56 | 80 | 2200 | 8.23 | 3,390 |
| 2200 | 5.27 | 876 | | | | 2300 | 7.65 | 2,740 |
| 2400 | 5.85 | 1,210 | Dec. 18 | | | 2400 | 7.63 | 2,720 |
| | | | 0200 | 2.96 | 129 | Dec. 19 | | |
| Nov. 25 | | | 0400 | 3.84 | 315 | 0400 | 6.80 | 1,920 |
| 0015 | 5.95 | 1,280 | 0600 | 4.94 | 714 | 0500 | 7.14 | 2,230 |
| 0100 | 5.81 | 1,190 | 0800 | 5.94 | 1,270 | 0900 | 6.81 | 1,930 |
| 0600 | 5.09 | 785 | 1100 | 7.79 | 2,890 | 1200 | 6.40 | 1,600 |
| 1500 | 4.16 | 411 | 1200 | 7.65 | 2,740 | 1800 | 6.13 | 1,400 |
| 2400 | 3.67 | 271 | 1700 | 8.30 | 3,470 | 2400 | 5.70 | 1,120 |

(76) 09490500 Black River near Fort Apache, Ariz.

Location.--Lat 33°42'46", long 110°12'40", in NW¼ sec.12, T.4 N., R.20 E. (unsurveyed), Gila County, Hydrologic Unit 15060101, on downstream side of bridge, 5 mi (8 km) upstream from confluence with White River, and 14 mi (23 km) west of Fort Apache.

Drainage area.--1,232 mi² (3,191 km²).

Gage-height record.--Digital water-stage recorder tape, except 0700 hours Dec. 19 to 1100 hours Dec. 20, which were reconstructed. Altitude of gage is 4,345 ft (1,324.4 m), from river-profile map.

Discharge record.--Stage-discharge relation extended above 8,900 ft³/s (250 m³/s) on basis of slope-area measurements at gage heights 14.70 and 22.33 ft (4.481 and 6.806 m).

Maxima.--November 1978 to March 1979: Discharge, 40,200 ft³/s (1,140 m³/s) 2200 hours, Dec. 18, gage height, 24.05 ft (7.330 m).

1957 to October 1978: Discharge, 33,200 ft³/s (940 m³/s) Mar. 2, 1978, gage height, 22.33 ft (6.896 m).

1912 to October 1978: Discharge, probably in excess of 50,000 ft³/s (1,420 m³/s) Jan. 19, 1916, from correlation with Salt River near Chrysotile.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19—Con. | | | Jan. 17—Con. | | |
| 1800 | 2.50 | 172 | 1200 | 19.40 | 23,300 | 1900 | 13.01 | 9,200 |
| 2000 | 2.76 | 226 | 1800 | 16.80 | 16,500 | 2100 | 15.48 | 13,600 |
| 2200 | 4.38 | 754 | 2400 | 14.60 | 11,900 | 2200 | 15.83 | 14,400 |
| 2400 | 6.54 | 1,960 | Dec. 20 | | | 2400 | 15.56 | 13,800 |
| Dec. 18 | | | 0600 | 12.7 | 8,720 | Jan. 18 | | |
| 0400 | 9.36 | 4,460 | 1200 | 11.28 | 6,740 | 0300 | 14.23 | 11,200 |

(76) 09490500 Black River near Fort Apache, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Dec. 20—Con. | | | Jan. 18—Con. | | |
| 0800 | 13.82 | 10,500 | 1800 | 10.16 | 5,360 | 0400 | 13.38 | 9,780 |
| 1200 | 18.80 | 21,600 | 2400 | 9.42 | 4,520 | 0600 | 11.83 | 7,470 |
| 1600 | 22.30 | 33,100 | Jan. 16 | | | 0800 | 10.83 | 6,170 |
| 1800 | 23.60 | 38,300 | 0700 | 3.02 | 316 | 1200 | 9.87 | 5,020 |
| 2000 | 23.62 | 38,400 | 1200 | 3.86 | 592 | 1800 | 9.23 | 4,320 |
| 2100 | 24.02 | 40,100 | 1800 | 4.91 | 1,050 | 2000 | 9.90 | 5,060 |
| 2200 | 24.05 | 40,200 | 2400 | 5.05 | 1,320 | 2200 | 10.43 | 5,680 |
| 2300 | 23.60 | 38,300 | | | | 2400 | 10.05 | 5,230 |
| 2400 | 23.60 | 38,300 | Jan. 17 | | | Jan. 19 | | |
| | | | 0200 | 6.11 | 1,890 | 0500 | 8.99 | 4,080 |
| Dec. 19 | | | 0800 | 5.81 | 1,700 | 1300 | 7.40 | 2,620 |
| 0100 | 23.06 | 36,100 | 1200 | 6.01 | 1,820 | 1900 | 6.51 | 1,940 |
| 0200 | 22.10 | 32,400 | 1500 | 12.23 | 8,030 | 2400 | 6.20 | 1,740 |
| 0300 | 22.60 | 34,300 | 1600 | 13.47 | 9,930 | Jan. 20 | | |
| 0400 | 22.10 | 32,400 | 1700 | 13.49 | 9,960 | 1200 | 5.45 | 1,280 |
| 0800 | 21.20 | 29,100 | 1800 | 13.19 | 9,480 | 2400 | 4.82 | 950 |

(77) 09491000 North Fork White River near McNary, Ariz.

Location.--Lat 34°02'47", long 109°44'02", in E½ sec.31, T.8 N., R.25 E. (unsurveyed), Apache County, Hydrologic Unit 15060102, in Fort Apache Indian Reservation, on left bank 1.9 mi (3.1 km) downstream from Paradise Creek and 7 mi (11 km) southeast of McNary.

Drainage area.--66 $mi^2$ (171 $km^2$), approximately.

Gage-height record.--Digital water-stage recorder tape to 0630 hours Dec. 18. Datum of gage is 7,723 ft (2,354.0 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 470 $ft^3/s$ (13.3 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 1,060 $ft^3/s$ (30.0 $m^3/s$) 0630 hours Dec. 18, gage height, 4.82 ft (1.469 m).

1945 to October 1978: Discharge, 1,290 $ft^3/s$ (36.5 $m^3/s$) Sept. 19, 1946, gage height, 5.36 ft (1.634 m), from rating curve extended above 350 $ft^3/s$ (9.9 $m^3/s$).

(78) 09492400 East Fork White River near Fort Apache, Ariz.

Location.--Lat 33°49'20", long 109°48'50", in SE¼ sec.16, T.5 N., R.24 E. (unsurveyed), Apache County, Hydrologic Unit 15060102, in Fort Apache Indian Reservation, on left bank 600 ft (180 m) downstream from highway bridge, 0.1 mi (0.2 km) upstream from Rock Creek, and 10 mi (16 km) east of Fort Apache.

Drainage area.--38.8 $mi^2$ (100.5 $km^2$).

Gage-height record.--Crest stage only during flood period. Altitude of gage is 6,050 ft (1,844 m), by barometer.

(78) 09492400 East Fork White River near Fort Apache, Ariz.—Continued

Discharge record.--Stage-discharge relation extended above 290 $ft^3/s$ (8.21 $m^3/s$).

Maxima.--November 1978 to March 1979: Discharge, 751 $ft^3/s$ (21.3 $m^3/s$) Dec. 18, 1978, gage height, 3.62 ft (1.103 m) from high-water mark in well.
1957 to October 1978: Discharge, 758 $ft^3/s$ (21.5 $m^3/s$), revised, Aug. 3, 1967, gage height, 3.63 ft (1.106 m), revised, in well and about 5.0 ft outside.

(79) 09494000 White River near Fort Apache, Ariz.

Location.--Lat 33°44'11", long 110°09'58", in SE¼ sec.32, T.4½ N., R.21 E. (unsurveyed), Gila County, Hydrologic Unit 15060102, in Fort Apache Indian Reservation, on right bank 2,200 ft (670 m) downstream from bridge, 4.5 mi (7.2 km) upstream from confluence with Black River, and 11 mi (18 km) west of Fort Apache.

Drainage area.--632 $mi^2$ (1,637 $km^2$).

Gage-height record.--Digital water-stage recorder tape except 1000 hours Dec. 19 to 1600 hours Dec. 20, when gage-height graph was reconstructed. Datum of gage is 4,365.99 ft (1,330.754 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 4,100 $ft^3/s$ (120 $m^3/s$) on basis of slope-area measurements at gage heights 9.8 and 15.71 ft (2.80 and 4.788 m).

Maxima.--November 1978 to March 1979: Discharge, 14,600 $ft^3/s$ (413 $m^3/s$) 2130 hours Dec. 18, gage height, 15.71 ft (4.788 m) from high-water mark in well.
1957 to January 1978: Discharge, 8,670 $ft^3/s$ (246 $m^3/s$) Aug. 12, 1971, from slope-area measurement of peak flow, gage height, 13.8 ft (4.21 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 1200 | 3.74 | 126 | 2400 | 12.96 | 9,510 | 0600 | 6.34 | 1,990 |
| 2200 | 3.74 | 126 | Dec. 19 | | | 1200 | 6.04 | 1,790 |
| 2400 | 4.01 | 145 | 0100 | 12.25 | 8,420 | 2000 | 5.83 | 1,660 |
| Dec. 18 | | | 0300 | 11.10 | 6,800 | 2100 | 6.09 | 1,820 |
| 0500 | 4.76 | 458 | 0400 | 11.02 | 6,700 | 2400 | 5.90 | 1,710 |
| 0600 | 6.23 | 1,570 | 0500 | 10.00 | 5,420 | Dec.21 | | |
| 0700 | 6.96 | 2,220 | 0600 | 11.30 | 7,070 | 1200 | 5.08 | 1,230 |
| 1000 | 9.65 | 5,020 | 0630 | 11.50 | 7,340 | 1900 | 4.90 | 1,140 |
| 1400 | 13.97 | 11,200 | 0800 | 10.70 | 6,280 | 2400 | 4.95 | 1,160 |
| 1600 | 14.19 | 11,600 | 0900 | 10.82 | 6,440 | | | |
| 1800 | 14.95 | 12,900 | 1200 | 9.80 | 5,190 | Dec.22 | | |
| 2130 | 15.71 | 14,600 | 1800 | 7.65 | 3,010 | 1200 | 4.45 | 914 |
| 2300 | 14.10 | 11,400 | 2400 | 6.75 | 2,280 | 2400 | 4.39 | 851 |

(80) 09496500 Carrizo Creek near Show Low, Ariz.

Location.--Lat 33°59'09", long 110°16'52", in sec.24, T.7 N., R.19 E. (unsurveyed), Gila County, Hydrologic Unit 15060104, in Fort Apache Indian Reservation, on right bank 500 ft (152 m) upstream from U.S. Highway 60, 1 mi (2 km) downstream from Corduroy Creek, 23 mi (37 km) southwest of Show Low, and 24 mi (39 km) upstream from mouth.

Drainage area.--439 $mi^2$ (1,137 $km^2$).

Gage-height record.--Fragmentary record from water-stage recorder and floodmarks; record estimated 0900 Dec. 18 to 2400 Dec. 20. Datum of gage is 4,750.53 ft (1,447.98 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 160 $ft^3/s$ (4.53 $m^3/s$) on basis of current-meter measurements at 4,300 and 5,800 $ft^3/s$ (122 and 164 $m^3/s$) and slope-area measurement at gage height 12.07 ft (3.679 m). Above 160 $ft^3/s$ (4.53 $m^3/s$) rating is shaped through measurements by step-backwater analysis.

Maxima.--November 1978 to March 1979: Discharge, 19,400 $ft^3/s$ (549 $m^3/s$) 1600 hours Dec. 18, gage height, 15.1 ft (4.60 m) from floodmark.

1951 to October 1978: Discharge, about 23,000 $ft^3/s$ (650 $m^3/s$) Dec. 30, 1965, gage height, 13.0 ft (3.96 m), from high water in well at site and datum then in use, from rating curve extended above 2,000 $ft^3/s$ (57 $m^3/s$) on basis of slope-area measurement at gage height, 12.08 ft (3.682 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 0600 | 2.07 | 57 | 0500 | 7.60 | 4,360 | 1200 | 10.0 | 8,120 |
| 1500 | 2.15 | 69 | 0900 | 9.5 | 7,300 | 1800 | 5.9 | 2,450 |
| 2200 | 2.35 | 106 | 1500 | 13.4 | 15,000 | 2400 | 4.85 | 1,540 |
| 2400 | 3.00 | 314 | 1600 | 15.1 | 19,400 | Dec. 20 | | |
| | | | 2000 | 14.85 | 18,800 | 0600 | 4.5 | 1,260 |
| Dec. 18 | | | 2400 | 13.5 | 15,300 | 1200 | 4.2 | 1,050 |
| 0200 | 5.46 | 2,050 | Dec. 19 | | | 1800 | 4.0 | 918 |
| 0300 | 7.00 | 3,580 | 0600 | 11.5 | 10,900 | 2400 | 3.8 | 765 |

(81) 09497500 Salt River near Chrysotile, Ariz.

Location.--Lat 33°47'53", long 110°29'57", in sec.25, T.5 N., R.17 E. (unsurveyed), Gila County, Hydrologic Unit 15060103, in San Carlos Indian Reservation, on left bank 1,200 ft (366 m) upstream from U.S. Highway 60, 5.7 mi (9.2 km) northeast of Chrysotile, 8 mi (13 km) upstream from Cibecue Creek, and 33 mi (53 km) downstream from confluence of Black and White Rivers.

Drainage area.--2,849 $mi^2$ (7,379 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Datum of gage is 3,354.57 ft (1,022.473 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

(81) 09497500 Salt River near Chrysotile, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 70,400 $ft^3/s$ (1,990 $m^3/s$) 1800 hours Dec. 18, gage height, 17.35 ft (5,288 m).

1906 to October 1978: Discharge, 74,000 $ft^3/s$ (2,100 $m^3/s$), gage height, 18 ft (5.5 m) from floodmarks, from rating curve extended above 52,000 $ft^3/s$ (1,500 $m^3/s$); occurred prior to 1924 probably on Jan. 19, 1916.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19—Con. | | | Jan. 17—Con. | | |
| 0600 | 2.03 | 392 | 1800 | 11.49 | 26,300 | 0800 | 5.75 | 4,780 |
| 1200 | 2.00 | 375 | 2200 | 10.73 | 22,200 | 1000 | 7.45 | 9,150 |
| 2100 | 2.02 | 387 | 2400 | 10.48 | 21,000 | 1200 | 9.06 | 14,700 |
| 2200 | 2.06 | 410 | Dec. 20 | | | 1400 | 9.31 | 15,700 |
| 2300 | 2.88 | 969 | 0200 | 10.21 | 19,700 | 1600 | 10.01 | 18,800 |
| 2400 | 4.22 | 2,370 | 0600 | 9.51 | 16,600 | 1800 | 12.30 | 30,900 |
| Dec. 18 | | | 1200 | 8.80 | 13,700 | 2000 | 12.76 | 33,700 |
| 0400 | 4.66 | 2,970 | 1800 | 8.01 | 10,900 | 2115 | 12.99 | 35,100 |
| 0800 | 9.17 | 15,100 | 2400 | 7.31 | 8,730 | 2400 | 12.25 | 30,600 |
| 1000 | 10.49 | 21,100 | Dec. 21 | | | | | |
| 1200 | 12.50 | 32,100 | 0500 | 7.06 | 8,020 | Jan. 18 | | |
| 1400 | 14.51 | 45,700 | 1500 | 6.35 | 6,180 | 0200 | 12.09 | 29,700 |
| 1600 | 16.09 | 58,500 | 2400 | 5.89 | 5,050 | 0600 | 11.15 | 24,500 |
| 1700 | 16.57 | 62,900 | Jan. 15 | | | 1200 | 8.97 | 14,300 |
| 1800 | 17.35 | 70,400 | 2400 | 2.55 | 727 | 2400 | 7.59 | 9,570 |
| 2300 | 16.98 | 66,700 | Jan. 16 | | | Jan. 19 | | |
| 2400 | 16.78 | 64,800 | 1200 | 3.41 | 1,450 | 1200 | 6.86 | 7,480 |
| Dec. 19 | | | 2400 | 4.30 | 2,470 | 2400 | 5.67 | 4,640 |
| 0800 | 13.41 | 37,800 | Jan. 17 | | | Jan. 20 | | |
| 1000 | 13.12 | 35,900 | 0200 | 4.29 | 2,460 | 1200 | 4.94 | 3,390 |
| 1600 | 11.09 | 24,100 | 0600 | 4.66 | 2,970 | 2400 | 4.24 | 2,390 |

(82) 09497800 Cibecue Creek near Chrysotile, Ariz.

Location.--Lat 33°50'35", long 110°33'25", in E½ sec.8, T.5 N., R.17 E. (unsurveyed), Gila County, Hydrologic Unit 15060103, in Fort Apache Indian Reservation, on right bank 0.5 mi (0.8 km) upstream from mouth, and 7 mi (11 km) north of Chrysotile.

Drainage area.--295 $mi^2$ (764 $km^2$).

Gage-height record.--Digital water-stage recorder tape except on recession from peak of Dec. 18, which was estimated. Altitude of gage is 3,200 ft (975 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 2,200 $ft^3/s$ (62 $m^3/s$) on basis of slope-area measurements at gage heights 7.70, 10.50, and 17.3 ft (2.35, 3.20, and 5.27 m).

Maxima.--November 1978 to March 1979: Discharge, 7,740 $ft^3/s$ (219 $m^3/s$) 0900 hours Dec. 18, gage height, 10.20 ft (3.109 m).

1959 to October 1978: Discharge, 22,200 $ft^3/s$ (629 $m^3/s$) Sept. 2, 1977, gage height, 17.3 ft (5.27 m).

(82) 09497800 Cibecue Creek near Chrysotile, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19 | | | Jan. 16—Con. | | |
| 1400 | 2.18 | 38 | 0600 | 5.2 | 1,850 | 1800 | 3.86 | 661 |
| 1600 | 2.26 | 49 | 1200 | 4.8 | 1,360 | 2400 | 3.53 | 481 |
| 1800 | 3.01 | 232 | 1800 | 4.4 | 1,010 | | | |
| 2000 | 3.59 | 495 | 2400 | 4.1 | 789 | Jan. 17 | | |
| 2200 | 3.77 | 605 | | | | 0500 | 3.42 | 430 |
| 2400 | 3.73 | 578 | Jan. 16 | | | 0900 | 3.94 | 708 |
| Dec. 18 | | | 0000 | 2.12 | 48 | 1200 | 5.20 | 1,800 |
| 0200 | 4.07 | 795 | 0200 | 2.19 | 58 | 1400 | 9.42 | 6,740 |
| 0400 | 5.18 | 1,770 | 0400 | 2.50 | 115 | 1800 | 7.15 | 3,780 |
| 0600 | 6.81 | 3,530 | 0600 | 3.26 | 356 | 2200 | 5.48 | 1,970 |
| 0800 | 9.71 | 7,100 | 0700 | 3.90 | 684 | 2400 | 5.08 | 1,580 |
| 0900 | 10.20 | 7,740 | 0800 | 3.87 | 667 | Jan. 18 | | |
| 1000 | 9.6 | 6,960 | 1000 | 3.70 | 572 | 0600 | 4.50 | 1,060 |
| 1200 | 8.6 | 5,690 | 1200 | 3.65 | 541 | 1200 | 4.14 | 780 |
| 1800 | 6.9 | 3,640 | 1400 | 4.06 | 789 | 1800 | 3.87 | 602 |
| 2400 | 5.9 | 2,560 | 1600 | 4.07 | 795 | 2400 | 3.66 | 481 |

(83) 09497850 Canyon Creek near Globe, Ariz.

Location.--Lat 33°49'47", long 110°39'50", in sec.17, T.6 N., R.16 E. (unsurveyed), Gila County, Hydrologic Unit 15060103, on left bank 1.9 mi (3.1 km) upstream from mouth, 10 mi (16 km) northwest of Seneca, and 31 mi (50 km) north of Globe.

Drainage area.--316 $mi^2$ (818 $km^2$).

Gage-height record.--Digital water-stage recorder tape from recorder driven by manometer. Altitude of gage is 3,080 ft (940 m), from topographic map. Record affected by drawdown from 0900 hours to 1800 hours Dec. 18.

Discharge record.--Stage-discharge relation extended above 4,200 $ft^3/s$ (119 $m^3/s$) on basis of slope-area measurement at 18.8 ft (5.73 m), outside stage. Discharge estimated during period of drawdown.

Maxima.--November 1978 to March 1979: Discharge, 22,700 $ft^3/s$ (643 $m^3/s$) (revised) about 1715 hours Dec. 18, gage height, 19.4 ft (5.913 m) from floodmark.

1975 to October 1978: Discharge, 21,100 $ft^3/s$ (598 $m^3/s$) Mar. 1, 1978, gage height, 18.8 ft (5.73 m), from floodmark.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 1000 | 2.90 | 40 | 0400 | 10.55 | 5,440 | 0300 | 6.20 | 1,220 |
| 1800 | 3.06 | 60 | 0500 | 12.32 | 7,920 | 0400 | 6.36 | 1,320 |
| 1900 | 3.12 | 69 | 0600 | 13.56 | 9,950 | 0600 | 6.07 | 1,130 |
| 2000 | 3.59 | 156 | 0900 | 19.4 | 22,700 | 0700 | 6.13 | 1,170 |
| 2100 | 4.37 | 300 | 1200 | ----- | 19,000 | 1200 | 5.79 | 952 |

(83) 09497850 Canyon Creek near Globe, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 2200 | 6.25 | 1,250 | 1500 | ----- | 14,000 | 2400 | 5.36 | 728 |
| 2300 | 7.81 | 2,480 | 1800 | 13.88 | 10,500 | Dec. 21 | | |
| 2330 | 9.50 | 4,180 | 2000 | 12.93 | 8,890 | 1200 | 4.95 | 531 |
| 2400 | 8.83 | 3,420 | 2200 | 11.48 | 6,680 | 2400 | 4.74 | 404 |
| Dec. 18 | | | 2400 | 10.23 | 5,040 | Dec. 22 | | |
| 0100 | 9.49 | 4,170 | Dec. 20 | | | 1200 | 4.59 | 345 |
| 0200 | 9.32 | 3,990 | 0100 | 6.61 | 1,490 | 2400 | 4.38 | 298 |

(84) 09497980 Cherry Creek near Globe, Ariz.

Location.--Lat 33°49'40", long 110°51'20", in SW¼ sec.30, T.6 N., R.15 E. (unsurveyed), Gila County, Hydrologic Unit 15060103, in Tonto National Forest, on left bank 0.2 mi (0.3 km) upstream from Devils Chasm, 13 mi (21 km) upstream from mouth, and 30 mi (48 km) north of Globe.

Drainage area.--200 $mi^2$ (518 $km^2$).

Gage-height record.--Crest stage only during flood periods. Recording station destroyed by flood of Jan. 17, 1979. Altitude of gage is 3,200 ft (980 m), from topographic map.

Maxima.--November 1978 to March 1979: Discharge, 15,700 $ft^3/s$ (445 $m^3/s$) Jan. 17, from slope-area measurement of peak flow, gage height, 15.2 ft (4.63 m) from profile past gage site.

1965 to October 1978: Discharge, 8,300 $ft^3/s$ (235 $m^3/s$) Oct. 19, 1972, gage height, 14.0 ft (4.27 m), from floodmarks, from rating curve extended above 330 $ft^3/s$ (9.35 $m^3/s$) on basis of slope-area measurements at gage heights 5.85, 6.70, 8.70 and 12.3 ft (1.783, 2.042, 2.652, and 3.75 m).

(85) 09498500 Salt River near Roosevelt, Ariz.

Location.--Lat 33°37'10", long 110°55'15", in SE¼NE¼ sec.9, T.3 N., R.14 E. (unsurveyed), Gila County, Hydrologic Unit 15060103, in Tonto National Forest on left bank 100 ft (30 m) downstream from State Highway 288, 0.3 mi (0.5 km) downstream from Pinal Creek, 14 mi (23 km) east of village of Roosevelt, and 17 mi (27 km) upstream from Roosevelt Dam.

Drainage area.--4,306 $mi^2$ (11,153 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,177.14 ft (663.592 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 95,800 $ft^3/s$ (2,710 $m^3/s$) 0130 hours Dec. 19, gage height, 29.35 ft (8.946 m).

1906 to October 1978: Discharge, 117,000 $ft^3/s$ (3,310 $m^3/s$) Mar. 14, 1941 from rating curve extended above 55,000 $ft^3/s$ (1,600 $m^3/s$) on basis of velocity-area studies and float-area measurements at 66,000 $ft^3/s$ (1,870 $m^3/s$) and 102,000 $ft^3/s$ (2,890 $m^3/s$). Gage height, 25.8 ft (7.86 m) Dec. 23, 1965.

(85) 09498500 Salt River near Roosevelt, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 21 | | | Jan. 17—Con. | | |
| 2400 | 10.40 | 3,470 | 0600 | 14.15 | 10,800 | 2100 | 21.40 | 41,700 |
| Dec. 18 | | | 1200 | 13.50 | 9,080 | 2400 | 22.20 | 46,100 |
| 0200 | 11.21 | 5,120 | 1800 | 13.12 | 8,070 | | | |
| 0330 | 13.74 | 11,400 | 2400 | 12.73 | 7,070 | Jan. 18 | | |
| 0500 | 15.58 | 16,700 | | | | 0100 | 22.40 | 47,000 |
| 0730 | 18.24 | 26,600 | Jan. 15 | | | 0500 | 20.65 | 37,800 |
| 0900 | 20.07 | 34,900 | 2400 | 8.56 | 908 | 1300 | 18.00 | 25,600 |
| 1000 | 21.34 | 41,400 | Jan. 16 | | | 1700 | 16.00 | 18,100 |
| 1200 | 24.20 | 58,100 | 0800 | 8.53 | 820 | 2000 | 15.30 | 15,800 |
| 1700 | 28.25 | 87,000 | 1200 | 8.65 | 908 | 2400 | 14.50 | 13,400 |
| 2100 | 29.08 | 93,600 | 1400 | 9.00 | 1,260 | Jan. 19 | | |
| 2230 | 29.20 | 94,600 | 1500 | 10.15 | 2,730 | 0400 | 14.00 | 11,900 |
| 2400 | 29.05 | 93,400 | 1600 | 10.68 | 3,580 | 0730 | 13.60 | 10,800 |
| Dec. 19 | | | 2200 | 11.06 | 4,330 | 1030 | 14.00 | 11,900 |
| 0130 | 29.35 | 95,800 | 2400 | 11.80 | 6,040 | 1130 | 14.10 | 12,200 |
| 0600 | 27.80 | 83,200 | | | | 1230 | 14.00 | 11,900 |
| 1200 | 24.98 | 62,200 | Jan. 17 | | | 1600 | 13.25 | 9,840 |
| 1800 | 22.24 | 44,700 | 0600 | 11.50 | 5,400 | 2400 | 12.43 | 7,580 |
| 2400 | 19.74 | 31,800 | 0830 | 12.00 | 6,500 | | | |
| Dec. 20 | | | 1030 | 13.50 | 10,500 | Jan. 20 | | |
| 0600 | 17.83 | 23,400 | 1200 | 15.80 | 17,400 | 0200 | 12.37 | 7,530 |
| 1200 | 16.24 | 17,400 | 1400 | 18.80 | 29,000 | 0700 | 11.97 | 6,550 |
| 1800 | 15.18 | 14,000 | 1500 | 20.90 | 39,100 | 1500 | 11.45 | 5,460 |
| 2400 | 14.44 | 11,700 | 1700 | 22.70 | 48,900 | 2200 | 11.00 | 4,470 |

(86) 09498508 Upper Parker Creek Watershed near Roosevelt, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°47'50", long 110°57'35", in NE¼NW¼ sec.7, T.5 N., R.14 E., Gila County, Hydrologic Unit 15060103, Tonto National Forest, 1.5 mi (2.41 km) upstream from confluence with Pocket Creek, and 12 mi (19 km) northeast of Roosevelt.

Drainage area.--1.09 $mi^2$ (2.82 $km^2$).

Gage-height record.--Water-stage recorder tape and chart. Altitude of gage is 5,440 ft (1,658 m).

Discharge record.--Stage-discharge relation for 90° v-notch and Cippoletti weirs defined by model studies furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge, 64 $ft^3/s$ (1.81 $m^3/s$) 1045 hours Jan. 17, gage height, 3.63 ft (1.106 m).
1934 to October 1978: Discharge, 270 $ft^3/s$ (7.65 $m^3/s$) Dec. 23, 1945, gage height 5.91 ft (1.801 m).

Remarks.--Data for other small research watersheds in this area are available from the experiment station.

(86) 09498508 Upper Parker Creek Watershed near Roosevelt, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19 | | | Jan. 17—Con. | | |
| 0915 | 0.72 | 1.1 | 0530 | 2.54 | 26 | 0630 | 2.62 | 28 |
| 1200 | 1.32 | 5.1 | 0930 | 1.86 | 12 | 0820 | 3.23 | 48 |
| 1400 | 2.38 | 22 | 1400 | 1.43 | 6.2 | 1045 | 3.63 | 64 |
| 1825 | 3.15 | 45 | 2400 | 1.32 | 5.1 | 1600 | 2.82 | 34 |
| 2100 | 3.36 | 53 | | | | 2030 | 2.42 | 33 |
| 2200 | 3.00 | 40 | Dec. 20 | | | 2400 | 2.18 | 19 |
| 2400 | 2.83 | 34 | 1200 | 1.42 | 6.1 | Jan. 18 | | |
| | | | 2400 | 1.28 | 4.7 | 1000 | 1.76 | 10 |
| Dec. 18 | | | Jan. 15 | | | 2400 | 1.53 | 7.4 |
| 0200 | 3.44 | 56 | 2400 | .67 | .9 | Jan. 19 | | |
| 0245 | 3.45 | 56 | Jan. 16 | | | 2400 | 1.28 | 4.7 |
| 0330 | 3.30 | 50 | 1800 | 1.02 | 2.7 | Jan. 20 | | |
| 1000 | 2.84 | 35 | 2400 | 1.36 | 5.5 | 1000 | 1.20 | 4.0 |
| 1440 | 3.03 | 41 | Jan. 17 | | | 1500 | 1.21 | 4.1 |
| 2400 | 2.71 | 31 | 0300 | 1.97 | 14 | 2400 | 1.18 | 3.9 |

(87) 09498550 Workman Creek near Roosevelt, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°49', long 110°56', in SW¼ sec.33, T.6 N., R.14 E., Gila County, Hydrologic Unit 15060103, 16 mi (26 km) northeast of Roosevelt.

Drainage area.--1.70 $mi^2$ (4.40 $km^2$).

Gage-height record.--Water-stage recorder. Altitude of gage is 6,600 ft (2,012 m), from topographic map.

Discharge record.--Stage-discharge relation defined by model studies for Cippoletti weir. Discharges furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge, 204 $ft^3/s$ (5.78 $m^3/s$) 1400 hours Dec. 18, gage height, 5.78 ft (1.762 m).
1938 to October 1978: Discharge, 289 $ft^3/s$ (8.184 $m^3/s$) Oct. 19, 1972, gage height, 6.64 ft (2.023 m).

Remarks.--Data for other small research watersheds in this area are available from the experiment station.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 0345 | 0.56 | 0.6 | 1110 | 5.15 | 154 | 1200 | 1.45 | 6.4 |
| 0800 | .64 | .8 | 1230 | 5.40 | 172 | 2400 | 1.17 | 3.8 |
| 1025 | .88 | 1.9 | 1300 | 5.41 | 174 | Jan. 16 | | |
| 1215 | .95 | 2.3 | 1400 | 5.78 | 204 | 2100 | .65 | .9 |

(87) 09498550 Workman Creek near Roosevelt, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 18—Con. | | | Jan. 16—Con. | | |
| 1500 | 1.51 | 8.3 | 1525 | 5.09 | 148 | 2400 | .91 | 2.0 |
| 1655 | 2.13 | 17 | 1635 | 4.51 | 110 | Jan. 17 | | |
| 1815 | 2.51 | 28 | 1715 | 4.24 | 94 | 0300 | .99 | 2.5 |
| 1945 | 2.93 | 37 | 1730 | 4.33 | 99 | 0700 | 1.90 | 13 |
| 2000 | 3.28 | 50 | 2030 | 3.65 | 55 | 0825 | 2.63 | 28 |
| 2140 | 3.55 | 50 | 2115 | 3.68 | 66 | 0905 | 3.31 | 51 |
| 2230 | 3.53 | 59 | 2325 | 3.24 | 48 | 1015 | 4.06 | 85 |
| 2400 | 3.45 | 56 | 2400 | 3.34 | 52 | 1100 | 4.21 | 93 |
| | | | Dec. 19 | | | 1300 | 3.70 | 67 |
| Dec. 18 | | | 0100 | 3.65 | 65 | 1600 | 3.31 | 51 |
| 0100 | 3.55 | 65 | 0300 | 4.34 | 100 | 1900 | 2.94 | 38 |
| 0150 | 4.89 | 134 | 0400 | 3.97 | 80 | 2230 | 2.63 | 28 |
| 0230 | 5.09 | 148 | 0440 | 3.80 | 71 | 2400 | 2.48 | 24 |
| 0320 | 5.36 | 169 | 0510 | 3.84 | 73 | Jan. 18 | | |
| 0415 | 5.26 | 161 | 0900 | 3.21 | 47 | 0425 | 2.18 | 18.0 |
| 0500 | 5.24 | 159 | 1200 | 2.77 | 33 | 0900 | 1.95 | 13 |
| 0535 | 5.04 | 145 | 1700 | 2.39 | 22 | 1600 | 1.70 | 9.6 |
| 0625 | 5.21 | 158 | 2400 | 1.97 | 14 | 2400 | 1.51 | 7.1 |
| 0700 | 5.05 | 146 | | | | Jan. 19 | | |
| 0835 | 4.66 | 119 | Dec. 20 | | | 0910 | 1.38 | 5.6 |
| 0920 | 4.66 | 119 | 0400 | 1.76 | 10 | 2400 | 1.21 | 4.0 |

(88) 09498870 Rye Creek near Gisela, Ariz.

Location.--Lat 34°01'57", long 111°17'26", in SW¼ sec.13, T.8 N., R.10 E., Gila County, Hydrologic Unit 15060105, in Tonto National Forest, on right bank, 0.5 mi (0.8 km) upstream from mouth, 0.8 mi (1.3 km) downstream from county road, and 4.8 mi (7.7 km) south of Gisela.

Drainage area.--122 $mi^2$ (316 $km^2$).

Gage-height record.--Water-stage recorder graph in December; crest stage only in January. Altitude of gage is 2,730 ft (832 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 1,100 $ft^3/s$ (31 $m^3/s$) on basis of slope-area measurements at gage heights 9.0 and 14.1 ft (2.74 and 4.30 m), present datum.

Maxima.--November 1978 to March 1979: Discharge, 5,230 $ft^3/s$ (148 $m^3/s$) Jan. 17, gage height, 6.15 ft (1.875 m) from high-water mark in gage well.

1963 to October 1978: Discharge, 44,400 $ft^3/s$ (1,260 $m^3/s$) Sept. 5, 1970, gage height, 14.1 ft (4.30 m) in gage well and 18.7 ft (5.70 m) from profile past gage.

(88) 09498870 Rye Creek near Gisela, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2000 | 0.61 | 6.0 | 1100 | 4.90 | 3,270 | 1030 | 3.01 | 1,180 |
| 2000? | .80 | 55 | 1400 | 4.85 | 3,200 | 1200 | 2.96 | 1,150 |
| 2030 | .93 | 110 | 1500 | 4.95 | 3,340 | 1800 | 2.56 | 864 |
| 2130 | 1.31 | 128 | 1700 | 4.50 | 2,750 | 2400 | 2.28 | 692 |
| 2200 | 2.18 | 675 | 2000 | 3.70 | 1,860 | | | |
| 2400 | 3.06 | 1,280 | 2200 | 3.40 | 1,570 | Dec. 20 | | |
| Dec. 18 | | | 2400 | 3.52 | 1,680 | 1200 | 1.77 | 433 |
| 0200 | 4.90 | 3,270 | Dec. 19 | | | 1800 | 1.58 | 354 |
| 0300 | 4.75 | 3,070 | 0230 | 3.95 | 2,040 | 2400 | 1.44 | 301 |
| 0400 | 5.25 | 3,770 | 0300 | 3.65 | 1,740 | Dec. 21 | | |
| 0600 | 4.80 | 3,140 | 0830 | 3.11 | 1,260 | 1200 | 1.17 | 207 |
| 0900 | 4.80 | 3,140 | 0930 | 3.10 | 1,260 | 2400 | 1.02 | 159 |

(89) 09498900 Gold Creek near Payson, Ariz.
(Discontinued crest-stage station)

Location.--Lat 33°00'10", long 111°21'30", in SW¼ sec.29, T.8 N., R.10 E., Gila County, Hydrologic Unit 15060105, on left bank at State Highway 87, 16 mi (26 km) south of Payson.

Drainage area.--6.44 $mi^2$ (16.7 $km^2$).

Gage-height record.--Crest stage only. Datum of gage is 3,470.58 ft (1,057.833 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by computations of discharge through culvert.

Maxima.--November 1978 to March 1979: Discharge, 1,120 $ft^3/s$ (31.7 $m^3/s$) Dec. 18 or Jan. 17, gage height, 6.72 ft (2.048 m).
1963 to October 1978: Discharge, 2,800 $ft^3/s$ (79.3 $m^3/s$), gage height 11.94 ft (3.639 m) from profile of floodmarks.

(90) 09499000 Tonto Creek above Gun Creek, near Roosevelt, Ariz.

Location.--Lat 33°58'48", long 111°18'10", in SW¼NE¼ sec.2, T.7 N., R.10 E., Gila County, Hydrologic Unit 15060105, in Tonto National Forest, on left bank 600 ft (183 m) upstream from Gun Creek, 17 mi (27 km) upstream from high-water line of Roosevelt Lake, and 24 mi (39 km) northwest of Roosevelt.

Drainage area.--675 $mi^2$ (1,750 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,523.14 ft (769.053 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

(90) 09499000 Tonto Creek above Gun Creek, near Roosevelt, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 61,400 $ft^3/s$ (1,580 $m^3/s$), revised, 1100 hours Jan. 17, gage height, 17.0 ft (5.18 m), from high-water mark in gage well.

1940 to October 1978: Discharge, 57,200 $ft^3/s$ (1,620 $m^3/s$), revised, Mar. 2, 1978, gage height, 16.5 ft (5.029 m), from rating curve extended above 27,000 $ft^3/s$ (765 $m^3/s$) on basis of slope-area measurement of peak flow.

Peak of January 1979 is probably the highest since at least 1905.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 20 | | | Jan.17—Con. | | |
| 2400 | 3.50 | 55 | 0400 | 6.10 | 3,280 | 0400 | 6.4 | 4,980 |
| Dec. 17 | | | 0800 | 5.85 | 2,810 | 0600 | 8.0 | 10,500 |
| 0600 | 3.52 | 59 | 1600 | 5.53 | 2,240 | 0700 | 10.0 | 18,600 |
| 1400 | 3.61 | 79 | 2400 | 5.33 | 1,920 | 0900 | 14.0 | 37,600 |
| 2000 | 3.80 | 141 | Dec. 21 | | | 1000 | 16.0 | 49,100 |
| 2200 | 4.80 | 770 | 0800 | 5.10 | 1,600 | 1100 | 17.0 | 61,400 |
| 2400 | 5.90 | 2,300 | 1600 | 4.80 | 1,230 | 1200 | 16.9 | 55,100 |
| | | | 2400 | 4.68 | 1,110 | 1300 | 16.1 | 49,700 |
| Dec. 18 | | | Dec. 22 | | | 1400 | 15.0 | 43,200 |
| 0100 | 7.00 | 4,710 | 1200 | 4.45 | 868 | 1500 | 13.5 | 34,900 |
| 0200 | 9.00 | 11,900 | 2400 | 4.25 | 724 | 1600 | 12.3 | 29,200 |
| 0400 | 10.45 | 18,800 | Jan. 15 | | | 1800 | 11.2 | 24,200 |
| 0600 | 12.00 | 26,800 | 2400 | 3.17 | 144 | 2000 | 9.5 | 16,800 |
| 0900 | 14.20 | 38,700 | Jan. 16 | | | 2100 | 8.9 | 14,300 |
| 1200 | 13.70 | 35,400 | 0600 | 3.20 | 155 | 2200 | 8.7 | 13,500 |
| 1600 | 13.40 | 33,900 | 1100 | 3.34 | 212 | 2300 | 8.2 | 11,600 |
| 2000 | 13.80 | 36,000 | 1400 | 3.66 | 400 | 2400 | 7.9 | 10,500 |
| 2200 | 11.00 | 21,800 | 1500 | 4.50 | 1,200 | Jan.18 | | |
| 2400 | 9.80 | 15,600 | 1600 | 5.35 | 2,610 | 0500 | 7.25 | 8,100 |
| Dec. 19 | | | 1900 | 6.05 | 4,100 | 1200 | 6.65 | 6,100 |
| 0200 | 8.80 | 11,000 | 2100 | 7.2 | 7,530 | 1500 | 6.50 | 5,650 |
| 0900 | 8.80 | 11,000 | 2400 | 6.7 | 5,830 | 1700 | 6.10 | 4,200 |
| 1600 | 7.55 | 6,600 | Jan. 17 | | | 1900 | 6.20 | 4,580 |
| 2400 | 6.50 | 4,040 | 0200 | 6.5 | 5,250 | 2400 | 6.10 | 4,200 |

(91) 09500100 Three Bar D Watershed near Roosevelt, Ariz.
(U.S. Forest Service station)

Location.--Lat 33°42'55", long 111°18'15", in SE¼SE¼ sec.3, T.4 N., R.10 E., Gila County, Hydrologic Unit 15060105, 1 mi (1.6 km) upstream from confluence of Rock Creek and Fox Gulch, and 11 mi (18 km) northwest of Roosevelt.

Drainage area.--0.13 $mi^2$ (0.34 $km^2$).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 3,695 ft (1,126 m) from topographic map.

Discharge record.--Stage-discharge relation for 90° v-notch weir defined by model studies. Discharge furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

(91) 09500100 Three Bar D Watershed near Roosevelt, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 3.7 $ft^3/s$ (0.105 $m^3/s$) 0035 hours Dec. 18, gage height, 1.16 ft (0.354 m).
1963 to October 1978: Discharge, 99 $ft^3/s$ (2.80 $m^3/s$) July 26, 1964.

Remarks.--Data for other small research watersheds in the area are available from the experiment station.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Jan. 17 | | |
| 2400 | 0.15 | 0.02 | 0515 | 0.95 | 2.25 | 0600 | 0.94 | 2.15 |
| Dec. 17 | | | 0645 | .89 | 1.88 | 0655 | 1.07 | 3.03 |
| 0605 | .15 | .02 | 0835 | 1.04 | 2.82 | 0720 | .96 | 2.28 |
| 1000 | .26 | .09 | 1215 | 1.11 | 3.30 | 0745 | 1.09 | 3.14 |
| 1200 | .43 | .32 | 1355 | 1.07 | 3.00 | 0805 | 1.05 | 2.86 |
| 1400 | .53 | .51 | 1805 | .81 | 1.50 | 0820 | 1.13 | 3.44 |
| 1535 | .67 | .94 | 2100 | .78 | 1.34 | 0900 | 1.04 | 2.84 |
| 1740 | .92 | 2.05 | 2400 | .72 | 1.12 | 1200 | .84 | 1.62 |
| 1810 | .87 | 1.80 | | | | 1800 | .70 | 1.03 |
| 1850 | 1.06 | 2.95 | Dec. 19 | | | 2400 | .65 | .87 |
| 1905 | 1.08 | 3.06 | 0130 | .84 | 1.63 | Jan. 18 | | |
| 2020 | .91 | 2.03 | 1205 | .70 | 1.05 | 0205 | .77 | 1.33 |
| 2200 | .88 | 1.86 | 2400 | .55 | .58 | 0500 | .65 | .88 |
| 2350 | .70 | 1.06 | | | | 0700 | .69 | 1.00 |
| 2400 | .74 | 1.19 | Dec. 20 | | | 0800 | .67 | .95 |
| Dec. 18 | | | 2400 | .45 | .34 | 1025 | .69 | 1.02 |
| 0030 | 1.04 | 2.84 | Jan. 15 | | | 1805 | .64 | .83 |
| 0035 | 1.16 | 3.71 | 2400 | .30 | .13 | 2050 | .76 | 1.30 |
| 0125 | .92 | 2.08 | Jan. 16 | | | 2400 | .68 | .99 |
| 0145 | .99 | 2.46 | 0405 | .36 | .20 | Jan. 19 | | |
| 0220 | .97 | 2.35 | 1200 | .49 | .42 | 1200 | .61 | .75 |
| 0305 | 1.13 | 3.45 | 2400 | .58 | .64 | 2400 | .59 | .68 |

(92) 09500500 Salt River at Roosevelt, Ariz.
(Former gaging station)

Location.--Lat 33°40'30", long 111°09'30", in sec.20, T.4 N., R.12 E. (unsurveyed), Gila County, Hydrologic Unit 15060103, at Roosevelt Dam, about 0.5 mi (0.8 km) downstream from Tonto Creek, and 1 mi (1.6 km) west of Roosevelt.

Drainage area.--5,824 $mi^2$ (15,100 $km^2$).

Discharge record.--Computed by U.S. Army Corps of Engineers, Los Angeles District on basis of change in contents of and outflow from Roosevelt Lake.

Maxima.--November to March 1979: Discharge, 152,000 $ft^3/s$ (4,300 $m^3/s$) about 2200 hours Dec. 18.
1888 to October 1978: Discharge, known to be about 155,000 $ft^3/s$ (4,390 $m^3/s$) Mar. 1, 1978; computed on the basis of flood-routing studies.

(92) 09500500 Salt River at Roosevelt, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 0400 | ----- | 1,000 | 1600 | ----- | 114,000 | 2400 | ----- | 50,300 |
| 0800 | ----- | 1,000 | 1800 | ----- | 131,000 | Dec. 20 | | |
| 1200 | ----- | 1,000 | 2000 | ----- | 142,000 | 0600 | ----- | 40,000 |
| 1600 | ----- | 1,000 | 2200 | ----- | 152,000 | 1200 | ----- | 33,000 |
| 2000 | ----- | 2,200 | 2400 | ----- | 142,500 | 1800 | ----- | 28,000 |
| 2400 | ----- | 18,000 | Dec. 19 | | | 2400 | ----- | 24,000 |
| | | | 0400 | ----- | 126,000 | Dec. 21 | | |
| Dec. 18 | | | 0800 | ----- | 111,000 | 0600 | ----- | 20,800 |
| 0400 | ----- | 42,000 | 1200 | ----- | 93,300 | 1200 | ----- | 18,000 |
| 0800 | ----- | 69,500 | 1600 | ----- | 76,100 | 1800 | ----- | 15,200 |
| 1200 | ----- | 96,500 | 2000 | ----- | 61,200 | 2400 | ----- | 13,100 |

(93) 09501000 Reservoir system on Salt River at and below Roosevelt Dam, Ariz.

Location.--This system comprises four storage reservoirs created by four separate dams on Salt River: Roosevelt Lake, formed by Roosevelt Dam, in sec.20, T.4 N., R.12 E. (unsurveyed), Apache Lake, formed by Horse Mesa Dam, 17 mi (27 km) downstream from Roosevelt Dam; Canyon Lake, formed by Mormon Flat Dam, 27 mi (43 km) downstream from Roosevelt Dam; and Saguaro Lake, formed by Stewart Mountain Dam, 37 mi (60 km) downstream from Roosevelt Dam. Hydrologic Unit 15060106.

Drainage area.--6,211 $mi^2$ (16,086 $km^2$), at Stewart Mountain Dam.

Gage-height record.--Nonrecording gages read at intervals varying from once daily at 0800 hours during periods of low inflow to hourly during periods of high inflow.

Cooperation.--Records furnished by Salt River Valley Water Users' Association.

Maxima.--November 1978 to March 1979: Combined contents, 1,710,000 acre-ft (2,110 $hm^3$) 0300 hours to 0900 hours Mar. 29.
1910 to January 1978: Combined contents, 1,764,000 acre-ft (2,180 $hm^3$) May 22, 1941.

Remarks.--Total capacity of the four reservoirs to top of spillway gates is 1,755,000 acre-ft (2,160 $hm^3$), divided as follows: Roosevelt Lake, 1,382,000 acre-ft (1,700 $hm^3$); Apache Lake, 245,000 acre-ft (302 $hm^3$); Canyon Lake, 58,000 acre-ft (71.5 $hm^3$); and Saguaro Lake, 70,000 acre-ft (86.3 $hm^3$). Dead storage negligible. Dams forming these reservoirs were completed as follows: Roosevelt, 1911 (enlarged 1924); Horse Mesa, 1927; Mormon Flat, 1926; and Stewart Mountain, 1930. Since 1910, spill over Roosevelt Dam because of capacity or near-capacity storage has occurred in 1915, 1916, 1917, 1920, 1941, 1965, 1966, 1968, 1973, 1979, and 1980 water years. Reservoir contents reached 1,748,000 acre-ft in May 1979.

(94) Fish Creek above Lewis and Pranty Creek, near Tortilla Flat, Ariz.
(Miscellaneous site)

Location.--Lat 33°31', long 111°18'30", (unsurveyed), Maricopa County, Hydrologic Unit 15060106, about 4 mi (6.4 km) southeast of Horse Mesa Dam, and 4 mi (6.4 km) northeast of Tortilla Flat.

Drainage area.--32.2 $mi^2$ (83.4 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 2,650 $ft^3/s$ (75.0 $m^3/s$) Dec. 18, from slope-area measurement of peak flow.

Remarks.--Tributary to Salt River downstream from Horse Mesa Dam.

(95) Lewis and Pranty Creek near Tortilla Flat, Ariz.
(Miscellaneous site)

Location.--Lat 33°32'22", long 111°16'13", in Maricopa County, Hydrologic Unit 15060106, 150 ft (46 m) downstream from Arizona Highway Department maintenance yard, 2.4 mi (6.3 km) above mouth and 4 mi (6.4 km) northeast of Tortilla Flat.

Drainage area.--13.4 $mi^2$ (34.7 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 1,210 $ft^3/s$ (34.3 $m^3/s$) probably Dec. 18, from slope-area measurement.

Peak of Aug. 18, 1967: Discharge, 3,310 $ft^3/s$ (93.7 $m^3/s$), from slope-area measurement of peak flow is probably the highest since at least 1960.

Remarks.--Tributary to Fish Creek.

(96) 09501300 Tortilla Creek at Tortilla Flat, Ariz.
(Crest-stage station)

Location.--Lat 33°31'38", long 111°23'13", in NW¼ sec.13, T.2 N., R.9 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060106, 600 ft (180 m) upstream from State Highway 88 and Tortilla Flat store, and 3.7 mi (6.0 km) southeast of Mormon Flat Dam.

Drainage area.--24.3 $mi^2$ (62.9 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 1,755 ft (535 m), from topographic map.

Discharge record.--Stage-discharge relation defined by computations of peak flow over weir.

Maxima.--November 1978 to March 1979: Discharge, 4,400 $ft^3/s$ (125 $m^3/s$) Dec. 18, gage height, 10.07 ft (3.069 m).

1942 to October 1978: Discharge, 7,500 $ft^3/s$ (213 $m^3/s$) Sept. 1, 1971, gage height, 13.23 ft (4.033 m).

(97) 09502000 Salt River below Stewart Mountain Dam, Ariz.

Location.--Lat 33°33'10", long 111°34'33", in NW¼NW¼ sec.6, T.2 N., R.8 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060106, on left bank 3.5 mi (5.6 km) downstream from Stewart Mountain Dam, and 6 mi (10 km) upstream from Verde River.

Drainage area.--6,232 mi² (16,141 km²), of which 21 mi² (54 km²) is below Stewart Mountain Dam.

Gage-height record.--Water-stage recorder graph. Supplemented by water-stage recorder tape. Operation was sporadic during flood period, and record is missing Dec. 22-26. Altitude of gage is 1,370 ft (418 m), from topographic map.

Discharge record.--Stage-discharge relation in December extended above 14,900 ft³/s (422 m³/s) on basis of computation of flow over dam at gage height 22.4 ft (6.83 m). Stage-discharge relation in January and March extended above 11,000 ft³/s (312 m³/s) on basis of data furnished by Salt River Valley Water Users' Association on releases from Stewart Mountain Dam. Discharges from 2400 hours Dec. 19 to 0900 hours Dec. 27 and during periods of no gage-height record in January are from release data in January.

Maxima.--November 1978 to March 1979: Discharge, 65,000 ft³/s (1,840 m³/s) 1900-2200 hours Jan. 18, gage height, 23.3 ft (7.10 m) from high-water mark in well.

1930 to January 1978: Discharge, 51,600 ft³/s (1,460 m³/s) Jan. 1, 1966, gage height, 22.4 ft (6.83 m), from floodmarks.

Outside period of record: Peak discharge in January 1916 when a mean daily discharge of 50,000 ft³/s (1,420 m³/s) was released from Roosevelt Dam, may have exceeded the peak discharge of Jan. 1, 1966.

Remarks.--Flow regulated by four reservoirs above station. (See sta 09501000).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 29 | | | Jan. 22—Con. | | |
| 2400 | 0.70 | 5 | 1100 | 5.60 | 3,340 | 1100 | 4.8 | 2,560 |
| Dec. 18 | | | 2300 | 5.62 | 3,370 | 1300 | 3.5 | 1,450 |
| 0500 | 2.14 | 218 | 2400 | 3.20 | 1,030 | 1500 | 3.60 | 1,200 |
| 0700 | 2.75 | 420 | Dec. 30 | | | 1530 | 11.0 | 13,000 |
| 0900 | 2.60 | 366 | 0100 | 2.30 | 512 | 1800 | 12.4 | 16,500 |
| 1100 | 2.56 | 352 | 0500 | 1.38 | 163 | 2400 | 12.4 | 17,500 |
| 1130 | 4.80 | 1,670 | 1200 | 1.10 | 102 | Jan. 23 | | |
| 1200 | 3.92 | 1,030 | 2400 | .92 | 66 | 1400 | 12.3 | 16,200 |
| 1300 | 9.00 | 7,860 | | | | 1500 | 11.0 | 13,000 |
| 1500 | 12.50 | 16,200 | Jan. 15 | | | 2400 | 11.0 | 13,000 |
| 1800 | 15.40 | 24,900 | 2400 | 2.47 | 297 | Mar. 27 | | |
| 2100 | 18.15 | 34,500 | Jan. 16 | | | 2400 | 8.78 | 8,600 |
| 2400 | 19.43 | 39,400 | 1600 | 2.47 | 297 | Mar. 28 | | |
| | | | 1730 | 2.05 | 178 | 0600 | 8.91 | 8,840 |
| Dec. 19 | | | 2400 | 2.52 | 314 | 1030 | 9.07 | 9,130 |
| 0300 | 19.05 | 37,800 | | | | 1700 | 9.12 | 9,210 |
| 0500 | 20.60 | 44,100 | Jan. 17 | | | 1900 | 9.90 | 10,700 |
| 0700 | 20.75 | 44,700 | 0300 | 2.55 | 325 | 2100 | 15.03 | 24,100 |
| 0900 | 22.2 | 51,000 | 0430 | 2.45 | 290 | 2400 | 20.53 | 48,600 |
| 2400 | ----- | 50,000 | 0600 | 2.50 | 308 | Mar. 29 | | |
| Dec. 20 | | | 1000 | ----- | 400 | 0400 | 20.43 | 48,200 |
| 0500 | ----- | 50,000 | 1200 | ----- | 10,000 | 0500 | 20.10 | 46,500 |

(97) 09502000 Salt River below Stewart Mountain Dam, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1977

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 20—Con. | | | Jan. 17—Con. | | | Mar. 29—Con. | | |
| 0600 | 21.1 | 47,000 | 1500 | ----- | 20,000 | 1100 | 19.80 | 45,000 |
| 1700 | 21.15 | 47,000 | 1700 | 16.0 | 28,000 | 1900 | 19.55 | 43,800 |
| 2400 | 20.94 | 47,000 | 1800 | 17.0 | 32,000 | 2000 | 17.80 | 35,200 |
| Dec. 21 | | | 2000 | 18.0 | 36,000 | 2300 | 17.80 | 35,200 |
| 0800 | 20.75 | 47,000 | 2100 | 19.5 | 43,500 | Mar. 30 | | |
| 1630 | 20.4 | 47,000 | 2400 | 20.0 | 46,000 | 0100 | 14.95 | 23,800 |
| 1700 | ----- | 30,000 | Jan. 18 | | | 0800 | 15.02 | 24,100 |
| 2400 | ----- | 30,000 | 0600 | 20.4 | 48,000 | 0900 | 17.80 | 35,200 |
| | | | 1200 | 20.8 | 50,000 | 2400 | 17.80 | 35,200 |
| Dec. 22 | | | 1800 | 21.3 | 53,000 | Mar. 31 | | |
| 1800 | ----- | 30,000 | 1900 | 23.3 | 65,000 | 0500 | 17.8 | 35,200 |
| 1800 | ----- | 28,000 | 2200 | ----- | 65,000 | 0545 | 15.0 | 24,000 |
| 2400 | ----- | 28,000 | 2400 | ----- | 63,000 | 0700 | 13.5 | 19,500 |
| 2400 | ----- | 27,000 | Jan. 19 | | | 1700 | 13.35 | 19,000 |
| Dec. 23 | | | 0200 | ----- | 62,000 | 1900 | 12.60 | 17,000 |
| 1200 | ----- | 27,000 | 0600 | ----- | 60,000 | 2400 | 12.40 | 16,500 |
| 1200 | ----- | 23,100 | 0900 | 21.8 | 56,000 | Apr. 1 | | |
| 1930 | ----- | 23,100 | 1300 | 21.5 | 54,200 | 0800 | 12.08 | 15,700 |
| 1930 | ----- | 5,000 | 1700 | 20.6 | 49,000 | 1500 | 11.22 | 13,600 |
| Dec. 24 | | | 2000 | 20.2 | 47,000 | 2400 | 10.30 | 11,500 |
| 2400 | ----- | 5,000 | 2400 | 19.6 | 44,000 | Apr. 2 | | |
| Dec. 25 | | | Jan. 20 | | | 0500 | 9.85 | 10,600 |
| 1400 | ----- | 5,000 | 0600 | 19.0 | 41,000 | 0600 | 8.90 | 8,820 |
| 1400 | ----- | 3,500 | 1100 | 18.6 | 39,000 | 0800 | 8.82 | 8,680 |
| 2400 | ----- | 3,500 | 1300 | 19.2 | 42,000 | Apr. 3 | | |
| Dec. 26 | | | 1600 | 18.7 | 39,500 | 1200 | 7.40 | 6,120 |
| 0600 | ----- | 3,500 | 2000 | 18.4 | 38,000 | 1300 | 9.90 | 10,700 |
| 0600 | ----- | 3,290 | 2400 | 18.0 | 36,000 | 1400 | 10.20 | 11,300 |
| 1600 | ----- | 3,260 | Jan. 21 | | | 2400 | 9.85 | 10,600 |
| 1600 | ----- | 2,780 | 0300 | 17.6 | 34,400 | Apr. 4 | | |
| 2400 | ----- | 2,780 | 0700 | 16.6 | 30,400 | 1100 | 9.50 | 9,900 |
| | | | 0800 | 17.0 | 32,000 | 1200 | 8.76 | 8,570 |
| Dec. 27 | | | 1200 | 16.6 | 30,400 | 1600 | 8.81 | 8,660 |
| 0900 | ----- | 2,780 | 1400 | 15.9 | 27,600 | 1800 | 7.38 | 6,090 |
| 0900 | ----- | 2,320 | 1600 | 13.9 | 20,700 | 2400 | 7.75 | 6,750 |
| 1630 | 4.66 | 2,320 | 2400 | 14.2 | 21,600 | Apr. 5 | | |
| 1730 | 5.35 | 3,220 | | | | 0500 | 8.06 | 7,310 |
| | | | Jan. 22 | | | 1700 | 7.08 | 5,620 |
| Dec. 28 | | | 0900 | 14.4 | 22,200 | 2000 | 4.70 | 2,440 |
| 2400 | 5.35 | 3,220 | 1000 | 6.2 | 4,300 | 2400 | 4.66 | 2,390 |

(98) 09502800 Williamson Valley Wash near Paulden, Ariz.

Location.--Lat 34°52'00", long 112°36'45", in SE¼SE¼ sec.7, T.17 N., R.3 W., Yavapai County, Hydrologic Unit 15060201, on left bank 3.6 mi (5.8 km) north of Simmons, and 8.5 mi (13.7 km) west of Paulden.

(98) 09502800 Williamson Valley Wash near Paulden, Ariz.—Continued

Drainage area.--255 mi² (660 km²).

Gage-height record.--Digital water-stage recorder tape. Datum of gage is 4,455 ft (1,357.9 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 2,200 ft³/s (62.3 m³/s) on basis of slope-area measurements at gage heights 7.38, 8.22, and 8.93 ft (2.249, 2.505, and 2.722 m).

Maxima.--November 1978 to March 1979: Discharge, 4,890 ft³/s (138 m³/s) 1600 hours Dec. 18, gage height, 7.28 ft (2.219 m).
1965 to October 1978: Discharge, 7,490 ft³/s (212 m³/s) Mar. 1, 1978, gage height, 8.22 ft (2.505 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19 | | |
| 2400 | 2.43 | 5.8 | 0900 | 5.32 | 1,430 | 0300 | 5.30 | 1,410 |
| | | | 1000 | 5.19 | 1,290 | 0600 | 4.82 | 947 |
| Dec. 18 | | | 1100 | 5.17 | 1,270 | 1200 | 4.23 | 510 |
| 0100 | 3.72 | 275 | 1300 | 5.67 | 1,860 | 1800 | 3.83 | 318 |
| 0200 | 3.96 | 373 | 1500 | 7.16 | 4,600 | 2400 | 3.68 | 261 |
| 0600 | 4.46 | 662 | 1600 | 7.28 | 4,890 | Dec. 20 | | |
| 0700 | 5.10 | 1,200 | 2000 | 7.00 | 4,230 | 1200 | 3.15 | 102 |
| 0800 | 5.33 | 1,440 | 2400 | 6.01 | 2,350 | 2400 | 3.00 | 72.8 |

(99) 09503700 Verde River near Paulden, Ariz.

Location.--Lat 34°53'40", long 112°20'32", in SW¼SW¼ sec.35, T.18 N., R.1 W., Yavapai County, Hydrologic Unit 15060201, in Prescott National Forest, on right bank 0.3 mi (0.5 km) upstream from Verde Valley Ranch, 7 mi (11 km) east of Paulden, 8 mi (13 km) upstream from Hell Canyon, 8 mi (13 km) downstream from Granite Creek, and 10 mi (16 km) downstream from Sullivan Lake.

Drainage area.--2,530 mi² (6,550 km²), approximately (includes 373 mi² or 966 km² in Aubrey Valley Playa, a closed basin).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 4,117 ft (1,255 m), from topographic map.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 5,700 ft³/s (161 m³/s) 0215 hours Dec. 19, gage height, 8.78 ft (2.676 m).
1963 to January 1978: Discharge, 8,080 ft³/s (229 m³/s) Mar. 1, 1978, gage height, 9.66 ft (2.944 m).

(99) 09503700 Verde River near Paulden, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19—Con. | | | Dec. 21 | | |
| 2400 | 2.37 | 29 | 1200 | 7.09 | 2,560 | 1200 | 4.39 | 403 |
| Dec. 18 | | | 1630 | 6.44 | 1,780 | 2400 | 4.02 | 283 |
| 1700 | 2.35 | 28 | 2200 | 7.20 | 2,710 | Dec. 22 | | |
| 1800 | 4.59 | 482 | 2400 | 7.36 | 2,950 | 1200 | 3.61 | 182 |
| 2100 | 6.21 | 1,550 | Dec. 20 | | | 2400 | 3.45 | 151 |
| 2400 | 8.20 | 4,420 | 0600 | 6.75 | 2,130 | | | |
| Dec. 19 | | | 1200 | 6.02 | 1,380 | Dec. 23 | | |
| 0215 | 8.78 | 5,700 | 1800 | 5.29 | 838 | 1200 | 3.24 | 117 |
| 0600 | 8.21 | 4,440 | 2400 | 4.92 | 633 | 2400 | 3.01 | 86 |

(100) 09503720 Hell Canyon near Williams, Ariz.
(Discontinued station)

Location.--Lat 35°09'40", long 112°12'33", in NW¼NW¼ sec.32, T.21 N., R.2 E., in Kaibab National Forest, on right bank, 6 mi (10 km) south of Williams.

Drainage area.--14.9 mi² (38.6 km²).

Gage-height record.--Crest stage only from high-water mark in well of former gaging station. Altitude of gage is 6,750 ft (2,057 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 110 ft³/s (3.12 m³/s) on basis of slope-area measurement at 4.78 ft (1.457 m)

Maxima.--November 1978 to March 1979: Discharge, 220 ft³/s (6.23 m³/s) probably Dec. 18, gage height, 2.68 ft (0.817 m).
1966 to October 1978: Discharge, 1,080 ft³/s (30.6 m³/s) Nov. 25, 1965, and Mar.5, 1978, gage height, 4.78 ft (1.457 m).

(101) 09503750 Limestone Canyon near Paulden, Ariz.
(Discontinued crest-stage station)

Location.--Lat 34°58'48", long 112°24'05", in S½ sec.31, T. 19 N., R.1 W., Yavapai County, Hydrologic Unit 15060202, 1.3 mi (2.1 km) upstream from mouth, 1.5 mi (2.4 km) west of Drake, and 7.5 mi (12.0 km) northeast of Paulden.

Drainage area.--14.5 mi² (37.6 km²).

Gage-height record.--Crest stage only. Altitude of gage is: 4,650 ft (1,420 m) from topographic map.

Discharge record.--Stage-discharge relation defined by computations of discharge through culvert.

Maxima.--November 1978 to March 1979: Discharge, 200 ft³/s (5.66 m³/s) Dec. 18, gage height, 3.62 ft (1.103 m).
1969 to October 1978: Discharge, 4,100 ft³/s (116 m³/s), Aug. 12, 1971, gage height, 1,651 ft (5.032 m).

(102) 09503800 Volunteer Wash near Bellemont, Ariz.
(Discontinued station)

Location.--Lat 35°09'00", long 111°53'50", in SE¼SE¼ sec.31, T.21 N., R.5 E., In Kaibab National Forest, on right bank, 7 mi (11 km) southwest of Bellemont, and 14 mi (22 km) west of Flagstaff.

Drainage area.--131 mi² (368 km²).

Gage-height record.--Crest stage only from high-water mark in well of former gaging station. Altitude of gage is: 6,820 ft (2,079 m) from topgraphic map.

Discharge record.--Stage-discharge relation extended above 400 ft³/s (2.27 m³/s) on basis of slope-area measurement of peak flow, at gage height 5.73 ft (1.75 m).

Maxima.--November 1978 to March 1979: Discharge, 100 ft³/s (2.32 m³/s) Dec. 18, gage height, 3.00 ft (0.914 m).
1965 to October 1978: Discharge, 2,300 ft³/s (65.1 m³/s), Mar. 1, 1978, gage height, 6.55 ft (1.996 m).

(103) 09504000 Verde River near Clarkdale, Ariz.

Location .--Lat 34°51'08", long 112°03'55", in NW¼SE¼ sec.17, T.17 N., R.3 E., Yavapai County, Hydrologic Unit 15060202, in Prescott National Forest, on left bank 1.7 mi (2.7 km) downstream from Sycamore Creek, and 5.6 mi (9.0 km) north of Clarkdale.

Drainage area.--3,520 mi² (9,120 km²), approximately (includes 373 mi² or 966 km² in Aubrey Valley Playa, a closed basin).

Gage-height record.--Digital water-stage recorder tape after 1500 hours, Dec. 18. Altitude of gage is 3,500 ft (1,070 m) from bench mark at gage.

Discharge record.--Stage-discharge relation defined by current-meter measurements. Discharge during period of missing gage-height record estimated on basis of records for nearby streams.

Maxima.--November 1978 to March 1979: Discharge, 19,900 ft³/s (564 m³/s) 1900 hours Dec. 18, gage height, 14.89 (4.538 m).
1915-21, 1965 to October 1978: Discharge, 50,600 ft³/s (1,430 m³/s) Feb. 21, 1920, gage height, 19.1 ft (5.82 m), site and datum then in use, from rating curve extended above 2,500 ft³/s (71 m³/s) on basis of float-area measurement at 35,000 ft³/s (990 m³/s). Peak probably is the maximum since at least 1905.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 19 | | | Dec. 20—Con. | | |
| 2400 | ---- | 1,000 | 0300 | 12.03 | 13,000 | 2300 | 4.72 | 1,820 |
| 0400 | ---- | 11,000 | 0600 | 11.88 | 12,600 | 2400 | 4.57 | 1,720 |
| 0800 | ---- | 8,000 | 1100 | 10.12 | 8,640 | | | |
| 1200 | ---- | 9,000 | 1700 | 7.98 | 5,220 | Dec.21 | | |
| Dec. 18 | | | 2300 | 7.03 | 4,050 | 1200 | 3.67 | 1,070 |
| 1500 | 11.91 | 12,700 | 2400 | 7.18 | 4,230 | 2400 | 2.84 | 618 |
| 1700 | 13.87 | 17,500 | Dec. 20 | | | | | |
| 1800 | 14.39 | 18,700 | 0100 | 7.07 | 4,100 | Dec.22 | | |
| 1900 | 14.89 | 19,900 | 0300 | 7.23 | 4,270 | 0200 | 2.78 | 590 |

(103) 09504000 Verde River near Clarkdale, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Dec. 20—Con. | | | Dec. 22—Con. | | |
| 2000 | 14.60 | 19,200 | 0600 | 7.12 | 4,150 | 0400 | 2.87 | 633 |
| 2200 | 13.65 | 17,000 | 1200 | 6.12 | 3,020 | 0900 | 2.86 | 628 |
| 2400 | 13.08 | 15,600 | 2100 | 4.76 | 1,850 | 2400 | 2.33 | 415 |

(104) 09504400 Munds Canyon tributary near Sedona, Ariz.
(Discontinued crest-stage station)

Location.--Lat 34°55'20", long 111°38'40", in SW¼ sec.22, T.18 S., R.7 E., Coconino County, Hydrologic Unit 15060202, at Interstate Highway 17, 7 mi (11 km) northeast of Sedona.

Drainage area.--1.19 mi² (2.85 km²).

Gage-height record.--Crest stage only. Datum of gage is 6,485.72 ft (1,976.847 m) from Arizona Highway Department bench mark.

Discharge record.--Stage-discharge relation defined by computations of discharges through culvert.

Maxima.--November 1978 to March 1979: Discharge, 275 ft³/s (7.79 m³/s) probably Dec. 18, gage height 7.17 ft (2.185 m).

1963 to October 1978: Discharge, 705 ft³/s (20.0 m³/s) Sept. 5, 1970, gage height, 11.10 ft (3.383 m), from high-water profile.

(105) 09504500 Oak Creek near Cornville, Ariz.

Location.--Lat 34°45'56", long 111°53'24", in NW¼SE¼ sec.23, T.16 N., R.4 E., Yavapai County, Hydrologic Unit 15060202, near left bank on downstream side of pier of county highway bridge, 0.2 mi (0.3 km) upstream from Page Springs, 4 mi (6 km) northeast of Cornville, and 15 mi (24 km) upstream from mouth.

Drainage area.--357 mi² (925 km²).

Gage-height record.--Water-stage recorder tape except 0800 hours to 2400 hours Dec. 19. Altitude of gage is 3,470 ft (1,058 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 11,000 ft³/s (312 m³/s) on basis of shape of previous rating. Discharges estimated for period of missing record.

Maxima.--November 1978 to March 1979: Discharge, 25,100 ft³/s (711 m³/s) 0115 hours Dec. 19, gage height, 16.00 ft (4.877 m) in gage well, and 17.8 ft (5.425 m) outside from floodmarks.

1940 to October 1978: Discharge, 24,700 ft³/s (700 m³/s) Sept. 5, 1970, gage height, 16.48 ft (5.023 m).

Outside period of record: Maximum stage since at least 1885, 23 ft (7.0 m) in March 1938, from floodmarks upstream from bridge.

(105) 09504500 Oak Creek near Cornville, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 18—Con. | | |
| 0100 | 2.49 | 51 | 0900 | 12.99 | 14,300 | 2300 | 14.44 | 19,000 |
| 0700 | 2.48 | 50 | 1000 | 13.00 | 14,300 | 2400 | 15.45 | 22,900 |
| 2000 | 2.57 | 60 | 1200 | 11.25 | 9,690 | | | |
| 2100 | 4.74 | 707 | 1300 | 11.44 | 10,100 | Dec. 19 | | |
| 2200 | 5.81 | 1,380 | 1400 | 11.00 | 9,090 | 0115 | 16.00 | 25,100 |
| 2300 | 6.92 | 2,380 | 1500 | 12.00 | 11,600 | 0200 | 15.82 | 24,400 |
| 2400 | 7.74 | 3,280 | 1600 | 13.82 | 16,900 | 0400 | 13.39 | 15,600 |
| Dec. 18 | | | 1700 | 14.61 | 19,700 | 0600 | 10.43 | 8,000 |
| 0100 | 8.32 | 4,060 | 1800 | 14.61 | 19,700 | 0700 | 9.16 | 5,680 |
| 0200 | 9.68 | 6,340 | 1900 | 14.15 | 18,000 | 1000 | ----- | 2,000 |
| 0400 | 10.50 | 7,980 | 2000 | 13.65 | 16,450 | 1400 | ----- | 1,000 |
| 0600 | 10.80 | 8,630 | 2100 | 14.07 | 17,800 | 2000 | ----- | 700 |
| 0700 | 11.18 | 9,520 | 2200 | 14.16 | 18,000 | 2400 | ----- | 500 |

(106) 09505200 Wet Beaver Creek near Rimrock, Ariz.

Location.--Lat 34°40'29", long 111°40'17", in NW¼SW¼ sec.24, T.15 N., R.6 E., Yavapai County, Hydrologic Unit 15060202, in Coconino National Forest, on right bank 4.5 mi (7.2 km) northeast of Rimrock, and 5.7 mi (9.2 km) upstream from Red Tank Draw.

Drainage area.--111 mi² (287 km²).

Gage-height record.--Digital water-stage recorder tape. Altitude of gage is 4,020 ft (1,225 m), from topographic map.

Discharge record.--Stage-discharge relation for concrete control defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 7,560 ft³/s (214 m³/s) 1745 Dec. 18, gage height, 12.38 ft (3.773 m).

1961 to October 1978: Discharge, 7,670 ft³/s (217 m³/s) Sept. 5, 1970, gage height, 12.41 ft (3.783 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18 | | | Dec. 18—Con. | | |
| 2400 | 3.50 | 21 | 0130 | 8.48 | 2,150 | 2300 | 11.39 | 5,590 |
| Dec. 17 | | | 0400 | 8.19 | 1,910 | 2400 | 11.52 | 5,830 |
| 0400 | 3.64 | 28 | 0500 | 8.65 | 2,300 | Dec. 19 | | |
| 0500 | 3.81 | 40 | 0700 | 11.32 | 5,460 | 0100 | 10.94 | 4,920 |
| 0700 | 3.80 | 39 | 0900 | 10.69 | 4,580 | 0400 | 10.43 | 4,240 |
| 1200 | 3.71 | 33 | 1100 | 10.37 | 4,160 | 0600 | 9.78 | 3,460 |
| 1700 | 3.73 | 34 | 1300 | 10.77 | 4,680 | 1200 | 7.04 | 1,080 |
| 1900 | 4.16 | 79 | 1500 | 11.82 | 6,400 | 1400 | 6.65 | 843 |
| 2100 | 5.05 | 235 | 1700 | 12.00 | 6,760 | 1600 | 6.62 | 838 |
| 2200 | 5.64 | 405 | 1745 | 12.38 | 7,560 | 1800 | 6.74 | 894 |
| 2300 | 6.87 | 970 | 2000 | 11.44 | 5,680 | 2300 | 5.81 | 465 |
| 2400 | 7.76 | 1,570 | 2130 | 11.60 | 5,980 | 2400 | 5.69 | 423 |

(107) 09505220 Rocky Gulch near Rimrock, Ariz.
(U.S. Forest Service Beaver Creek Watershed No. 13)

Location.--Lat 34°44'49", long 111°29'38", in SE¼NW¼ sec.27, T.16 N., R.8 E., Coconino County, Hydrologic Unit 150602, Forest Service 5th Code Watershed 189, Coconino National Forest, on headwaters of Rocky Gulch, and 7 mi (11 km) northeast of Rimrock.

Drainage area.--1.40 $mi^2$ (3.62 $km^2$).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 6,750 ft (2,060 m) from topographic map.

Discharge record.--Stage-discharge relation defined by laboratory rating for trapezoidal venturi flume. Record furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge, 166 $ft^3/s$ (4.70 $m^3/s$) 0415 hours Dec. 18, gage height 2.75 ft (0.838 m).
1959 to October 1978: Discharge, 1,550 $ft^3/s$ (43.9 $m^3/s$) Sept. 5, 1970, gage height 4.91 ft (1.500 m) from slope-area measurement of peak flow.

Remarks.--Additional data for other small research watersheds in the area are available from the experiment station.

(108) 09505255 Woods Canyon near Munds Park, Ariz.
(U.S. Forest Service Beaver Creek Watershed No. 19)

Location.--Lat 34°51'14", long 111°36'07", in SW¼NE¼ sec.13, T.17 N., R.7 E., Coconino County, Hydrologic Unit 150602, 1 mi (1.6 km), upstream from confluence with Bar M Canyon, and 6 mi (9.7 km) southeast of Munds Park.

Drainage area.--18.9 $mi^2$ (48.9 $km^2$).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 6,475 ft (1,974 m) from topographic map.

Discharge record.--Stage-discharge relation for concrete flume defined by current-meter measurement and slope-area measurement at 7.9 ft (2.408 m). Record furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge, 3,200 $ft^3/s$ (90.6 $m^3/s$) 2220 hours Dec. 18, gage height, 7.00 ft (2.134 m).
1961 to October 1978: Discharge, 3,990 $ft^3/s$ (113 $m^3/s$) Sept. 5, 1970, gage height 7.9 ft (2.408 m) from slope-area measurement.

Remarks.--Record published as "near Sedona" in WSP 2052.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec.16 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 0.83 | 7.60 | 0700 | 5.30 | 1,770 | 1000 | 2.65 | 224 |
| Dec. 17 | | | 0900 | 4.91 | 1,480 | 1600 | 2.48 | 182 |
| 1040 | 1.05 | 14.3 | 1100 | 5.37 | 1,820 | 1800 | 2.28 | 141 |

(108) 09505255 Woods Canyon near Munds Park, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 1155 | 1.35 | 28.2 | 1400 | 5.69 | 2,070 | 2400 | 2.05 | 102 |
| 1700 | 2.58 | 206 | 1500 | 5.52 | 1,940 | Dec. 20 | | |
| 2000 | 3.34 | 470 | 1530 | 5.51 | 1,930 | 0600 | 1.85 | 74.2 |
| 2200 | 3.85 | 752 | 2100 | 6.43 | 2,730 | 1200 | 1.82 | 71.6 |
| 2400 | 4.58 | 1,225 | 2220 | 7.00 | 3,200 | 1800 | 1.85 | 74.2 |
| Dec. 18 | | | 2300 | 6.76 | 3,000 | 2400 | 1.55 | 43.1 |
| 0100 | 4.67 | 1,290 | 2400 | 5.90 | 2,250 | Dec. 21 | | |
| 0200 | 4.65 | 1,280 | Dec. 19 | | | 1200 | 1.51 | 40.0 |
| 0300 | 4.96 | 1,520 | 0100 | 4.97 | 1,530 | 2400 | 1.38 | 30.2 |
| 0400 | 5.79 | 2,160 | 0300 | 3.85 | 752 | Dec. 22 | | |
| 0455 | 6.28 | 2,590 | 0500 | 3.23 | 421 | 1200 | 1.28 | 2.43 |
| 0600 | 5.85 | 2,210 | 0800 | 2.81 | 268 | 2400 | 1.20 | 20.4 |

(109) 09505260 Bar M Canyon near Munds Park, Ariz.
(U.S. Forest Service Beaver Creek Watershed No. 20)

Location.--Lat 34°51'42", long 111°36'18", in SE¼SW¼ sec.12, T.17 N., R.7 E., Coconino County, Hydrologic Unit 150602, 1 mi (1.6 km) upstream from confluence with Woods Canyon and 6 mi (9.7 km) southeast of Munds Park.

Drainage area.--25.6 $mi^2$ (66.2 $km^2$).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 6,380 ft (1,945 m) from topographic map.

Discharge record.--Stage-discharge relation for concrete flume defined by discharge measurements and slope-area measurements above 3.5 ft (1.07 m). Record furnished by U.S. Forest Service Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge, 4,210 $ft^3/s$ (119 $m^3/s$) 2225 hours Dec. 18, gage height, 8.77 ft (2.673 m) from slope-area measurement of peak flow.
1961 to October 1978: Discharge, 4,100 $ft^3/s$ (116 $m^3/s$) Sept. 5, 1970.

Remarks.--Record published as "near Sedona" in WSP 2052.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 0.61 | 3.98 | 0900 | 5.85 | 2,080 | 0330 | 5.33 | 1,780 |
| | | | 1200 | 7.05 | 2,860 | 0600 | 4.38 | 1,270 |
| Dec. 17 | | | 1330 | 7.98 | 3,520 | 0900 | 3.65 | 811 |
| 1045 | .89 | 11.1 | 1600 | 7.65 | 3,280 | 1200 | 3.19 | 508 |
| 1800 | 2.54 | 232 | 1800 | 8.31 | 3,780 | 2000 | 2.52 | 226 |
| 2400 | 4.09 | 1,130 | 1900 | 8.17 | 3,670 | 2400 | 2.30 | 171 |

(109) 09505260 Bar M Canyon near Munds Park, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 18—Con. | | | Dec. 20 | | |
| 0300 | 4.71 | 1,440 | 2225 | 8.86 | 4,210 | 0200 | 2.30 | 171 |
| 0400 | 5.93 | 2,130 | 2400 | 7.53 | 3,190 | 1140 | 2.02 | 115 |
| 0445 | 6.36 | 2,400 | Dec. 19 | | | 1645 | 2.31 | 173 |
| 0700 | 5.57 | 1,910 | 0200 | 6.10 | 2,230 | 2400 | 2.07 | 124 |

(110) 09505326 Beaver Creek Watershed No. 15 near Munds Park, Ariz.
(U.S. Forest Service station)

Location.--Lat 34°54'15", long 111°36'14", in NW¼NE¼ sec.36, T.18 N., R.7 E., Coconino County, Hydrologic Unit 150602, Forest Service 5th Code Watershed 188, Coconino National Forest, 0.3 mi (0.5 km) upstream from confluence with T-Six Canyon, and 3 mi (4.8 km) southeast of Munds Park.

Drainage area.--0.25 $mi^2$ (0.65 $km^2$).

Gage-height record.--Water-stage recorder tape. Altitude of gage is 6,720 ft (2,050 m) from topographic map.

Discharge record.--Stage-discharge relation defined by laboratory rating of trapezoidal venturi flume. Record furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge 62 $ft^3/s$ (1.76 $m^3/s$) 0355 hours Dec. 18, gage height, 1.85 ft (0.564 m).
1962 to October 1978: Discharge, 84 $ft^3/s$ (2.38 $m^3/s$) Sept. 5, 1970.

Remarks.--Additional data for other small research watersheds in the area are available from the experiment station.

(111) 09505300 Rattlesnake Canyon near Rimrock, Ariz.

Location.--Lat 34°46'01", long 111°40'23", in NW¼SW¼ sec.24, T.16 N., R.6 E., Yavapai County, Hydrologic Unit 15060202, in Coconino National Forest, on left bank 2.6 mi (4.2 km) upstream from mouth, 7 mi (11 km) northeast of Beaver Creek Ranger Station, and 9 mi (14 km) northeast of Rimrock.

Drainage area.--24.6 $mi^2$ (63.7 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Altitude of gage is 4,870 ft (1,484 m), from topographic map.

Discharge record.--Stage-discharge relation for concrete control extended above 1,100 $ft^3/s$ (31 $m^3/s$) on basis of computation of peak flow over weir at gage height 8.50 ft (2.591 m) and slope-area measurement at gage height 11.50 ft (3.505 m).

(111) 09505300 Rattlesnake Canyon near Rimrock, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 2,850 $ft^3/s$ (80.7 $m^3/s$) 2200 hours Dec. 18, gage height, 10.94 ft (3.335 m).
1957 to October 1978: Discharge, 3,590 $ft^3/s$ (102 $m^3/s$) Sept. 5, 1970, gage height, 11.50 ft (3.505 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 19 | | |
| 2400 | 2.98 | 20 | 0500 | 10.20 | 2,250 | 0100 | 9.22 | 1,710 |
| Dec. 17 | | | 0515 | 10.17 | 2,230 | 0200 | 8.01 | 1,100 |
| 1100 | 2.98 | 20 | 0730 | 8.00 | 1,070 | 0600 | 6.99 | 733 |
| 1245 | 3.51 | 53 | 0845 | 7.61 | 919 | 1100 | 5.06 | 247 |
| 1330 | 4.59 | 168 | 1100 | 8.05 | 1,090 | 1700 | 4.90 | 224 |
| 1600 | 4.67 | 180 | 1245 | 7.82 | 998 | 2000 | 4.29 | 134 |
| 2000 | 6.86 | 677 | 1400 | 8.75 | 1,420 | 2400 | 4.14 | 116 |
| 2130 | 7.16 | 766 | 1700 | 8.91 | 1,510 | | | |
| 2230 | 7.58 | 908 | 2000 | 9.84 | 2,030 | | | |
| 2400 | 8.78 | 1,440 | 2100 | 10.10 | 2,190 | Dec. 20 | | |
| Dec. 18 | | | 2200 | 10.94 | 2,850 | 0600 | 4.00 | 102 |
| 0200 | 7.71 | 956 | 2245 | 10.77 | 2,700 | 1200 | 3.64 | 68 |
| 0245 | 7.58 | 908 | 2315 | 10.86 | 2,780 | 1800 | 3.91 | 93 |
| 0345 | 8.34 | 1,220 | 2400 | 10.25 | 2,290 | 2400 | 3.53 | 59 |

(112) 09505350 Dry Beaver Creek near Rimrock, Ariz.

Location.--Lat 34°43'43", long 111°46'30", in NE¼NW¼ sec.1, T.15 N., R.5 E., Yavapai County, Hydrologic Unit 15060202, in Coconino National Forest, on left upstream abutment of abandoned highway bridge, 400 ft (122 m) upstream from State Highway 179, and 5.5 mi (8.8 km) north of Rimrock.

Drainage area.--142 $mi^2$ (368 $km^2$).

Gage-height record.--Digital water-stage recorder tape. Datum of gage is 3,694.38 ft (1,126.047 m) National Geodetic Vertical Datum of 1929 (Arizona Highway Department bench mark).

Discharge record.--Stage-discharge relation for concrete weir in bridge opening extended above 6,000 $ft^3/s$ (170 $m^3/s$) on basis of computations of peak flow over weir at gage heights 9.07 and 9.69 ft (2.765 and 2.954 m), slope-area measurement at gage height 14.35 ft (4.374 m), and contracted opening measurement at 12.53 ft (3.819 m).

Maxima.--November 1978 to March 1979: Discharge, 17,300 $ft^3/s$ (490 $m^3/s$) 2230 hours (revised) Dec. 18, gage height, 12.20 ft (3.67 m).
1960 to October 1978: Discharge, 26,600 $ft^3/s$ (753 $m^3/s$) Sept. 5, 1970, gage height, 14.35 ft (4.374 m).

(112) 09505350 Dry Beaver Creek near Rimrock, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con | | | Dec. 18—Con. | | |
| 2400 | 2.78 | 23 | 0715 | 9.12 | 8,090 | 2145 | 11.44 | 14,600 |
| Dec. 17 | | | 0830 | 8.07 | 5,830 | 2230 | 12.20 | 17,300 |
| 1500 | 2.94 | 44 | 1030 | 8.06 | 5,810 | 2300 | 11.95 | 16,400 |
| 1530 | 4.14 | 473 | 1230 | 8.74 | 7,230 | 2400 | 11.29 | 14,100 |
| 1900 | 5.68 | 1,880 | 1330 | 8.68 | 7,100 | | | |
| 2315 | 7.16 | 4,074 | 1445 | 9.33 | 8,600 | Dec. 19 | | |
| 2400 | 7.74 | 5,150 | 1700 | 9.20 | 8,290 | 0015 | 11.14 | 13,700 |
| | | | 1800 | 9.76 | 9,710 | 0030 | 11.1 | 13,600 |
| Dec. 18 | | | 1845 | 11.6 | 15,200 | 0115 | 10.0 | 10,400 |
| 0015 | 7.82 | 5,310 | 1915 | 11.54 | 15,000 | 0300 | 8.47 | 6,660 |
| 0100 | 8.04 | 5,760 | 1930 | 11.74 | 15,700 | 0445 | 7.49 | 4,670 |
| 0200 | 8.04 | 5,760 | 1945 | 11.76 | 15,700 | 0800 | 6.03 | 2,320 |
| 0230 | 7.86 | 5,390 | 2000 | 11.34 | 14,300 | 1000 | 5.29 | 1,440 |
| 0415 | 8.04 | 5,760 | 2045 | 11.2 | 13,900 | 1200 | 4.94 | 1,090 |
| 0600 | 10.12 | 10,700 | 2115 | 11.69 | 15,500 | 1800 | 4.54 | 747 |

(113) 09505550 Verde River below Camp Verde, Ariz.

Location.--Lat 34°33'02", long 111°51'02", in SW¼NW¼ sec.5, T.13 N., R.5 E., Yavapai County, Hydrologic Unit 15060203, on downstream side of bridge on county highway, 0.5 mi (0.8 km) southeast of Camp Verde, and 2.2 mi (3.5 km) downstream from Beaver Creek.

Drainage area.--4,670 mi² (12,100 km²), approximately (includes 373 mi² or 966 km² in Aubrey Valley Playa, a closed basin).

Gage-height record.--Digital water-stage recorder tape except 0030 to 0400, Dec. 19, when float was against floor of recorder shelter; record reconstructed on basis of high-water mark in shelter. Datum of gage is 3,045.10 ft (948.148 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 55,000 ft³/s (1,560 m³/s) about 0200 hours Dec. 19, gage height, 21.27 ft (6.483 m) from high-water mark in recorder shelter.

1970 to October 1978: Discharge, 43,000 ft³/s (1,220 m³/s) Sept. 5-6, 1970, gage height, 19.5 ft (5.94 m) from profile past gage site.

Outside period of record: A peak discharge of 97,000 ft³/s (2,750 m³/s) was recorded at former gaging station at site 8.5 mi (13.7 km) downstream (below West Cear Creek) on Mar. 3, 1938, and is the highest since at least 1924.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 4.48 | 247 | 1230 | 15.88 | 27,300 | 2400 | 11.29 | 9,710 |
| Dec. 17 | | | 1700 | 16.56 | 30,500 | Dec. 20 | | |
| 0600 | 4.44 | 236 | 2000 | 18.02 | 37,900 | 0600 | 10.34 | 7,270 |

(113) 09505550 Verde River below Camp Verde, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 18—Con. | | | Dec. 20—Con. | | |
| 1200 | 4.44 | 236 | 2200 | 18.67 | 41,200 | 1200 | 9.96 | 6,570 |
| 2100 | 4.51 | 258 | 2400 | 19.75 | 46,800 | 2400 | 8.56 | 4,240 |
| 2400 | 6.22 | 1,320 | Dec. 19 | | | Dec. 21 | | |
| Dec. 18 | | | 0200 | 21.27 | 55,000 | 1200 | 7.79 | 3,130 |
| 0100 | 8.01 | 3,440 | 0400 | 19.83 | 47,200 | 2400 | 6.91 | 2,020 |
| 0200 | 9.24 | 5,320 | 0700 | 18.60 | 40,800 | Dec. 22 | | |
| 0400 | 10.78 | 8,320 | 0900 | 17.05 | 32,900 | 1200 | 6.59 | 1,670 |
| 0600 | 12.15 | 12,300 | 1100 | 15.46 | 25,400 | 2400 | 6.21 | 1,310 |
| 0800 | 13.38 | 16,600 | 1200 | 14.77 | 22,300 | Dec. 23 | | |
| 1000 | 16.26 | 29,100 | 1800 | 12.62 | 13,900 | 1200 | 6.00 | 1,120 |
| 1045 | 16.40 | 29,700 | 2100 | 11.84 | 11,300 | 2400 | 5.67 | 864 |

(114) 09505800 West Clear Creek near Camp Verde, Ariz.

Location.--Lat 34°32'19", long 111°41'36", in NW¼NW¼ sec.11, T.13 N., R.6 E., Yavapai County, Hydrologic Unit 15060203, in Coconino National Forest, on left bank at Bull Pen Ranch, 9 mi (14 km) upstream from mouth, and 9 mi (14 km) east of Camp Verde.

Drainage area.--241 $mi^2$ (624 $km^2$).

Gage-height record.--Digital water-stage recorder tape to 1900 hours, Dec. 18. Altitude of gage is 3,630 ft (1,106 m) from topographic map.

Discharge record.--Stage-discharge relation extended above 2,700 $ft^3/s$ (60 $m^3/s$) on basis of slope-area measurements at gage heights 8.3 and 10.15 ft (2.53 and 3.094 m). Discharge for period of missing gage-height record estimated on basis of records for nearby stations.

Maxima.--November 1978 to March 1979: Discharge, 22,400 $ft^3/s$ (634 $m^3/s$) 1830 hours Dec. 18, gage height, 11.6 ft (3.54 m) from high-water mark in well.
1964 to October 1978: Discharge, 13,800 $ft^3/s$ (391 $m^3/s$) Mar. 1, 1978, gage height, 10.15 ft (3.094 m).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18 | | | Dec. 18—Con. | | |
| 2400 | 2.92 | 38.5 | 0100 | 6.23 | 2,000 | 1830 | 11.6 | 22,400 |
| Dec. 17 | | | 0300 | 6.10 | 1,850 | 2400 | ----- | 13,100 |
| 0300 | 2.97 | 43.4 | 0500 | 7.33 | 3,990 | Dec. 19 | | |
| 0700 | 2.93 | 39.7 | 0700 | 8.54 | 7,250 | 1200 | ----- | 5,900 |
| 1300 | 2.93 | 39.7 | 0900 | 8.25 | 6,340 | 2400 | ----- | 2,900 |
| 2000 | 3.51 | 122 | 1500 | 10.00 | 13,100 | Dec. 20 | | |
| 2100 | 3.64 | 149 | 1600 | 11.22 | 19,800 | 0700 | ----- | 2,100 |
| 2200 | 4.24 | 328 | 1700 | 11.52 | 21,900 | 1500 | ----- | 1,700 |
| 2400 | 6.04 | 1,770 | 1800 | 11.47 | 21,500 | 2400 | ----- | 2,100 |

(115) 09507980 East Verde River near Childs, Ariz.

Location.--Lat 34°17'00", long 111°38'50", in sec.21, T.11 N., R.7 E. (unsurveyed), Gila County, Hydrologic Unit 15060203, in Tonto National Forest, on left bank 1.3 mi (2.1 km) upstream from mouth, and 6 mi (10 km) southeast of Childs.

Drainage area.--328 mi² (850 km²).

Gage-height record.--Water-stage recorder graph. Altitude of gage is 2,500 ft (760 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 960 ft³/s (27 m³/s) on basis of slope-area measurements at gage heights 8.82 and 19.2 ft (2.688 and 5.85 m).

Maxima.--November 1978 to March 1979: Discharge, 11,600 ft³/s (329 m³/s) 1330 hours Jan. 17, gage height, 13.45 ft (4.100 m).
1961 to October 1978: Discharge, 23,500 ft³/s (666 m³/s) Sept. 5, 1970, gage height, 19.2 ft (5.85 m), from profile past gage.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 19 | | | Jan .17—Con. | | |
| 2400 | 2.84 | 37 | 0100 | 7.76 | 4,220 | 1130 | 13.36 | 11,400 |
| Dec. 17 | | | 0400 | 7.58 | 4,080 | 1200 | 12.19 | 9,740 |
| 1700 | 2.89 | 44 | 0700 | 8.19 | 4,740 | 1330 | 13.45 | 11,600 |
| 2100 | 3.00 | 62 | 0900 | 7.31 | 3,800 | 1500 | 11.25 | 8,420 |
| 2200 | 5.00 | 968 | 1200 | 6.50 | 3,000 | 1700 | 9.78 | 6,510 |
| 2300 | 5.29 | 1,180 | 1800 | 5.71 | 2,280 | 1800 | 8.99 | 5,530 |
| 2400 | 5.78 | 1,560 | 2400 | 4.98 | 1,680 | 2000 | 8.09 | 4,500 |
| | | | Dec. 20 | | | 2200 | 7.22 | 3,570 |
| Dec. 18 | | | 0600 | 4.25 | 1,140 | 2400 | 6.50 | 2,860 |
| 0200 | 6.22 | 1,930 | 1200 | 3.90 | 909 | Jan. 18 | | |
| 0300 | 7.93 | 3,540 | 1800 | 3.57 | 712 | 0800 | 5.73 | 2,160 |
| 0400 | 9.42 | 5,150 | 2400 | 3.40 | 639 | 0600 | 5.30 | 1,790 |
| 0600 | 10.30 | 6,220 | Jan. 15 | | | 1100 | 5.03 | 1,580 |
| 0800 | 12.53 | 9,480 | 2400 | 1.80 | 44 | 1500 | 5.30 | 1,790 |
| 0815 | 12.62 | 10,300 | Jan. 16 | | | 1800 | 5.60 | 2,040 |
| 0900 | 12.22 | 9,780 | 1200 | 1.86 | 52 | 2100 | 6.38 | 2,740 |
| 1000 | 11.43 | 8,700 | 1600 | 2.41 | 167 | 2400 | 5.68 | 2,110 |
| 1400 | 11.53 | 8,830 | 2100 | 3.69 | 764 | | | |
| 1600 | 12.37 | 9,990 | 2400 | 4.15 | 1,050 | Jan .19 | | |
| 1700 | 11.92 | 9,360 | Jan .17 | | | 0600 | 4.88 | 1,460 |
| 1900 | 11.22 | 8,420 | 0300 | 5.00 | 1,680 | 1200 | 4.37 | 1,080 |
| 2100 | 10.00 | 6,860 | 0600 | 7.51 | 3,980 | 1800 | 4.18 | 954 |
| 2400 | 8.05 | 4,580 | 0900 | 11.00 | 8,140 | 2400 | 4.03 | 853 |

(116) 09508000 Verde River below East Verde River near Pine, Ariz.

Location.--Lat 34°16', long 111°41', in sec.30, T.11 N., R.7 E. (unsurveyed), Yavapai County, Hydrologic Unit 15060203, on right bank 2.5 mi (4.0 km) downstream from East Verde River, and 15 mi (24 km) southwest of Pine.

(116) 09508000 Verde River below East Verde River near Pine, Ariz.—Continued

Drainage area.--5,623 mi² (14,560 km²), approximately (includes 373 mi² or 966 km² in Aubrey Valley Playa, a closed basin).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,401.6 ft (732.0 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 40,000 ft³/s (1,130 m³/s).

Maxima.--November 1978 to March 1979: Discharge, 79,400 ft³/s (2,250 m³/s) 0645 hours Dec. 19, gage height, 26.07 ft (7.946 m).

1924 to January 1978: Discharge, 110,000 ft³/s (3,115 m³/s) Mar. 3, 1938, gage height, 24.7 ft (7.52 m), from rating curve extended above 27,000 ft³/s (765 m³/s), on basis of slope-area measurement of peak flow, verified by comparison with records for other stations on Verde River.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 20 | | | Jan. 17—Con. | | |
| 2400 | 5.57 | 400 | 0600 | 12.10 | 12,800 | 1800 | 16.04 | 26,600 |
| Dec. 17 | | | 1200 | 11.18 | 10,400 | 2400 | 13.08 | 15,600 |
| 0700 | 5.57 | 400 | 1330 | 11.20 | 10,200 | Jan. 18 | | |
| 2000 | 5.66 | 490 | 1800 | 10.65 | 8,860 | 0530 | 11.50 | 11,200 |
| 2300 | 5.83 | 639 | 2400 | 10.27 | 7,970 | 0800 | 11.43 | 11,000 |
| 2400 | 7.80 | 3,140 | Dec. 21 | | | 1015 | 11.18 | 10,400 |
| Dec. 18 | | | 0500 | 9.38 | 6,050 | 1330 | 11.18 | 10,400 |
| 0130 | 9.04 | 5,360 | 1400 | 9.13 | 5,530 | 1530 | 11.48 | 11,100 |
| 0245 | 9.32 | 5,920 | 2400 | 8.58 | 4,480 | 1730 | 11.18 | 10,400 |
| 0400 | 11.20 | 10,400 | Dec. 22 | | | 2100 | 11.58 | 11,400 |
| 0500 | 12.00 | 12,600 | 1130 | 8.07 | 3,580 | 2400 | 11.26 | 10,600 |
| 0700 | 13.22 | 16,000 | 1500 | 8.03 | 3,510 | | | |
| 0900 | 17.00 | 31,000 | 2400 | 7.76 | 3,070 | Jan. 19 | | |
| 1000 | 16.90 | 30,600 | Jan. 15 | | | 0400 | 11.08 | 10,100 |
| 1130 | 18.40 | 37,500 | 2400 | 5.72 | 536 | 0900 | 11.70 | 11,700 |
| 1330 | 20.80 | 49,500 | Jan. 16 | | | 1600 | 9.65 | 6,540 |
| 1600 | 23.52 | 64,300 | 1500 | 5.74 | 545 | 2400 | 9.33 | 5,880 |
| 1900 | 24.18 | 68,100 | 1800 | 5.96 | 739 | Jan. 20 | | |
| 2400 | 24.20 | 68,200 | 2200 | 7.19 | 2,190 | 0600 | 9.13 | 5,480 |
| Dec. 19 | | | 2400 | 7.18 | 2,170 | 1200 | 8.84 | 4,910 |
| 0130 | 24.10 | 67,600 | Jan. 17 | | | 1800 | 8.64 | 4,540 |
| 0400 | 24.82 | 71,900 | 0045 | 7.35 | 2,420 | 2400 | 8.40 | 4,100 |
| 0645 | 26.07 | 79,400 | 0230 | 7.60 | 2,790 | Jan. 21 | | |
| 0800 | 25.07 | 73,400 | 0400 | 8.70 | 4,670 | 0600 | 8.22 | 3,790 |
| 0900 | 24.20 | 68,200 | 0530 | 11.00 | 9,650 | 1200 | 8.12 | 3,620 |
| 1000 | 23.17 | 62,400 | 0700 | 12.80 | 14,800 | 1600 | 8.09 | 3,560 |
| 1230 | 21.00 | 50,500 | 1000 | 15.50 | 24,300 | 2400 | 7.88 | 3,220 |
| 1430 | 19.13 | 41,200 | 1200 | 15.87 | 25,900 | | | |
| 1700 | 17.10 | 31,400 | 1300 | 16.96 | 30,700 | Jan. 22 | | |
| 2000 | 15.28 | 23,400 | 1330 | 17.30 | 32,400 | 1200 | 7.70 | 2,930 |
| 2400 | 13.66 | 17,400 | 1530 | 17.09 | 31,400 | 2400 | 7.63 | 2,820 |

(117) 09508300 Wet Bottom Creek near Childs, Ariz.

Location.--Lat 34°09'39", long 111°41'32", in sec.36, T.9½ N., R.6 E. (unsurveyed), Gila County, Hydrologic Unit 15060203, in Tonto National Forest, on right bank 1.4 mi (2.3 km) upstream from mouth, and 13 mi (21 km) south of Childs.

Drainage area.--36.4 mi² (94.3 km²).

Gage-height record.--Digital water-stage recorder tape except 1000 hours Dec. 18 to 1600 hours Dec. 20. Altitude of gage is 2,320 ft (707 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 3,000 ft³/s (85.0 m³/s) on basis of slope-area measurements at gage heights 9.77, 11.00, 14.18, and 15.66 ft (2.978, 3.353, 4.322, and 4.773 m). Discharge during period of missing gage height estimated on basis of records for nearby streams.

Maxima.--November 1978 to March 1979: Discharge, 6,680 ft³/s (189 m³/s) about 0315 hours Dec. 18, gage height, 15.72 ft (4.791 m) from high-water mark in well.

1967 to October 1978: Discharge, 6,660 ft³/s (189 m³/s) Mar. 2, 1978, from slope-area measurement of peak flow, gage height, 15.66 ft (4.773 m) from high-water mark in gage well.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 18—Con. | | |
| 2400 | 3.77 | 3.3 | 0200 | 7.53 | 1,330 | 1000 | 8.55 | 2,230 |
| Dec. 17 | | | 0300 | 14.44 | 6,160 | 1200 | ----- | 1,800 |
| 0800 | 3.77 | 3.3 | 0315 | 15.72 | 6,680 | 1800 | ----- | 1,100 |
| 1800 | 3.93 | 8.8 | 0400 | 13.83 | 5,830 | 2400 | ----- | 800 |
| 2200 | 4.43 | 36 | 0500 | 12.81 | 5,320 | Dec. 19 | | |
| 2300 | 6.27 | 566 | 0600 | 9.75 | 3,570 | 0600 | ----- | 550 |
| 2400 | 6.77 | 833 | 0700 | 8.67 | 2,350 | 1200 | ----- | 450 |
| Dec. 18 | | | 0800 | 8.25 | 1,950 | 1800 | ----- | 350 |
| 0100 | 6.89 | 898 | 0900 | 7.74 | 1,500 | 2400 | ----- | 250 |

(118) 09508500 Verde River below Tangle Creek, above Horseshoe Dam, Ariz.

Location.--Lat 34°04'23", long 111°42'56", in sec.35, T.9 N., R.6 E. (unsurveyed), Yavapai County, Hydrologic Unit 15060203, in Tonto National Forest, on right bank 1.3 mi (2.1 km) downstream from Tangle Creek, and 9 mi (14 km) upstream from Horseshoe Dam.

Drainage area.--5,872 mi² (15,208 km²), includes 373 mi² (966 km²) in Aubrey Valley Playa, a closed basin.

Gage-height record.--Water-stage recorder chart. Datum of gage is 2,029.0 ft (618.44 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 94,000 ft³/s (2,660 m³/s) 0730 hours Dec. 19, gage height, 21.36 ft (6.511 m).

1924 to October 1978: Discharge, 100,000 ft³/s (2,830 m³/s) Mar. 3, 1938, based on comparison with peak discharge at other stations on Verde River, gage height, 19.0 ft (5.79 m) from floodmarks.

1888 to October 1978: Discharge about 150,000 ft³/s (4,250 m³/s) Feb. 24, 1891, estimated from records for Salt River above and below Verde River.

(118) 09508500 Verde River below Tangle Creek, above Horseshoe Dam, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 3.74 | 426 | 1600 | 19.1 | 62,200 | 2000 | 15.4 | 28,200 |
| Dec. 17 | | | 1800 | 20.0 | 73,700 | 2400 | 14.2 | 20,900 |
| 1200 | 3.83 | 458 | 2100 | 20.5 | 80,800 | Dec. 20 | | |
| 2100 | 4.15 | 579 | 2400 | 20.45 | 80,000 | 0600 | 13.0 | 15,100 |
| 2200 | 4.39 | 675 | Dec. 19 | | | 1200 | 12.0 | 11,600 |
| 2300 | 5.15 | 1,030 | 0300 | 20.85 | 86,000 | 1800 | 11.35 | 9,730 |
| 2400 | 5.65 | 1,340 | 0400 | 20.6 | 82,200 | 2400 | 10.75 | 8,240 |
| Dec. 18 | | | 0600 | 21.0 | 88,300 | Dec. 21 | | |
| 0300 | 11.0 | 8,610 | 0730 | 21.36 | 94,000 | 1200 | 9.75 | 6,140 |
| 0500 | 13.15 | 15,800 | 0900 | 21.0 | 88,300 | 2400 | 8.75 | 4,520 |
| 0800 | 14.05 | 20,100 | 1200 | 19.8 | 71,000 | | | |
| 1000 | 15.5 | 28,800 | 1400 | 18.6 | 56,400 | Dec. 22 | | |
| 1200 | 16.48 | 36,100 | 1600 | 17.4 | 44,100 | 1200 | 7.75 | 3,290 |
| 1400 | 17.6 | 46,000 | 1800 | 16.2 | 33,900 | 2400 | 7.10 | 2,630 |

## (119) Deadman Creek near Horseshoe Dam, Ariz.
(Miscellaneous site)

Location.--Lat 34°01'33", long 111°39'04", Yavapai County, Hydrologic Unit 15060203, 3.9 mi (6.2 km) upstream from mouth, 4.4 mi (7.1 km) northeast of Horseshoe Dam.

Drainage area.--36.3 $mi^2$ (92.9 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 3,900 $ft^3/s$ (110 $m^3/s$) Dec. 18, from floodmark and rating defined by slope-area measurements of peak flows in March 1978 and February 1980.

February to October 1978: Discharge, 6,620 $ft^3/s$ (187 $m^3/s$) probably Mar. 2 (revised), from slope-area measurement of peak flow.

Remarks.--Tributary to Horseshoe Reservoir from the northeast.

## (120) Lime Creek near Horseshoe Dam, near Carefree, Ariz.
(Miscellaneous site)

Location.--Lat 33°59'11", long 111°45'03", in sec.4, T.7 N., R.6 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060203, 0.5 mi (0.8 km) upstream from mouth at maximum reservoir level, 2.5 mi (4.0 km) west of Horseshoe Dam.

Drainage area.--41.9 $mi^2$ (109 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 1,540 $ft^3/s$ (43.6 $m^3/s$) revised Dec. 18 from slope-area measurement of peak flow.

February to October 1978: Discharge, 5,180 $ft^3/s$ (147 $m^3/s$) probably Mar. 2 (revised), from slope-area measurement of peak flow.

Remarks.--Tributary to Horseshoe Reservoir from the northwest.

(121) Davenport Creek near Horseshoe Dam, Ariz.
(Miscellaneous site)

Location.--Lat 33°59'54", long 111°38'32", in sec.32, T.8 N., R.7 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060203, 4.2 mi (6.7 km) upstream from mouth, 4 mi (6.4 km) east of Horseshoe Dam, and 13.7 mi (22.0 km) northwest of Sunflower.

Drainage area.--25.5 $mi^2$ (66.0 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 3,600 $ft^3/s$ (102 $m^3/s$) Dec. 18 from floodmark and rating defined by slope-area measurements at 5,500 $ft^3/s$ (156 $m^3/s$) in March 1978 and 3,220 $ft^3/s$ (91.2 $m^3/s$) in February 1980.

February to October 1978: Discharge, 5,500 $ft^3/s$ (156 $m^3/s$) probably Mar. 2 (revised), from slope-area measurement of peak flow.

Remarks.--Tributary to Verde River from the northeast between Horseshoe and Bartlett Reservoirs.

(122) Sheep Creek near Horseshoe Dam, Ariz.
(Miscellaneous site)

Location.--Lat 33°55'24", long 111°38'12", in sec.28, T.7 N., R.7 E. (unsurveyed), in Maricopa County, Hydrologic Unit 15060203, 1 mi (1.6 km) upstream from mouth at maximum reservoir level, and 6 mi (9.6 km) southeast of Horseshoe Dam.

Drainage area.--34.2 $mi^2$ (88.6 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 2,500 $ft^3/s$ (70.8 $m^3/s$) revised Dec. 18 from slope-area measurement of peak flows.

February to October 1978: Discharge, 6,660 $ft^3/s$ (189 $m^3/s$) probably Mar. 2 (revised) from slope-area measurement of peak flow.

Remarks.--Tributary to Bartlett Reservoir from the northeast.

(123) 09509500 Reservoir System on Verde River at and below Horseshoe Dam, Ariz.

Location.--This system comprises two storage reservoirs created by Horseshoe and Bartlett Dams on Verde River. Gages on Horseshoe Reservoir, formed by Horseshoe Dam, lat 33°59'05", long 111°42'35", in sec.2, T.7 N., R.6 E. (unsurveyed); and Bartlett Reservoir, formed by Bartlett Dam, lat 33°49'05", long 111°37'52", in sec.34, T.6 N., R.7 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060203.

Drainage area.--6,185 $mi^2$ (16,019 $km^2$), at Bartlett Dam.

Gage-height record.--Water-stage recorder graphs. Datum of gage on Horseshoe Reservoir is 1,900.00 ft (579.120 m) and on Bartlett Reservoir, 1,599.46 ft (487.515 m) National Geodetic Vertical Datum of 1929.

Maxima.--November 1978 to March 1979: Contents, 302,100 acre-ft (373 $hm^3$) 1500 hours Mar. 26.

1939 to January 1978: Contents, 318,000 acre-ft (392 $hm^3$) May 9, 1973.

Cooperation.--Capacity tables furnished by Salt River Valley Water Users' Association.

(123) 09509500 Reservoir System on Verde River at and below Horseshoe Dam, Ariz.—Continued

Remarks.--Horseshoe Reservoir is formed by earthfill and rockfill dam; dam completed and storage began Nov. 15, 1945. Bartlett Reservoir is formed by concrete multiple-arch dam; dam completed May 1939 and storage began Feb. 5, 1939. Total capacity of the two reservoirs is 309,600 acre-ft (382 $hm^3$) divided as follows: Horseshoe Reservoir, 131,400 acre-ft (162 $hm^3$) at elevation 2,026.0 ft (617.52 m)—top of spillway gates and Bartlett Reservoir, 178,200 acre-ft (220 $hm^3$) at elevation 1,787.46 ft (544.818 m)—top of spillway gates. Capacities given here are from tables put in use October 1, 1978, and are approximately 8,100 acre-ft less than those from tables used previously. Since 1939, spill has occurred in the 1941, 1965, 1966, 1973, 1978, 1979, and 1980 water years.

(124) 09510000 Verde River below Bartlett Dam, Ariz.

Location.--Lat 33°48'30", long 111°39'09", in NW¼ sec.5, T.5 N., R.7 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060203, in Tonto National Forest, on right bank 2.1 mi (3.4 km) downstream from Bartlett Dam, 4.0 mi (6.4 km) upstream from Camp Creek, and 18 mi (29 km) east of town of Cave Creek.

Drainage area.--6,185 $mi^2$ (16,019 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 1,572.34 ft (479.249 m) National Geodetic Vertical Datum of 1929. This gage was used as a supplemental gage for records published in water resources data for Arizona.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 75,800 $ft^3/s$ (2,150 $m^3/s$) 1700 hours Dec. 18, gage height, 22.60 ft (6.888 m).

1939 to January 1978 (regulated): Discharge, 101,000 $ft^3/s$ (2,860 $m^3/s$) Mar. 2, 1978, gage height 25.9 ft (7.894 m).

1888 to 1939 (unregulated): Discharge not determined, probably over 150,000 $ft^3/s$ (4,250 $m^3/s$) Feb. 24, 1891. Floods of Nov. 27, 1905, and Mar. 4, 1938, reached maximum discharges of 96,000 $ft^3/s$ (2,720 $m^3/s$) and 95,000 $ft^3/s$ (2,690 $m^3/s$), respectively.

Remarks.--Flow regulated by Bartlett Reservoir since 1939 and by Horseshoe Reservoir since 1945 (see station 09509500).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 15 | | | Dec. 18—Con. | | | Jan. 17—Con. | | |
| 2400 | 3.30 | 427 | 2400 | 20.69 | 62,800 | 0400 | 7.07 | 2,910 |
| Dec. 16 | | | Dec. 19 | | | 1000 | 7.07 | 2,910 |
| 1000 | 3.30 | 427 | 0600 | 21.13 | 65,800 | 1030 | 10.00 | 13,300 |
| 1200 | 3.89 | 713 | 1200 | 21.56 | 68,700 | 1115 | 12.00 | 19,800 |
| 1330 | 2.85 | 205 | 1330 | 21.67 | 69,400 | 1200 | 12.24 | 20,700 |
| 1800 | 3.78 | 713 | 2000 | 15.14 | 26,900 | 1445 | 12.25 | 20,700 |
| 2400 | 3.87 | 788 | 2100 | 14.78 | 26,100 | 1515 | 13.53 | 25,700 |
| Dec. 17 | | | 2400 | 14.86 | 26,400 | 2400 | 13.61 | 26,000 |
| 1500 | 3.87 | 788 | Dec. 20 | | | Jan. 18 | | |
| 1700 | 3.35 | 446 | 1100 | 14.86 | 26,400 | 0830 | 13.70 | 26,400 |
| 1900 | 3.17 | 328 | 1200 | 14.11 | 22,900 | 0900 | 12.37 | 21,000 |

(124) 09510000 Verde River below Bartlett Dam, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 20—Con. | | | Jan. 18—Con. | | |
| 2400 | 3.16 | 321 | 1300 | 7.45 | 3,740 | 1000 | 12.27 | 20,600 |
| | | | 2400 | 7.16 | 3,160 | 1500 | 12.35 | 20,900 |
| Dec. 18 | | | Jan. 15 | | | 2400 | 12.15 | 20,100 |
| 0100 | 3.32 | 427 | 2400 | 4.45 | 24 | Jan. 19 | | |
| 0700 | 3.20 | 350 | Jan. 16 | | | 0100 | 10.70 | 15,000 |
| 0800 | 5.30 | 2,530 | 0800 | 4.45 | 24 | 2400 | 10.60 | 14,700 |
| 1000 | 5.48 | 2,820 | 1000 | 5.30 | 484 | Jan. 20 | | |
| 1100 | 12.17 | 15,500 | 1600 | 5.32 | 499 | 1200 | 10.50 | 14,400 |
| 1200 | 15.85 | 31,700 | 1800 | 5.22 | 400 | 2400 | 10.40 | 14,100 |
| 1430 | 20.33 | 60,300 | 2400 | 5.22 | 400 | Jan. 21 | | |
| 1600 | 19.81 | 56,760 | | | | 0100 | 5.90 | 3,720 |
| 1700 | 22.60 | 75,800 | Jan. 17 | | | 0700 | 5.74 | 3,440 |
| 2000 | 22.33 | 74,000 | 0300 | 5.23 | 418 | 2400 | 5.74 | 4,440 |

(125) 09510080 West Fork Sycamore Creek near Sunflower, Ariz.
(Discontinued station)

Location.--Lat 33°56'45", long 111°29'05", in SE¼ sec.13, T.7 N., R.8 E., Maricopa County, Hydrologic Unit 15060203, in Tonto National Forest, on right bank 1.2 mi (1.9 km) upstream from confluence with East Fork, and 5.7 mi (9.2 km) north of Sunflower.

Drainage area.--9.8 $mi^2$ (25.4 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 4,000 ft (1,200 m), from topographic map.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 420 $ft^3/s$ (11.9 $m^3/s$) and extended above on basis of slope-area measurements of peak flows at 6.7 and 9.50 ft (2.04 and 2.896 m).

Maxima.--November 1978 to March 1979: Discharge, 463 $ft^3/s$ (13.1 $m^3/s$) probably Jan. 17, gage height, 5.60 ft (1.707 m) from high-water mark in well.
1959 to October 1978: Discharge, 3,480 $ft^3/s$ (98.6 $m^3/s$) Sept. 5, 1970, gage height, 9.50 ft (2.896 m).

(126) 09510100 East Fork Sycamore Creek near Sunflower, Ariz.

Location.--Lat 33°56'58", long 111°27'39", in NE¼SE¼ sec.18, T.7 N., R.9 E., Maricopa County, Hydrologic Unit 15060203, in Tonto National Forest, on left bank 1.7 mi (2.7 km) upstream from confluence with West Fork, and 6.0 mi (9.7 km) north of Sunflower.

Drainage area.--4.49 $mi^2$ (11.6 $km^2$).

Gage-height record.--Crest stage only during flood period. Altitude of gage is 4,140 ft (1,262 m), from topographic map.

(126) 09510100 East Fork Sycamore Creek near Sunflower, Ariz.—Continued

Discharge record.--Stage-discharge relation extended above 130 $ft^3/s$ (3.7 $m^3/s$) on basis of slope-area measurement at gage height 9.50 ft (2.896 m).

Maxima.--November 1978 to March 1979: Discharge, 298 $ft^3/s$ (8.44 $m^3/s$) Dec. 18, gage height, 4.80 ft (1.463 m) from high-water mark in well.
1959 to October 1978: Discharge, 1,940 $ft^3/s$ (54.9 $m^3/s$) Sept. 5, 1970, gage height, 9.50 ft (2.896 m) from profile past gage.

(127) 09510170 Camp Creek near Sunflower, Ariz.
(Crest-stage station)

Location.--Lat 33°45'35", long 111°29'44", in SW¼ sec.24, T.5 N., R.8 E., Maricopa County, Hydrologic Unit 15060203, on right bank at upstream side of culvert on State Highway 87, 0.5 mi (0.8 km) upstream from mouth, and 7 mi (11 km) south of Sunflower.

Drainage area.--2.6 $mi^2$ (6.7 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,186.61 ft (666.479 m) Arizona State Highway datum.

Discharge record.--Stage-discharge relation extended above 27 $ft^3/s$ (0.76 $m^3/s$) on basis of computations of flow through culvert.

Maxima.--November 1978 to March 1979: Discharge, 134 $ft^3/s$ (3.79 $m^3/s$) 1600 hours Dec. 18, gage height, 2.52 ft (0.768 m).
1963 to October 1978: Discharge, 402 $ft^3/s$ (11.4 $m^3/s$) Mar. 2, 1978, gage height, 5.05 ft (1.554 m).

Remarks.--Tributary to Sycamore Creek from the east.

Mean discharge, in cubic feet per second, 1978

| Day | Discharge | Day | Discharge | Day | Discharge |
|---|---|---|---|---|---|
| Dec. 17 . . . . | 16 | Dec. 20 . . . . | 10 | Jan. 19 . . . . | 24 |
| 18 . . . . | 98 | Jan. 17 . . . . | 39 | 20 . . . . | 9.5 |
| 19 . . . . | 51 | 18 . . . . | 44 | | |

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 19—Con. | | | Jan. 18—Con. | | |
| 2400 | 0.09 | 0 | 1400 | 1.51 | 53 | 0300 | 1.60 | 60 |
| Dec. 17 | | | 1800 | 1.27 | 34 | 0430 | 1.73 | 70 |
| 1600 | .36 | 0 | 1900 | 1.48 | 50 | 0530 | 1.61 | 61 |
| 2200 | 2.15 | 104 | 2400 | 1.17 | 26 | 0700 | 1.36 | 41 |
| 2400 | 1.72 | 70 | Jan. 16 | | | 1100 | 1.21 | 29 |
| Dec. 18 | | | 2400 | .60 | .3 | 1700 | 1.18 | 26 |
| 0300 | 1.54 | 55 | Jan. 17 | | | 1900 | 1.20 | 28 |
| 0400 | 2.16 | 105 | 0200 | .82 | 4.8 | 2000 | 1.61 | 61 |
| 0500 | 2.45 | 128 | 0400 | 1.10 | 20 | 2100 | 2.09 | 99 |

(127) 09510170 Camp Creek near Sunflower, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18—Con. | | | Jan. 17—Con. | | | Jan. 18—Con. | | |
| 0600 | 2.51 | 133 | 0600 | 1.40 | 44 | 2200 | 1.76 | 73 |
| 1300 | 1.97 | 90 | 0700 | 1.94 | 87 | 2400 | 1.50 | 52 |
| 1600 | 2.52 | 134 | 0830 | 2.18 | 106 | | | |
| 2400 | 1.38 | 42 | 1000 | 1.85 | 80 | Jan. 19 | | |
| Dec. 19 | | | 1200 | 1.55 | 56 | 0200 | 1.30 | 36 |
| 0300 | 2.05 | 96 | 1500 | 1.32 | 38 | 0600 | 1.19 | 27 |
| 0500 | 1.63 | 62 | 1800 | 1.15 | 24 | 0930 | 1.17 | 26 |
| 1000 | 1.36 | 41 | 2400 | 1.09 | 19 | 1200 | 1.13 | 22 |
| 1100 | 1.52 | 54 | Jan. 18 | | | 1800 | 1.06 | 17 |
| 1300 | 1.46 | 49 | 0100 | 1.27 | 34 | 2400 | 1.03 | 15 |

(128) 09510200 Sycamore Creek near Fort McDowell, Ariz.

Location.--Lat 33°41'39", long 111°32'28", in sec.16, T.4 N., R.8 E. (unsurveyed), Maricopa County, Hydrologic Unit 15060203, in Tonto National Forest, on right bank 0.7 mi (1.1 km) southwest of Sugarloaf Mountain, 9 mi (14 km) northeast of Fort McDowell, 10 mi (16 km) upstream from mouth, and 25 mi (40 km) northeast of Scottsdale.

Drainage area.--164 $mi^2$ (425 $km^2$).

Gage-height record.--Water-stage recorder tape from recorder driven by manometer. Datum of gage is 1,759.33 ft (536.244 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 3,600 $ft^3/s$ (102 $m^3/s$) on basis of slope-area measurements at gage heights 15.0, 16.0, and 19.7 ft (4.57, 4.88, and 6.00 m).

Maxima.--November 1978 to March 1979: Discharge, 9,520 $ft^3/s$ (270 $m^3/s$) 0500 hours, Dec. 18, gage height, 10.84 ft (3.304 m).
1959 to October 1978: Discharge, 24,200 $ft^3/s$ (685 $m^3/s$) Sept. 5, 1970, gage height, 19.7 ft (6.00 m), from profile past gage.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 19 | | | Jan. 17—Con. | | |
| 2400 | 1.00 | 7.0 | 0300 | 7.37 | 4,900 | 1800 | 5.03 | 2,420 |
| Dec. 17 | | | 0600 | 5.82 | 3,180 | 1900 | 5.11 | 2,490 |
| 0700 | 1.00 | 7.0 | 0700 | 5.82 | 3,180 | 2200 | 4.71 | 2,130 |
| 1200 | 1.04 | 11 | 0800 | 6.15 | 3,520 | 2400 | 4.44 | 1,890 |
| 1400 | 1.05 | 12 | 1200 | 5.32 | 2,680 | Jan. 18 | | |
| 1600 | 1.13 | 22 | 1300 | 4.83 | 2,240 | 0200 | 4.17 | 1,670 |
| 1700 | 1.23 | 37 | 1500 | 4.94 | 2,340 | 0500 | 5.22 | 2,590 |
| 1900 | 1.27 | 43 | 1800 | 4.37 | 1,830 | 0700 | 5.35 | 2,710 |
| 2000 | 1.81 | 205 | 2100 | 4.23 | 1,710 | 1200 | 4.66 | 2,080 |

(128) 09510200 Sycamore Creek near Fort McDowell, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17—Con. | | | Dec. 19—Con. | | | Jan. 18—Con. | | |
| 2100 | 3.31 | 1,000 | 2400 | 3.69 | 1,280 | 1500 | 4.97 | 2,360 |
| 2200 | 6.20 | 3,580 | | | | 1900 | 4.39 | 1,840 |
| 2300 | 6.28 | 3,670 | Dec. 20 | | | 2100 | 4.53 | 1,970 |
| 2400 | 6.23 | 3,610 | 0600 | 3.12 | 891 | 2230 | 6.05 | 3,420 |
| Dec. 18 | | | 1200 | 2.82 | 704 | 2400 | 5.45 | 2,810 |
| 0100 | 6.57 | 3,990 | 1800 | 2.58 | 565 | Jan. 19 | | |
| 0200 | 7.05 | 4,520 | 2400 | 2.44 | 490 | 0300 | 4.46 | 1,900 |
| 0300 | 8.52 | 6,310 | Dec. 21 | | | 0400 | 4.46 | 1,900 |
| 0400 | 8.33 | 6,060 | 1800 | 2.08 | 320 | 0800 | 3.88 | 1,430 |
| 0500 | 10.84 | 9,520 | 2400 | 2.04 | 304 | 0900 | 3.97 | 1,510 |
| 0600 | 9.81 | 8,020 | Jan. 16 | | | 1500 | 3.54 | 1,160 |
| 0900 | 7.51 | 5,070 | 2400 | 1.77 | 194 | 1600 | 3.59 | 1,200 |
| 1000 | 7.51 | 5,070 | Jan. 17 | | | 2400 | 3.25 | 962 |
| 1100 | 7.59 | 5,170 | 0200 | 2.01 | 284 | Jan. 20 | | |
| 1200 | 7.22 | 4,720 | 0500 | 1.97 | 268 | 0600 | 2.42 | 470 |
| 1300 | 7.70 | 5,300 | 0600 | 4.49 | 1,930 | 1400 | 2.31 | 415 |
| 1600 | 10.14 | 8,490 | 0700 | 5.05 | 2,440 | 1800 | 2.34 | 430 |
| 1700 | 9.22 | 7,220 | 0800 | 5.85 | 3,210 | 2400 | 2.12 | 329 |
| 2100 | 7.08 | 4,560 | 0900 | 7.40 | 4,940 | Jan. 21 | | |
| 2400 | 6.19 | 3,570 | 0945 | 8.68 | 6,510 | 0600 | 2.07 | 308 |
| | | | 1100 | 8.49 | 6,270 | 1200 | 2.05 | 300 |
| Dec. 19 | | | 1200 | 7.59 | 5,170 | 1500 | 2.09 | 316 |
| 0100 | 5.86 | 3,220 | 1400 | 6.63 | 4,050 | 1800 | 1.99 | 276 |
| 0200 | 6.00 | 3,360 | 1600 | 5.69 | 3,050 | 2400 | 1.89 | 236 |

(129) 09511300 Verde River near Scottsdale, Ariz.

Location.--Lat 33°34'52", long 111°40'12", in NE¼ sec.30, T.3 N., R.7 E., Maricopa County, Hydrologic Unit 15060203, on pier near left bank on downstream side of bridge on State Highway 87, in Fort McDowell Indian Reservation, 2.5 mi (4.0 km) upstream from mouth, 3.8 mi (6.1 km) downstream from Fort McDowell, and 16 mi (26 km) northeast of Scottsdale.

Drainage area.--6,600 mi² (17,090 km²), approximately.

Gage-height record.--Remote readings from water-stage recorder from Dec. 16 to 1600 hours Dec. 18 when gage was destroyed. Water-stage recorder graph Jan. 16-21 and Mar. 26-Apr. 1. Datum of gage is 1,351.35 ft (411.891 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 32,000 ft³/s (906 m³/s).

Maxima.--November 1978 to March 1979: Discharge, 64,000 ft³/s (1,812 m³/s) Dec. 18 estimated on basis of flood routing, gage height not determined.

1939 to October 1978: Discharge, 96,000 ft³/s (2,719 m³/s) Mar. 2, 1978, on basis of flood routing, gage height, 18.3 ft (5.58 m), from profile past gage.

Remarks.--Flow regulated by Bartlett Reservoir since 1939 and by Horseshoe Reservoir since 1945 (see sta 09509500).

(129) 09511300 Verde River near Scottsdale, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1979

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Jan. 16 | | | Jan. 19 | | | Mar. 28 | | |
| 2100 | 6.15 | 134 | 0200 | 11.46 | 25,400 | 2000 | 8.45 | 9,400 |
| 2400 | 6.55 | 538 | 0400 | 11.21 | 23,600 | 2200 | 9.16 | 12,200 |
| | | | 0600 | 11.58 | 26,200 | 2400 | 9.11 | 12,040 |
| Jan. 17 | | | 0800 | 10.18 | 16,800 | Mar. 29 | | |
| 0900 | 6.71 | 790 | 1600 | 10.20 | 16,900 | 0200 | 9.49 | 13,600 |
| 1200 | 8.60 | 6,310 | 2400 | 10.17 | 16,700 | 0600 | 8.96 | 11,500 |
| 1400 | 9.32 | 10,600 | Jan. 20 | | | 0800 | 8.85 | 11,100 |
| 1500 | 9.48 | 11,900 | 1200 | 9.97 | 16,100 | 2400 | 8.81 | 10,900 |
| 1600 | 10.38 | 18,600 | 2400 | 10.01 | 16,400 | Mar. 30 | | |
| 1900 | 10.95 | 21,000 | Jan. 21 | | | 1200 | 8.74 | 10,600 |
| 2000 | 11.47 | 24,500 | 0300 | 9.87 | 15,600 | 1400 | 9.45 | 13,400 |
| 2200 | 11.65 | 25,000 | 0600 | 7.69 | 5,820 | 1600 | 9.74 | 14,900 |
| 2400 | 11.74 | 25,400 | 1000 | 7.20 | 4,980 | 1800 | 9.63 | 14,300 |
| | | | 2400 | 7.21 | 5,000 | 2400 | 9.64 | 14,300 |
| Jan. 18 | | | Mar. 26 | | | Mar. 31 | | |
| 0300 | 11.87 | 27,000 | 2200 | 6.60 | 4,140 | 2000 | 9.67 | 14,500 |
| 0600 | 11.87 | 27,000 | 2400 | 7.31 | 5,730 | 2200 | 8.77 | 10,700 |
| 0900 | 12.02 | 27,600 | | | | 2400 | 8.50 | 9,570 |
| 1100 | 12.05 | 27,800 | Mar. 27 | | | Apr. 1 | | |
| 1200 | 11.99 | 27,500 | 1400 | 7.52 | 6,330 | 1000 | 8.53 | 9,670 |
| 1500 | 11.40 | 24,300 | 1600 | 8.31 | 8,840 | 1300 | 7.69 | 6,790 |
| 2400 | 11.23 | 23,000 | 2400 | 8.36 | 9,040 | 2400 | 6.38 | 3,610 |

(130) 09512100 Indian Bend Wash at Scottsdale, Ariz.

Location.--Lat 33°32'19", long 111°54'57", in SW¼SE¼ sec.2, T.2 N., R.4 E., Maricopa County, Hydrologic Unit 15060106, at Indian Bend Road in Scottsdale.

Drainage area.--62 $mi^2$ (161 $km^2$) excluding area upstream from Central Arizona Canal.

Gage-height record.--Water-stage recorder. Datum of gage is 1,280.29 ft (390.232 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 7,000 $ft^3/s$ (200 $m^3/s$) on basis of partial measurement at gage height 4.2 ft (1.28 m) and slope-conveyance computation at gage height 4.90 ft (1.494 m).

Maxima.--November 1978 to March 1979: Discharge, 252 $ft^3/s$ (7.14 $m^3/s$) 1200 hours Jan. 17, gage height, 1.62 ft (0.494 m).

1922 to October 1978: Discharge, 21,000 $ft^3/s$ (595 $m^3/s$) June 22, 1972, gage height 4.90 ft (1.494 m).

(131) 09512170 Salt River at Jointhead Dam at Phoenix, Ariz.

Location.--Lat 33°26'25", long 111°58'22", in SW¼ sec.8, T.1 N., R.4 E., Maricopa County, Hydrologic Unit 15060106, 1,500 ft (460 m) upstream from 48th Street in Phoenix, 1.7 mi (2.7 km) downstream from Tempe bridge, and 5.8 mi (9.3 km) east of Phoenix Post Office.

(131) 09512170 Salt River at Jointhead Dam at Phoenix, Ariz.—Continued

Drainage area.--13,225 mi² (35,000 km²).

Gage-height record.--Frequent staff gage readings from 2400 hours Dec. 18 to 1000 hours Dec. 21, and water-stage recorder graph 1000 hours Dec. 19 to 1400 hours Dec. 22, and after 1800 hours Jan. 17. Record furnished by the Salt River Valley Water Users' Association. Altitude of gage is 1,130 ft (350 m) from topographic map.

Discharge record.--Stage-discharge relation prior to 1000 hours Dec. 19 is uncertain; thereafter, the stage-discharge relation is defined by current-meter measurements. Discharge during periods of no gage-height record and periods of shifting control were estimated on the basis of releases from Stewart Mountain and Bartlett Dams.

Maxima.--November 1978 to March 1979: Discharge, 126,000 ft³/s (3,570 m³/s) 2300 hours Dec. 19, gage height, 10.05 ft (3.064 m).

1939 to October 1978: Discharge, 122,000 ft³/s (3,455 m³/s) Mar. 2, 1978, gage height, 12.50 ft (3.81 m).

1870 to October 1939: Discharge, about 300,000 ft³/s (8,500 m³/s) Feb. 24, 1891, estimated on basis of records for former station at Arizona Dam.

Remarks.--Flow regulated by reservoirs on the Salt River since 1910 (see sta 09502000) and by reservoirs on the Verde River since 1939 (see sta 09509500).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Jan. 17 | | | Mar. 27 | | |
| 2400 | ----- | 0 | 1200 | ----- | 0 | 0800 | 3.65 | 11,500 |
| Dec. 18 | | | 1800 | 4.5 | 15,000 | 1800 | 3.74 | 12,400 |
| 1000 | ----- | 0 | 2000 | 5.48 | 27,800 | 2200 | 4.05 | 15,600 |
| 1800 | ----- | 5,000 | 2200 | 6.17 | 38,700 | 2400 | 4.07 | 15,800 |
| 2000 | ----- | 30,000 | 2400 | 7.20 | 57,500 | Mar. 28 | | |
| 2400 | 8.4 | 48,000 | | | | 0400 | 4.10 | 16,200 |
| Dec. 19 | | | Jan. 18 | | | 1000 | 4.17 | 16,900 |
| 0200 | 9.9 | 77,100 | 0500 | 7.70 | 67,100 | 1200 | 4.22 | 17,600 |
| 0330 | 10.2 | 83,100 | 0900 | 7.95 | 72,100 | 2000 | 4.28 | 18,300 |
| 0450 | 10.4 | 101,000 | 1400 | 8.13 | 75,700 | 2400 | 4.60 | 22,500 |
| 0550 | 10.2 | 97,100 | 1800 | 7.98 | 72,700 | Mar. 29 | | |
| 0630 | 10.0 | 93,100 | 2200 | 8.15 | 76,100 | 0200 | 5.75 | 40,100 |
| 0700 | 9.9 | 93,100 | 2400 | 8.40 | 81,100 | 0400 | 6.90 | 61,500 |
| 0800 | 10.0 | 103,000 | | | | 0800 | 7.18 | 67,400 |
| 0930 | 9.8 | 107,000 | Jan. 19 | | | 1800 | 6.92 | 61,900 |
| 1100 | 9.8 | 113,000 | 0200 | 8.60 | 85,100 | 2000 | 6.94 | 62,400 |
| 1200 | 9.85 | 121,000 | 0800 | 8.07 | 74,500 | 2200 | 6.90 | 61,500 |
| 1315 | 9.9 | 122,000 | 2000 | 7.64 | 65,900 | 2400 | 6.70 | 57,500 |
| 1800 | 10.0 | 125,000 | 2400 | 7.45 | 62,300 | Mar. 30 | | |
| 2030 | 10.0 | 125,000 | Jan. 20 | | | 0600 | 5.65 | 38,400 |
| 2300 | 10.05 | 126,000 | 0200 | 7.28 | 61,100 | 1000 | 5.48 | 35,600 |
| 2400 | 10.0 | 125,000 | 1600 | 6.96 | 56,700 | 1400 | 5.53 | 36,400 |
| | | | 1800 | 7.03 | 60,100 | 1800 | 6.35 | 50,800 |
| Dec. 20 | | | 2400 | 6.90 | 59,500 | 2000 | 6.50 | 53,600 |
| 0200 | 10.0 | 125,000 | | | | 2200 | 6.55 | 54,600 |
| 0300 | 9.5 | 113,000 | Jan. 21 | | | 2400 | 6.55 | 54,600 |
| 0400 | 8.5 | 93,100 | 0500 | 6.79 | 59,300 | Mar. 31 | | |
| 0600 | 8.3 | 89,100 | 1200 | 6.00 | 44,400 | 1000 | 6.55 | 54,600 |

(131) 09512170 Salt River at Jointhead Dam at Phoenix, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 20—Con. | | | Jan. 21—Con. | | | Mar. 31—Con. | | |
| 0800 | 8.15 | 86,100 | 1800 | 5.65 | 38,400 | 1200 | 6.30 | 49,900 |
| 1000 | 8.0 | 83,100 | 2400 | 4.93 | 27,100 | 1600 | 5.33 | 33,200 |
| 1420 | 8.0 | 83,100 | | | | 1800 | 5.30 | 32,700 |
| 1540 | 7.9 | 82,100 | Jan. 22 | | | 2200 | 5.32 | 33,000 |
| 1800 | 7.9 | 81,100 | 0800 | 5.00 | 28,100 | 2400 | 5.22 | 31,500 |
| 1900 | 7.8 | 79,100 | 1400 | 4.97 | 27,700 | Apr. 1 | | |
| 2000 | 7.5 | 73,100 | 1500 | 4.50 | 21,100 | 0400 | 4.83 | 25,700 |
| 2400 | 6.58 | 55,200 | 1600 | 4.08 | 15,900 | 1400 | 4.63 | 22,900 |
| | | | 2000 | 2.83 | 4,700 | 1600 | 4.55 | 21,800 |
| Dec. 21 | | | 2200 | 2.63 | 3,370 | 2400 | 3.95 | 14,600 |
| 0115 | 6.4 | 51,700 | 2400 | 4.15 | 16,700 | Apr. 2 | | |
| 0230 | 6.4 | 51,700 | Jan. 23 | | | 0600 | 3.70 | 12,000 |
| 0430 | 6.6 | 51,700 | 0100 | 4.30 | 18,500 | 1000 | 3.65 | 11,600 |
| 1100 | 6.6 | 55,600 | 0400 | 4.40 | 19,800 | 1400 | 3.32 | 8,500 |
| 1600 | 6.5 | 53,600 | 1800 | 4.94 | 27,200 | 1800 | 3.00 | 5,940 |
| 1730 | 5.7 | 39,200 | 2200 | 4.16 | 16,800 | 2000 | 2.85 | 4,840 |
| 2000 | 5.7 | 39,200 | 2400 | 4.10 | 16,200 | 2400 | 2.85 | 4,840 |
| 2300 | 5.4 | 34,300 | | | | Apr. 3 | | |
| 2400 | 5.4 | 34,300 | Jan. 24 | | | 1800 | 2.78 | 4,360 |
| | | | 0900 | 4.04 | 15,500 | 2000 | 2.85 | 4,840 |
| Dec. 22 | | | 2400 | 4.05 | 15,600 | 2200 | 3.43 | 9,460 |
| 0300 | 5.4 | 34,300 | | | | 2400 | 3.48 | 9,920 |
| 0900 | 5.48 | 35,600 | Jan. 25 | | | Apr. 4 | | |
| 1330 | 5.30 | 32,700 | 0200 | 3.91 | 14,100 | 1600 | 3.42 | 9,380 |
| 1800 | ----- | 31,000 | 0500 | 3.93 | 14,300 | 2400 | 2.95 | 5,570 |
| 2400 | ----- | 30,000 | 0800 | 3.73 | 12,300 | Apr. 5 | | |
| | | | 1000 | 3.73 | 12,300 | 0400 | 2.78 | 4,360 |
| Dec. 23 | | | 1500 | 3.85 | 13,500 | 1000 | 2.88 | 5,060 |
| 1800 | ----- | 25,000 | 1800 | 3.75 | 12,500 | 2200 | 2.63 | 3,370 |
| 2400 | ----- | 8,000 | 2400 | 3.93 | 14,300 | 2400 | 2.55 | 2,880 |

(132) 09512300 Cave Creek near Cave Creek, Ariz.
(Crest-stage station)

Location.--Lat 33°47'07", long 112°00'24", in SW¼ sec.12, T.5 N., R.3 E., Maricopa County, Hydrologic Unit 15060106, on left bank 200 ft (61 m) upstream from power transmission line, 4.75 mi (7.6 km) southwest of the town of Cave Creek, and 5.0 mi (8.0 km) upstream from Cave Creek Dam.

Drainage area.--121 $mi^2$ (314 $km^2$).

Gage-height record.--Crest stage only. Altitude of gage is 1,800 ft (550 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 720 $ft^3/s$ (20.4 $m^3/s$) on basis of slope-area measurements at gage heights 6.79 and 8.62 ft (2.094 and 2.656 m).

(132) 09512300 Cave Creek near Cave Creek, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 6,900 $ft^3/s$ (195 $m^3/s$) probably Dec. 18, gage height, 7.34 ft (2.237 m).
1958 to October 1978: Discharge, 12,400 $ft^3/s$ (351 $m^3/s$) Dec. 19, 1967, gage height, 8.62 ft (2.627 m).

Remarks.--Flow stored in Cave Creek Reservoir and released slowly to prevent flooding in Phoenix.

(133) 09512410 Mingus C Watershed near Prescott, Ariz.
(U.S. Forest Service station)

Location.--Lat 34°38'54", long 112°10'27", in NW¼SE¼ sec.29, T.15 N., R.2 E., Yavapai County, Hydrologic Unit 15070102, Prescott National Forest, 3 mi ( 5 km) upstream from the confluence of Lang Canyon with Yeager Canyon, and 19 mi (31 km) east-northeast of Prescott.

Drainage area.--0.07 $mi^2$ (0.18 $km^2$).

Gage-height record.--Water-stage recorder chart. Altitude of gage is 6,310 ft (1,923 m) from topographic map.

Discharge record.--Computed from theoretical rating for 120° v-notch weir. Records furnished by U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station.

Maxima.--November 1978 to March 1979: Discharge, 5.1 $ft^3/s$ (0.144 $m^3/s$) 2400 hours Mar. 13, gage height, 1.06 ft (0.323 m).
1958 to October 1978: Discharge, 17.3 $ft^3/s$ (0.49 $m^3/s$) July 28, 1961.

Remarks.--Additional data for other small research watersheds are available from the experiment station.

(134) 09512500 Agua Fria River near Mayer, Ariz.

Location.--Lat 34°18'55", long 112°03'48", in NW¼SE¼ sec.20, T.11 N., R.3 E., Yavapai County, Hydrologic Unit 15070102, on left bank at Sycamore damsite, 700 ft (210 m) downstream from Big Bug Creek, and 12 mi (19 km) southeast of Mayer.

Drainage area.--588 $mi^2$ (1,523 $km^2$).

Gage-height record.--Water-stage recorder graph except 2100 hours, Dec. 18 1730 hours Dec. 21, which was estimated on the basis of high-water mark and adjacent good record. Datum of gage is 3,434 ft (1,046.7 m), Maricopa County Municipal Water Conservation District No. 1 datum.

Discharge record.--Stage-discharge relation extended above 1,600 $ft^3/s$ (45 $m^3/s$) on basis of slope-area measurement for peak of February 1980 at 15.76 ft (4.804 m).

Maxima.--November 1978 to March 1979: Discharge, 26,700 $ft^3/s$ (756 $m^3/s$) revised, 2130 hours, Dec. 18, gage height, 14.3 ft (4.359 m).
1940 to October 1978: Discharge, 19,800 $ft^3/s$ (561 $m^3/s$) Sept. 5, 1970, gage height, 14.90 ft (4.542 m) on basis of slope-area measurement of peak flow.

(134) 09512500 Agua Fria River near Mayer, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 19 | | | Jan. 17—Con. | | |
| 2400 | 3.18 | 2.8 | 0200 | 9.4 | 9,920 | 2200 | 5.30 | 1,720 |
| Dec. 17 | | | 0600 | 7.0 | 4,510 | 2400 | 4.98 | 1,340 |
| 1000 | 3.18 | 2.8 | 1000 | 5.7 | 2,330 | Jan. 18 | | |
| 2100 | 3.30 | 7.3 | 2400 | 4.9 | 1,230 | 0600 | 4.75 | 1,050 |
| 2400 | 3.68 | 69.2 | Jan. 15 | | | 1200 | 4.58 | 846 |
| | | | 2400 | 3.09 | 6.3 | 1400 | 4.60 | 870 |
| Dec. 18 | | | Jan. 16 | | | 1600 | 4.95 | 1,300 |
| 0200 | 4.54 | 706 | 1300 | 3.09 | 6.3 | 1800 | 5.44 | 1,970 |
| 0500 | 4.70 | 918 | 2400 | 3.24 | 17 | 2000 | 6.25 | 3,100 |
| 0700 | 5.80 | 2,570 | Jan. 17 | | | 2100 | 7.00 | 4,150 |
| 0900 | 6.50 | 3,630 | 0200 | 3.30 | 25 | 2130 | 7.26 | 4,510 |
| 1200 | 5.65 | 2,260 | 0400 | 4.45 | 695 | 2300 | 6.34 | 3,230 |
| 1300 | 6.30 | 3,300 | 0600 | 8.77 | 8,310 | 2400 | 5.73 | 2,370 |
| 1400 | 7.10 | 4,690 | 0700 | 11.7 | 16,900 | Jan. 19 | | |
| 1600 | 8.50 | 7,660 | 0730 | 12.5 | [1]19,700 | 0600 | 4.64 | 918 |
| 1800 | 9.00 | 8,880 | 0800 | 12.3 | 19,000 | 1200 | 4.32 | 560 |
| 1900 | 10.38 | 12,700 | 0900 | 11.4 | 15,900 | 1800 | 4.18 | 434 |
| 2000 | 9.05 | 9,010 | 1200 | 9.98 | 11,500 | 2400 | 4.28 | 522 |
| 2100 | 8.22 | 7,020 | 1400 | 8.19 | 6,950 | Jan. 20 | | |
| 2300 | 14.30 | [1]26,700 | 1600 | 6.69 | 3,950 | 1200 | 4.00 | 300 |
| 2400 | 10.6 | 13,300 | 1800 | 5.80 | 2,570 | 2400 | 3.92 | 250 |

[1]Revised.

(135) Agua Fria River at Black Canyon City, Ariz.
(Miscellaneous site)

Location.--Lat 34°04'23", long 112°08'08", SW¼, sec.34, T.9 N., R.2 E., Yavapai County, Hydrologic Unit 15070102, 1,500 ft (457 m) upstream from Interstate Highway 17 at Black Canyon City.

Drainage area.--845 $mi^3$ (2,190 $km^3$).

Maxima.--November 1978 to March 1979: Discharge, 32,100 $ft^3/s$ (909 $m^3/s$) probably Dec. 19, 1978, from slope-area measurement of peak flow.

(136) Black Canyon Creek near Black Canyon City, Ariz.
(Miscellaneous site)

Location.--Lat 34°05'10", long 112°09'10", in SE¼ sec.28, T.9 N., R.2 E., Yavapai County, Hydrologic Unit 15070102, 1.2 mi (1.9 km) above mouth and 1 mi (1.6 km) north of Black Canyon City, Ariz.

Drainage area.--238 $mi^2$ (161 $km^2$).

(136) Black Canyon Creek near Black Canyon City, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 22,300 $ft^3/s$ (632 $m^3/s$) Dec. 18, 1978, from slope-area measurement of peak flow.

Observations by local resident at slope-area reach indicate Dec. 18 peak was 0.8 ft (0.24 m) lower than peak in September 1970 flood and 2 ft (0.61 m) above peak in March 1978. Peak in September 1978 is the highest since at least 1957.

Remarks.--Tributary to Agua Fria River.

(137) 09512700 Agua Fria River Tributary No. 2 near Rock Springs, Ariz.
(Crest-stage station)

Location.--Lat 34°02'00", long 112°08'42", in SW¼ sec.15, T.8 N., R.2 E., Maricopa County, Hydrologic Unit 15070102, at State Highway 69, 1 mi (1.6 km) south of Rock Springs.

Drainage area.--1.11 $mi^2$ (2.87 $km^2$).

Gage-height record.--Crest-stage record only. Altitude of gage is 2,010 ft (613 m), from topographic map.

Discharge record.--Stage-discharge relation defined by culvert computations.

Maxima.--November 1978 to March 1979: Discharge, 265 $ft^3/s$ (7.50 $m^3/s$) probably Dec. 18, gage height, 4.92 ft (1.500 m).

1963 to October 1978: Discharge, 1,200 $ft^3/s$ (34.0 $m^3/s$) Aug. 2, 1964, gage height, 19.54 ft (5.956 m).

(138) 09512800 Agua Fria River near Rock Springs, Ariz.

Location.--Lat 34°00'56", long 112°10'02", in NW¼NW¼ sec.28, T.8 N., R.2 E., Yavapai County, Hydrologic Unit 15070102, on right bank 2.5 mi (4.0 km) southwest of Rock Springs, and 10 mi (16 km) upstream from Lake Pleasant.

Drainage area.--1,130 $mi^2$ (2,930 $km^2$), approximately.

Gage-height record.--Crest stage only during flood periods. Altitude of gage is 1,800 ft (549 m), from topographic map.

Maxima.--November 1978 to March 1979: Discharge, 52,800 $ft^3/s$ (1,500 $m^3/s$) Dec. 18 from slope-area measurement of peak flow, gage height, 27.2 ft (8.29 m) from profile of floodmarks.

1970 to October 1978: Discharge, 40,100 $ft^3/s$ (1,140 $m^3/s$) Sept. 5, 1970, from slope-area measurement of peak flow; gage height, 25.3 ft (7.71 m), present site and datum from profile of floodmarks.

(139) Castle Creek near Castle Hot Springs, Ariz.

Location.--Lat 33°59'40", long 112°22'10", in W½ sec.33, T.8 N., R.1 W., Yavapai County, Hydrologic Unit 15070102, about 1 mi (1.6 km) northwest of Castle Hot Springs, and 8 mi (13 km) upstream from mouth at Lake Pleasant.

Drainage area.--72.0 $mi^2$ (186 $km^2$).

Maxima.--November 1978 to March 1979: Discharge, 5,780 $ft^3/s$ (164 $m^3/s$) probably Dec. 18, 1978, from slope-area measurement of peak flow.

Remarks.--Tributary to Lake Pleasant on the Aqua Fria River.

(140) 095313000 Agua Fria River at (above and below) Waddell Dam, Ariz.

Location.--Lat 33°51'20", long 112°15'58", in SW¼ sec.16, T.6 N., R.1 E., Maricopa County, Hydrologic Unit 15070102, at left upstream end of Waddell Dam, and 22 mi (35 km) northwest of Glendale.

Drainage area.--1,459 mi² (3,779 km²).

Gage-height record.--Nonrecording gage on Lake Pleasant, read hourly or more frequently and staff gage at diversion dam below Waddell Dam. Datum of gage is 1,431.2 ft (436.23 m) above National Geodetic Vertical Datum of 1929.

Discharge record.--Figures given herein represent flow into Lake Pleasant and release to Agua Fria River below diversion dam. Inflow computed on basis of three factors as follows: 1. Change in contents of Lake Pleasant and in contents of small reservoir behind diversion dam 1.5 mi (2.4 km) downstream from Lake Pleasant. 2. (a) Release from Lake Pleasant, computed from readings by Calusen-Pierce weir rule in Beardsley Canal, checked by current-meter measurements by U.S. Geological Survey; (b) spill from Lake Pleasant measured over diversion dam based on staff-gage readings. 3. Effect of rainfall and evaporation on lake; evaporation assumed as 0.85 of that measured once daily in 3-foot-square (0.9-meter-square) land pan buried 1.5 ft (0.5 m) in ground near left end of Waddell Dam. Effect of bank storage and bank release in Lake Pleasant is not taken into account.

Maxima.--November 1978 to March 1979: Inflow, 79,500 ft³/s (2,250 m³/s) 2230 hours Dec. 18, outflow, 59,900 ft³/s (1,700 m³/s) 0130 hours, Dec. 19.

1927 to October 1978: Inflow, not determined. Outflow, 16,300 ft³/s (460 m³/s) Mar. 5, 1978.

1891 to October 1978: Recorded discharge about 105,000 ft³/s (2,970 m³/s) Jan. 28, 1916, gage height, 30 ft (9.1 m) datum then in use from floodmarks; from rating curve extended above 13,000 ft³/s (370 m³/s) on basis of velocity-area studies. Gage height, 33 ft (10.1 m), Nov. 27, 1919, to same datum as in 1916, from floodmarks; discharge believed to be greater than that of 1916.

Remarks.--Since 1927, outflow has been regulated at Lake Pleasant (see sta 09513500) and record has been furnished by Maricopa County Municipal Water Conservation District No 1. Spills occurred in 1941, 1966, 1968, 1978, 1979, and 1980 water years. The spill that started Dec. 18, 1978 continued into April 1979.

Inflow and outflow, in cubic feet per second, 1978-79

| Hour | Inflow | Outflow | Hour | Inflow | Outflow | Hour | Inflow | Outflow |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 19—Con. | | | Jan. 18—Con. | | |
| 1000 | 7,410 | 0 | 2400 | 4,960 | 3,600 | 1200 | 4,410 | 5,900 |
| 1200 | 8,180 | 0 | Jan .17 | | | 1400 | 4,170 | 3,950 |
| 1400 | 11,600 | 0 | 0200 | 1,550 | 150 | 1600 | 5,980 | 4,930 |
| 1600 | 16,300 | 0 | 0400 | 1,840 | 150 | 1800 | 6,120 | 5,900 |
| 1800 | 23,200 | 0 | 0600 | 6,920 | 150 | 2000 | 8,440 | 5,900 |
| 2000 | 37,200 | 0 | 0800 | 6,350 | 4,200 | 2200 | 8,440 | 5,900 |
| 2200 | 53,000 | 0 | 1000 | 23,800 | 15,300 | 2400 | 10,200 | 5,900 |
| 2230 | 79,500 | 6,000 | 1200 | 28,800 | 19,800 | Jan. 19 | | |
| 2400 | 68,600 | 25,100 | 1400 | 24,800 | 25,700 | 0200 | 8,250 | 5,900 |
| Dec. 19 | | | 1600 | 19,700 | 25,700 | 0400 | 8,820 | 6,900 |
| 0130 | 76,300 | 59,900 | 1800 | 11,700 | 19,800 | 0600 | 6,900 | 6,900 |
| 0400 | 51,200 | 50,800 | 2000 | 13,500 | 13,900 | 0800 | 5,480 | 5,900 |
| 0600 | 28,600 | 31,200 | 2200 | 8,640 | 8,000 | 1000 | 3,590 | 2,950 |

(140) 095313000 Agua Fria River at (above and below) Waddell Dam, Ariz.—Continued

Inflow and outflow, in cubic feet per second, 1978-79

| Hour | Inflow | Outflow | Hour | Inflow | Outflow | Hour | Inflow | Outflow |
|---|---|---|---|---|---|---|---|---|
| Dec. 19—Con. | | | Jan. 17—Con. | | | Jan. 19—Con. | | |
| 0800 | 20,500 | 24,000 | 2400 | 6,720 | 8,000 | 1200 | 4,440 | 2,950 |
| 1000 | 15,100 | 16,800 | Jan. 18 | | | 1400 | 2,950 | 2,950 |
| 1200 | 11,500 | 13,200 | 0200 | 6,280 | 8,000 | 1600 | 2,100 | 2,950 |
| 1400 | 10,600 | 7,200 | 0400 | 5,230 | 8,000 | | | |
| 1600 | 9,340 | 7,200 | 0600 | 5,020 | 8,000 | Jan. 20 | | |
| 1800 | 6,490 | 7,200 | 0800 | 4,820 | 8,000 | 0800 | 2,470 | 2,950 |
| 2000 | 6,490 | 7,200 | 1000 | 4,640 | 5,900 | 1400 | 1,810 | 2,950 |

(141) 09513500 Lake Pleasant at Waddell Dam, Ariz.

Location.--Lat 33°51'20", long 112°15'58", in SW¼ sec.16, T.6 N., R.1 E., Maricopa County, Hydrologic Unit 15070102, at left upstream end of Waddell Dam on Agua Fria River.

Drainage area.--1,459 mi² (3,779 km²).

Gage-height record.--Nonrecording gage read hourly or more frequently. Datum of gage is 1,431.2 ft (436.53 m) National Geodetic Vertical Datum of 1929.

Maxima.--November 1978 to March 1979: Contents, 161,000 acre-ft (198 hm³) Mar. 29, gage height 170.92 ft (52.712 m).

1927 to October 1978: Contents, 178,500 acre-ft (220 hm³) Apr. 19, 1941. Gage height, 170.52 ft (51.989 m) Mar. 23, 1978.

Remarks.--Lake is formed by concrete multiple-arch dam; dam completed and storage began in 1927. Capacity, 157,600 acre-ft (194 hm³), of which 86,870 acre-ft (107 hm³) is below the crest of spillway and 70,730 acre-ft (87.2 hm³) is between the crest of the spillway and the top of spillway gates. Figures given herein represent usable contents in Lake Pleasant (based on 1965 capacity table). Contents of small reservoir formed by diversion dam downstream from Waddell Dam is not included.

Cooperation.--Gage-height record furnished by Maricopa County Municipal Water Conservation District No. 1.

(142) 09513650 Agua Fria River at El Mirage, Ariz.
(Crest-stage station)

Location.--Lat 33°36'24", long 112°18'14", in NW¼NW¼ sec.18, T.3 N., R.1 E., Maricopa County, Hydrologic Unit 15070102, at Grand Avenue 0.75 mi (1.2 km) southeast of El Mirage.

Drainage area.--1,637 mi² (4,240 km²), of which 1,459 mi² (3,779 km²) is above Lake Pleasant.

Gage-height record.--Crest stage only. Datum of gage is 1,113.00 ft (339.242 m) Arizona Highway Department datum.

(142) 09513650 Agua Fria River at El Mirage, Ariz.—Continued

Maxima.--November 1978 to March 1979: Discharge, 58,400 $ft^3/s$ (1,650 $m^3/s$) Dec. 19, from slope-area measurement of peak flow, gage height, 11.70 ft (3.566 m) from outside high-water mark.
1963 to October 1978: Discharge, 9,870 $ft^3/s$ (280 $m^3/s$) Mar. 2, 1978, gage height, 7.95 ft (2.423 m).

Remarks.--Flow regulated by Lake Pleasant since 1927 (see station 09513500). Excess floodwater released from McMicken Dam on Trilby Wash may enter Agua Fria River upstream from station. Record poor.

(143) 09513780 New River near Rock Springs, Ariz.

Location.--Lat 33°58'27", long 112°05'54", in SW¼SW¼ sec.6, T.7 N., R.3 E., Maricopa County, Hydrologic Unit 15070102, on right bank 180 ft (55 m) upstream from road crossing, and 6 mi (10 km) southeast of Rock Springs.

Drainage area.--67.3 $mi^2$ (174 $km^2$).

Gage-height record.--Water-stage recorder graph. Altitude of gage is 2,310 ft (704 m), from topographic map.

Discharge record.--Stage-discharge relation extended above 380 $ft^3/s$ (11 $m^3/s$) on basis of five slope-area measurements at gage heights 3.6 to 13.5 ft (1.10 to 4.11 m).

Maxima.--November 1978 to March 1979: Discharge, 6,530 $ft^3/s$ (185 $m^3/s$) 2200 hours Mar. 28, gage height, 7.09 ft (2.161 m).
1960 to October 1978: Discharge, 18,600 $ft^3/s$ (527 $m^3/s$) Sept. 5, 1970, gage height, 13.5 ft (4.11 m), from profile past gage.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 16 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 1.50 | 2.55 | 0400 | 6.54 | 5,250 | 0800 | 4.54 | 1,770 |
| Dec.17 | | | 0700 | 5.39 | 3,030 | 0830 | 4.54 | 1,770 |
| ---- | 1.49 | 2.31 | 0930 | 4.78 | 2,080 | 1200 | 3.97 | 1,160 |
| ---- | 1.57 | 4.70 | 1030 | 5.09 | 2,530 | 1700 | 3.58 | 654 |
| ---- | 1.66 | 9.30 | 1300 | 5.29 | 2,820 | 2000 | 3.47 | 538 |
| ---- | 5.29 | 2,850 | 1500 | 6.29 | 4,720 | 2200 | 3.49 | 562 |
| ---- | 5.21 | 2,730 | 1600 | 6.51 | 5,180 | 2400 | 3.40 | 476 |
| ---- | 5.54 | 3,300 | 1700 | 6.51 | 5,180 | | | |
| ---- | 5.24 | 2,770 | 2000 | 6.13 | 4,390 | Dec. 20 | | |
| ---- | 4.97 | 2,450 | 2130 | 6.59 | 5,360 | 0300 | 3.27 | 375 |
| ---- | 4.79 | 2,096 | 2330 | 6.28 | 4,700 | 0900 | 3.10 | 279 |
| ---- | 4.54 | 1,770 | 2400 | 6.41 | 4,970 | 1500 | 2.95 | 206 |
| Dec. 18 | | | Dec. 19 | | | 2100 | 2.84 | 161 |
| 0030 | 4.46 | 1,680 | 0030 | 6.46 | 5,080 | 2400 | 2.80 | 147 |
| 0100 | 4.54 | 1,770 | 0200 | 5.79 | 3,710 | Dec. 21 | | |
| 0200 | 4.81 | 2,120 | 0330 | 5.51 | 3,250 | 1200 | 2.65 | 98.5 |
| 0300 | 6.19 | 4,510 | 0700 | 4.64 | 1,890 | 2400 | 2.57 | 88.5 |

(144) 09513800 New River at New River, Ariz.

Location.--Lat 33°54'41", long 112°08'26", in NW¼NE¼ sec.34, T.7 N., R.2 E., Maricopa County, Hydrologic Unit 15070102, near center of downstream side of bridge on east frontage road of Interstate Highway 17, 0.5 mi (0.8 km) southwest of village of New River, and 10 mi (16 km) south of Rock Springs.

Drainage area.--83.3 mi² (215.7 km²).

Gage-height record.--Water-stage recorder graph. Datum of gage is 1,984.02 ft (604.729 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 960 ft³/s (27 m³/s) on basis of slope-area measurement at 12.34 ft (3.761 m) and step-backwater computations.

Maxima.--November 1978 to March 1979: Discharge, 5,560 ft³/s (157 m³/s) 2230 hours Dec. 18, gage height, 7.88 ft (2.402 m).

1960 to October 1978: Discharge, 19,500 ft³/s (552 m³/s) Sept. 5, 1970, gage height, 9.98 ft (3.042 m), at site and datum then in use, from rating curve extended above 1,300 ft³/s (37 m³/s) on basis of slope-area measurements at gage heights 5.57, 7.33, 9.12, and 9.98 ft (1.698, 2.234, 2.780, and 3.042 m).

1972 to October 1978: Gage height at present site and datum, 12.34 ft (3.761 m) Mar. 2, 1978, from high-water mark in well.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 0130 | 5.34 | 1,704 | 1730 | 7.55 | 4,930 | 0430 | 6.34 | 2,966 |
| 0300 | 5.47 | 1,854 | 1900 | 7.13 | 4,191 | 0700 | 5.67 | 2,010 |
| 0400 | 6.65 | 3,415 | 2030 | 7.08 | 4,106 | 0830 | 5.45 | 1,693 |
| 0500 | 7.20 | 4,310 | 2100 | 6.95 | 3,890 | 1000 | 5.38 | 1,605 |
| 0700 | 6.35 | 2,980 | 2130 | 7.00 | 3,970 | 1400 | 5.02 | 1,130 |
| 0900 | 5.80 | 2,250 | 2230 | 7.88 | 5,560 | 1800 | 4.74 | 804 |
| 1030 | 5.62 | 2,034 | 2400 | 7.43 | 4,714 | 2100 | 4.60 | 651 |
| 1130 | 5.82 | 2,274 | | | | 2400 | 4.57 | 615 |
| 1300 | 5.88 | 2,346 | Dec. 19 | | | | | |
| 1430 | 6.05 | 2,565 | 0030 | 7.25 | 4,395 | Dec. 20 | | |
| 1600 | 6.98 | 3,938 | 0130 | 7.48 | 4,804 | 1200 | 4.19 | 285 |
| 1700 | 7.51 | 4,858 | 0300 | 6.55 | 3,265 | 2400 | 4.04 | 204 |

(145) 09513820 Deadman Wash near New River, Ariz.
(Crest-stage station)

Location.--Lat 33°50'30", long 112°08'40", in NW¼ sec.27, T.6 N., R.2 E., Maricopa County, Hydrologic Unit 15070102, at State Highway 69, 4.5 mi (7.2 km) south of New River.

Drainage area.--11.1 mi² (28.7 km²).

Gage-height record.--Crest stage only. Datum of gage is 1,720.82 ft (524.506 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation extended above 60 ft³/s (1.7 m³/s) on basis of slope-area measurements at gage heights 5.58 and 5.92 ft (1.701 and 1.804 m) and field estimates.

Maxima.--November 1978 to March 1979: Discharge, 88 ft³/s (2.5 m³/s) Nov. 11, gage height, 2.77 ft (0.844 m).

1959 to October 1978: Discharge, 1,850 ft³/s (52.4 m³/s) Dec. 25, 1959, gage height, 7.0 ft (2.13 m), from floodmarks.

(146) 09513835 New River at Bell Road, near Peoria, Ariz.

Location.--Lat 33°38'18", long 112°14'22", in NE¼NE¼ sec.3, T.3 N., R.1 E., Maricopa County, Hydrologic Unit 15070102, on downstream side of bridge at Bell Road, 1.6 mi (2.6 km) upstream from Skunk Creek, 3.1 mi (5.0 km) north of Peoria, and 9 mi (14 km) upstream from mouth.

Drainage area.--187 mi² (484 km²).

Gage-height record.--Water-stage recorder graph. Datum of gage is 1,190.00 ft (362.712 m), Arizona State Highway Department datum.

Discharge record.--Stage-discharge relation extended above 1,800 ft³/s (51 m³/s) on basis of slope-area measurement at gage height 11.0 ft (3.35 m).

Maxima.--November 1978 to March 1979: Discharge, 8,410 ft³/s (238.17 m³/s), revised, 0330 hours Dec. 19, gage height, 7.61 ft (2.320 m).

1960 to October 1978: Discharge, 14,600 ft³/s (413 m³/s) Dec. 19, 1967, gage height, 13.5 ft (4.11 m) from slope-area measurement of peak flow.

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 17 | | | Dec. 18—Con. | | | Dec. 19—Con. | | |
| 2400 | 1.32 | 0 | 2000 | 5.67 | 3,770 | 0800 | 5.97 | 4,400 |
| Dec. 18 | | | 2100 | 6.02 | 4,510 | 0900 | 5.77 | 3,980 |
| 0500 | 1.32 | 0 | 2200 | 6.61 | 5,860 | 1000 | 5.20 | 2,820 |
| 0530 | 3.25 | 154 | 2230 | 6.84 | 6,420 | 1100 | 4.30 | 1,310 |
| 0600 | 3.87 | 748 | 2300 | 6.76 | 6,220 | 1300 | 3.92 | 807 |
| 0700 | 4.02 | 926 | 2400 | 6.73 | 6,150 | 1900 | 3.54 | 390 |
| 0800 | 4.32 | 1,340 | Dec. 19 | | | 2200 | 3.43 | 293 |
| 0830 | 5.07 | 2,570 | 0200 | 6.77 | 6,250 | 2400 | 3.36 | 237 |
| 0900 | 5.47 | 3,350 | 0300 | 7.12 | 7,110 | | | |
| 0945 | 5.80 | 4,040 | 0330 | 7.61 | 8,410 | Dec. 20 | | |
| 1100 | 5.57 | 3,560 | 0400 | 7.27 | 7,500 | 0100 | 3.35 | 228 |
| 1300 | 4.86 | 2,190 | 0430 | 6.82 | 6,370 | 0430 | 3.17 | 105 |
| 1500 | 4.45 | 1,530 | 0500 | 7.04 | 6,900 | 0830 | 3.08 | 70 |
| 1700 | 4.77 | 2,030 | 0600 | 6.72 | 6,130 | 1400 | 2.93 | 47 |
| 1900 | 5.12 | 2,670 | 0700 | 6.32 | 5,200 | 2400 | 2.67 | 31 |

(147) 09513860 Skunk Creek near Phoenix, Ariz.

Location.--Lat 33°43'44", long 112°07'12", in SE¼ sec.35, T.5 N., R.2 E., Maricopa County, Hydrologic Unit 15070102, on downstream side of right end of bridge on east frontage road of Interstate Highway 17, 3 mi (5 km) north of Adobe, and 20 mi (32 km) north of city hall in Phoenix.

Drainage area.--64.6 mi² (167.3 km²).

Gage-height record.--Water-stage recorder graph. Datum of gage is 1,459.95 ft (444.993 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 600 ft³/s (17.0 m³/s) 2200 hours Jan. 18, gage height, 6.80 ft (2.073 m).

1960 to October 1978: Discharge, 11,500 ft³/s (326 m³/s) Aug. 1, 1964, from rating curve extended above 6,200 ft³/s (180 m³/s). Gage height, 12.24 ft (3.731 m) Sept. 5, 1970.

(148) 09513970 Agua Fria River at Avondale, Ariz.

Location.--Lat 33°26'06", long 112°19'59", in NW¼ sec.14, T.1 N., R.1 W., Maricopa County, Hydrologic Unit 15070102, on downstream side of bridge on U.S. Highway 80, 0.5 mi (0.8 km) east of Avondale, and 3 mi (5 km) upstream from mouth.

Drainage area.--2,013 mi² (5,214 km²), of which 1,459 mi² (3,779 km²) is above Lake Pleasant. Floodwater from drainage area of 247 mi² (640 km²) above McMicken Dam on Trilby Wash was diverted into Agua Fria River basin above station.

Gage-height record.--Water-stage recorder graph. Datum of gage is 952.92 ft (290.450 m), Arizona Highway Department datum.

Discharge record.--Stage-discharge relations poorly defined by current-meter measurements below 23,500 ft³/s (666 m³/s) and extended above on basis of slope-area measurement of peak flow. Record poor.

Maxima.--November 1978 to March 1979: Discharge, 29,300 ft³/s (830 m³/s) at 1100 hours, Dec. 19, gage height, 6.48 ft (1.975 m), from profile past gage.

1959 to October 1978: Discharge, 20,600 ft³/s (583 m³/s) Sept. 6, 1970, gage height, 11.21 ft (3.417 m), from rating curve extended above 1,500 ft³/s (42 m³/s) on basis of slope-area measurement of peak flow.

Remarks.--Flow regulated by Lake Pleasant, 35 mi (56 km) upstream. (See station 09513500.)

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 18 | | | Dec. 21 | | | Jan. 19—Con. | | |
| 1300 | 0 | 0 | 0400 | 0.10 | 286 | 0300 | 2.53 | 7,700 |
| 1330 | 0 | 0 | 0800 | .10 | 188 | 0700 | 2.13 | 5,700 |
| 1400 | 1.90 | 3,500 | 1400 | ----- | 80 | 0800 | 1.80 | 4,000 |
| 1500 | 1.55 | 2,150 | 2400 | ----- | 20 | 1100 | 2.30 | 6,600 |
| 1830 | 1.20 | 1,100 | | | | 1130 | 2.15 | 5,800 |
| 2000 | 1.37 | 1,550 | Jan. 17 | | | 1200 | 2.25 | 6,400 |
| 2130 | 1.50 | 1,960 | 0000 | ----- | 0 | 1800 | 1.32 | 1,900 |
| 2300 | 1.93 | 3,650 | 1500 | ----- | 0 | 2000 | 1.27 | 1,750 |
| 2400 | 2.05 | 4,150 | 1530 | .80 | 550 | 2300 | 1.38 | 2,150 |
| Dec. 19 | | | 1800 | 1.05 | 1,080 | 2400 | 1.35 | 2,050 |
| 0330 | 1.90 | 3,500 | 1900 | .96 | 860 | Jan. 20 | | |
| 0550 | 2.34 | 5,550 | 1930 | 2.00 | 5,000 | 0600 | 1.23 | 1,600 |
| 0730 | 2.10 | 4,400 | 2000 | 3.34 | 12,500 | 1200 | 1.21 | 1,530 |
| 0830 | 3.73 | 12,700 | 2030 | 3.96 | 16,250 | 1800 | 1.17 | 1,430 |
| 0930 | 1.40 | 1,650 | 2100 | 4.47 | 19,400 | 2100 | 1.12 | 1,250 |
| 1100 | 6.48 | 29,300 | 2200 | 5.10 | 23,500 | 2400 | .81 | 570 |
| 1130 | 5.00 | 22,500 | 2230 | 5.23 | 24,600 | Jan. 21 | | |
| 1230 | 4.65 | 20,300 | 2300 | 4.94 | 22,500 | 1200 | .09 | 90 |
| 1300 | 5.50 | 24,500 | 2400 | 3.86 | 15,600 | 2400 | .60 | 0 |
| 1500 | 3.75 | 16,000 | | | | Mar. 29 | | |
| 1600 | 3.25 | 13,400 | Jan. 18 | | | 0000 | ----- | 0 |
| 1630 | 3.85 | 16,400 | 0200 | 3.11 | 11,200 | 0800 | ----- | 0 |
| 1800 | 2.95 | 11,900 | 0300 | 2.59 | 8,200 | 1000 | 2.60 | 8,400 |
| 1830 | 3.89 | 16,500 | 0400 | 2.21 | 6,150 | 1200 | 2.44 | 7,400 |
| 2000 | 3.18 | 13,000 | 0600 | 2.00 | 5,000 | 2000 | 1.27 | 1,750 |
| 2200 | 2.60 | 10,100 | 0830 | 1.78 | 3,950 | 2200 | 1.15 | 1,350 |

(148) 09513970 Agua Fria River at Avondale, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978-79

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 19—Con. | | | Jan. 18—Con. | | | Mar. 29—Con. | | |
| 2400 | 2.50 | 9,600 | 1200 | 2.00 | 5,000 | 2400 | 1.10 | 1,200 |
| | | | 1600 | 2.00 | 5,000 | Mar. 30 | | |
| Dec. 20 | | | 1700 | 1.80 | 4,000 | 1200 | 1.06 | 1,100 |
| 0100 | 2.50 | 9,600 | 1800 | 1.95 | 4,760 | 2400 | 1.00 | 960 |
| 0200 | 2.10 | 7,500 | 2000 | 1.90 | 4,500 | | | |
| 0600 | 2.00 | 7,000 | 2200 | 2.13 | 5,700 | Mar. 31 | | |
| 1200 | 1.10 | 2,850 | 2400 | 2.50 | 7,800 | 0600 | 1.00 | 960 |
| 1500 | .60 | 1,060 | | | | 1200 | .40 | 250 |
| 1700 | .43 | 645 | Jan. 19 | | | 1800 | .15 | 80 |
| 2400 | .17 | 325 | 0130 | 2.33 | 6,800 | 2400 | .55 | 0 |

(149) 09514400 Whitespar A Watershed near Prescott, Ariz.
(U.S. Forest Service station)

Location.--Lat 34°28'51", long 112°31'06", in SE¼NE¼ sec.25, T.13 N., R.3 W., Yavapai County, Hydrologic Unit 15070103, Prescott National Forest, 2 mi (3.2 km) upstream from confluence with Little Copper Creek, and 5.5 mi (8.8 km) southwest of Prescott.

Drainage area.--0.47 $mi^2$ (1.22 $km^2$).

Gage-height record.--Water-stage recorder chart. Altitude of gage is 6,020 ft (1,835 m) from topographic map.

Discharge record.--Computed from theoretical rating for 120° v-notch weir.

Maxima.--November 1978 to March 1979: Discharge, 13.6 $ft^3/s$ (0.39 $m^3/s$) 2000 hours Dec. 18, gage height, 1.58 ft (0.482 m).
1957 to October 1978: Discharge, 24 $ft^3/s$ (0.68 $m^3/s$) Mar. 2, 1978, gage height, 2.00 ft (0.61 m).

Remarks.--Records furnished by U.S. Forest Service Rocky Mountain Forest and Range Experiment Station. Additional data for other small research watersheds in this area are available from the experiment station.

(150) 09515500 Hassayampa River at Box Damsite, near Wickenburg, Ariz.

Location.--Lat 34°02'42", long 112°42'33", in SW¼SE¼ sec.7, T.8 N., R.4 W., Yavapai County, Hydrologic Unit 15070103, on right bank at Box damsite, 5.5 mi (8.8 km) northeast of Wickenburg.

Drainage area.--417 $mi^2$ (1,080 $km^2$).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,236.12 ft (681.569 m) National Geodetic Vertical Datum of 1929.

(150) 09515500 Hassayampa River at Box Damsite, near Wickenburg, Ariz.—Continued

Discharge record.--Average rating curve defined by four slope-area measurements between gage heights of 9.0 and 34.6 ft (2.743 and 10.55 m). Shifts to average curve defined by current meter measurements below 400 $ft^3/s$ (11.3 $m^3/s$). Records are poor.

Maxima.--November 1978 to March 1979: Discharge, 9,640 $ft^3/s$ (273 $m^3/s$) 2330 hours Mar. 28, gage height, 11.50 ft (3.505 m).

At least 1891 to October 1978: Discharge, 58,000 $ft^3/s$ (1,640 $m^3/s$) Sept. 5, 1970, gage height, 34.6 ft (10.55 m), from profile past gage, from slope-area measurement of peak flow. Relation to flood in February 1890, which was caused by failure of dam near Wagoner, is unknown.

(151) 09516500 Hassayampa River near Morristown, Ariz.
(Crest-stage station)

Location.--Lat 33°53'06", long 112°39'41", in SW¼SE¼ sec.3, T.6 N., R.4 W., Maricopa County, Hydrologic Unit 15070103, 3.0 mi (5.0 km) northwest of Morristown, and 7 mi (11 km) southeast of Wickenburg.

Drainage area.--774 $mi^2$ (2,005 $km^2$).

Gage-height record.--Crest stage only. Datum of gage is 1,831.16 ft (558.138 m) National Geodetic Vertical Datum of 1929, supplemental adjustment of 1965.

Discharge record.--Stage-discharge relation based on estimated flows and slope-area measurements. Record is poor.

Maxima.--November 1978 to March 1979: Discharge, 9,600 $ft^3/s$ (27.2 $m^3/s$) Dec. 18, gage height, 11.67 ft (3.557 m).

1921 to October 1978: Discharge, 47,500 $ft^3/s$ (1,350 $m^3/s$) Sept. 5, 1970, gage height, 19.0 ft (5.79 m), from high-water profile, from slope-area measurement of peak flow.

(152) 09517000 Hassayampa River near Arlington, Ariz.

Location.--Lat 33°20'50", long 112°43'30", in NW¼ sec.13, T.1 S., R.5 W., Maricopa County, Hydrologic Unit 15070104, at former U.S. Highway 80, 1.8 mi (2.9 km) upstream from mouth, and 2.8 mi (4.5 km) northeast of Arlington.

Drainage area.--1,470 $mi^2$ (3,810 $km^2$), approximately.

Gage-height record.--Water-stage recorder. Datum of gage is 831.87 ft (253.443 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Determined by shifting two current-meter measurements of less than 420 $ft^3/s$ (11.9 $m^3/s$) and slope-area measurement of peak flow to base rating defined by step-backwater computations. Record is poor.

Maxima.--November 1978 to March 1979: Discharge, 3,300 $ft^3/s$ (93.5 $m^3/s$) 2245 hours Nov. 11, gage height, 2.83 ft (0.863 m).

1961 to October 1978: Discharge, 39,000 $ft^3/s$ (1,100 $m^3/s$) Sept. 5, 1970, gage height, 8.40 ft (2.560 m), result of slope-area measurement of peak flow.

(153) 09517500 Centennial Wash near Arlington, Ariz.

Location.--Lat 33°16'12", long 112°47'50", in sec.7, T.2 S., R.5 W., Maricopa County, Hydrologic Unit 15070104, on upstream side of ford on former U.S. Highway 80, 3.0 mi (4.8 km) upstream from Gillespie Dam, and 4.4 mi (7.1 km) southwest of Arlington.

Drainage area.--1,810 $mi^2$ (4,690 $km^2$), approximately.

Gage-height record.--Water-stage recorder graph. Datum of gage is 773.22 ft (235.677 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--February to March 1978: Discharge, 818 $ft^3/s$ (23.2 $m^3/s$) Jan. 17, gage height, 3.53 ft (1.076 m).

1961 to October 1978: Discharge, 14,500 $ft^3/s$ (411 $m^3/s$) July 23, 1961, from rating curve extended above 5,500 $ft^3/s$ (160 $m^3/s$). Gage height, 4.71 ft (1.436 m) Sept. 5, 1970.

(154) 09519500 Gila River below Gillespie Dam, Ariz.

Location.--Lat 33°13'45", long 112°46'00", in SE¼NE¼ sec.28, T.2 S., R.5 W., Maricopa County, Hydrologic Unit 15070101, at left end of Gillespie Dam, 8 mi (13 km) downstream from Hassayampa River.

Drainage area.--49,650 $mi^2$ (128,600 $km^2$).

Gage-height record.--Digital water-stage recorder tape except 0100 to 1200 hours Jan. 17. Datum of gage is 743.51 ft (226.622 m) National Geodetic Vertical Datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 125,000 $ft^3/s$ (3,540 $m^3/s$) 1400 hours Dec. 20, gage height, 17.06 ft (5.200 m).

1921 to October 1978: Discharge, 92,900 $ft^3/s$ (2,630 $m^3/s$) Mar. 4, 1978. Gage height, 16.1 ft (4.91 m) Jan. 2, 1966.

1891 to October 1978: Discharge estimated as 250,000 $ft^3/s$ (7,100 $m^3/s$) in February 1891.

Remarks.--Flow partially regulated by San Carlos Reservoir on the Gila River since 1928 (see sta 09469000), by a system of reservoirs on the Salt River since 1910 (see sta 09501000), by a system of reservoirs on the Verde River since 1939 (see sta 09509500), and by Lake Pleasant on the Agua Fria since 1927 (see sta 09513500).

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 19 | | | Jan. 17 | | | Mar. 29 | | |
| 1100 | 9.56 | 0 | 2400 | 10.42 | 1,590 | 1200 | 12.02 | 18,100 |
| 1200 | 10.12 | 223 | Jan. 18 | | | 1800 | 12.22 | 21,000 |
| 1500 | 10.41 | 1,540 | 1200 | 10.33 | 1,100 | 2000 | 12.57 | 26,200 |
| 2000 | 10.46 | 1,870 | 1600 | 10.39 | 1,440 | 2200 | 13.36 | 39,700 |
| 2400 | 10.41 | 1,540 | 1800 | 10.76 | 4,050 | 2400 | 13.97 | 51,500 |
| Dec. 20 | | | 2000 | 12.59 | 26,500 | Mar. 30 | | |
| 0200 | 10.54 | 2,340 | 2200 | 14.01 | 52,300 | 0400 | 14.27 | 57,700 |

(154) 09519500 Gila River below Gillespie Dam, Ariz.—Continued

Gage height, in feet, and discharge, in cubic feet per second, at indicated time, 1978

| Hour | Gage height | Discharge | Hour | Gage height | Discharge | Hour | Gage height | Discharge |
|---|---|---|---|---|---|---|---|---|
| Dec. 20—Con. | | | Jan. 18—Con. | | | Mar. 30—Con. | | |
| 0300 | 11.34 | 9,650 | 2400 | 14.55 | 63,500 | 0430 | 14.38 | 59,900 |
| 0400 | 14.95 | 72,300 | Jan. 19 | | | 0600 | 14.35 | 59,300 |
| 0500 | 16.01 | 97,500 | 0200 | 14.91 | 71,500 | 0800 | 14.32 | 58,700 |
| 0800 | 16.88 | 120,000 | 0400 | 15.03 | 74,100 | 1200 | 14.24 | 57,100 |
| 1100 | 16.98 | 123,000 | 0600 | 15.15 | 76,800 | 1800 | 14.03 | 52,700 |
| 1300 | 16.93 | 122,000 | 0800 | 15.17 | 77,300 | 2400 | 13.52 | 42,800 |
| 1400 | 17.06 | 125,000 | 1200 | 15.27 | 79,600 | Mar. 31 | | |
| 1600 | 16.99 | 123,000 | 1400 | 15.34 | 81,200 | 0400 | 13.33 | 39,200 |
| 1900 | 16.65 | 114,000 | 1830 | 15.56 | 86,600 | 0800 | 13.40 | 40,400 |
| 2400 | 15.90 | 94,800 | 2000 | 15.52 | 85,200 | 1200 | 13.69 | 45,900 |
| Dec. 21 | | | 2400 | 15.44 | 83,500 | 1600 | 13.93 | 50,700 |
| 0600 | 15.47 | 84,200 | Jan. 20 | | | 2000 | 13.97 | 51,500 |
| 1200 | 15.24 | 78,900 | 0600 | 15.18 | 77,500 | 2400 | 13.97 | 51,500 |
| 1800 | 14.65 | 65,600 | 1200 | 15.02 | 73,900 | | | |
| 2400 | 14.37 | 59,700 | 1800 | 14.74 | 67,500 | Apr. 1 | | |
| Dec. 22 | | | 2400 | 14.57 | 63,900 | 0600 | 13.65 | 45,200 |
| 0600 | 14.23 | 56,600 | Jan. 21 | | | 0900 | 13.38 | 40,000 |
| 1200 | 14.16 | 55,200 | 1200 | 14.37 | 59,700 | 1200 | 13.18 | 36,400 |
| 1800 | 13.89 | 49,900 | 2400 | 14.16 | 55,200 | 1800 | 12.95 | 32,600 |
| 2400 | 13.48 | 41,900 | Jan. 22 | | | 2400 | 12.67 | 27,900 |
| Dec. 23 | | | 1200 | 13.65 | 45,200 | Apr. 2 | | |
| 0500 | 13.36 | 39,700 | 2400 | 13.28 | 38,300 | 1200 | 12.37 | 23,200 |
| 1700 | 13.72 | 46,500 | Jan. 23 | | | 2400 | 11.95 | 17,200 |
| 2400 | 13.59 | 44,100 | 1200 | 12.80 | 30,000 | | | |
| Dec. 24 | | | 2400 | 12.57 | 26,200 | Apr. 3 | | |
| 1200 | 13.35 | 39,600 | Mar. 28 | | | 1200 | 11.58 | 12,400 |
| 2400 | 12.78 | 29,500 | 2400 | 11.83 | 15,500 | 2400 | 11.34 | 9,700 |

(155) Painted Rock Reservoir at Painted Rock Dam, Ariz.

Location.--Lat 33°04'30", long 113°00'50", in SE¼ sec.18, T.4 S., R.7 W., Maricopa County, Hydrologic Unit 15070201, at Painted Rock Dam, 19 mi (31 km) northeast of Sentinel.

Drainage area.--50,910 mi² (131,860 km²), approximately.

Gage-height record.--Water-stage recorder graph. Record furnished by U.S. Army Corps of Engineers, Los Angeles District. Datum of gage is 0.0 ft (0.0 m) National Geodetic Vertical Datum of 1929.

Reservoir-contents record.--Capacity table furnished by U.S. Army Corps of Engineers, Los Angeles District.

Maxima.--November 1978 to April 1979: Contents, 1,616,000 acre-ft (1,992.5 hm³) Apr. 17, 1979, gage height, 642.35 ft (195.788 m).

1959 to October 1978: Contents, 439,860 acre-ft (542 hm³) May 21, 1973, gage height, 601.25 ft (183.261 m).

Remarks.--Flood control reservoir is formed by earthfill dam completed in 1959, capacity 2,492,000 acre-ft (3,070 hm³). Last water from floods of November 1978 to March 1979 was released in January 1980.

(156) 09519800 Gila River below Painted Rock Dam, Ariz.

Location.--Lat 33°04'30", long 113°00'50", in SE¼ sec.18, T.4 S., R.7 W., Maricopa County, Hydrologic Unit 15070201, on left bank 0.3 mi (0.5 km) downstream from Painted Rock Dam, and 19 mi (31 km) northeast of Sentinel.

Drainage area.--50,910 $mi^2$ (131,860 $km^2$), approximately.

Gage-height record.--Water-stage recorder graph. Datum of gage is 518.69 ft (158.097 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers).

Discharge records.--Stage-discharge relation defined by current-meter measurements.

Maxima.--November 1978 to March 1979: Discharge, 3,340 $ft^3/s$ (94.6 $m^3/s$) 0800 hours Feb. 9, gage height, 10.57 ft (3.222 m).
1959 to October 1978: Discharge, 2,860 $ft^3/s$ (81.0 $m^3/s$) Apr. 5, 1973, gage height, 10.29 ft (3.136 m).

Remarks.--Flow regulated by Painted Rock Reservoir since 1959 (capacity 2,492,000 acre-ft or 3,070 $hm^3$). Release of water from the flood began Dec. 22, 1978, and continued into January 1980. Daily discharges ranged from 1,200 to 5,020 $ft^3/s$ (34 to 142 $m^3/s$) and were generally in the range from 2,000 to 3,000 $ft^3/s$ (57 to 85 $m^3/s$). See U.S. Geological Survey Water Resources Data for Arizona, 1979 water year and 1980 water year.

(157) 09520360 Gila River near Mohawk, Ariz.

Location.--Lat 32°47'18", long 113°45'48", on section line between secs.25 and 26, T.7 S., R.15 W., Yuma County, Hydrologic Unit 15070201, in center of channel, 70 ft (21 m) upstream from Avenue 51E, and 4.0 mi (6.4 km) north of Mohawk.

Drainage area.--55,430 $mi^2$ (143,560 $km^2$).

Gage-height record.--Water-stage recorder. Altitude of gage is 300 ft (91.4 m), revised, from topographic map.

Maxima.--November 1978 to March 1979: Daily discharge, 2,430 $ft^3/s$ (68.8 $m^3/s$) Mar. 21.
1973 to October 1978: Discharge, 1,730 $ft^3/s$ (49.0 $m^3/s$) June 2, 1973, gage height, 7.44 ft (2.268. m).

Remarks.--Records fair. Flow regulated by Painted Rock Dam (see Remarks for sta 09519800).

(158) 09520500 Gila River near Dome, Ariz.

Location.--Lat 32°45'39", long 114°25'11", in SW¼ sec.4, T.8 S., R.21 W., Yuma County, Hydrologic Unit 15070201, on right bank 440 ft (134 m) upstream from McPhal bridge on old route of State Highway 95, 3 mi (5 km) west of Dome, and 12 mi (19 km) upstream from mouth.

Drainage area.--57,850 $mi^2$ (149,800 $km^2$), approximately—includes 373 $mi^2$ (966 $km^2$) in Aubrey Valley Playa, a closed basin, but excludes all other closed basins.

Gage-height record.--Water-stage recorder. Datum of gage is 139.18 ft (42.422 m) National Geodetic Vertical Datum of 1929.

(158) 09520500 Gila River near Dome, Ariz.—Continued

Maxima.--November 1978 to March 1979: Daily discharge, 2,360 $ft^3/s$ (66.8 $m^3/s$) Mar. 25. Maximum due to releases from dam is 1,380 $ft^3/s$ (39.1 $m^3/s$) in 1973.

1903 to 1929: Maximum daily discharge about 200,000 $ft^3/s$ (5,700 $m^3/s$) Jan. 22, 1916.

1929 to 1959: Maximum discharge, 20,700 $ft^3/s$ (586 $m^3/s$) Feb. 15, 1932, gage height, 16.75 ft (5.105 ).

1959 to 1981: Maximum discharge, 4,820 $ft^3/s$ (137 $m^3/s$) Sept. 18, 1963, gage height, 16.20 ft (4.938 m), result of tributary inflow below Painted Rock Dam.

Remarks.--Many diversions above station for irrigation. Flow above station regulated by several reservoirs on Gila, Salt, Verde and Agua Fria Rivers (see Remarks for sta 09519500 and 09519800).

(159) 09520700 Gila River near mouth, near Yuma, Ariz.

Location.--Lat 32°42'38", long 114°33'06", in NW¼NE¼ sec.30, T.8 S., R.22 W., Yuma County, Hydrologic Unit 15070201, on left bank just upstream from South Gila Pump Outlet Channel No. 1, 0.6 mi (1.0 km) upstream from mouth, and 4 mi (6 km) east of Yuma.

Drainage area.--57,950 $mi^2$ (150,090 $km^2$), approximately.

Gage-height record.--Water-stage recorder and weir. Datum of gage is 122.01 ft (37.189 m) U.S. Bureau of Reclamation datum.

Maxima.--November 1978 to March 1979: Daily discharge, 2,040 $ft^3/s$ (57.8 $m^3/s$) Mar. 29.

1975 to October 1978: Daily discharge, 757 $ft^3/s$ (21.4 $m^3/s$) Sept. 11, 1977.

Remarks.--Flow regulated by Painted Rock Reservoir (see sta 09519800). Record includes flow of South Gila Pump Outlet Channel No. 1.

# SUMMARY

Severe flooding occurred December 18-20, 1978, in central Arizona and west-central New Mexico as a result of as much as 10 in. of warm rain on a snowpack of moderate depth. The December 17-20 rainfall followed a period of above-average runoff in November 1978. Lesser floods occurred in November 1978 and January and March 1979.

In December 1978 flooding occurred at Winslow, Ariz., where the Little Colorado River was the highest in nearly 30 years. The flood on the Gila River upstream from San Francisco River was the highest since at least 1891 and probably many years earlier. Downstream from the San Francisco River, the peak discharge of 100,000 $ft^3/s$ is the highest since 1916 and is about equal to four peaks that occurred between 1891 and 1916. The flood that occurred upstream from the San Francisco River in December 1978 originated mainly in the West and Middle Forks Gila River and in tributaries to the Gila River between Gila Hot Springs, N. Mex., and Redrock, N. Mex. In New Mexico the flood was at least 3 ft above the previous known maximum stages that occurred in 1941 and 1972. The flood inundated Duncan, Ariz., to a depth of 7 ft and caused severe agricultural losses in Virden Valley of New Mexico and Duncan, York, and Safford Valleys of Arizona. At Clifton, Ariz., the San Francisco River was from 0.8 to 3.5 ft lower than in October 1972; however, Eagle Creek was higher than in 1972. Extreme amounts of runoff came from Marijilda and Deadman Creeks, which drain the Pinaleno Mountains south of Safford.

As the peak on the Gila River moved downstream through west-central New Mexico, the peak discharge increased and the duration of the crest became shorter. Although the possibility of a debris dam in Gila Middle Box cannot be completely ruled out, changes in the hydrograph appear to be due entirely to inflow and changes in channel conditions. The peak moved from Redrock, N. Mex., to Duncan, Ariz., in about 6 hours. Average traveltime in this reach for other floods differs with the discharge at Redrock and is about 5 hours for discharges of 40,000 to 50,000 $ft^3/s$ and about 14 hours for discharges of 10,000 $ft^3/s$. Average traveltime for floodwaves moving from Clifton to Safford is 8 to 10 hours.

Flooding occurred in the Phoenix area where the discharge of the Salt River was about equal to the discharge of March 1978. Peak discharges of March and December 1978 were the highest since 1920. The Agua Fria River had the highest peak since 1919. The flooding occurred because the unusually large volume of inflow could not be contained in water-conservation reservoirs on the Salt, Verde, and Agua Fria Rivers. The reservoirs already contained above-average storage for that time of year because of a large carryover storage from the 1978 water-use season and above-average runoff in November 1978. The volume of inflow to reservoirs on the Salt, Verde, and Agua Fria Rivers was high, but in most years, unfilled storage capacity in the reservoirs would have been adequate to allow all inflow during the 3 days of maximum discharge to be retained in the reservoirs.

Floodwater reached Phoenix about 8 hours after the main release began from Bartlett Dam and reached Gillespie Dam 32 hours later. The crest traveled from Granite Reef Dam to Jointhead Dam in about 8 hours.

The flood caused 12 deaths and between $150 million and $200 million in damage of which $51.8 million occurred in Maricopa County and $40 million occurred in the Gila River basin above San Carlos Reservoir. Along most of the rivers in the flood area, ground-water levels rose several feet from spring of 1978 to spring of 1979.

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ARIZONA, 1974 AND NEW MEXICO, 1968

EXPLANATION

▲91 STREAMFLOW-MEASURING SITE—Number, 91, refers to table 10 and station data

10 0 10 20 30 40 50 MILES
10 0 10 20 30 40 50 60 70 80 KILOMETERS

SITES WHERE STREAMFLOW DATA WERE COLLECTED IN ARIZONA AND NEW MEXICO

BASE FROM U.S. GEOLOGICAL SURVEY
STATE BASE MAPS, 1:1,000,000,
ARIZONA, 1974 AND NEW MEXICO, 1968

EXPLANATION

◆ 63 / 4.8 — CLIMATOLOGICAL STATION—Upper number, 63, refers to table 2 or table 3. Lower number, 4.8, is precipitation, in inches, December 17-20, 1978

4 — LINE OF EQUAL PRECIPITATION—December 17-20, 1978. Approximately located. Interval, 1 inch. Hachure line indicates depression

HIGH-ELEVATION AREA—Precipitation was probably considerably greater than indicated isohyet

10 0 10 20 30 40 50 MILES
10 0 10 20 30 40 50 60 70 80 KILOMETERS

PRECIPITATION DURING FLOOD OF DECEMBER 17-20, 1978.