WATER RESOURCES OF THE BARONA, CAPITAN GRANDE, AND SYCUAN INDIAN RESERVATIONS SAN DIEGO COUNTY, CALIFORNIA

U.S. GEOLOGICAL SURVEY

Open-File Report 77-289

PREPARED IN COOPERATION WITH THE
U.S. BUREAU OF INDIAN AFFAIRS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES OF THE BARONA, CAPITAN GRANDE, AND SYCUAN INDIAN RESERVATIONS, SAN DIEGO COUNTY, CALIFORNIA

By W. R. Moyle, Jr., and R. L. Blazs

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CONTENTS

ILLUSTRATIONS

TABLES

CONVERSION FACTORS

For readers who may prefer to use metric units rather than English units, the conversion factors for the terms used in this report are listed below.

Multiply English unit	*By*	*To obtain metric unit*
acres	4.047×10^{-3}	square kilometers
acre-ft (acre-feet)	1.233×10^{3}	cubic meters
ft (feet)	3.048×10^{-1}	meters
ft^3/s (cubic feet per second)	2.832×10^{-2}	cubic meters per second
gal/d (gallons per day)	3.785×10^{-3}	cubic meters per day
gal/min (gallons per minute)	6.309×10^{-2}	liters per second
in (inches)	2.540×10	millimeters
mi (miles)	1.609	kilometers
mi^2 (square miles)	2.590	square kilometers

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ABSTRACT

The Barona and Capitan Grande Indian Reservations have sufficient water to satisfy present (1976) domestic and stock needs; however, the Sycuan Indian Reservation is experiencing a shortage of water for domestic supply because of the decline of the water table beneath the reservation well field and a general decline of the water table surrounding the reservation. Drilling a test well on the main branch of the Sweetwater River channel on the reservation would help to determine if sufficient water can be obtained to satisfy the domestic needs of the reservation.

The water quality on the three reservations is generally good; however, the water is at or near land surface in several areas. This shallow water could be subject to contamination by animal waste, septic tanks, or farming operations. Sampling the water periodically for chemical analysis would determine if any chemical changes are occurring. Because of the nature of the possible contaminants, the presence of nitrate in the water warrants particular attention. Periodic sampling for determination of the presence of coliform organisms would also be indicated.

INTRODUCTION

The Capitan Grande and Sycuan Indian Reservations in San Diego County, Calif. (fig. 1), were established by Executive Order December 27, 1875. At inception, the Capitan Grande Reservation consisted of 14,293.31 acres, or 22.33 mi^2, and the Sycuan Reservation of approximately 640 acres, or 1 mi^2. The Sycuan Reservation was patented to the Indians February 10, 1893. In 1894 the best lands on the reservation were subdivided into 17 allotments, and in 1897 these allotments were patented to the individual tribal members. Although the boundary of the Sycuan Reservation has remained the same, the boundary of the Capitan Grande Reservation has changed significantly.

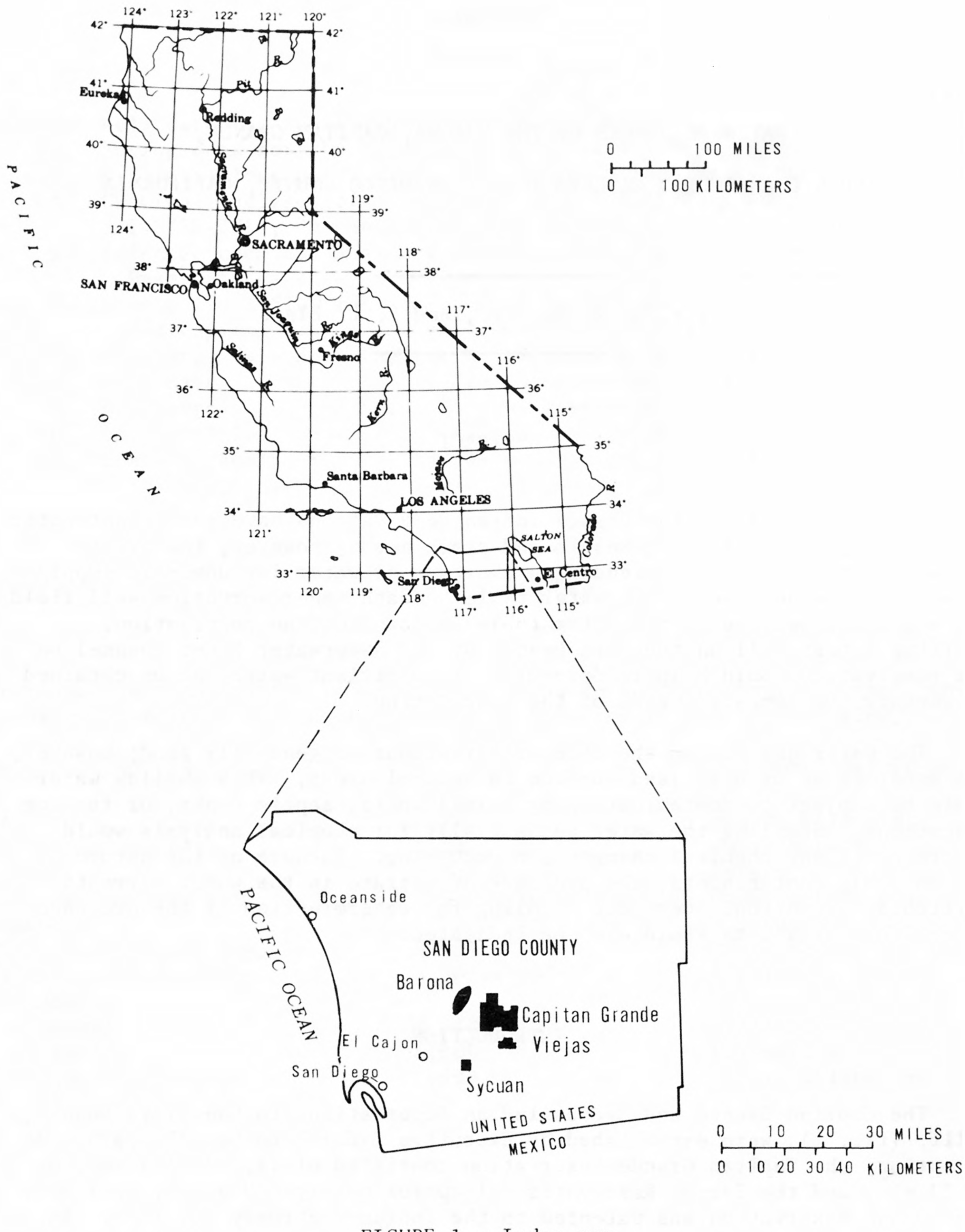


FIGURE 1.--Index map.

The city of San Diego wanted part of the San Diego River valley on the Capitan Grande Reservation for a reservoir. Negotiations to purchase the Indian lands and water rights along the river started in 1919. Final payment of $396,995.20 was made February 14, 1934. The funds were used to purchase the Barona and Baron Long Ranches and to relocate the Indians. Those ranches are now known as the Barona and Viejas Indian Reservations. At the present time (1976), the Capitan Grande Reservation consists of 15,753.4 acres, or 24.6 mi^2. The Barona Ranch officially became the Barona Indian Reservation June 11, 1932, and consists of about 5,120 acres, or 8 mi^2.

Most of the data shown above were obtained from the U.S. Bureau of Indian Affairs.

PURPOSE AND SCOPE

The purpose of this investigation, made in cooperation with the U.S. Bureau of Indian Affairs, was to collect and evaluate water-resources data for the Barona, Capitan Grande, and Sycuan Indian Reservations and to write a report tabulating the data and summarizing the findings.

This information is needed by the Bureau to develop plans for facilities that may improve the economy and living conditions on the reservations. Further, the Sycuan Indian Reservation is presently experiencing a shortage of domestic water supply.

The scope included collecting historical hydrologic data from government agencies and private individuals and visiting all wells and springs on the reservations. This report summarizes the data collected and the findings of the study.

ACKNOWLEDGMENTS

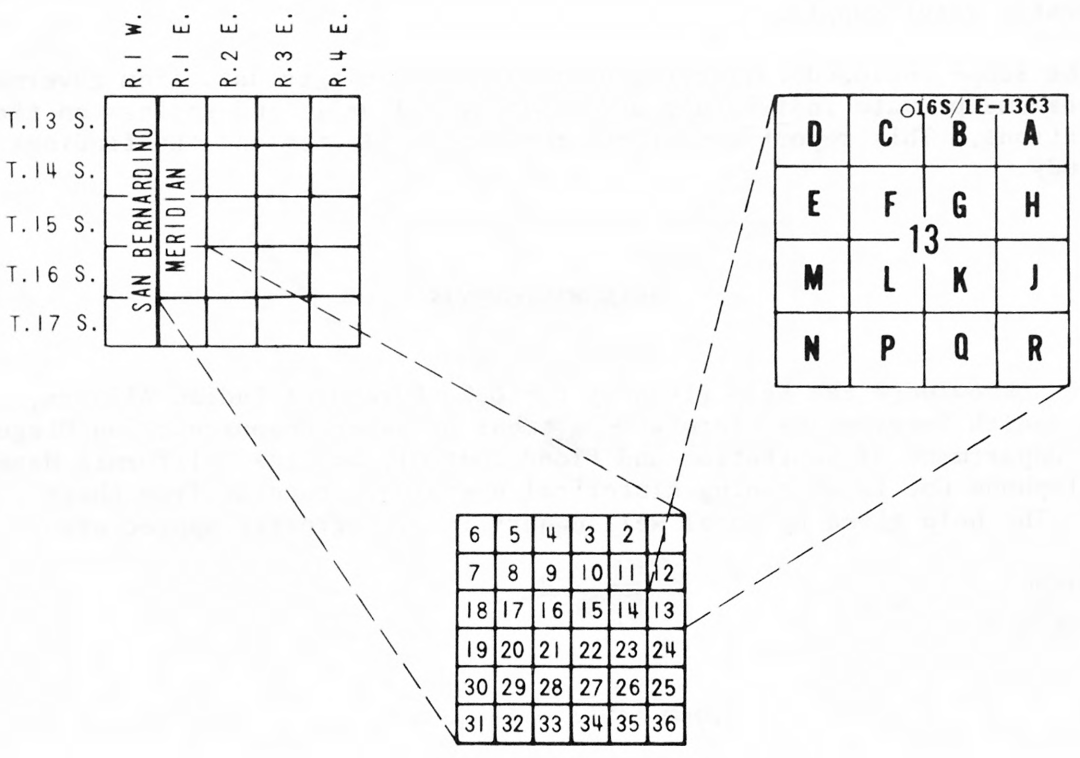
We acknowledge the help given by the U.S. Bureau of Indian Affairs, Indian Health Service; California Department of Water Resources; San Diego County Department of Sanitation and Flood Control; and the California Water and Telephone Co. in obtaining historical hydrologic records from their files. The help given by local well owners is also greatly appreciated.

WELL- AND SPRING-NUMBERING SYSTEM

Wells are numbered according to their location in the rectangular system for subdivision of public land. For example, in the well number 16S/1E-13C3 that part of the number preceding the slash indicates the township (T. 16 S.); the number and letter following the slash indicate the range (R. 1 E.); the number following the dash indicates the section (sec. 13); the letter after the section number indicates the 40-acre subdivision of the section according to the lettered diagram below. The final digit is a serial number for wells in each 40-acre subdivision. The area lies entirely in the southeast quadrant of the San Bernardino base line and meridian.

Springs are numbered similar to wells except that an S is placed between the 40-acre letter and the final digit (as in 14S/1E-1LS1).

The Barona Reservation was formerly part of the Barona Ranch, which was a Spanish land grant. Many Spanish land grants in California have not been subdivided into sections. Within the present boundary of the Barona Indian Reservation there is only one section line; therefore projected section lines (dashed lines) were added to the base map (pl. 1) to determine well numbers to be used on reservation wells and springs.



BARONA INDIAN RESERVATION

Location and General Features

The Barona Indian Reservation (pl. 1) is in San Diego County, about 25 mi northeast of the city of San Diego and 30 mi north of the United States boundary with Mexico. The reservation consists of flat valley land and rolling hills surrounded by steep mountain peaks.

The altitude of land surface on the reservation ranges from about 1,300 ft above sea level on Padre Barona Creek at the west edge of the reservation boundary to 2,520 ft on the isolated 40-acre plot in sec. 7, T. 14 S., R. 2 E.

The principal use of reservation lands other than for homes is for grazing livestock. About 300 head of cattle and horses were reported to be on the reservation during the spring of 1976. In addition, small business enterprises on the reservation include an automobile-dismantling yard and Indian jewelry sales.

Hydrology

Average precipitation on the Barona Indian Reservation ranges from 16 to 20 in per year (Ellis and Lee, 1919, pl. 15) depending on the altitude of the area. The reservation contains only 8 mi^2; however, the flow from Padre Barona Creek is derived from precipitation on the approximately 18 mi^2 of area within the drainage basin on and surrounding the reservation.

The reservation is near the eastern boundary of the surface-water drainage basin, and all surface water flows from east to west across the reservation into San Vicente Reservoir (west of pl. 1).

Surface-water outflow from Barona Valley occurs in Padre Barona Creek in sec. 21, T. 14 S., R. 1 E., near surface-water measuring site 1 (pl. 1). On April 7, 1976, a flow of 0.035 ft^3/s or 15.7 gal/min was measured at site 1 with a 3-in venturi flume. If this flow is considered to be base flow (a tribal official said there is little variation throughout the year), then at least 25 acre-ft of water per year crosses the reservation boundary and is impounded in a small lake just west of the reservation boundary.

Ground water beneath the reservation moves from the east toward the west. As shown by the well and spring data (tables 1 and 2), water is at or near land surface in many areas on the reservation. In some areas ground water seeps onto the land surface and collects in small streams. The area of this seepage is called the sphere of discharge. This shallow water subirrigates the grass that supplies a great deal of food for grazing livestock. Heavy pumping in these areas of subirrigation would lower the water table, and the grass would probably die from lack of water. No crops were irrigated on the reservation during spring 1976.

The thickness of the alluvial deposits in Barona Valley ranges from almost nothing to about 50 ft. Drillers' logs of wells on the Barona Indian Reservation are included in table 3.

Wells with the largest yields penetrate and are perforated throughout the entire saturated alluvial thickness of the aquifer. Wells that penetrate about 50 ft of saturated alluvium generally produce about 100 gal/min of water for periods of sustained pumping. Granitic rocks underlie the alluvial fill in Barona Valley and the stream channels on the reservation. The quantity of water that can be obtained from these granitic rocks is directly related to the number of fractures penetrated when the well is drilled. Normally, the yield is less than 20 gal/min, and in many wells it may be less than 1 gal/min, as indicated by logs of wells near the reservation.

The chemical quality of water on the reservation is good in most places as indicated by the data in tables 4 and 5. Chemical analyses previously available for two wells (table 4) were supplemented by measurement of the specific electrical conductance of water at all wells, the springs, and at the surface-water site (table 5). According to Hem (1959, p. 40), the specific conductance (in micromhos) multiplied by a factor that ranges from 0.55 to 0.75 indicates the dissolved-solids concentration of the water (in milligrams per liter). For this study a factor of 0.6 was used, based on about 50 chemical analyses of water from wells that are outside the reservation.

One specific-conductance measurement of water in well 14S/1E-22H1 was 3,400 μmhos/cm (micromhos per centimeter at 25°C). This indicates a dissolved-solids concentration of about 2,000 mg/L (milligrams per liter). The U.S. Environmental Protection Agency (1972) recommended 500 mg/L or less for drinking water for human consumption. Livestock can tolerate higher dissolved solids than humans in their drinking water. The high dissolved-solids concentration in water from this uncapped well may be due to foreign material in the well or to the well not being pumped since it was drilled in 1960. The well did not have a pump when visited.

The specific conductance measured at surface-water site 1 April 7, 1976, was 1,010 μmhos/cm, and the water temperature was 14°C (Celsius). The approximate dissolved-solids concentration of the surface water was 600 mg/L.

One of the samples for which a chemical analysis was available contained 43 mg/L nitrate (NO_3). This is only 1 mg/L below the recommended upper limit for drinking water set by the U.S. Environmental Protection Agency (1972). Because of the presence of this high nitrate in the analysis, several water samples from secs. 21, 22, and 23 in Barona Valley were analyzed for nitrate. These analyses showed the nitrate was 15 mg/L or less (tables 4 and 5).

High concentrations of nitrate are frequently found in shallow wells on farms in a rural environment. These high concentrations are often the result of inadequate protection from barnyard drainage and septic tanks, especially where the water table is near land surface. According to the U.S. Environmental Protection Agency (1972), high-nitrate concentrations may cause the development of methemoglobinemia in infants under 3 months of age. The disease is dependent upon the bacterial conversion of the relatively innocuous nitrate (NO_3^-) ion to nitrite (NO_2^-). Nitrite is absorbed into the blood stream and converts hemoglobin to methemoglobin. The altered pigment can then no longer transport oxygen, and the clinical effect of methemoglobinemia is that of oxygen deprivation or suffocation.

Conclusions

The reservation seems to have an adequate water supply for domestic use, grazing cattle, and some light irrigation. Any attempt to irrigate large acreage on the reservation by wells may be detrimental to the naturally subirrigated land in Barona Valley depending on the location of the pumping wells. One of the possibilities for irrigation may be the capture of surface water leaving the reservation at Padre Barona Creek and pumping it back upstream into the valley.

The water quality on the reservation is generally good but it may change in the future because of livestock pens and septic tanks located in areas where ground water is at or near land surface. If samples of water are collected and analyzed for water quality, they should be analyzed for nitrate, dissolved solids, and coliform bacteria as a minimum.

CAPITAN GRANDE INDIAN RESERVATION

Location and General Features

The Capitan Grande Indian Reservation (pl. 2) is predominantly in steep mountainous terrain surrounding the relatively small Conejos Valley and the San Diego River valley. The reservation, entirely surrounded by the Cleveland National Forest, is about 28 mi northeast of San Diego and about 20 mi north of the United States boundary with Mexico. The terrain ranges in altitude from 750 ft above sea level at El Capitan Reservoir on the west edge of the reservation to 3,538 ft on top of a peak near the east edge of the reservation. On the reservation the predominantly steep, one-lane, dirt roads in some areas have been deeply eroded because of runoff from precipitation. The roads are few, and many are a long distance from the stream channels that may contain flowing water. In some instances heavy brush would not allow access to measure flow in the streams; however, flowing water could be seen through fieldglasses.

No one lives on the reservation at present, and probably no wells have been drilled within the present-day boundary of the reservation.

Hydrology

According to Ellis and Lee (1919, pl. 15) precipitation on the reservation ranges from 18 to 26 in depending on the altitude. All precipitation on the reservation flows into El Capitan Reservoir on the San Diego River drainage. Nearly all water in El Capitan Reservoir has flowed across the boundary of the Capitan Grande Indian Reservation except for rain that has fallen directly on the reservoir.

The geology of the Capitan Grande Indian Reservation is simple as shown by Weber (1963, pl. 1). The valley floor in Conejos Valley, the San Diego River channel, Boulder Creek, and Sand Creek has a thin layer of alluvial material lying on granitic rocks at a shallow depth. The thickness of the alluvium beneath the San Diego River channel within the present reservation boundary is probably less than 100 ft. The alluvium beneath the other stream channels on the reservation is probably thinner. Because of the shallow depth to consolidated rock, many of the streams are perennial on the reservation. Other streams cease surface flow where the alluvial fill is thick enough to intercept the flow or where trees and plants use up the available water by transpiration.

The five major stream channels that contribute surface-water flow into El Capitan Reservoir are the San Diego River, Conejos Creek, King Creek, Sand Creek, and Boulder Creek. Surface-water flow was observed or measured at seven locations in 1976 as shown on plate 2 (labeled 1-7) and listed in table 6. The largest flow in April 1976 was in the San Diego River near the north edge of the reservation. The largest flow across the reservation in April 1976 was the combined flow at sites 6 and 7 of about 9.2 ft^3/s or 4,100 gal/min. The combined flow of Conejos and King Creeks was about 0.16 ft^3/s or 72 gal/min, and the flow of Sand Creek was about 0.002 ft^3/s or 0.9 gal/min.

Streamflow was measured at locations labeled 8-10 on plate 2 at various times between October 1912 and September 1926. Data on these stations are listed in table 7, and the entire record is published by the U.S. Geological Survey (1960) in Water-Supply Paper 1315-B, pages 495-497. The largest reported daily surface-water flow occurred January 27 and 28, 1916. These data show that the maximum daily discharge of Boulder Creek at location 8 (pl. 2) was about 3,000 ft^3/s or 5,950 acre-ft per day January 27, 1916; the San Diego River at location 9 (pl. 2) was 15,800 ft^3/s or 31,340 acre-ft per day January 28, 1916; and Conejos Creek at location 10 (pl. 2) was 242 ft^3/s

or 480 acre-ft per day February 11, 1915. No measurements were made at location 10 during the 1916 flood. The data also show that at times there is no flow in some of the stream channels.

The specific conductance of the water was measured at each surface-water measuring site and these data are listed in table 6. The specific conductance ranged from 360 to 1,280 μmhos/cm, indicating a dissolved-solids concentration between 220 and 770 mg/L, which will probably be chemically acceptable for all uses on the reservation. Upon leaving the reservation, this water enters El Capitan Reservoir and is used by the city of San Diego as a public water supply. Measurements on El Capitan Reservoir have been made since October 1936 and are published annually by the U.S. Geological Survey (see Selected References).

Conclusions

Surface water can be obtained in several places on the reservation; however, the flow varies depending upon time of year, location, altitude, temperature, precipitation, and transpiration by plants along the stream channels.

According to the Bureau of Indian Affairs, some of the water rights formerly held by the Capitan Grande Band of Mission Indians along the San Diego River were sold with the land to the city of San Diego. The water rights on and beneath the San Diego River in sec. 11, T. 14 S., R. 2 E., however, were retained. This area has the largest quantity of surface-water flow on the reservation.

Wells can be drilled along many of the stream channels and will produce water even when the streams have ceased flowing. For instance, wells could be drilled in Conejos Valley between surface water sites 3 and 4 (pl. 2). The dry channel in sec. 32, T. 14 S., R. 3 E., indicates that the alluvium may be relatively thick compared to areas to the west and east and probably contains ground water in storage.

Another possibility for obtaining water is to build a small dam on Conejos Creek near the intersection of King and Conejos Creeks. This would slow down the surface-water outflow from Conejos Valley and form a small lake.

The chemical quality of the water on all parts of the reservation is probably adequate for potential reservation uses. The water that leaves the reservation flows into El Capitan Reservoir and is used by the city of San Diego for a public water supply.

SYCUAN INDIAN RESERVATION

Location and General Features

The Sycuan Indian Reservation (pl. 3) consists of mountainous terrain between two stream channels in sec. 13, T. 16 S., R. 1 E. The reservation is about 20 mi northeast of San Diego and 16 mi north of the United States boundary with Mexico. North Fork, which crosses from the north-central part to the southwestern part of the reservation, is a small, normally dry stream channel tributary to the Sweetwater River. This channel has a surface altitude of 520 ft above sea level where it crosses the southwest boundary of the reservation. This is the lowest altitude of land surface on the reservation. The highest altitude is 1,480 ft on a ridge in the southeastern part of the reservation.

Access to the reservation is from Dehesa Road over a 0.35-mi long graded dirt road. It is reported that 7 Indian families and 1 non-Indian family, which total 42 people, are presently living on the reservation. All water used by these families is obtained from well 16S/1E-13C3 (table 8). In addition to the domestic use of water, a small grove of trees near the church is being irrigated. The only commercial endeavor on the reservation is a racetrack for motorcycles.

Hydrology

All ground water beneath the Sycuan Indian Reservation and all surface water that flows down the Sweetwater River and North Fork channels is derived from precipitation. The total area within the drainage divide above the reservation on North Fork is about 8 mi^2. Rainfall on and adjacent to the reservation is 16 in per year according to Ellis and Lee (1919, pl. 15). This means that approximately 6,800 acre-ft of precipitation falls on the 8 mi^2 upstream from the reservation. Transpiration by vegetation and runoff of streamflow use about 95 percent of the available rain according to Blaney (1954). This leaves 5 percent, or about 340 acre-ft, available for recharge to ground water.

The Sweetwater River is the main channel for surface-water flow in the area. Above the reservation, the Sweetwater River drainage area is 98.1 mi^2 (table 9); however, Loveland Reservoir impounds most of the runoff behind the Sweetwater Falls Dam, which is about 2 mi east of the reservation (off pl. 3). Two surface-water gaging stations were operated between the reservation and the dam in the past. One station was at the dam, and the other was 1.25 mi above the reservation boundary.

The data from these gaging stations show that 34,300 acre-ft of water flowed down the Sweetwater River during the 1915 water year[1] (table 9). The data also show that 24,300 ft^3/s flowed in the Sweetwater channel January 27, 1916. The channel was dry, however, at test well site 1 (pl. 3) June 1, 1976.

Periodic releases of water from Loveland Reservoir down the Sweetwater River recharge the ground water through the stream channel, which traverses reservation property for only 900 ft.

The water needs of the reservation for domestic purposes, however, are obtained from the well field along the North Fork and are estimated by the Bureau of Indian Affairs at 125 gal/d per person. This amounts to about 5.9 acre-ft of water per year for the present reservation population, or 1 percent of the yearly ground-water recharge along North Fork. The reservation well must produce 3.6 gal/min continuously to pump this quantity of water. Table 8 shows that production of water from wells in the reservation well field has decreased from 70 gal/min in 1939 to 20 gal/min in 1976 because of the decline of the water table. If the water table continues to decline, it may cause a serious water shortage for the tribe. At present, no development can be started on the reservation unless additional water is found.

The water-level measurements listed in table 8 indicate that the water table fluctuates in response to pumping from wells and recharge from precipitation. Table 10 shows drillers' logs of wells on the reservation. The water level in well 16S/1E-13C1 was 1 ft below land surface in January 1939 (table 8). This shallow depth to water was probably the result of the March 2, 1938, flood that caused flooding throughout southern California.

This well produced about 70 gal/min when the water level was near land surface. As the water level declined, the well produced less water because of a smaller saturated thickness of aquifer at the well. The alluvial deposits beneath well 13C1 are only 26 ft thick. Below these sediments are fractured granitic rocks. When the static water level is below the bottom of the alluvium in the granitic rock, the well will produce less than 20 gal/min. Large-production wells cannot be drilled on the reservation because of the lack of alluvial fill and ground-water storage.

Where the Sweetwater River channel crosses the reservation boundary, the alluvium is probably less than 50 ft thick and the depth to water is probably only a few feet below the surface near the channel. A well near proposed test well site 1 (pl. 3) may supply additional water for the reservation. The well, however, would be subject to the type of flooding that has occurred regionally in 1916, 1938, and 1969, or could be destroyed by future large floods.

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[1]The water year is the 12-month period ending September 30 and is designated by the calendar year in which it ends.

The chemical quality of water from wells on and around the reservation seems to be excellent at the present time as shown by the chemical data in table 11. All individual constituents analyzed are below the recommended limits set by the U.S. Environmental Protection Agency (1972) for drinking water.

A future problem may be the deterioration of the ground water on North Fork. The data show that the water levels are declining because of water withdrawals. The data also show that the thickness of the alluvial deposits is small. As the number of people and farm animals increase in the area, the demand on ground water will increase.

Water seeping from septic tanks and runoff across pastures will tend to increase the dissolved solids in the ground water. As the percentage of return water increases with relation to the quantity of ground water in storage, the water will deteriorate in quality.

Conclusions

Large-capacity wells cannot be drilled on the Sycuan Indian Reservation because of the thinness of saturated alluvial fill. The alluvial fill at the reservation well field is 26 ft thick. The static water level declined from 1 ft below land surface to 26 ft below land surface between 1939 and 1976. Because of this, yield has dropped from 70 gal/min to less than 20 gal/min. Drilling several small-capacity wells would not be sufficient for a large-scale irrigation project on the reservation.

A test well drilled (pl. 3) in the southeast corner of the reservation in the Sweetwater River channel would assess the feasibility of providing an additional supply of domestic water for the reservation. If test drilling shows an adequate supply of water, a pipeline could be built to lift the water about 400 ft up the hill to the north and follow land-surface contours around the hill. Water could then flow by gravity to all the homes on the reservation.

If there is insufficient water at the test well site, water could possibly be piped in from Loveland Reservoir, which is about 2 mi east of the reservation (off pl. 3).

The data indicate that the mineral content of the local ground-water supply is excellent for most purposes at the present time (1976). As the area continues to grow in population, however, periodic chemical and bacterial analyses of water would determine if any ground-water deterioration is occurring in the area along the North Fork stream channel.

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EXPLANATION OF WELL-RECORD TABLES

State well number: The official State well number assigned to the well.

Date of observation: Date the well was visited and the data collected.

Owner or user: The owner or user of the well is named.

Year completed: Year the well drilling was completed.

Depth of well: Depth in feet measured or reported on date shown.

Type and diameter: The type of well indicates how the well was drilled: A auger; AR air rotary; C cable tool; D hand dug; and DD diamond drill. The inside diameter of the well casing, in inches, at land surface; N no well casing or no hole.

Type of pump and power: The type of pump is indicated thus: C centrifugal; L lift; N none; S submersible; T turbine; and V vacuum. The type of power is indicated thus: E electric; G gas; H hand; N none; and W wind.

Yield: Yield in gallons per minute.

Use: The use of the well is indicated thus: Dom domestic; Ds destroyed; Irr irrigation; Ps public supply; S stock; T test; and Un unused.

Measuring point: The point from which the water level is measured. It also shows the distance of the measuring point, in feet, above land-surface datum. The measuring points are indicated thus: Hcc hole in casing cover and Tc top of casing.

Altitude of lsd: The altitude of land-surface datum is the altitude, in feet, of the ground adjacent to the well, as interpolated from the topographic base maps having a contour interval of 40 feet.

Water level below lsd: The water level below land-surface datum is the depth to water, in feet, after the distance between land-surface datum and the measuring point has been subtracted from the measurement.

Other data: The other data are indicated by the following symbols: C chemical analysis of water and L drillers' logs.

TABLE 1.--*Well data for the Barona Indian Reservation*

State well number	Date of observation	Owner or user	Year completed	Depth of well (feet)	Type and diameter (inches)		Type of pump and power		Yield (gal/min)	Use	Measuring point		Altitude of lsd (feet)	Water level below lsd (feet)	Other data
											Description	Distance above or below(-) lsd (feet)			
14S/1E-1R1	3-31-76	Barona Indian Res.		13.6		6	N	N		Un	Tc	0	1,680	6.26	
14S/1E-21A1	4-01-76	Great Oaks Ranch				6	L	H		Un	Tc	1.0	1,390	36.95	
14S/1E-21R1	4-01-76	Barona Indian Res.				6	V	G		Un			1,310		
14S/1E-21R2	4-01-76	Barona Indian Res.	1960	2.5	A	3	N	N		Un	Tc	2.5	1,315	dry	L
14S/1E-22B1	3-31-76	Barona Indian Res.		5.9		8	N	W		Un	Tc	0	1,355	4.50	
14S/1E-22H1	4-01-76 1960	Barona Indian Res. Test hole 4	1960	12.8 22	C	12	N	N		Un	Tc	1.0	1,340	9.25	C
14S/1E-22H2	4-08-76 1960	Barona Indian Res. Test hole 2	1960	0 53	C	N 8	N	N		Ds T			1,340	 17	L
14S/1E-22H3	4-08-76 1960	Barona Indian Res. Test hole 3	1960	0 46	C	N 8	N	N		Ds T			1,340	 20	
14S/1E-22H4	4-08-76 1960	Barona Indian Res. Test hole 5	1960	0 46	C	N 8	N	N		Ds T			1,340		L
14S/1E-22H5	4-08-76 1960	Barona Indian Res. Test hole 16	1960	0 49	C	N	N	N		Ds T			1,340		
14S/1E-22H6	4-08-76 1960	Barona Indian Res. Test hole 7	1960	0 60	C	N 8	N	N		Ds T			1,340		L
14S/1E-22H7	4-08-76 1960	Barona Indian Res. Test hole 15	1960	0 24	C	N 8	N	N		Ds T			1,340		
14S/1E-22L1	3-31-76	Barona Indian Res.		1.8		12	L	N		Un	Tc	0	1,325	dry	
14S/1E-22P1	3-31-76 1932	Barona Indian Res. Irrigation well 3					S	E	 100	Dom			1,315		
14S/1E-22P2	4-08-76 11-06-74 11-06-74 5-31-73 5-31-73	Barona Indian Res. I.H.S. well 2	1973	46	C	8.5	S	E	 25 30	Dom	Hcc	3.0	1,315	7.03 9.2 a27.8 7 a28	L
14S/1E-23A1	3-31-76	Barona Indian Res.		0		5	N	N		Ds	Tc	0	1,395	dry	
14S/1E-23E1	3-31-76	Barona Indian Res.		24.6	D	78	T	E		Un	Tc	1.0	1,340	8.15	C

See footnotes at end of table.

TABLE 1.--*Well data for the Barona Indian Reservation*--Continued

State well number	Date of observation	Owner or user	Year completed	Depth of well (feet)	Type and diameter (inches)	Type of pump and power	Yield (gal/min)	Use	Measuring point		Altitude of lsd (feet)	Water level below lsd (feet)	Other data
									Description	Distance above or below(-) lsd (feet)			
14S/1E-23E2	4-08-76 1960	Barona Indian Res. B.I.A. well 6	1960	 59	C 8.5	S E	66 50	Dom	Hcc	1.0	1,340	a33.02	
14S/1E-23E3	4-08-76 1960	Barona Indian Res. Test hole 1	1960	0 35	C N 8	N N		Ds T			1,340		
14S/1E-23E4	4-08-76 1960	Barona Indian Res. Test hole 9	1960	0 63	DD N 2	N N		Ds T			1,340		L
14S/1E-23E5	4-08-76 1960	Barona Indian Res. Test hole 8	1960	0 55	C N 8	N N		Ds T			1,340		L
14S/1E-23E6	4-08-76 1960	Barona Indian Res. Test hole 10	1960	0 22	DD N 2	N N		Ds T			1,340		
14S/1E-23E7	4-08-76 1960	Barona Indian Res. Test hole 11	1960	0 23	DD N	N N		Ds T			1,340		
14S/1E-23E8	4-08-76 1960	Barona Indian Res. Test hole 12	1960	0 25	DD N	N N		Ds T			1,340		
14S/1E-23E9	4-08-76 1960	Barona Indian Res. Test hole 14	1960	0 50	DD N	N N		Ds T			1,340		
14S/1E-23E10	4-08-76 1960	Barona Indian Res. Test hole 13	1960	0 57	DD N	N N		Ds T			1,340		
14S/1E-23E11	4-08-76 1960	Barona Indian Res. Test hole 17	1960	0 49	C N 8	N N		Ds T			1,340		
14S/1E-23F1	3-31-76	Barona Indian Res.		46.8	D 54	T N		Un	Tc	1.0	1,380	26.68	C
14S/1E-23K1	3-31-76	Barona Indian Res.		0	N	N N		Ds			1,360		
14S/1E-23L1	3-31-76 7-29-53	Barona Indian Res.		19.8	24	T G		Un	Tc	0	1,355	7.28 9.5	C
14S/1E-23L2	3-31-76	Barona Indian Res.		8.6	16	N N		Un	Tc	0	1,355	7.30	
14S/1E-23L3	3-31-76	Barona Indian Res.		2.0	7	N N		Ds	Tc	.5	1,355		
14S/1E-23P1	4-01-76 10-27-14	Jack Bundy W. H. Jones	1914	 b39	 D 120	N N	 45				1,370	 8	L
14S/1E-27H1	3-31-76	Barona Indian Res.		8.2	6	N N		Un	Tc	0	1,420	5.10	

a. Well being pumped.
b. Reported to have 250 ft long, 4-ft x 6-ft tunnels connected to bottom of well.

TABLE 2.--*Spring data for the Barona Indian Reservation*

State spring number: The number given is the number assigned to the spring according to the system described in the well- and spring-numbering system.
Date of observation: Date the data were collected.
Owner or user: Name of the owner or user on the date given.
Year developed: The year the spring was improved.
Number of openings: This is the number of openings used to determine the sphere of discharge.
Sphere of discharge: The area of water surface.
Yield: This indicates the amount of flow from the spring.
Use: The use is as follows: S stock.
Altitude of lsd: The altitude of land-surface datum at the spring.
Other data: C data in chemical-analysis table.

State spring number	Date of observation	Owner or user	Year developed	Number of openings	Sphere of discharge (feet)	Yield (gal/min)	Use	Altitude of lsd (feet)	Other data
14S/1E-1LS1	3-31-76	Barona Indian Res.	--	1	25 x 25	(a)	S	1,680	C
14S/1E-1NS1	3-31-76	Barona Indian Res.	--	2	40 x 40	(a)	S	1,670	C
14S/1E-12MS1	3-31-76	Barona Indian Res.	1938	1	(b)	0.31	S	1,510	C
14S/1E-12MS2	3-31-76	Barona Indian Res.	--	1	20 x 20	(a)	S	1,520	C
14S/1E-15RS1	3-31-76	Barona Indian Res.	--	1	400 x 10	(a)	S	1,360	C

a. Flow too small to measure.
b. Spring dug out, flowline buried, and entrance sealed with cement.

TABLE 3.--*Drillers' logs of wells on the Barona Indian Reservation*

14S/1E-21R2. Drilled in 1960 by contract driller to the U.S. Bureau of Indian Affairs. 2-inch core hole; 2½-inch casing installed at surface.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Alluvium------------	50	50	Granite, fine-grained, many fractures------	4	70
Rock----------------	2	52	Granite, solid, few fractures-----------	93	163
"Soft material"-----	1	53			
Granite, solid (12 feet of core, no fractures)------	13	66			

14S/1E-22H2. Drilled in 1960 by the U.S. Bureau of Indian Affairs. 8-inch casing 0-53 feet; casing pulled at end of drilling.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil--------------	15	15	Granite, decomposed, hard at 53 feet-----	38	53

14S/1E-22H4. Drilled in 1960 by the U.S. Bureau of Indian Affairs. 8-inch casing 0-46 feet; casing pulled at end of drilling.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil--------------	16	16	Granite, decomposed, soft----------------	16	36
Clay, light-colored, and sand or decomposed granite--	4	20	No record------------	9	45
			Rock-----------------	1	46

14S/1E-22H6. Drilled in 1960 by the U.S. Bureau of Indian Affairs. 8-inch casing 0-60 feet; casing pulled at end of drilling.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil--------------	12	12	Granite, decomposed, yellow-------------	12	44
"Creek" sand---------	2	14	No record------------	15	59
Granite, decomposed, gray----------------	16	30	Rock-----------------	1	60
No record------------	2	32			

TABLE 3.--*Drillers' logs of wells on the Barona Indian Reservation*--Continued

14S/1E-22P2. Drilled by Oren Kirk in 1960. 8.5-inch casing 0-49.2 feet; perforated 37.2-45.2 feet.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil, sandy, black	10	10	Sand, coarse, blue---	6	33
Sand, fine, and yellow---------------	5	15	Sand, coarse, with red-brown gravel----	7	40
Sand, coarse, hard, and yellow with clay balls----------------	5	20	Sand, coarse, with blue gravel---------	6	46
Sand, fine, changes from brown to blue with depth----------	7	27	Granite, hard, blue and white-----------	3.2	49.2

14S/1E-23E4. Drilled in 1960 by contract driller to the U.S. Bureau of Indian Affairs. 2-inch core hole; no casing installed in hole.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Alluvium-------------	50	50	Granite, hard--------	63	113

14S/1E-23E5. Drilled in 1960 by the U.S. Bureau of Indian Affairs. 8-inch casing 0-55 feet; casing pulled at end of drilling.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil--------------	14	14	Granite, decomposed, soft and hard-------	22	48
Granite, decomposed, medium hard---------	6	20	Granite, decomposed, hard, with quartz and clay seams------	4	52
Granite, decomposed, soft----------------	4	24	No record------------	2	54
Quartz cuttings------	2	26	Hard rock------------	1	55

14S/1E-23P1. Well hand dug in 1914. 10-foot diameter hole 0-39 feet. 4-foot wide, 6-foot high tunnels connected to bottom of well. One tunnel is 125 feet long to north and one tunnel 125 feet to south.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Residuum-------------	39	39			

TABLE 4.--*Chemical analyses of water from wells 14S/1E-23F1 and 14S/1E-23L1, Barona Indian Reservation*

[Results are shown in milligrams per liter (mg/L) except for boron which is shown in micrograms per liter (µg/L); water temperature in degrees Celsius; specific conductance in micromhos per centimeter at 25°C; percent sodium and pH]

	14S/1E-23F1	14S/1E-23L1		
	9-22-59	7-29-53	3-31-76	5-14-76
Temperature (°C)	23	--	15	22
Silica	36	--	--	--
Calcium	52	12	--	--
Magnesium	29	20	--	--
Sodium	58	120	--	--
Potassium	3	.9	--	--
Bicarbonate	180	240	--	--
Carbonate	0	0	--	--
Sulfate	29	41	--	--
Chloride	120	140	--	--
Fluoride	.1	.6	--	--
Nitrate (NO_3)	43	15	--	0
Approximate dissolved solids (spec. cond. x 0.6)	470	566	570	534
Dissolved solids	530	497	--	--
Hardness as $CaCO_3$	250	--	--	--
Percent sodium	34	--	--	--
Specific conductance	783	943	950	890
pH	7.3	7.1	--	--
Boron	0	0	--	--

TABLE 5.--*Selected chemical analyses of water from the Barona Indian Reservation*

Well or spring number	Date of sample	Temperature (°C)	Nitrate (NO_3) (mg/L)	Approximate dissolved solids[1] (spec. cond. x 0.6) (mg/L)	Specific conductance (μmhos/cm at 25°C)
14S/1E-1LS1	3-31-76	15	--	290	490
14S/1E-1NS1	3-31-76	13.5	--	160	270
14S/1E-12MS1	3-31-76	13.5	--	510	850
14S/1E-12MS2	3-31-76	16	--	390	650
14S/1E-15RS1	3-31-76	16	--	140	230
14S/1E-22H1	5-14-76	18.0	15	2,000	3,400
14S/1E-22P2	3-31-76	16.5	--	680	1,130
	5-14-76	18.5	15	770	1,280
14S/1E-23E1	4-08-76	18	--	370	620
14S/1E-23E2	4-08-76	20	--	360	605
([2])	4-07-76	14	--	610	1,010
	5-14-76	28.5	.4	690	1,150

[1]Measured value times 0.6, rounded to two significant figures.
[2]Surface-water site 1, sec. 21, T. 14 S., R. 1 E.

TABLE 6.--*Chemical and flow measurements of surface water on and near the Capitan Grande Indian Reservation during 1976*

Site number (pl. 2)	Location (Township, range, and section)	Date of measurement	Chemistry of water			Measured flow[1]			Name
			Spec. cond. (µmhos at 25°C)	Temperature (in degrees Celsius)	pH (units)	Cubic feet per second	Gallons per minute	Gallons per day	
1	15S/3E-8	4-6-76	790	11.0	7.3	0.097	44	62,700	King Creek
2	15S/3E-9	4-5-76	--	--	--	--	--	([2])	King Creek
3	15S/3E-6	4-6-76	1,280	13.0	7.4	.063	28	40,700	Conejos Creek
4	14S/3E-32	4-6-76	905	15.5	7.3	.007	3.1	4,520	Conejos Creek
5	14S/3E-19	4-6-76	600	14.0	7.2	.002	1.1	1,640	Sand Creek
6	14S/2E-11	4-7-76	360	13.0	7.1	2.460	1,100	1,590,000	Boulder Creek
7	14S/2E-11	4-7-76	--	--	--	6.72	3,000	4,330,000	San Diego River

[1]Numbers rounded.
[2]Water was observed through fieldglasses flowing in a hard rock channel.

TABLE 7.--*Discharge data near Capitan Grande Indian Reservation*

[Data from U.S. Geological Survey, 1960, p. 495-497]

MAP LOCATION 8

11017500 Boulder Creek near Lakeside, Calif.

Location.--Lat 32°58'30", long 116°44'05", in NW¼ sec. 12, T. 14 S., R. 2 E., just upstream from mouth and 14 mi northeast of Lakeside.

Drainage area.--33.5 mi^2.

Gage.--Staff gage on short section of lined channel. Altitude of gage is 840 ft (from topographic map). Oct. 1, 1919, to Jan. 21, 1924, at datum 0.15 ft higher. Aug. 12, 1912, to Jan. 26, 1916, at different datums.

Average discharge.--9 years (1912-15, 1919-25), 9.68 ft^3/s.

Extremes.--1912-16, 1919-26: Maximum discharge, about 3,000 ft^3/s Jan. 27, 1916 (gage height, 9.5 ft, from floodmark, datum then in use); no flow July 2-8, 1914, Oct. 10-14, 1919.

Remarks.--Flow regulated by Cuyamaca Reservoir (capacity, 11,595 acre-ft) in 1950. Small diversions for local use near dam.

Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet
1913	3,520	1920	8,500	1923	6,360
1914	3,660	1921	3,860	1924	4,220
1915	11,600	1922	18,100	1925	3,290

See footnote at end of table.

TABLE 7.--*Discharge data near Capitan Grande Indian Reservation*--Continued

MAP LOCATION 9

11019000 San Diego River at diverting dam, near Lakeside, Calif.

Location.--Lat 32°58'10", long 116°44'15", in NE¼SE¼ (revised) sec. 11, T. 14 S., R. 2 E., at diversion dam, 2,000 ft (revised) downstream from Boulder Creek, and 13 mi northeast of Lakeside.

Drainage area.--102 mi^2.

Gage.--Staff gages on upstream face of diverting dam and in stilling well connected to flume. Altitude of gage is 825 ft (from topographic map). Prior to Jan. 28, 1916, water-stage recorders at different datums.

Extremes.--1912-16: Maximum discharge, 15,800 ft^3/s Jan. 28, 1916, computed by weir formula from floodmarks; no flow at times.

Remarks.--Cuyamaca Water Co.'s flume diverted at station. Flow partly regulated by Cuyamaca Reservoir on Boulder Creek. Flow in river combined with diversion for discharge used in table.

Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet
1913	6,620	1915	41,700	1916	126,000
1914	13,800				

See footnote at end of table.

TABLE 7.--*Discharge data near Capitan Grande Indian Reservation*--Continued

MAP LOCATION 10

11020000 Los Conejos Creek near Alpine, Calif.

Location.--Lat 32°53'30", long 116°45'35", in SE¼ sec. 3 (revised), T. 15 S., R. 2 E., about half a mile upstream from mouth and 4 mi north of Alpine.

Drainage area.--44.5 mi^2.

Gage.--Water-stage recorder. Altitude of gage is 870 ft (revised, from topographic map).

Extremes.--1913-15: Maximum discharge, 242 ft^3/s Feb. 11, 1915 (gage height, 5.0 ft); no flow during several months each year.

Remarks.--South Fork of Cuyamaca Water Co.'s flume diverted 100 ft above station. Discharge in creek adjusted for diversion by flume.

Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet
1914	2,070	1915	8,120		

[1]The water year is the 12-month period ending September 30 and is designated by the calendar year in which it ends.

TABLE 8.--*Well data for the Sycuan Indian Reservation and vicinity*

State well number	Date of observation	Owner or user	Year completed	Depth of well (feet)	Type and diameter (inches)	Type of pump and power	Yield (gal/min)	Use	Measuring point: Description	Measuring point: Distance above or below(-) lsd (feet)	Altitude of lsd (feet)	Water level below lsd (feet)	Other data
16S/1E-11H1	4-08-76	Pooler		a109	8	N N		Un	Tc	0	580	46.69	
	1975											53	
	1973											32	
	1969											26	
16S/1E-11H2	4-08-76	Pooler	1973	a75	8	S E		Dom			580		
16S/1E-11J1	4-08-76	Bill Hand			8	S E		Dom	Hcc	.3	565	42.48	C
16S/1E-12A1	4-07-76	Don Beck				S E		Dom			755		C
16S/1E-12H1	4-07-76				8.5	S E			Hcc	2.0	710	54.17	C
16S/1E-12M1	4-13-76	A. M. Tillery	1972	a572	AR 6.5	S E		Dom	Hcc	.2	650	108.40	C
	12-20-72						13						
16S/1E-12P1	4-07-76	L. C. Reed	1959		13	S E		Dom			680		
16S/1E-12Q1	4-07-76	Tom Epperson	1949	76.1	D 6	S E		S	Hcc	.5	700	50.21	
16S/1E-12Q2	4-07-76			a75	8	S E		Dom	Hcc	.1	715	54.05	C
16S/1E-13C1	4-07-76	Sycuan I. R.	1939	b19	7	N N		Un	Tc	.5	640	dry	L
	1- -39						70					1	
16S/1E-13C2	4-07-76	Sycuan I. R.		a75	10	S E		Un	Hcc	0	620	8.63	
16S/1E-13C3	4-07-76	Sycuan I. R.	1970	a90	8	S E		Ps	Hcc	.2	630	c67.35	C,L
	6-27-76											27.13	
	6-27-76						20					c66.97	
	1-30-76			89								34.8	
16S/1E-14A1	4-08-76					S E		Un			555		
16S/1E-14F1	4-08-76					N N		Ds			500		C
	6- -15	J. M. Owen		50	6	C G	270	Irr					
16S/1E-14G1	4-08-76	San Diego Co. School	1955	a103	C 8	S E		Dom			520		C
16S/1E-14G2	4-08-76	San Diego Co. School	1914	0				Ds			520		C
	10-07-14	J. M. Owen		21.2	D 72	L H		Dom					
16S/1E-14G3	4-08-76	Steve Smith	1956	a70	D 72	S E		Irr	Hcc	1.5	520	37.55	

See footnotes at end of table.

TABLE 8.--*Well data for the Sycuan Indian Reservation and vicinity*--Continued

State well number	Date of observation	Owner or user	Year completed	Depth of well (feet)	Type and diameter (inches)	Type of pump and power	Yield (gal/min)	Use	Measuring point: Description	Measuring point: Distance above or below(-) lsd (feet)	Altitude of lsd (feet)	Water level below lsd (feet)	Other data
16S/1E-14H1	4-08-76	Steve Smith	1950	76.0	D 76	S E		Dom	Hcc	1.5	550	33.05	
	6-09-74											28.9	
	10-19-56											47.0	
	2-12-56											33.0	
	2-01-55											26.5	
	3-22-54											22.0	
	10-03-53											20.0	
	2-12-53											28.5	
	4-01-52											18.5	
	11-15-51											29.5	
	8-15-51											29.5	
	8-15-50											22.5	
	5- -50											19.5	
16S/1E-14P1				b36.5	14	N N		Un	Tc	3.5	510	31.05	
16S/1E-14P2	4-08-76			28.2	2	N N		Un	Tc	2.5	510	dry	
16S/1E-15J1	4-08-76			0		N N		Ds	Tc	2.49	476.10	(d)	
	12-03-36	Calif. Water & Tel. Co.										4.33	
	4-22-36											+.79	
	12-03-35											4.41	
	5-11-35											+.49	
	12-18-34											5.31	
	10-16-34											4.76	
	8-02-34											2.91	
	4-19-34											+.05	
	1-05-34											3.81	
	1-12-32											1.14	
	12-03-31											4.04	
	11-06-31											4.81	
	9-17-31											4.13	
	7-17-31											2.21	
	6-08-31											.13	
	3-30-31											+.75	
	1-26-31											4.51	
	1-07-31											4.71	
	12-03-30											4.49	
	11-14-30											4.26	
	10-20-30											3.27	
	8-18-30											1.82	
	7-31-30											1.03	
	7-05-30											+.14	
	6-14-30											+.29	
16S/2E-6N1	4-07-76			36.2	D	N N		Un	Hcc	1.0	767	dry	
16S/2E-6N3	4-07-76				7	S E		Dom	Hcc	.4	770	39.86	
16S/2E-7D1	4-12-76	James O'Berry	1966	a110	C 6	S E		Dom	Hcc	.5	730	47.58	

a. Reported depth by owner or driller.
b. Obstruction at depth shown.
c. Well being pumped.
d. Well destroyed by flood on Feb. 7, 1937.

TABLE 9.--*Discharge data near Sycuan Indian Reservation*

[Data from U.S. Geological Survey, 1960, p. 492-493; 1970, p. 29; 1976, p. 36]

11015500 Sweetwater River at Loveland Dam, near Alpine, Calif.

Location. Lat 32°46'54", long 116°47'35", in SE¼SW¼NE¼ sec. 17, T. 16 S., R. 2 E., on upstream face near center of Loveland Dam, 4 mi southwest of Alpine.

Drainage area.-- 98.1 mi^2.

Records available.--October 1944 to September 1966 (discontinued).

Gage. Staff gage read once daily. Datum of gage is 1,215 ft above mean sea level, datum of 1929.

Average discharge.--22 years, 4.50 ft^3/s (3,260 acre-ft per year); median of yearly mean discharges, 1.2 ft^3/s (900 acre-ft per year).

Remarks.--Records of discharge represent all water reaching Loveland Reservoir, including precipitation on the reservoir. Discharge computed on the basis of records of storage, release (draft), spill, leakage, and evaporation. Evaporation from reservoir surface computed on basis of evaporation from Colorado land pan using a coefficient of 0.66, excepting the period October 1960 to June 1963, when the mass-transfer method was used, and prior to October 1960 when a coefficient of 0.80 was used. Area and capacity tables for the reservoir are dated April 1946. Loveland Dam was completed in July 1945; storage began in March 1945. Capacity of reservoir at spillway level (gage height, 140.00 ft), 25,387 acre-ft. Dead storage, 125 acre-ft below lowest outlet at gage height -1.25 ft, included in these records. One small diversion for irrigation. Water is released from Lowland Reservoir down Sweetwater River to Sweetwater Reservoir as required.

Cooperation.--Records of stage, draft and spill plus leakage furnished by California-American Water Co.

Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet
1945	8,120	1953	3,587	1960	540
1946	4,828	1954	6,212	1961	132
1947	1,420	1955	906	1962	910
1948	611	1956	542	1963	74
1949	2,340	1957	448	1964	199
1950	835	1958	12,057	1965	867
1951	457	1959	613	1966	4,144
1952	21,906				

See footnote at end of table.

TABLE 9.--*Discharge data near Sycuan Indian Reservation*--Continued

11016000 Sweetwater River near Dehesa, Calif.

Location.--Lat 32°46'20", long 116°48'05", in NW¼NW¼ sec. 20, T. 16 S., R. 2 E., 1,000 ft downstream from Lawson Creek, 1.1 mi downstream from Loveland Dam, and 3 mi east of Dehesa.

Drainage area.--112 mi^2.

Gage.--Staff gage. Altitude of gage is 900 ft (from topographic map). Prior to Jan. 17, 1916, staff gage, Bristol recorder, and concrete control at same site at different datum.

Extremes.--1913-16: Maximum discharge, 24,300 ft^3/s Jan. 27, 1916 (gage height, 15.5 ft), from rating curve extended above 400 ft^3/s on basis of slope-area determination of peak flow; stream practically dry for several days each year.

Remarks.--Small diversion for irrigation above station.

Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet	Water year[1]	Discharge in acre-feet
1914	4,740	1915	34,300		

[1]The water year is the 12-month period ending September 30 and is designated by the calendar year in which it ends.

TABLE 10.--*Drillers' logs of wells on the Sycuan Indian Reservation*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
16S/1E-13C1. Drilled in 1939. 8.5-inch casing 0-54 feet, open hole 54-57 feet; perforated 5-52 feet.					
Mud, black, and sand-	18	18	Granite, decomposed--	28	54
Gravel and boulders--	8	26	Granite, hard--------	3	57
16S/1E-13C3. Drilled by the Indian Health Service in 1970. 8-inch casing 0-90 feet; perforated 35-90 feet.					
Topsoil--------------	4	4	Granite, hard--------	6	90
Granite, decomposed--	80	84			

TABLE 11.--*Chemical analyses of ground water from the Sycuan Indian Reservation*

[Results are shown in milligrams per liter (mg/L) except for iron and boron which are shown in micrograms per liter (μg/L); water temperature in degrees Celsius; specific conductance in micromhos per centimeter at 25°C; percent sodium and pH]

	16S/1E-11J1		16S/1E-12A1		16S/1E-12H1	16S/1E-12M1
	6-19-58	4-08-76	6-25-58	4-09-76	4-12-76	4-13-76
Temperature (°C)	21.5	17	22	20.5	18.5	20
Silica	27	--	39	--	--	--
Iron	--	--	--	--	--	--
Calcium	51	--	41	--	--	--
Magnesium	25	--	22	--	--	--
Sodium	98	--	83	--	--	--
Potassium	1.5	--	3.1	--	--	--
Bicarbonate	180	--	190	--	--	--
Carbonate	0	--	0	--	--	--
Sulfate	71	--	26	---	--	--
Chloride	150	--	130	--	--	--
Fluoride	.9	--	.4	--	--	--
Nitrate	8.6	--	8.4	--	--	--
Sum of determined constituents	--	--	--	--	--	--
Dissolved solids	589	--	512	--	--	--
Hardness as $CaCO_3$	230	--	190	--	--	--
Noncarbonate hardness	--	--	--	--	--	--
Percent sodium	48	--	48	--	--	--
Specific conductance	931	1,100	806	1,000	1,000	480
pH	7.2	7.1	7.2	7.0	7.1	6.8
Boron	400	--	400	--	--	--

TABLE 11.--*Chemical analyses of ground water from the Sycuan Indian Reservation*--Continued

	16S/1E-14G1		16S/1E-14G2	16S/1E-14H1	16S/2E-7D1
	5-12-58	4-07-76	6- -15	4-08-76	4-12-76
Temperature (°C)	22	22.5	--	21.5	20.0
Silica	50	--	--	--	--
Iron	--	--	trace	--	--
Calcium	76	--	--	--	--
Magnesium	29	--	--	--	--
Sodium	93	--	--	--	--
Potassium	3.0	--	--	--	--
Bicarbonate	240	--	310	--	--
Carbonate	0	--	0	--	--
Sulfate	39	--	37	--	--
Chloride	180	--	200	--	--
Fluoride	.5	--	--	--	--
Nitrate	26	--	--	--	--
Sum of determined constituents	616	--	--	--	--
Dissolved solids	667	--	--	--	--
Hardness as $CaCO_3$	310	--	--	--	--
Noncarbonate hardness	--	--	--	--	--
Percent sodium	39	--	--	--	--
Specific conductance	1,070	825	--	605	1,020
pH	7.1	7.1	--	7.1	7.1
Boron	0	--	--	--	--

TABLE 11.--*Chemical analyses of ground water from the Sycuan Indian Reservation*--Continued

	16S/1E-12Q2	16S/1E-13C3			16S/1E-14F1
	6-25-58	7-07-70	2-02-76	4-09-76	6- -15
Temperature (°C)	23	--	--	22	--
Silica	29	--	46	43	--
Iron	--	600	100	0	Trace
Calcium	36	68	50	54	--
Magnesium	23	22	33	30	--
Sodium	110	100	100	100	--
Potassium	3.1	4	2.5	2.7	--
Bicarbonate	210	260	--	250	290
Carbonate	0	0	--	0	0
Sulfate	24	48	50	38	Trace
Chloride	160	140	160	170	160
Fluoride	.3	.6	.4	.4	--
Nitrate	2.1	10	10	19	--
Sum of determined constituents	--	--	--	579	--
Dissolved solids	587	593	602	--	--
Hardness as $CaCO_3$	180	260	260	260	---
Noncarbonate hardness	--	--	--	55	--
Percent sodium	56	45	--	45	---
Specific conductance	873	900	926	980	--
pH	7.2	6.9	6.9	7.3	--
Boron	500	--	--	140	--

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