

**SANTA ANA RIVER WATERMASTER**  
**FOR**  
**ORANGE COUNTY WATER DISTRICT Vs. CITY OF CHINO, et al**  
**CASE No. 117628 – COUNTY OF ORANGE**

**ELEVENTH**  
**ANNUAL REPORT**  
**OF THE**  
**SANTA ANA RIVER WATERMASTER**

**1980-81**

**MARCH 2, 1982**

# SANTA ANA RIVER WATERMASTER

FOR  
ORANGE COUNTY WATER DISTRICT VS. CITY OF CHINO, ET AL  
CASE NO. 117628 - COUNTY OF ORANGE

WATERMASTER  
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March 2, 1982

To: Clerk of Superior Court of Orange County  
and all Parties

Re: Watermaster Report for 1980-81

Gentlemen:

We have the honor of submitting herewith the Eleventh Annual Report of the Santa Ana River Watermaster.

The principal findings of the Watermaster for the water year 1980-81 are as follows:

## At Prado

(1)	Base Flow at Prado	74,875	acre-feet
(2)	Annual Weighted TDS of Base and Storm Flows	728	ppm
(3)	Annual Adjusted Base Flow	74,875	acre-feet
(4)	One-half Lake Elsinore Discharge Reaching Prado	8,045	acre-feet
(5)	Cumulative Adjusted Base Flow	665,473	acre-feet
(6)	Cumulative Entitlement of OCWD	462,000	acre-feet
(7)	Cumulative Credit	203,473	acre-feet
(8)	One-third of Cumulative Debit	0	acre-feet
(9)	Minimum Required Base Flow in 1981-82	34,000	acre-feet

## At Riverside Narrows

(1)	Base Flow at Riverside Narrows	19,764	acre-feet
(2)	Annual Weighted TDS of Base Flow	715	ppm
(3)	Annual Adjusted Base Flow	19,550	acre-feet
(4)	Cumulative Adjusted Base Flow	210,196	acre-feet
(5)	Cumulative Entitlement of CBMWD and WMWD	167,750	acre-feet
(6)	Cumulative Credit	42,446	acre-feet
(7)	One-third of Cumulative Debit	0	acre-feet
(8)	Minimum Required Base Flow in 1981-82	12,420	acre-feet

The above findings show that at the end of the 1980-81 water year Chino Basin Municipal Water District and Western Municipal Water District have a cumulative credit of 203,473 acre-feet to their Base Flow obligation at Prado Dam. San Bernardino Valley Municipal Water District has a cumulative credit of 42,446 acre-feet to its Base Flow obligation at Riverside Narrows.

SANTA ANA RIVER WATERMASTER

Clerk of the Superior Court of Orange County  
and All Parties

March 2, 1982  
Page Two

The above average rainfall in the San Jacinto watershed which occurred during 1979-80 caused extensive flooding in the areas surrounding Lake Elsinore. In order to protect against further flooding during the 1980-81 rainy season water was pumped from Lake Elsinore and discharged to Temescal Creek during the period October 18, 1980 to January 22, 1981.

The discharge of water from Lake Elsinore to the Santa Ana River is considered a rare event and was not contemplated under this Judgment. In view of this special case and since that portion of the water pumped from Lake Elsinore which was determined by the Watermaster to have passed Prado Dam was recharged to the groundwater basin in Orange County, one-half of such amount has been considered a credit against the Upper Area Base Flow Obligation at Prado Dam.

Since 1973 Orange County Water District has purchased some 197,144 acre-feet of State water (nontributary flow) which has been released into San Antonio Creek near Upland from the Rialto Reach of the Foothill Feeder at OC-59. During this time the Committee has been conducting a study to determine the amount and quality of the State water that actually passed Prado Dam. Orange County Water District did not purchase State water from OC-59 during the 1980-81 water year and for this reason the Committee did not make a final determination but intends to continue its investigation and will make a final determination and adjustment at some subsequent time.

Sincerely yours,

SANTA ANA RIVER WATERMASTER

By: Max Bookman  
Max Bookman

Donald L. Harriger  
Donald L. Harriger

William J. Carroll  
William J. Carroll

William R. Mills, Jr.  
William R. Mills, Jr.

James C. Hanson  
James C. Hanson

## TABLE OF CONTENTS

	Page
<b>CHAPTER I - WATERMASTER ACTIVITIES</b>	
Stream Flow and Water Quality Measurements .....	2
Compilation and Analysis of Basic Data .....	4
Administration Costs .....	4
Summary of Findings .....	5
<b>CHAPTER II - WATER SUPPLY CONDITIONS</b>	
Precipitation During 1980-81 .....	7
Runoff During 1980-81 .....	7
Below Prado Dam .....	7
At Riverside Narrows .....	8
Sewage Discharges .....	9
Lake Elsinore Pumpout .....	9
<b>CHAPTER III - BASE FLOW AT PRADO</b>	
Total Flow at Prado .....	12
Nontributary Flow .....	12
Releases Above Riverside Narrows .....	12
Releases to San Antonio Creek .....	14
Discharge from Lake Elsinore .....	14
Storm Flow .....	14
Base Flow .....	15
Water Quality .....	16
Water Quality Adjustment for Nontributary Flow and Discharge from Lake Elsinore .....	17
Adjusted Base Flow .....	18
Entitlement and Credit or Debit .....	18
<b>CHAPTER IV - BASE FLOW AT RIVERSIDE NARROWS</b>	
Total Flow at Riverside Narrows .....	20
Nontributary Flow .....	20
Base Flow .....	21
Water Quality .....	22
Adjusted Base Flow at Riverside Narrows .....	23
Entitlement and Credit or Debit .....	23

Table of Contents (Continued)

**LIST OF TABLES**

<b>No.</b>	<b>Title</b>	<b>Page</b>
1	Costs to the Parties and USGS for Measurements Which Provide Data Used by the Santa Ana River Watermaster October 1, 1980 to September 30, 1981 .....	3
2	Santa Ana River Watermaster Budget and Expenses .....	5
3	Summary of Findings .....	6
4	Treated Sewage Effluent Discharged to the Santa Ana River, Riverside Narrows to Prado Dam .....	10
5	Components of Flow at Prado Dam for Water Year 1980-81 (acre-feet) .....	13
6	Components of Flow at Riverside Narrows for Water Year 1980-81 .....	21

**LIST OF FIGURES**

<b>No.</b>	<b>Title</b>	<b>Following Page</b>
1	Variation in Precipitation at San Bernardino .....	7
2	Discharge of Santa Ana River Below Prado Dam .....	8
3	Discharge of Santa Ana River at Riverside Narrows .....	8

**LIST OF PLATES**  
(Located at Back of Report)

<b>No.</b>	<b>Title</b>
1	Santa Ana River Watershed
2	Discharge of Santa Ana River Below Prado Dam
3	Dissolved Solids in the Santa Ana River Below Prado Dam
4	Discharge of Santa Ana River at Riverside Narrows and San Bernardino Precipitation

**APPENDICES**  
(Located at Back of Report)

<b>No.</b>	<b>Title</b>
A	State Water Released by MWD to San Antonio Creek Near Upland (Connection OC-59)
B	Water Quality - Santa Ana River Below Prado Dam
C	Water Quality - Lake Elsinore Discharge
D	Water Quality - Santa Ana River at Riverside Narrows
E	Quantity and Quality of Wastewater From Rubidoux
F	Santa Ana River Watermaster Financial Statements with Report on Examination by Certified Public Accountants

## CHAPTER I WATERMASTER ACTIVITIES

This is the eleventh annual report of the Santa Ana River Watermaster required by the stipulated Judgment in the case of Orange County Water District vs. City of Chino, et al, entered by the court on April 17, 1969. This stipulated Judgment became effective on October 1, 1970 and contains a declaration of rights of the entities in the lower area of the Santa Ana River Basin downstream of Prado Dam as against those in the upstream area, and provides a physical solution to implement the provisions of the Judgment. The physical solution accomplishes, in general, a regional intrabasin allocation of the surface flow of the Santa Ana River System. All defendants and cross-defendants were dismissed except the four major public water districts within the Santa Ana River Watershed; namely, the San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District of Riverside County (WMWD), Chino Basin Municipal Water District (CBMWD) and Orange County Water District (OCWD). The boundaries of these districts are shown on Plate 1. This arrangement leaves to each of the major hydrologic units in the watershed the determination and regulation of individual rights therein and the development and implementation of its own basin management plan. The history of the litigation and the Summary of the Judgment were included in the annual report for the water year 1974-75.

In order to administer the provisions of the Judgment, the court appointed a Watermaster composed of five persons. During the 1980-81 water year the Santa Ana River Watermaster Committee consisted of Max Bookman, William J. Carroll, James C. Hanson, William R. Mills, Jr. and Donald L. Harriger. Mr. Bookman served as Chairman during the 1980-81 water year, and Mr. Mills served as Secretary. The office of the Santa Ana River Watermaster is located at 972 Town and Country Rd., P.O. Box 5367, Orange, California 92667.

Heretofore, Section 7(c) of the Judgment required the Watermaster to report to the Court and to each party not more than five months after the end of

each water year starting with 1970-71. On December 24, 1981 the Court issued an Order Modifying Judgment which extends the time for submission of the annual report from five months to seven months after the end of each water year. The items to be reported upon are listed in the letter of transmittal of this report.

### **Stream Flow and Water Quality Measurements**

Stream flow measurements and water quality data required by the Watermaster are, for the most part, furnished by the U.S. Geological Survey (USGS). The financing of the cooperative monitoring program with the USGS was shared by the parties to the Judgment. Such costs are set forth in Table 1. The USGS measured and computed the mean daily discharge of the Santa Ana River at MWD Crossing and below Prado Dam as well as the daily discharge of the Riverside Water Quality Control Plant into the Santa Ana River. Discharge measurements were also provided for several smaller streams tributary to Prado Reservoir; namely, Chino Creek at Schaefer Avenue, Cucamonga Creek near Mira Loma and Temescal Wash at Corona.

The 1980-81 discharge record for the USGS gaging station, "Santa Ana River below Prado" is considered by the USGS to be a "Very Good" record. Some seventeen direct discharge measurements, which ranged from 63 to 651 cubic feet per second, were made during the year. Beginning on January 11, 1981 the discharge was regulated by Prado Reservoir with a maximum of 12,698 acre-feet in storage on March 22, 1981. The maximum daily discharge after regulation by Prado Reservoir occurred on March 3, 1981 and amounted to 668 cubic feet per second. The mean annual discharge was approximately 163 cubic feet per second.

The Watermaster has noted the unusual peak that occurred in the discharge hydrograph between May 25 and June 10, 1981. This peak is not reflected in the hydrographs for other gaging stations on the Santa Ana River or its tributaries above Prado Reservoir. A similar peak is however noted at the Orange County Flood Control District Imperial Highway gaging station downstream from Prado. A possible explanation for this peak is that it may likely be the result of dewatering operations in connection with the construction of the Santa Ana Regional Interceptor in the Prado Basin which commenced during May, 1981.

Additional data related to the operation of Prado Reservoir were obtained from the Corps of Engineers and water quality data were supplied to the Watermaster by the State Department of Water Resources, Riverside and Corona

**TABLE 1**  
**COSTS TO THE PARTIES AND USGS FOR MEASUREMENTS WHICH PROVIDE**  
**DATA USED BY THE SANTA ANA RIVER WATERMASTER**

October 1, 1980 to September 30, 1981

**SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT**

At Riverside Water Quality Control Plant		
Surface Water Gage	\$ 583.	
Water Quality Monitor/TDS Samples	1,212.	
At Riverside Narrows (MWD Crossing)		
Water Quality Monitor/TDS Samples	500.	
Dozer	333.	
At Mission Boulevard		
Surface Water Gage	200.	
Dozer	200.	
	200.	\$ 3,028.

**WESTERN MUNICIPAL WATER DISTRICT**

Same as SBVMWD	\$ 3,028.	
Cucamonga Creek Discharge	1,025.	
Chino Creek Discharge	683.	
	683.	4,736.

**CHINO BASIN MUNICIPAL WATER DISTRICT**

Same as WMWD		4,737.(1)
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**ORANGE COUNTY WATER DISTRICT**

At Prado Dam		
Water Quality Monitor/TDS Samples, Water		
Quality Sampling and Conductivity Programs	\$10,300.	
At Mission Boulevard		
Surface Water Gage	400.	
Dozer	400.	
Chino Creek		
Surface Water Gage	684.	
Cleaning Control Area	1,400.	
	1,400.	13,184.
<b>TOTAL FOR PARTIES</b>		<b>\$25,685.</b>
<b>UNITED STATES GEOLOGICAL SURVEY</b>		<b>\$23,685.</b>
<b>GRAND TOTAL</b>		<b><u>\$49,370.</u></b>

(1) Difference results from rounding.

City Sanitation Departments and Chino Basin Municipal Water District. The State Department of Water Resources, the USGS and the Riverside County Flood Control and Water Conservation District furnished records pertaining to the water pumped from Lake Elsinore and discharged to Temescal Creek.

The 1980-81 discharge record for the USGS gaging station "Santa Ana River at MWD Crossing" is considered by the USGS to be a "Fair Record." The concrete low-flow control structure, submerged by 1 to 2 feet of sand during previous years remained inoperative. A sand dike constructed July 1, 1980 channels the flow through a 30 to 40 foot wide section along the left bank. This dike remained in place throughout the remainder of the water year providing good communication with the recorder bubbler orifice. The continuous downstream movement of sand deposits however continued to affect the stage discharge relationship for the station. Twenty-seven direct discharge measurements were made during the year which helped to improve the overall quality of the record.

Data necessary for implementation of the water quality provisions of the Judgment were obtained by the analysis of grab samples taken during the year by the USGS, the City of Riverside and the Department of Water Resources.

#### **Compilation and Analysis of Basic Data**

The Watermaster has established procedures for compiling and analyzing the basic data necessary to carry out the provisions of the Judgment. The records maintained by the Watermaster have been listed in prior annual reports. Based on these data, determinations were made of the Base Flow, Storm Flow, Nontributary Flow, Lake Elsinore flow passing Prado, and relationships between electrical conductivity (EC) and total dissolved solids (TDS). These determinations are explained in detail in Chapters III and IV.

#### **Administration Costs**

In accordance with Paragraph 7(d) of the Judgment, the fees and expenses of each of the members of the Watermaster are to be borne by the district which nominated such member. All other Watermaster administrative costs and expenses are borne by the parties, with OCWD paying 40 percent of the cost and CBMWD, SBVMWD and WMWD each paying 20 percent of the cost. The Judgment further provides that the Watermaster may from time to time, at its discretion, require advances of operating capital from the parties.

At its meeting on April 22, 1980 the Watermaster adopted a budget for the fiscal year 1980-81 in the amount of \$10,000. At its meeting on April 21, 1981 the Watermaster adopted a budget for the fiscal year 1981-82 in the amount of \$12,000. Table 2 shows the items and amounts included in said budgets together with actual expenses for the fiscal year 1980-81.

**TABLE 2**  
**SANTA ANA RIVER WATERMASTER BUDGET AND EXPENSES**

	July 1, 1980 to June 30, 1981 Budget	July 1, 1980 to June 30, 1981 Expenses	July 1, 1981 to June 30, 1982 Budget
Administration	\$ 2,500.00	\$2,252.00	\$ 2,500.00
Support Engineering Services	6,000.00	7,800.00	7,000.00
Reproduction of Annual Report	<u>1,500.00</u>	<u>1,820.00</u>	<u>2,500.00</u>
Total	\$10,000.00	\$11,872.00	\$12,000.00

An audit prepared by Diehl, Evans and Company showing the details of income and expenses of the Santa Ana River Watermaster for the fiscal year 1980-81 is included herein as Appendix F.

**Summary of Findings**

A summary of findings by the Watermaster for the period 1970-71 through 1980-81 is presented in Table 3. Note that the Base Flow obligations at both Riverside Narrows and Prado Dam provided for in the Judgment have been met and cumulative credits have been established.

**TABLE 3**  
**SUMMARY OF FINDINGS AT PRADO**

Water : Year :	Rainfall : inches <sup>(1)</sup> :	Total <sup>(2)</sup> : Flow : A.F. :	Base : Flow : A.F. :	Weighted : TDS <sup>(3)</sup> : PPM :	Adjusted : Base : Flow : A.F. :	Cumulative : Credit : A.F. :
1970-71	11.97	51,864	38,402	727	38,402	(3,598)
1971-72	9.62	51,743	40,416	707	40,416	(5,182)
1972-73	18.46	77,484	48,999	638	51,531	4,349
1973-74	12.72	63,312	43,769	704	43,769	6,118
1974-75	13.49	64,159	52,504	687	53,073	17,191
1975-76	15.86	59,355	45,562	688	46,018	21,209
1976-77	11.95	63,053	48,378	668	49,668	28,877
1977-78	30.47	252,865	58,516	384	73,925	60,802
1978-79	17.51	134,715	72,069	582	79,156	97,958
1979-80	30.93	527,938	82,685	353	106,595	162,553
1980-81	10.45	117,888 <sup>(4)</sup>	74,875 <sup>(5)</sup>	728	74,875 <sup>(5)</sup>	203,473 <sup>(6)</sup>

**AT RIVERSIDE NARROWS**

Water : Year :	Rainfall : inches <sup>(1)</sup> :	Total <sup>(2)</sup> : Flow : A.F. :	Base : Flow : A.F. :	Weighted : TDS <sup>(3)</sup> : PPM :	Adjusted : Base : Flow : A.F. :	Cumulative : Credit : A.F. :
1970-71	11.97	24,112	17,061	704	17,012	1,762
1971-72	9.62	22,253	16,157	712	16,017	2,529
1972-73	18.46	32,571	17,105	700	17,105	4,384
1973-74	12.72	24,494	16,203	700	16,203	5,337
1974-75	13.49	19,644	15,445	731	15,100	5,187
1975-76	15.86	26,540	17,263	723	16,977	6,914
1976-77	11.95	23,978	18,581	722	18,286	9,950
1977-78	30.47	181,760	22,360	726	21,941	16,641
1978-79	17.51	47,298	26,590	707	26,456	27,847
1979-80	30.93	254,077 <sup>(7)</sup>	25,549 <sup>(7)</sup>	676	25,549	38,146
1980-81	10.45	34,278	19,764	715	19,550	42,446

- (1) Measured at San Bernardino County Hospital.
- (2) Does not include Nontributary Flow.
- (3) For Base and Storm Flow at Prado and Base Flow only at Riverside Narrows.
- (4) Includes 16,090 acre-feet of water pumped from Lake Elsinore which passed Prado Dam
- (5) Excludes water pumped from Lake Elsinore.
- (6) Includes One-Half or 8,045 acre-feet of Lake Elsinore Discharge passing Prado.
- (7) Includes Rubidoux Wastewater in 1979-80 and subsequent years.

## **CHAPTER II WATER SUPPLY CONDITIONS**

The precipitation in the Santa Ana River Watershed during 1980-81, as represented by rainfall measured at San Bernardino, was far below normal in terms of the Base Period average. As a result of this below normal rainfall, the total flow of the Santa Ana River below Prado Dam excluding non-tributary flow, during the 1980-81 water year, decreased to 117,888 acre-feet as compared to the record flow of 527,938 acre-feet which occurred in the previous year.

### **Precipitation During 1980-81**

During the 1980-81 water year, the precipitation at the San Bernardino County Hospital amounted to 10.45 inches, which is 58 percent of the Base Period average. During 1980-81, precipitation on the entire Santa Ana River Basin Watershed ranged from 40 to 60 percent of normal, making it the second driest region in California. Most of the precipitation occurred during the months of January and March. The maximum monthly precipitation of 4.33 inches occurred during January.

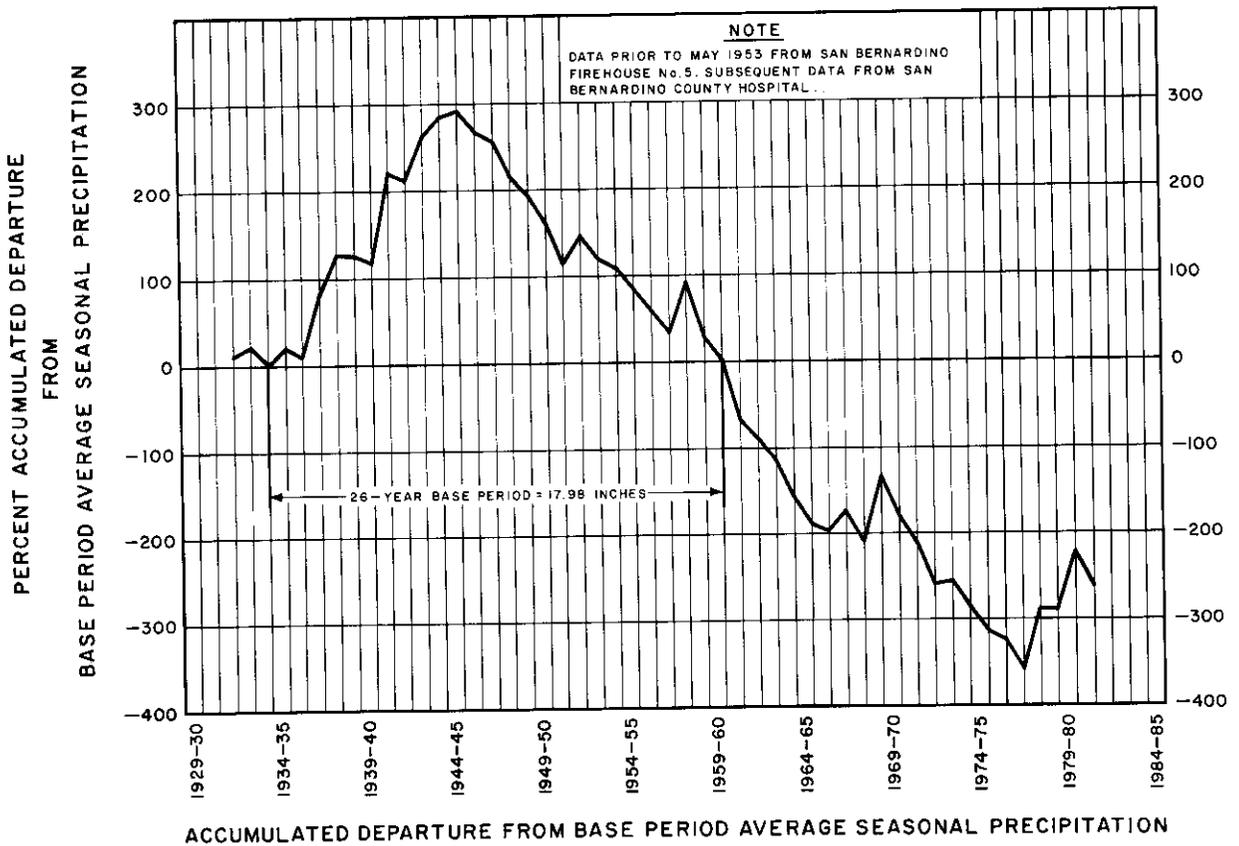
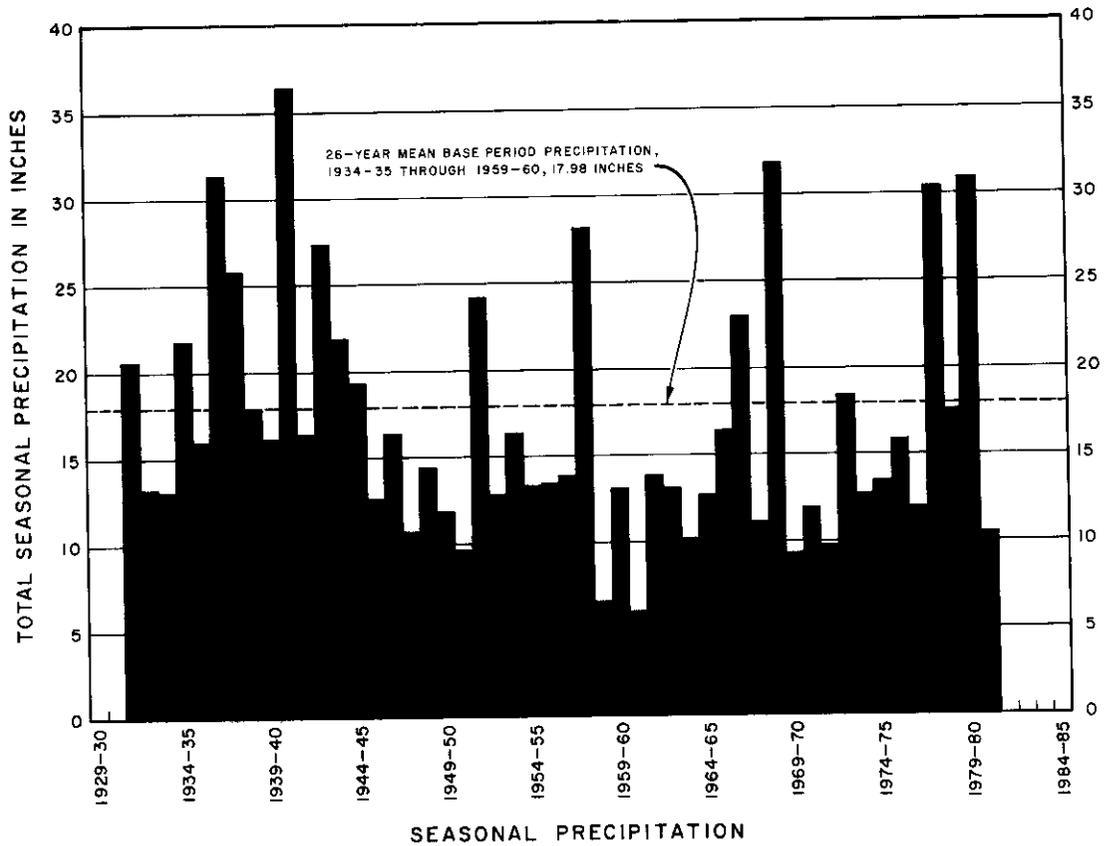
Figure 1 shows the seasonal precipitation from 1931-32 through 1980-81 and the accumulated departure from the 1934-35 through 1959-60 Base Period average.

### **Runoff During 1980-81**

#### **Below Prado Dam**

The total seasonal flow at Prado for the 1980-81 water year less Nontributary Flow but including water pumped from Lake Elsinore amounted to 117,888 acre-feet which is the lowest flow recorded since 1976-77 but which is still well above the Base Period (1934-35 through 1959-60) average of 78,780 acre-feet per year.

Since 1943-44, the Base Flow at Prado Dam progressively decreased and reached a low in 1960-61 of 26,190 acre-feet. Since that year, the Base Flow has



VARIATION IN PRECIPITATION AT SAN BERNARDINO

generally increased. During the eleven-year period (1970-71 through 1980-81) since the Judgment went into effect, the Base Flow, unadjusted for quality, has averaged 55,107\* acre-feet per year. This compares to the 26-year Base Period average of 47,470 acre-feet and the Base Flow requirements under the Judgment of 42,000 acre-feet. The 1980-81 Base Flow amounted to 74,875\* acre-feet, an increase of 19,768 acre-feet over the eleven-year average.

The calculated inflow to Prado Reservoir during the month of January amounted to 20,115 acre-feet or 17 percent of the seasonal total. The maximum storage in Prado Reservoir occurred on March 22nd when 12,648 acre-feet (about 6.45 percent of the reservoir capacity at spillway level) was in storage. The maximum release of 668 cfs from Prado Reservoir occurred on March 3, 1981. Storage of water in Prado occurred during the period December 4 through December 7 and from January 12 through May 3rd.

Figure 2 shows the Storm and Base Flow components of the Total Flow in the Santa Ana River below Prado Dam during the period 1934-35 through 1980-81.

#### **At Riverside Narrows**

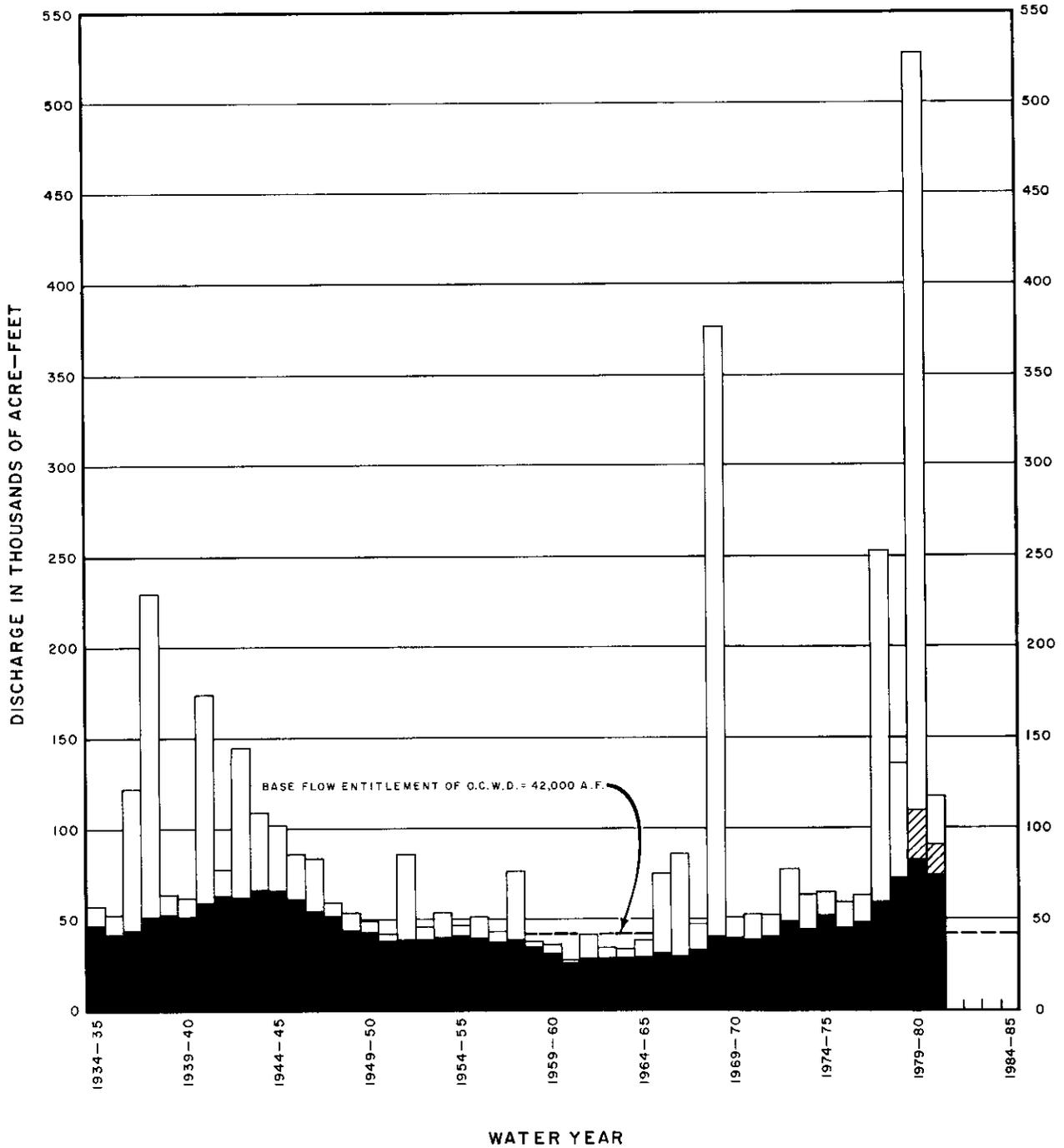
The Total Flow less Nontributary Flow of the Santa Ana River at Riverside Narrows for the 1980-81 water year was 34,278 acre-feet.

The Base Flow at Riverside Narrows decreased from 27,120 acre-feet in 1943-44 to an all-time low of 13,450 acre-feet in 1965-66. Since that time, the Base Flow at Riverside Narrows has gradually increased. During the eleven-year period 1970-71 through 1980-81 the Base Flow has averaged 19,280 acre-feet per year. The 1980-81 Base Flow amounted to 19,764 acre-feet, an increase of 484 acre-feet over the eleven-year average.

Figure 3 shows the components of Total Flow in the Santa Ana River at Riverside Narrows for the period from 1934-35 through 1980-81.

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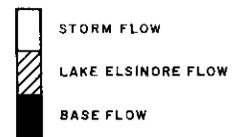
\* Does not include water pumped from Lake Elsinore and credited to the Upper Area Base Flow obligation at Prado Dam.



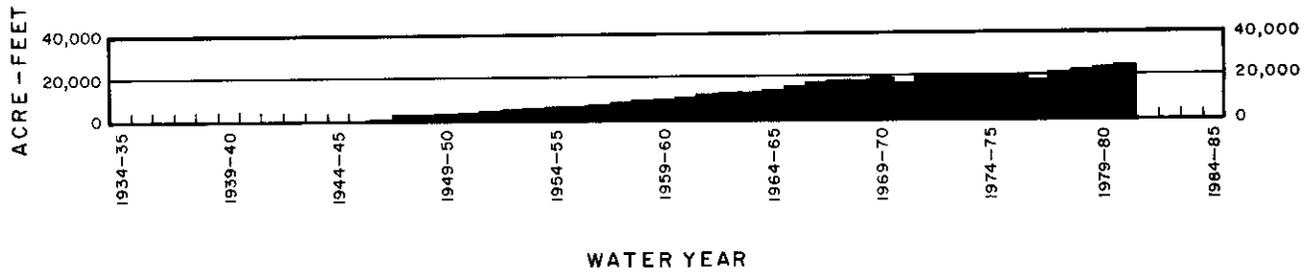
**NOTES**

- DISCHARGE EXCLUDES IMPORTED M.W.D. COLORADO RIVER OR STATE WATER PROJECT WATER BEING TRANSPORTED IN THE SANTA ANA RIVER.
- DISCHARGE INCLUDES EMERGENCY LAKE ELSINORE WATER IN 1979-80 AND 1980-81.

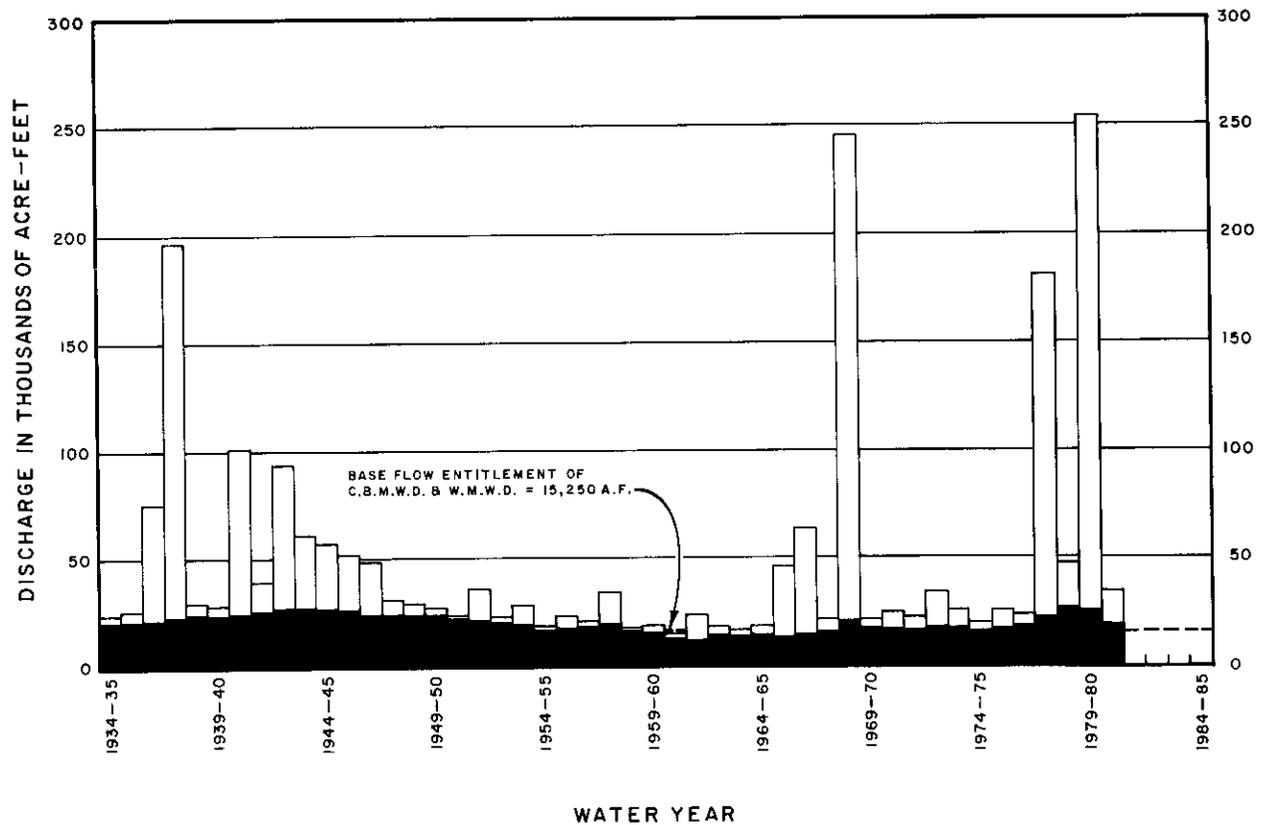
**LEGEND**



**DISCHARGE OF SANTA ANA RIVER BELOW PRADO DAM**



**SEWAGE EFFLUENT FROM RIVERSIDE WATER QUALITY CONTROL PLANTS**



**NOTES**

1. DISCHARGE EXCLUDES SEWAGE EFFLUENT FROM THE RIVERSIDE WATER QUALITY CONTROL PLANTS AND IMPORTED M.W.D. COLORADO RIVER OR STATE WATER PROJECT WATER BEING TRANSPORTED IN THE SANTA ANA RIVER.
2. DISCHARGE OF RUBIDOUX WASTEWATER PLANT INCLUDED IN BASE FLOW COMMENCING IN 1979-80.

**LEGEND**



**DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS**

### **Sewage Discharges**

A portion of the Base Flow at Prado is made up of treated sewage effluent discharged from the Riverside Water Quality Control Plant, the Chino Basin Municipal Water District's Regional Plants No. 1 and 2 and the City of Corona Treatment Plant.

Since the late 1940's, the sewage effluent from the Riverside Water Quality Control Plant, which is discharged at the Riverside Narrows between Pedley Bridge and the MWD Crossing, has been increasing in amount. In 1949-50, the amount of treated effluent discharged was 3,960 acre-feet. By 1959-60, the discharge had increased to 9,900 acre-feet. By 1969-70, the discharge of sewage effluent from the treatment plant was 18,657 acre-feet. The wastewater discharge of the Riverside Water Quality Control Plant during 1980-81 was 24,180 acre-feet.

CBMWD's Regional Plants No. 1 and 2 began discharging to the Santa Ana River in 1971-72 and 1973-74 respectively and in 1980-81 discharged 22,533 acre-feet of effluent to the Santa Ana River.

The City of Corona Sewage Treatment Plant discharged 3,192 acre-feet of treated sewage effluent to the River in 1970-71. This discharge has increased to 5,590 acre-feet in 1980-81.

Table 4 sets forth the amount of treated sewage effluent discharged to the Santa Ana River between Riverside Narrows and Prado Dam during the period 1970-71 through 1980-81. The values show that over the last eleven years, the amount of treated wastewater discharged to the river between these two points has more than doubled.

### **LAKE ELSINORE PUMPOUT**

The flooding which occurred at Lake Elsinore as a result of the 1980 storms was described in the 1979-80 Watermaster report. During the winter of 1980, the U.S. Army Corps of Engineers undertook emergency relief work to clear and re-excavate the original outflow channel from the lake so as to drain the flooded areas. This work allowed a portion of the flood waters in Lake Elsinore to be discharged to the Santa Ana River via Temescal Wash.

On October 1, 1980, the lake level stood at elevation 1,260 feet. This left only 1.5 feet of freeboard (approximately 5,000 acre-feet of storage) before the lake could once again flood the low lying area of the City of Elsinore and again

**TABLE 4**  
**TREATED SEWAGE EFFLUENT DISCHARGED TO THE SANTA ANA RIVER**  
**RIVERSIDE NARROWS TO PRADO DAM**  
**(ACRE-FEET)**

Year	Riverside	Corona	CBMWD #1	CBMWD #2	Total
1970-71	18,619	3,192	0	0	21,811
1971-72	19,006	3,227	6,742	0	28,975
1972-73	19,061	3,342	10,384	0	32,878
1973-74	19,561	3,507	11,435	2,322	36,825
1974-75	19,343	4,015	14,960	2,282	40,600
1975-76	19,579	4,699	15,448	2,947	42,673
1076-77	18,766	5,012	14,638	3,381	41,797
1977-78	20,314	5,201	14,651	4,061	44,227
1978-79	21,068	5,393	15,035	5,069	46,565
1979-80	22,910	5,364	14,413	5,523	48,210
1980-81	24,180	5,590	17,269	5,264	52,303

discharge to the Santa Ana River. With the possibility of another wet year ahead, the State Department of Water Resources (DWR) helped organize the Lake Elsinore Emergency Task Force which adopted a pumping plan to lower the lake level to elevation 1,255 feet, providing approximately 30,000 acre-feet of storage space.

In order to lower the lake level, DWR constructed a temporary 10 unit, 150 cfs, pumping plant which discharged into the previously excavated channel. On October 18, 1980, the first pumps were started and additional units were then brought on line in stages. After pumping some 1,329 acre-feet the pumps were shut down on October 28, 1980 to accommodate construction work along

Temescal Wash. The pumps were restarted on November 4 and the pumping rate increased in stages until full pumping capacity was reached on November 21, 1980. The pumping continued until 1:30 p.m. on January 22, 1981 when the lake level reached elevation 1,255 feet.

The amount of water pumped from Lake Elsinore which passed the gaging station below Prado Dam was determined by the scalping method and amounted to 16,090 acre-feet. The average quality of the water pumped from Lake Elsinore represented by TDS was 660 ppm which increased to about 780 ppm after reaching Lee Lake.

Prior to the 1980 flood at Lake Elsinore the lake had not spilled since 1916-17. During this 63 year period the overflow channel had filled with debris and had been occupied for other uses, in the belief that it was highly unlikely that the lake would ever overflow again. For this reason Lake Elsinore and its tributary drainage area were excluded from the Santa Ana River Watershed for purposes of the Orange County Settlement. Further, no instructions were provided in the Judgment as to how the Watermaster should treat waters originating in the Lake Elsinore watershed should this or similar rare events reoccur.

In discussing this occurrence in its 1979-80 report the Watermaster noted that the outflow from Lake Elsinore occurred during a storm flow period and was therefore treated as storm flow since it ultimately wasted to the ocean. However, the pumping from Lake Elsinore during 1980-81 occurred during a period of little or no storm flow at Prado Dam. The net result was that all of the water pumped from Lake Elsinore during this period and which was identified as having passed the Prado Gage was recharged to the ground water basin within OCWD. Accordingly, and in view of the unique nature of this occurrence, it was agreed that one-half of the water pumped from Lake Elsinore which passed Prado Dam, or 8,045 acre-feet, would be credited to the Cumulative Adjusted Base Flow.

## **CHAPTER III BASE FLOW AT PRADO**

This chapter deals with determinations of: 1) the components of flow at Prado Dam, which include Nontributary Flow; discharge from Lake Elsinore, Storm Flow, and Base Flow; and 2) the adjusted Base Flow at Prado credited to CBMWD and WMWD.

### **Total Flow at Prado**

The total flow of the Santa Ana River at Prado amounted to 118,300 acre-feet, measured at the USGS gaging station below Prado Dam. Separated into its components, Base Flow was 74,875 acre-feet, Storm Flow was 26,923 acre-feet, Nontributary Flow during 1980-81 due to the release of State water above Riverside Narrows during 1972-73 was 412 acre-feet, and discharge due to the pumpout program from Lake Elsinore that passed Prado Dam was 16,090 acre-feet. The components of flow of the Santa Ana River at Prado Dam for each month in the 1980-81 water year are listed in Table 5, and are shown graphically on Plate 2.

### **Nontributary Flow**

Since May 1973, OCWD has purchased State water for the replenishment of the groundwater basins in Orange County. The water has been released at two locations: Santa Ana River above Riverside Narrows and San Antonio Creek near Upland.

#### **Releases Above Riverside Narrows**

As fully discussed in Appendix F, the Fifth Annual Report, the Watermaster Committee made a determination of a schedule of credits to OCWD for State Water released above Riverside Narrows during 1972-73. For 1980-81 the credit is 412 acre-feet, assumed to be distributed uniformly throughout the year, as shown in Table 5.

TABLE 5

**COMPONENTS OF FLOW AT PRADO DAM  
FOR WATER YEAR 1980-81  
(acre-feet)**

Month	USGS Measured Outflow	Change in Storage <sup>(1)</sup>	Computed Inflow	Dis-charge from Lake Elsinore	Storm Flow	Base Flow	Non-tributary Water from Riverside Narrows <sup>(2)</sup>
October	6,500	-0-	6,500	173	78	6,214	35
November	9,566	4	9,570	2,732	-0-	6,803	35
December	15,970	(4)	15,966	7,790	342	7,799	35
January	12,958	7,157	20,115	5,395	6,306	8,379	35
February	11,352	401	11,753	-0-	4,017	7,702	34
March	14,503	3,535	18,038	-0-	10,145	7,859	34
April	22,503	(10,357)	12,146	-0-	5,134	6,978	34
May	7,924	(736)	7,188	-0-	901	6,253	34
June	5,054	-0-	5,054	-0-	-0-	5,020	34
July	4,028	-0-	4,028	-0-	-0-	3,994	34
August	3,880	-0-	3,880	-0-	-0-	3,846	34
September	4,062	-0-	4,062	-0-	-0-	4,028	34
<b>Total</b>	<b>118,300</b>	<b>-0-</b>	<b>118,300</b>	<b>16,090</b>	<b>26,923</b>	<b>74,875</b>	<b>412</b>

(1) The monthly change in storage included in the monthly components of flow.

(2) That portion of State water released during 1972-73 upstream of Riverside Narrows, determined to have reached Prado Dam in 1980-81.

### **Releases to San Antonio Creek**

During water year 1980-81, OCWD did not purchase State water to be released from the Rialto Reach of the Foothill Feeder at OC-59 into San Antonio Creek near Upland. Therefore, there was no Nontributary Flow of State water through Prado Dam from this source during 1980-81. The Watermaster has determined that additional testing and sampling programs should be made to quantify the extent of losses between OC-59 and the Prado Dam gage; however, due to zero releases, this program could not be continued in water year 1980-81. The Committee did not make a final determination and intends to continue investigation of the disposition of State water released into San Antonio Creek since the water year 1973-74, and to make a final determination and adjustment for each of these years at some subsequent time.

### **Discharge from Lake Elsinore**

As discussed in Chapter II, pumps at Lake Elsinore were first started on October 18, 1980 and brought on line in stages. Pumping was discontinued from October 28 to November 4 for flood control repairs along Temescal Wash. The pumps were subsequently placed back in operation in stages beginning on November 4, 1980 until January 22, 1981. A total calculated volume of 20,100 acre-feet was discharged to Temescal Wash from the lake during the program.

To separate Lake Elsinore discharge reaching Prado Dam from other flow components, the members of the Watermaster used the usual procedure for determining flow components. The hydrograph on Plate 2 indicates that Lake Elsinore discharge passed through Prado Dam from October 23 to October 31, 1980 and from November 6, 1980 to January 27, 1981. The total amount of Lake Elsinore discharge passing Prado Dam in the water year 1980-81 was 16,090 acre-feet. This total and the monthly distribution are shown in Table 5.

### **Storm Flow**

Generally during storms, the U.S. Army Corps of Engineers operates the Prado gates so that some of the storm runoff is temporarily held in storage behind the dam. As the storm ends, Prado Reservoir storage is gradually reduced by the controlled releases to the downstream water conservation facilities operated by

Orange County Water District. Monthly and annual quantities of Storm Flow are shown in Table 5.

The U.S. Army Corps of Engineers has an established operations guideline schedule with respect to required reservoir releases for specific water surface elevations. Flood releases would not be made below the debris pool elevation of 490 feet. With water elevations above 490 feet, water is released at a progressive increase in flowrate to a maximum of 5,000 cfs. This flowrate is maintained until the water surface elevation reaches the spillway crest elevation at 543 feet. The original reservoir operation plan, although never officially changed, was modified during water year 1977-78 by an Executive Order from President Carter which requested all government agencies to make every effort to maximize water conservation.

During water-year 1979-80, the Corps of Engineers initiated a study to reevaluate its operations schedule to increase the water conservation potential of Prado Reservoir while maintaining flood control protection in downstream areas. When finalized, the selected plan will consist of a combination of one of six alternative flood control plans and one of four alternative water conservation plans under evaluation by the study. Each of the water conservation alternatives, including the current plan, requires an empty reservoir in August and September to allow for annual maintenance. The study has not been completed and Prado Dam was operated under the original guidelines during the water year 1980-81.

During the 1980-81 water year, more than 100 acre-feet of water was stored behind Prado Dam during the periods December 5 to December 11; and January 13 to May 1. During these periods, the water stored in Prado Reservoir varied up to a maximum of 12,632 acre-feet and the maximum mean daily flow released to the Santa Ana River was 495 cfs.

#### **Base Flow**

The determination of Base Flow was affected by Nontributary Flow which was released at Riverside Narrows and discharge of Lake Elsinore reaching Prado Dam via the Temescal Wash.

The general procedure used by the members of the Watermaster to separate the 1980-81 flow components was the same as used for previous years and is fully described in the Fifth Annual Report. The monthly and annual amounts are shown in Table 5.

### Water Quality

The weighted average total dissolved solids (TDS) for the total flow passing Prado, including Nontributary Flow and discharge from Lake Elsinore, was found to be 735 ppm. This determination was based on continuous measurements of electrical conductivity (EC) by the USGS at the Santa Ana River below Prado and a statistical correlation of EC and TDS.

The EC of the outflow at Prado Dam was recorded hourly on a punched tape by the USGS. Combined, the USGS and DWR also collected 31 grab samples and performed laboratory analyses for TDS. A correlation between TDS and EC was developed using the TDS data from the grab samples and the EC recorded by the meter at the times when the samples were collected. Four samples were collected during the period from January 15 through March 4 when continuous EC measurements were unavailable due to meter malfunction. As a result, 27 data points were used to develop the TDS and EC collection. (Data used for the statistical analysis are listed in Table B-1; Appendix B.) The statistical analysis yields the best fit equation shown below:

$$\text{TDS} = 7.39 \text{ EC}^{0.65}$$

where: TDS = ppm  
EC = micromhos/cm

Application of the equation relating EC to TDS provided hourly TDS values. Using hourly data, flow weighted average daily values for TDS were computed and are listed in Table B-2, Appendix B.

The plot of TDS on Plate 3 shows the daily average TDS concentration of the Santa Ana River. The daily average TDS concentration was calculated from the continuous EC measurements and the correlation of EC and TDS. As daily TDS concentration could not be determined during the period when continuous EC data was not available, TDS was assumed to be unchanged unless there was a change in the amount of storm flow reaching Prado Dam. The TDS concentration would decrease soon after the on-set of a storm and would increase with a decrease in storm flow; the extent of the increase or decrease in TDS concentration was determined by the TDS concentration of the next available grab sample.

### Water Quality Adjustment for Nontributary Flow and Discharge from Lake Elsinore

The weighted average annual TDS value of 735 ppm, shown in Table B-3, Appendix B, represents the quality of Total Flow which includes Nontributary Flow from release of State water to Santa Ana River above Riverside Narrows and discharge from Lake Elsinore due to the pumpout program. The Judgment requires that Base Flow shall be subject to adjustment based on the TDS of Base Flow and Storm Flow only. Hence the following determination of Base Flow plus Storm Flow TDS has been made.

The flow weighted average TDS of Lake Elsinore water released to Temescal Wash in 1980-81 was 660 ppm as shown in Table C-1, Appendix C. A total of 20,100 acre-feet was pumped from Lake Elsinore of which 789 acre-feet was diverted at Lee Lake by the Temescal Water Company. Hence, the amount of salt transported down the Temescal Wash to Prado Dam was 12,745,260 acre-feet-ppm. The flow weighted average TDS of State water released above Riverside Narrows during 1972-73 was 235 ppm and was adjusted to 242 ppm to reflect a 3 percent evapotranspiration loss of the water released.

	Annual Flow (acre-feet)	Average TDS (ppm)	Annual Flow X Average TDS (acre-feet-ppm)
1. Total Flow	118,300	735	86,950,500
2. Less Nontributary Flow Riverside Narrows	412	242	99,704
3. Less Lake Elsinore Flow	<u>16,090</u>	792 (1)	<u>12,745,260</u> (2)
4. Total Base and Storm Flows	101,798		74,105,536
5. Average TDS of Total Base and Storm Flows	$74,105,536 \div 101,798 = 728$ ppm		

- (1) Determined from total salts transported down Temescal Wash to Prado Dam and total flow reaching Prado Dam from Lake Elsinore.
- (2) Determined from pumped out volume from Lake Elsinore and average TDS at discharge, less diversions from Lee Lake.

After adjusting for releases of State water and the discharge from Lake Elsinore, the weighted average annual TDS of Storm Flow and Base Flow for 1980-81 was 728 ppm. It is understood that the water quality adjustment will be changed for years subsequent to 1973-74 at the same time the final determination of the disposition of State water released into San Antonio Creek is made.

#### Adjusted Base Flow

According to the Judgment, "The amount of Base Flow at Prado received during any year shall be subjected to adjustment based on weighted average annual TDS in Base Flow and Storm Flow at Prado as follows:

If the Weighted Average TDS in Base Flow and Storm Flow at Prado is:	Then the Adjusted Base Flow shall be determined by the formula:
Greater than 800 ppm	$Q - \frac{35}{42,000} Q \text{ (TDS-800)}$
700 ppm - 800 ppm	Q
Less than 700 ppm	$Q + \frac{35}{42,000} Q \text{ (700-TDS)}$
Where: Q = Base Flow actually received."	

The weighted average annual TDS of 728 ppm is between 700 to 800 ppm. Therefore, the Base Flow of 74,875 acre-feet does not require adjustment.

#### Entitlement and Credit or Debit

From pages 12 and 13 of the Judgment, the following obligation of the CBMWD and WMWD is given: "CBMWD and WMWD shall be responsible for an average annual Adjusted Base Flow of 42,000 acre-feet at Prado..... CBMWD and WMWD each year shall be responsible for not less than 37,000 acre-feet of Base Flow at Prado, plus one-third of any cumulative debit; provided, however, that for any year commencing on or after October 1, 1986, when there is not cumulative debit, or for any year prior to 1986 whenever the cumulative credit exceeds 30,000 acre-feet, said minimum shall be 34,000 acre-feet."

The Watermasters agreed that Lake Elsinore flows were not envisioned during the formulation of the Judgment and because of the occurrence of Lake

Elsinore water at Prado, the Watermaster decided to credit one-half of the amount of Lake Elsinore flow reaching Prado against the Base Flow obligation at Prado Dam. Thus, an additional 8,045 acre-feet were credited to the Cumulative Adjusted Base Flow.

The Watermaster's findings at Prado for 1980-81 required under the Judgment are as follows:

1.	Total Flow at Prado	118,300 acre-feet
2.	Base Flow at Prado	74,875 acre-feet
3.	Annual Weighted TDS of Base and Storm Flows	728 ppm
4.	Annual Adjusted Base Flow	74,875 acre-feet
5.	One-Half Lake Elsinore Discharge Reaching Prado	8,405 acre-feet
6.	Cumulative Adjusted Base Flow	665,473 acre-feet
7.	Cumulative Entitlement of OCWD	462,000 acre-feet
8.	Cumulative Credit	203,473 acre-feet
9.	One-Third of Cumulative Debit	0 acre-feet
10.	Minimum Required Base Flow in 1981-82	34,000 acre-feet

## **CHAPTER IV**

### **BASE FLOW AT RIVERSIDE NARROWS**

This chapter deals with determination of 1) the components of flow at Riverside Narrows, which include Nontributary Flow, Storm Flow, and Base Flow; and 2) the adjusted Base Flow at Riverside Narrows credited to SBVMWD.

#### **Total Flow at Riverside Narrows**

The total flow of the Santa Ana River at Riverside Narrows amounted to 34,698 acre-feet, measured at the USGS gaging station just upstream of the MWD Upper Feeder Crossing. Separated into its components, Base Flow was 19,764 acre-feet, Storm Flow was 15,783 acre-feet, and Nontributary Flow due to the release of State water above Riverside Narrows was 420 acre-feet. Included in Base Flow is 1,269 acre-feet of wastewater from Rubidoux Community Services District which now bypasses the USGS gaging station. This item is discussed on the following page. The components of flow of the Santa Ana River at Riverside Narrows for each month in the 1980-81 water year are listed in Table 6 and graphically shown on Plate 4.

#### **Nontributary Flow**

During the period May through September, 1973, 11,617 acre-feet of State water from the East Branch of the California Aqueduct was purchased by the Orange County Water District and released into the Santa Ana River in the vicinity of Colton.

The Watermaster's determination of the effect of these releases has been discussed in the Fifth Annual Report of the Watermaster. For the water year 1980-81 the amount of State water reaching Riverside Narrows has been agreed upon as 420 acre-feet.

### Base Flow

Based on the hydrograph shown on Plate 4 and utilizing in general the same procedures reflected in the Work Papers of the engineers (as referenced in Paragraph 2 of the Engineering Appendix of the Judgment), a separation was made between Storm Flow and the sum of Base Flow and Nontributary Flow.

Nontributary Flow was assumed to be equally distributed throughout the year (420 acre-feet divided by 12 months) and subtracted from the sum of the Base Flow and Nontributary Flow as shown on Table 6.

**TABLE 6**  
**COMPONENTS OF FLOW AT RIVERSIDE NARROWS FOR WATER YEAR 1980-81**  
**(acre-feet)**

		Total Flow USGS Measurement	Storm Flow	Non- tributary Flow	Rubidoux Wastewater	Base(1) Flow
1980	October	1,523	0	35	103	1,591
	November	1,438	0	35	104	1,507
	December	1,622	0	35	108	1,695
1981	January	4,814	3,217	35	108	1,670
	February	7,928	6,038	35	72	1,927
	March	5,891	3,361	35	117	2,612
	April	5,133	3,056	35	111	2,153
	May	1,843	111	35	110	1,807
	June	1,200	0	35	103	1,268
	July	1,031	0	35	110	1,106
	August	1,103	0	35	110	1,178
	September	1,172	0	35	113	1,250
<b>Total</b>		<b>34,698</b>	<b>15,783</b>	<b>420</b>	<b>1,269</b>	<b>19,764</b>

(1) Base Flow includes Rubidoux wastewater.

In April 1980, Rubidoux Community Services District made the first delivery of wastewater to the regional waste treatment plant at Riverside. Prior to that time, Rubidoux had discharged to the river upstream of the Riverside Narrows Gaging Station. Therefore, wastewater from Rubidoux, as shown in Appendix E,

in the amount of 1,269 acre-feet, has been added to the streamflow as measured at the gaging station. The Base Flow was determined to be 19,764 acre-feet, as shown on Table 6.

### Water Quality

The determination of quality of water at the Riverside Narrows Gaging Station was made using periodic grab samples taken and analyzed for TDS by the USGS, the City of Riverside and the Department of Water Resources. The results are summarized in Appendix D, Table D-1. Table D-2 shows the flow weighted quality of the flow including the Nontributary Flow and excluding the Rubidoux wastewater. The Base Flow quality resulting from exclusion of the Nontributary Flow and inclusion of the Rubidoux wastewater is shown in the following table as 715 ppm.

	Annual Flow (acre-feet)	Avg. TDS (ppm)	(Annual Flow) x (Avg. TDS) (acre-feet - ppm)
1. Base Flow including Tributary Flow and excluding Rubidoux Wastewater	18,915 A.F.	702 ppm	13,286,692 A.F.-ppm
2. Less Nontributary Flow	420 A.F.	237 ppm	99,540 A.F.-ppm
3. Plus Rubidoux Wastewater	<u>1,269 A.F.</u>	<u>746 ppm</u>	<u>947,170 A.F.-ppm</u>
4. Base Flow	19,764 A.F.	715 ppm	14,134,322 A.F.-ppm

### Adjusted Base Flow at Riverside Narrows

The Judgment provides that the amount of Base Flow at Riverside Narrows received during any year shall be subject to adjustment based on the weighted average annual TDS in such Base Flow as follows:

If the Weighted Average TDS in Base Flow at Riverside Narrow is:	Then the Adjusted Base Flow shall be determined by the formula:
Greater than 700 ppm	$Q - \frac{11}{15,250} Q (TDS-700)$
600 ppm - 700 ppm	$Q$
Less than 600 ppm	$Q + \frac{11}{15,250} Q (600-TDS)$

Where: Q = Base Flow actually received.

From the previous subsection, the weighted average annual TDS in the Base Flow at Riverside Narrows for the water year 1980-81 was 715 ppm. Therefore, adjustment necessary to compute Adjusted Base Flow is as follows:

$$Q - \frac{11}{15,250} \times Q (TDS-700)$$

$$19,764 - \frac{11}{15,250} \times 19,764 (715-700)$$

$$19,764 - 214 = 19,550 \text{ A.F.}$$

Therefore, the Adjusted Base Flow for 1980-81 is 19,550 A.F.

### Entitlement and Credit or Debit

Paragraph 5(b) of the Judgment states that "SBVMWD shall be responsible for an average annual Adjusted Base Flow of 15,250 acre-feet at Riverside Narrows... SBVMWD each year shall be responsible at Riverside Narrows for not less than 13,420 acre-feet of Base Flow plus one-third of any cumulative debit,

provided, however, that for any year commencing on or after October 1, 1986, when there is no cumulative debit, or for any year prior to 1986 whenever the cumulative credit exceeds 10,000 acre-feet, said minimum shall be 12,420 acre-feet."

The Watermaster's findings at Riverside Narrows for 1980-81 required under the Judgment are as follows:

1.	Base Flow at Riverside Narrows	19,764	acre-feet
2.	Annual Weighted TDS of Base Flow	715	ppm
3.	Annual Adjusted Base Flow	19,550	acre-feet
4.	Cumulative Adjusted Base Flow	210,196	acre-feet
5.	Cumulative Entitlement of CBMWD and WMWD	167,750	acre-feet
6.	Cumulative Credit	42,446	acre-feet
7.	One-Third of Cumulative Debit	0	acre-feet
8.	Minimum Required Base Flow in 1981-82	12,420	acre-feet

**APPENDIX A**

**STATE WATER RELEASED BY MWD  
TO SAN ANTONIO CREEK NEAR UPLAND**

**CONNECTION OC-59**

**1980-81**

**PREPARED BY  
DONALD L. HARRIGER**

**TABLE A-1**  
**NONTRIBUTARY WATER FROM OC-59**  
**MONTHLY TOTALS**  
**(Acre-Feet)**

**WATER YEAR 1980-81**

No Water was Released in 1980-81 from OC-59 for  
Orange County Water District

**APPENDIX B**

**WATER QUALITY-  
SANTA ANA RIVER BELOW PRADO DAM**

**1980-81**

**PREPARED BY  
WILLIAM R. MILLS, JR.**

## METHOD OF ANALYZING WATER QUALITY DATA

Utilizing the USGS water quality records, the following analyses were performed by the Watermaster to determine the annual weighted TDS:

1. Mean daily flow weighted specific conductivity was calculated using the punched tape from the Prado water quality recorder, processed by a newly developed computer program designed by USGS. Input to the program included hourly specific conductivity data from the recorder tape, which was flow weighted using hourly discharge measurements from the water stage recorder. However, due to recorder malfunction, hourly specific conductivity data were not available for the period from January 15 through March 4, 1981.
2. Laboratory analyses of the 27 grab samples taken by the USGS and DWR below Prado Dam during the 1980-81 season were run to determine both specific conductance and TDS. Data from the grab samples are given in Table B-1. Results of these analyses were used to prepare a correlation between specific conductance recorded on punched tape of the USGS at the times when the grab samples were collected and the corresponding TDS. A detailed discussion of this statistical analysis is presented in the Fifth Annual Watermaster Report.
3. The equation from the curve fitting operation was then used to determine the mean daily TDS corresponding to the mean daily specific conductance values for each day of the year except for the period from January 15 through March 4, 1981. These data are given in Table B-2.
4. The TDS for the period from January 15 through March 4, 1981 when specific conductivity data were not available was constructed from sample data from four grab samples taken during that period. The TDS

TABLE B-1

USGS WATER QUALITY SAMPLES  
BELOW PRADO DAM DURING WATER YEAR 1980-81

Date	TDS <sup>(1)</sup> (ppm)	EC <sup>(2)</sup> (micromhos/cm)	Source of Data
1980 Oct. 3	824	1,120	USGS
23	822	1,366	DWR
29	823	1,410	USGS
Nov. 7	761	1,370	USGS
14	808	1,280	DWR
25	804	1,290	USGS
Dec. 5	810	1,250	USGS
12	812	1,310	DWR
17	791	1,190	USGS
1981 Jan. 15	864 (3)	---	USGS
Feb. 3	675 (3)	---	USGS
23	689 (3)	---	USGS
Mar. 2	650 (3)	---	USGS
5	621	983	USGS
12	606	900	DWR
23	679	1,120	USGS
31	630	1,080	USGS
Apr. 16	659	1,070	DWR
21	730	1,140	USGS
May 4	811	1,300	USGS
13	785	1,390	USGS
15	758	1,360	DWR
Jun. 4	724	1,300	USGS
16	834	1,400	USGS
16	783	1,450	DWR
Jul. 4	813	1,290	USGS
20	795	1,350	USGS
Aug. 24	752	1,240	USGS
26	763	1,170	DWR
Sep. 1	742	1,190	USGS
21	815	1,240	DWR

- (1) Based on analysis of grab samples.
- (2) Based on hourly EC recording.
- (3) Sample data not used in TDS/EC correlation determination due to malfunctioning EC meter.

concentration was assumed to be unchanged unless there was a change in the amount of storm flow passing through Prado Dam. TDS concentration would increase when there was a decrease in storm flow and decrease with an increase in storm flow; the extent of the increase or decrease in TDS concentration was determined by the TDS concentration of the next available grab sample.

5. The mean daily TDS values were then multiplied by the mean daily flow as shown in Table B-2. These products were then summed and divided by the total flow for the year to determine the weighted average TDS value for the water year. This value for TDS for the total flow including nontributary water was 735 ppm of TDS for the 1980-81 water year. The weighted TDS calculation for the water year 1980-81 is shown in Table B-3.

TABLE B-2

BELOW PRAVO DAM		P R C IOUPS WEIGHTED T.O.S. CALCULATION SHEET			0.6505)
MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.O.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.O.S.
		WATER YEAR 1980-1981 TDS= 7.3999*(EC**			
OCT	01	93.0	1140	721	67053.
OCT	02	91.0	1120	712	64792.
OCT	03	93.0	1120	712	66216.
OCT	04	94.0	1120	712	66928.
OCT	05	98.0	1100	704	68992.
OCT	06	100.0	1090	700	70000.
OCT	07	103.0	1090	700	72100.
OCT	08	105.0	1080	696	73080.
OCT	09	102.0	1100	704	71808.
OCT	10	106.0	1090	700	74200.
OCT	11	105.0	1090	700	73500.
OCT	12	104.0	1100	704	73216.
OCT	13	102.0	1090	700	71400.
OCT	14	108.0	1140	721	77868.
OCT	15	109.0	1210	749	81641.
OCT	16	115.0	1210	749	86135.
OCT	17	112.0	1250	765	85680.
OCT	18	107.0	1290	781	83567.
OCT	19	98.0	1330	797	78106.
OCT	20	99.0	1350	804	79596.
OCT	21	96.0	1350	804	77184.
OCT	22	97.0	1360	808	78376.
OCT	23	98.0	1360	808	79184.
OCT	24	108.0	1330	797	86076.
OCT	25	112.0	1340	801	89712.
OCT	26	128.0	1320	793	101504.
OCT	27	134.0	1360	808	108272.
OCT	28	117.0	1390	820	95940.
OCT	29	115.0	1400	824	94760.
OCT	30	120.0	1360	808	96960.
OCT	31	110.0	1330	797	87670.
TOTAL		3279.		757	2481516.
MONTHLY WEIGHTED T.O.S.					

B-4

TABLE B-2 (cont.)

MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.
NOV 01		107.0	1300	785	83995.
NOV 02		104.0	1280	777	80808.
NOV 03		103.0	1260	769	79207.
NOV 04		104.0	1250	765	79560.
NOV 05		104.0	1250	765	79560.
NOV 06		108.0	1290	781	84348.
NOV 07		118.0	1360	808	95344.
NOV 08		123.0	1340	801	98523.
NOV 09		132.0	1310	789	104148.
NOV 10		136.0	1290	781	106216.
NOV 11		141.0	1280	777	109557.
NOV 12		141.0	1280	777	109557.
NOV 13		141.0	1280	777	109557.
NOV 14		148.0	1290	781	115588.
NOV 15		138.0	1310	789	108882.
NOV 16		130.0	1310	789	102570.
NOV 17		137.0	1310	789	108093.
NOV 18		165.0	1310	789	130185.
NOV 19		170.0	1300	785	133450.
NOV 20		174.0	1300	785	136590.
NOV 21		184.0	1310	789	145176.
NOV 22		188.0	1320	793	149084.
NOV 23		211.0	1310	789	166479.
NOV 24		215.0	1300	785	168775.
NOV 25		206.0	1300	785	161710.
NOV 26		224.0	1290	781	174944.
NOV 27		235.0	1290	781	183535.
NOV 28		243.0	1290	781	189783.
NOV 29		293.0	1270	773	226489.
NOV 30		251.0	1250	765	192015.
TOTAL		4874.		782	3813728.
MONTHLY WEIGHTED T.D.S.					

B-5

TABLE B-2 (cont.)

MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICRUMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.
DEC 01		257.0	1250	765	196605.
DEC 02		246.0	1290	781	192126.
DEC 03		266.0	1280	777	206682.
DEC 04		324.0	1270	773	250452.
DEC 05		237.0	1290	781	185097.
DEC 06		222.0	1380	816	181152.
DEC 07		222.0	1370	812	180264.
DEC 08		244.0	1370	812	198128.
DEC 09		259.0	1360	808	209272.
DEC 10		272.0	1350	804	218688.
DEC 11		295.0	1340	801	236295.
DEC 12		325.0	1310	789	256425.
DEC 13		269.0	1290	781	210089.
DEC 14		250.0	1270	773	193250.
DEC 15		265.0	1250	765	202725.
DEC 16		253.0	1240	761	192533.
DEC 17		252.0	1230	757	190764.
DEC 18		253.0	1280	777	196581.
DEC 19		251.0	1300	785	197035.
DEC 20		247.0	1290	781	192907.
DEC 21		249.0	1290	781	194469.
DEC 22		251.0	1300	785	197035.
DEC 23		245.0	1300	785	192325.
DEC 24		250.0	1290	781	195250.
DEC 25		270.0	1280	777	209790.
DEC 26		267.0	1270	773	206391.
DEC 27		271.0	1270	773	209483.
DEC 28		264.0	1270	773	204072.
DEC 29		265.0	1260	769	203785.
DEC 30		263.0	1250	765	201195.
DEC 31		249.0	1260	769	191481.
TOTAL		8053.		781	6292346.
MONTHLY WEIGHTED T.D.S.				781	

TABLE B-2 (cont.)

BELOW PRADO DAM		P R C TOUPS WEIGHTED T.D.S. CALCULATION SHEET			7.3999
MONTH-DAY		WATER YEAR 1980-1981	TDS=	0.6505LN(EC)*	
		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICRUMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.
JAN	01	<55.0	1260	769	196095.
JAN	02	242.0	1260	769	186098.
JAN	03	253.0	1240	761	192533.
JAN	04	266.0	1240	761	202426.
JAN	05	265.0	1230	757	200605.
JAN	06	249.0	1230	757	188493.
JAN	07	245.0	1230	757	185465.
JAN	08	<55.0	1240	761	194055.
JAN	09	254.0	1240	761	193294.
JAN	10	<60.0	1240	761	197860.
JAN	11	356.0	1240	761	270916.
JAN	12	149.0	1240	761	113389.
JAN	13	45.0	1240	761	34245.
JAN	14	169.0	1250	765	129285.
JAN	15	241.0	1250	765	184365.
JAN	16	243.0	1250	765	185895.
JAN	17	242.0	1250	765	185130.
JAN	18	241.0	1250	765	184365.
JAN	19	243.0	1250	765	185895.
JAN	20	240.0	1250	765	183600.
JAN	21	236.0	1250	765	180540.
JAN	22	234.0	1250	765	179010.
JAN	23	149.0	1250	765	113985.
JAN	24	93.0	1250	765	71145.
JAN	25	93.0	1250	765	71145.
JAN	26	92.0	1250	765	70380.
JAN	27	119.0	1030	675	80325.
JAN	28	228.0	1030	675	153900.
JAN	29	304.0	1030	675	205200.
JAN	30	213.0	1030	675	143775.
JAN	31	62.0	1030	675	41850.
TOTAL		6536.		750	4905264.
MONTHLY WEIGHTED T.D.S.					

TABLE B-2 (cont.)

BELOW PRAVO DAM		P R C TOUPS WEIGHTED T.D.S. CALCULATION SHEET			
MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.
					0.6505)
FEB	01	72.0	1030	675	48600.
FEB	02	131.0	1030	675	88425.
FEB	03	211.0	1030	675	142425.
FEB	04	241.0	1030	675	162675.
FEB	05	263.0	1030	675	177525.
FEB	06	289.0	1030	675	195075.
FEB	07	252.0	1030	675	170100.
FEB	08	52.0	1030	675	35100.
FEB	09	120.0	1030	675	81000.
FEB	10	206.0	1030	675	139050.
FEB	11	247.0	1030	675	166725.
FEB	12	259.0	1030	675	174825.
FEB	13	216.0	1030	675	145800.
FEB	14	152.0	1070	692	105184.
FEB	15	153.0	1070	692	105876.
FEB	16	150.0	1070	692	103800.
FEB	17	210.0	1070	692	145320.
FEB	18	245.0	1070	692	169540.
FEB	19	282.0	1070	692	195144.
FEB	20	295.0	1070	692	204140.
FEB	21	288.0	1070	692	199296.
FEB	22	288.0	1070	692	199296.
FEB	23	285.0	1070	692	197220.
FEB	24	219.0	1070	692	151548.
FEB	25	132.0	980	653	86196.
FEB	26	172.0	980	653	112316.
FEB	27	175.0	980	653	114275.
FEB	28	118.0	980	653	77054.
TOTAL		5723.		680	3893530.
MONTHLY WEIGHTED T.D.S.					

TABLE B-2 (cont.)

MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.O.S.
MAR 01		118.0	980	653	77054.
MAR 02		523.0	980	653	341519.
MAR 03		668.0	980	653	436204.
MAR 04		660.0	980	653	430980.
MAR 05		332.0	995	660	219120.
MAR 06		89.0	986	656	58384.
MAR 07		89.0	997	661	58829.
MAR 08		89.0	1050	683	60787.
MAR 09		112.0	1050	683	76496.
MAR 10		134.0	1020	670	89780.
MAR 11		151.0	994	659	99509.
MAR 12		150.0	918	626	93900.
MAR 13		163.0	882	610	99430.
MAR 14		187.0	868	604	112948.
MAR 15		189.0	871	605	114345.
MAR 16		189.0	881	609	115101.
MAR 17		191.0	923	628	119948.
MAR 18		191.0	947	639	122049.
MAR 19		122.0	983	654	79788.
MAR 20		98.0	1020	670	65660.
MAR 21		172.0	1020	670	115240.
MAR 22		169.0	1060	687	116103.
MAR 23		185.0	1100	704	130240.
MAR 24		273.0	1080	696	190008.
MAR 25		304.0	1040	679	206416.
MAR 26		299.0	1000	662	197936.
MAR 27		297.0	944	637	189189.
MAR 28		295.0	961	645	190275.
MAR 29		293.0	1020	670	196310.
MAR 30		290.0	1020	670	194300.
MAR 31		290.0	1030	675	195750.
TOTAL		7312.		656	4793600.
MONTHLY WEIGHTED T.D.S.				656	

B-9

TABLE B-2 (cont.)

MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.U.S.
APR 01		288.0	1000	662	190656.
APR 02		288.0	988	657	189216.
APR 03		287.0	994	659	189133.
APR 04		285.0	1020	670	190950.
APR 05		284.0	1050	683	193972.
APR 06		282.0	1030	675	190350.
APR 07		285.0	1010	666	189810.
APR 08		287.0	1010	666	191142.
APR 09		320.0	1040	679	217280.
APR 10		343.0	1060	687	235641.
APR 11		340.0	1080	696	236640.
APR 12		340.0	1060	687	233580.
APR 13		335.0	1040	679	227465.
APR 14		331.0	1030	675	223425.
APR 15		324.0	1070	692	224208.
APR 16		321.0	1060	687	220527.
APR 17		404.0	1070	692	279568.
APR 18		438.0	1070	692	303096.
APR 19		434.0	1070	692	300328.
APR 20		420.0	1110	708	297360.
APR 21		412.0	1160	729	300348.
APR 22		446.0	1170	733	326918.
APR 23		480.0	1100	704	337920.
APR 24		492.0	1090	700	344400.
APR 25		495.0	1070	692	342540.
APR 26		486.0	1060	687	333882.
APR 27		475.0	1050	683	324425.
APR 28		463.0	1070	692	320396.
APR 29		482.0	1090	700	337400.
APR 30		478.0	1110	708	338424.
TOTAL		11345.		690	7831000.
MONTHLY WEIGHTED T.D.S.					

B-10

BELOW PRAUO DAM

P R C T O U P S  
WEIGHTED T.D.S. CALCULATION SHEET

WATER YEAR 1980-1981 TDS= 7.3999\*(EC\*\*

0.6505)

TABLE B-2 (cont.)

RELOW PRAUD DAM		P R C IOUPS WEIGHTED T.D.S. CALCULATION SHEET			
		WATER YEAR 1980-1981		TDS=	7.3999*(FC** 0.6505)
MONTH-DAY	U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.	
MAY 01	444.0	1140	721	320124.	
MAY 02	375.0	1260	769	288375.	
MAY 03	191.0	1330	797	152227.	
MAY 04	122.0	1340	801	97722.	
MAY 05	124.0	1410	828	102672.	
MAY 06	120.0	1410	828	99360.	
MAY 07	114.0	1350	804	91656.	
MAY 08	109.0	1300	785	85565.	
MAY 09	105.0	1280	777	81585.	
MAY 10	101.0	1250	765	77265.	
MAY 11	96.0	1250	765	73440.	
MAY 12	96.0	1260	769	73824.	
MAY 13	87.0	1320	793	68991.	
MAY 14	112.0	1390	820	91840.	
MAY 15	119.0	1370	812	96628.	
MAY 16	108.0	1340	801	86508.	
MAY 17	106.0	1320	793	84058.	
MAY 18	99.0	1390	820	81180.	
MAY 19	105.0	1420	831	87255.	
MAY 20	106.0	1450	843	89358.	
MAY 21	99.0	1500	862	85338.	
MAY 22	100.0	1540	876	87600.	
MAY 23	106.0	1530	873	92538.	
MAY 24	98.0	1530	873	85554.	
MAY 25	92.0	1520	869	79948.	
MAY 26	91.0	1460	847	77077.	
MAY 27	102.0	1390	820	83640.	
MAY 28	121.0	1370	812	98252.	
MAY 29	112.0	1460	847	94864.	
MAY 30	117.0	1530	873	102141.	
MAY 31	118.0	1600	898	105964.	
TOTAL	3995.		807	3222549.	
MONTHLY WEIGHTED T.D.S.					

B-11

TABLE B-2 (cont.)

BELOW PRAUD DAM		P R C IOUPS WEIGHTED T.D.S. CALCULATION SHEET WATER YEAR 1980-1981 TDS= 7.3999*(EC** 0.6505)			
MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.
JUN	01	129.0	1280	777	100233.
JUN	02	151.0	1290	781	117931.
JUN	03	163.0	1320	793	129259.
JUN	04	152.0	1280	777	118104.
JUN	05	132.0	1260	769	101508.
JUN	06	113.0	1320	793	89609.
JUN	07	104.0	1360	808	84032.
JUN	08	95.0	1420	831	78945.
JUN	09	95.0	1430	835	79325.
JUN	10	87.0	1440	839	72993.
JUN	11	69.0	1340	876	60444.
JUN	12	70.0	1340	876	61320.
JUN	13	71.0	1310	865	61415.
JUN	14	64.0	1330	873	55872.
JUN	15	59.0	1450	843	49737.
JUN	16	65.0	1430	835	54275.
JUN	17	65.0	1420	831	54015.
JUN	18	66.0	1360	808	53328.
JUN	19	68.0	1300	785	53380.
JUN	20	70.0	1420	831	58170.
JUN	21	66.0	1360	808	53328.
JUN	22	63.0	1330	797	50211.
JUN	23	65.0	1300	785	51025.
JUN	24	64.0	1290	781	49984.
JUN	25	67.0	1280	777	52059.
JUN	26	65.0	1290	781	50765.
JUN	27	68.0	1280	777	52836.
JUN	28	67.0	1280	777	52059.
JUN	29	67.0	1280	777	52059.
JUN	30	68.0	1260	769	52292.
TOTAL		2548.		805	2050513.
MONTHLY WEIGHTED T.D.S.					

B-12

TABLE B-2 (cont.)

MONTH-DAY		U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.
JUL 01		73.0	1340	801	58473.
JUL 02		75.0	1380	816	61200.
JUL 03		71.0	1350	804	57084.
JUL 04		66.0	1310	789	52074.
JUL 05		62.0	1300	785	48670.
JUL 06		56.0	1240	761	42616.
JUL 07		63.0	1240	761	47943.
JUL 08		64.0	1260	769	49216.
JUL 09		67.0	1270	773	51791.
JUL 10		68.0	1260	769	52292.
JUL 11		68.0	1280	777	52836.
JUL 12		68.0	1300	785	53380.
JUL 13		65.0	1330	797	51805.
JUL 14		65.0	1330	797	51805.
JUL 15		70.0	1340	801	56070.
JUL 16		70.0	1330	797	55790.
JUL 17		68.0	1330	797	54196.
JUL 18		67.0	1290	781	52327.
JUL 19		66.0	1300	785	51810.
JUL 20		62.0	1340	801	49662.
JUL 21		62.0	1330	797	49414.
JUL 22		63.0	1290	781	49203.
JUL 23		62.0	1250	765	47430.
JUL 24		62.0	1250	765	47430.
JUL 25		60.0	1270	773	46380.
JUL 26		58.0	1240	761	44138.
JUL 27		60.0	1240	761	45660.
JUL 28		65.0	1260	769	49985.
JUL 29		67.0	1280	777	52059.
JUL 30		69.0	1280	777	53613.
JUL 31		68.0	1280	777	52836.
TOTAL		2030.		783	1589188.
MONTHLY WEIGHTED T.D.S.				783	

B-13

P R C 10UPS

WEIGHTED T.D.S. CALCULATION SHEET

BELOW PRAUO DAM

WATER YEAR 1980-1981

TDS=

7.3999\*(EC\*\*

0.6505)

TABLE B-2 (cont.)

BELOW PRAVO DAM		P R C TOUPS WEIGHTED T.D.S. CALCULATION SHEET			
		WATER YEAR 1980-1981		TDS=	7.3999*(EC** 0.6505)
MONTH-DAY	U.S.G.S. MEAN DAILY FLOW (CFS-DAY)	U.S.G.S. MEAN DAILY SPECIFIC CONDUCTANCE (E.C.) (MICROMHOS)	MEAN DAILY ADJUSTED T.D.S. (PPM)	MEAN DAILY FLOW TIMES ADJUSTED T.D.S.	
AUG 01	66.0	1280	777	51282.	
AUG 02	63.0	1280	777	48951.	
AUG 03	65.0	1280	777	50505.	
AUG 04	67.0	1250	765	51255.	
AUG 05	68.0	1270	773	52564.	
AUG 06	69.0	1270	773	53337.	
AUG 07	67.0	1260	769	51523.	
AUG 08	65.0	1250	765	49725.	
AUG 09	65.0	1230	757	49205.	
AUG 10	58.0	1240	761	44138.	
AUG 11	59.0	1240	761	44899.	
AUG 12	60.0	1240	761	45660.	
AUG 13	61.0	1250	765	46665.	
AUG 14	64.0	1260	769	49216.	
AUG 15	64.0	1250	765	48960.	
AUG 16	65.0	1240	761	49465.	
AUG 17	64.0	1240	761	48704.	
AUG 18	63.0	1250	765	48195.	
AUG 19	63.0	1220	753	47439.	
AUG 20	64.0	1220	753	48192.	
AUG 21	60.0	1230	757	45420.	
AUG 22	62.0	1260	769	47678.	
AUG 23	65.0	1220	753	48945.	
AUG 24	64.0	1180	737	47168.	
AUG 25	63.0	1200	745	46935.	
AUG 26	62.0	1190	741	45942.	
AUG 27	60.0	1210	749	44940.	
AUG 28	62.0	1180	737	45694.	
AUG 29	62.0	1140	721	44702.	
AUG 30	57.0	1180	737	42009.	
AUG 31	57.0	1190	741	42237.	
TOTAL	1954.		758	1481550.	
MONTHLY WEIGHTED T.D.S.					

B-14



**TABLE B-3**  
**SUMMARY OF WEIGHTED TDS**  
**BELOW PRADO DAM WATER YEAR 1980-1981**

	Monthly Flow (cfs-day)	Monthly Flow Times TDS	Monthly Weighted TDS (ppm)
October	3,279	2,481,516	757
November	4,874	3,813,728	782
December	8,053	6,292,346	781
January	6,536	4,905,264	750
February	5,723	3,893,530	680
March	7,312	4,793,600	656
April	11,345	7,831,000	690
May	3,995	3,222,549	807
June	2,548	2,050,513	805
July	2,030	1,589,188	783
August	1,954	1,481,550	758
September	2,048	1,533,333	749
<b>Total</b>	<b>59,697</b>	<b>43,888,117</b>	
<b>Yearly Weighted TDS</b>			<b>735</b>

**APPENDIX D**

**WATER QUALITY - SANTA ANA  
RIVER AT RIVERSIDE NARROWS**

**1980-81**

**PREPARED BY  
DONALD L. HARRIGER**

**TABLE D-1**  
**WATER QUALITY SAMPLES**  
**SANTA ANA RIVER AT RIVERSIDE NARROWS**  
**WATER YEAR 1980-81**

Date		EC at 25°C	TDS ppm	Agency
1980	Oct. 03	1120	682	USGS
	09	1100	692	C of R
	14	1060	784 (1)	C of R
	23	1080	684	C of R
	23	1100	712	DWR
	24	1120	685	USGS
	28	990	585 (1)	C of R
	Nov. 06	940	700	C of R
	10	1130	698	USGS
	11	740	686	C of R
	14	1120	717	DWR
	20	1030	696	C of R
	25	1120	715	C of R
	25	1160	841 (1)	USGS
	Dec. 03	1130	793	USGS
	04	1040	685	C of R
	09	1100	695	C of R
	09	1140	724	DWR
	17	1130	686	USGS
	18	1090	690	C of R
	23	1090	686	C of R
1981	Jan. 01	1080	696	C of R
	06	1100	701	C of R
	09	1210	746	USGS
	15	1090	698	C of R
	19	1120	710	DWR
	20	1090	694	C of R
	26	1110	679	USGS
	28	478	282	USGS
	29	870	562	C of R

(1) Excluded from computation of the monthly average shown on Table D-2.

TABLE D-1  
 WATER QUALITY SAMPLES  
 SANTA ANA RIVER AT RIVERSIDE NARROWS  
 WATER YEAR 1980-81 (CONTINUED)

Date	EC at 25°C	TDS ppm	Agency
1981			
Cont'd Feb. 03	1020	660	C of R
09	930	594	USGS
12	970	656	C of R
17	1020	659	C of R
24	1100	685	USGS
25	635	438	C of R
Mar. 03	977	592	USGS
03	840	507	C of R
12	980	644	C of R
12	1060	711	DWR
16	1100	669	USGS
17	1010	660	C of R
26	1020	650	C of R
31	1000	660	C of R
31	1120	675	USGS
Apr. 09	990	674	C of R
14	950	654	C of R
16	1100	703	DWR
21	1070	679	USGS
23	1020	665	C of R
28	1040	670	C of R
May 06	1130	723	USGS
07	1030	688	C of R
12	1040	672	C of R
15	1120	695	DWR
18	1140	730	USGS
21	1070	680	C of R
26	1080	689	C of R
June 04	1180	750	USGS
04	1100	712	C of R
09	1070	735	C of R
16	1150	753	DWR

TABLE D-1  
 WATER QUALITY SAMPLES  
 SANTA ANA RIVER AT RIVERSIDE NARROWS  
 WATER YEAR 1980-81 (CONTINUED)

Date	EC at 25°C	TDS ppm	Agency
1981			
Cont'd June 18	1100	667	USGS
18	1060	724	C of R
23	1040	691	C of R
Jul. 02	1070	698	C of R
07	1120	725	C of R
16	1070	712	C of R
17	1210	739	USGS
21	1080	748	C of R
30	1050	734	C of R
30	1120	708	DWR
Aug. 04	1080	702	C of R
07	1150	713	USGS
13	1090	704	C of R
18	1090	693	C of R
20	1105	720	USGS
26	1140	723	DWR
27	1020	648	C of R
Sept. 01	1050	681	C of R
10	1040	678	C of R
10	1160	731	USGS
15	1060	681	C of R
21	1100	736	DWR
24	1125	708	USGS
24	1090	705	C of R
29	1060	685	C of R

**TABLE D-2**  
**FLOW WEIGHTED TDS OF FLOW AT RIVERSIDE NARROWS**  
(Including Nontributary Flow and Excluding Rubidoux Wastewater)  
**WATER YEAR 1980-81**

Month	Acre Feet <sup>(1)</sup>	TDS <sup>(2)</sup> (ppm)	Acre Feet Times TDS	
1980	October	1,523	691	1,049,347
	November	1,438	702	1,009,476
	December	1,622	708	1,148,376
1981	January	1,597	703	1,122,691
	February	1,890	701	1,324,890
	March	2,530	700	1,771,000
	April	2,077	699	1,451,823
	May	1,732	697	1,207,204
	June	1,200	719	862,800
	July	1,031	723	745,413
	August	1,103	700	772,100
	September	1,172	701	821,572
Total		18,915		13,286,692
Flow Weighted TDS		$\frac{13,286,692}{18,915} = 702$		

- (1) Total Flow minus Storm Flow from Table 6.
- (2) Estimated average TDS based on water quality data from Table D-1.

**APPENDIX E**

**QUANTITY AND QUALITY OF  
WASTEWATER FROM RUBIDOUX  
COMMUNITY SERVICES DISTRICT**

**1980-81**

**PREPARED BY  
DONALD L. HARRIGER**

**TABLE E-1**  
**QUANTITY AND QUALITY OF WASTEWATER FROM RUBIDOUX**  
**DISCHARGED BELOW THE**  
**RIVERSIDE NARROWS GAGING STATION**  
**WATER YEAR 1980-81**

Month	Flow A.F.	TDS (ppm)	Acre-Feet x TDS	
1980	October	103	758	78,074
	November	104	764	79,456
	December	108	725	78,300
1981	January	108	735	79,380
	February	72	755	54,360
	March	117	795	93,015
	April	111	755	83,805
	May	110	720	79,200
	June	103	730	75,190
	July	110	730	80,300
	August	110	760	83,600
	September	<u>113</u>	<u>730</u>	<u>82,490</u>
	Total	1,269	---	947,170
		$\frac{947,170}{1,269}$	= 746 ppm	

Average Flow Weighted Quality of Base Flow = 746 ppm.

**APPENDIX F**

**SANTA ANA RIVER WATERMASTER  
FINANCIAL STATEMENTS WITH REPORT  
ON  
EXAMINATION BY CERTIFIED PUBLIC ACCOUNTANTS**

SANTA ANA RIVER WATERMASTER

FINANCIAL STATEMENTS

WITH REPORT ON EXAMINATION BY CERTIFIED PUBLIC ACCOUNTANTS

JUNE 30, 1981

DIEHL, EVANS AND COMPANY  
A PARTNERSHIP OF ACCOUNTANCY CORPORATIONS  
CERTIFIED PUBLIC ACCOUNTANTS  
1910 NORTH BUSH STREET  
SANTA ANA, CALIFORNIA 92706

**DIEHL, EVANS AND COMPANY**

A PARTNERSHIP OF ACCOUNTANCY CORPORATIONS

**CERTIFIED PUBLIC ACCOUNTANTS**

1910 NORTH BUSH STREET

SANTA ANA, CALIFORNIA 92706

(714) 542-4453

ELLIS C. DIEHL, C.P.A. (1925-1956)  
BRYN B. EVANS, C.P.A.  
WIN G. PETERS, C.P.A.  
DONALD H. PETERSON, C.P.A.  
DONALD E. CALLAHAN, C.P.A.  
L. PETER SCHERER, C.P.A.  
PHILIP H. HOLTkamp, C.P.A.  
RODNEY K. McDANIEL, C.P.A.  
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OTHER OFFICES AT:  
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CARLSBAD, CALIFORNIA 92008  
(714) 729-2343

120 WEST WOODWARD AVENUE  
ESCONDIDO, CALIFORNIA 92025  
(714) 741-3141

July 20, 1981

**ACCOUNTANTS' REPORT**

Santa Ana River Watermaster  
Orange, California

We have examined the statement of assets and liabilities arising from cash transactions of the Santa Ana River Watermaster as of June 30, 1981 and the related statement of revenue collected, expenses paid and changes in fund balance for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

As described in Note 1, the Watermaster's policy is to prepare its financial statements on the basis of cash receipts and disbursements; consequently, certain revenue and the related assets are recognized when received rather than when earned and certain expenses are recognized when paid rather than when the obligation is incurred. Accordingly, the accompanying financial statements are not intended to present financial position and results of operations in conformity with generally accepted accounting principles.

In our opinion, the aforementioned financial statements present fairly the assets and liabilities arising from cash transactions of the Santa Ana River Watermaster at June 30, 1981, and the revenue collected and expenses paid for the year then ended, on the basis of accounting described in Note 1, which basis has been applied in a manner consistent with that of the preceding year.

*Diehl, Evans and Company*

SANTA ANA RIVER WATERMASTER  
STATEMENT OF ASSETS AND LIABILITIES  
ARISING FROM CASH TRANSACTIONS

June 30, 1981

ASSETS

Cash in checking account	\$ 500
Cash in savings account	<u>4,769</u>
TOTAL ASSETS	<u>\$ 5,269</u>

LIABILITIES AND FUND BALANCE

Liabilities	\$ -
Fund balance	<u>5,269</u>
TOTAL LIABILITIES AND FUND BALANCE	<u>\$ 5,269</u>

See accountants' report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

STATEMENT OF REVENUE COLLECTED, EXPENSES  
PAID AND CHANGES IN FUND BALANCE

For the year ended June 30, 1981

	<u>Actual</u>	<u>Budget</u>	<u>Over (Under) Budget</u>
REVENUE COLLECTED:			
Water district contributions:			
Orange County Water District	\$ -	\$ 4,000	\$ (4,000)
Chino Basin Municipal Water District	2,000	2,000	-
San Bernardino Valley Municipal Water District	2,000	2,000	-
Western Municipal Water District	2,000	2,000	-
Interest from savings account	<u>435</u>	<u>-</u>	<u>435</u>
TOTAL REVENUE COLLECTED	<u>6,435</u>	<u>10,000</u>	<u>(3,565)</u>
EXPENSES PAID:			
Professional engineering services	7,800	6,000	1,800
Administrative expenses:			
Office and secretarial expense	\$ 1,782		
Auditing services	<u>470</u>	2,500	(248)
Annual reports	<u>1,820</u>	<u>1,500</u>	<u>320</u>
TOTAL EXPENSES PAID	<u>11,872</u>	<u>10,000</u>	<u>1,872</u>
EXCESS OF EXPENSES PAID OVER REVENUE COLLECTED	(5,437)	<u>\$ -</u>	<u>\$ (5,437)</u>
FUND BALANCE AT JULY 1, 1980	<u>10,706</u>		
FUND BALANCE AT JUNE 30, 1981	<u>\$ 5,269</u>		

See accountants' report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

NOTES TO FINANCIAL STATEMENTS

June 30, 1981

1. SIGNIFICANT ACCOUNTING POLICIES:

The Watermaster uses the cash receipts and disbursements method of accounting for all of its financial activity.

2. ORGANIZATION AND HISTORY:

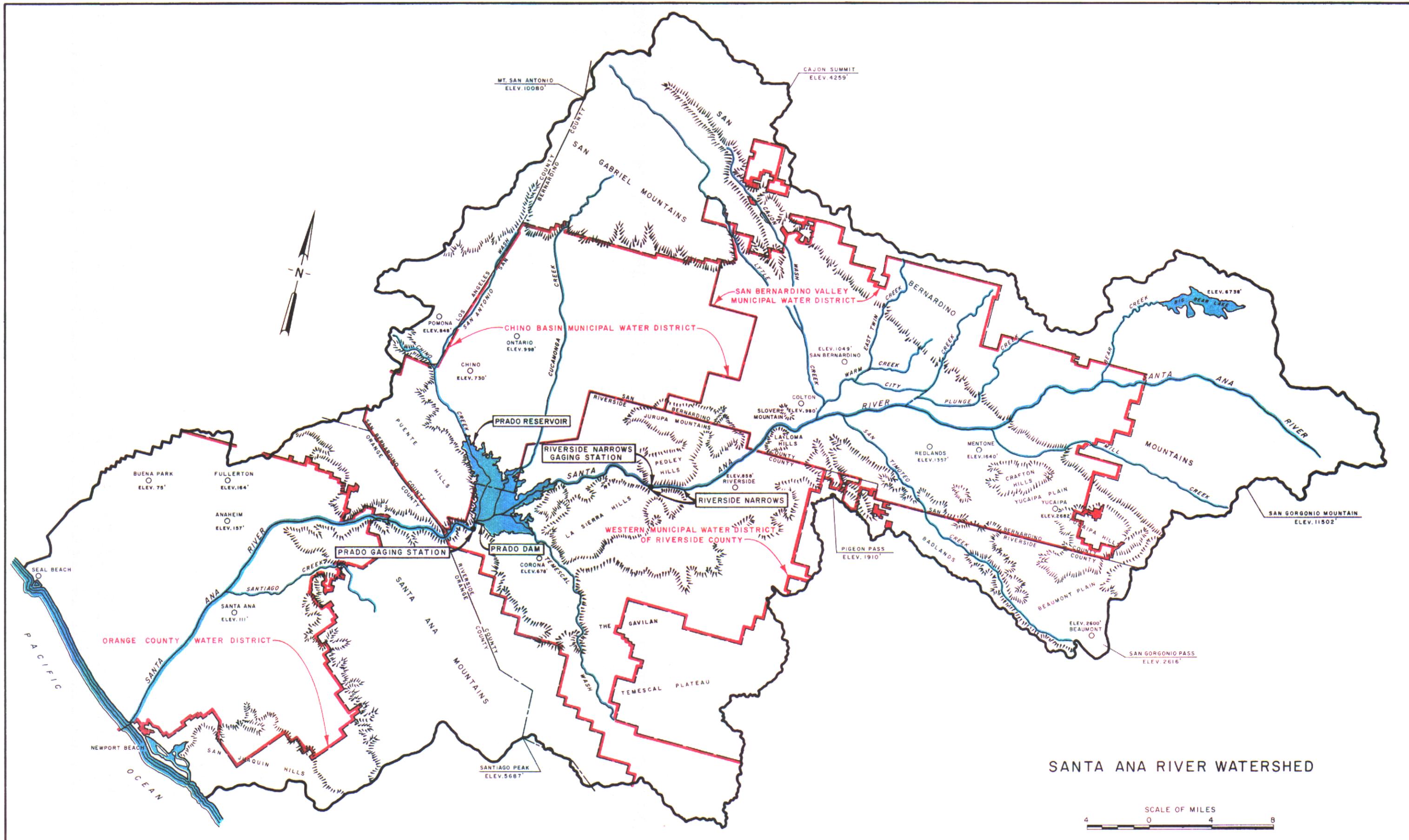
The Santa Ana River Watermaster is composed of a committee of five representatives of four water districts. Two representatives serve from Orange County Water District and one representative each serves from Chino Basin Municipal Water District, Western Municipal Water District and San Bernardino Valley Municipal Water District. The committee was established on April 23, 1969 by order of the Superior Court of California in Orange County as part of a judgement resulting from a lawsuit by Orange County Water District as plaintiff vs. City of Chino, et al, as defendants.

Costs and expenses incurred by the individual representatives are reimbursed directly from the water districts. Collective Watermaster costs and expenses are budgeted and paid for by the Watermaster after receiving contributions from the water districts. Water district contributions are made in the following ratios:

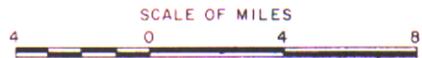
Orange County Water District	40%
Chino Basin Municipal Water District	20
Western Municipal Water District	20
San Bernardino Valley Municipal Water District	<u>20</u>
Total	<u>100%</u>

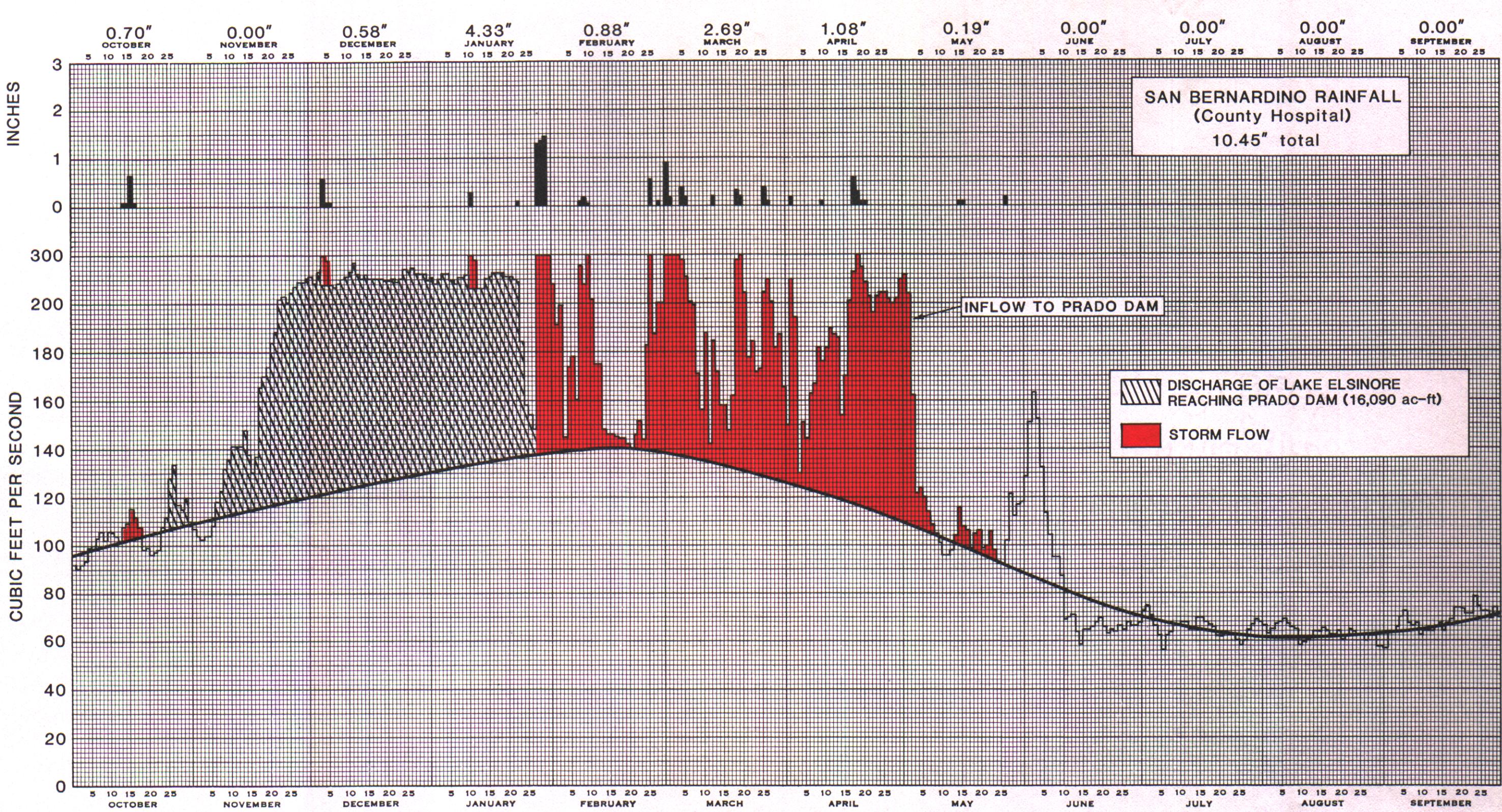
The Watermaster issues a report each year to satisfy its obligation to monitor and test water flows from the Upper Area to the Lower Area of the Santa Ana River.

See accountants' report.

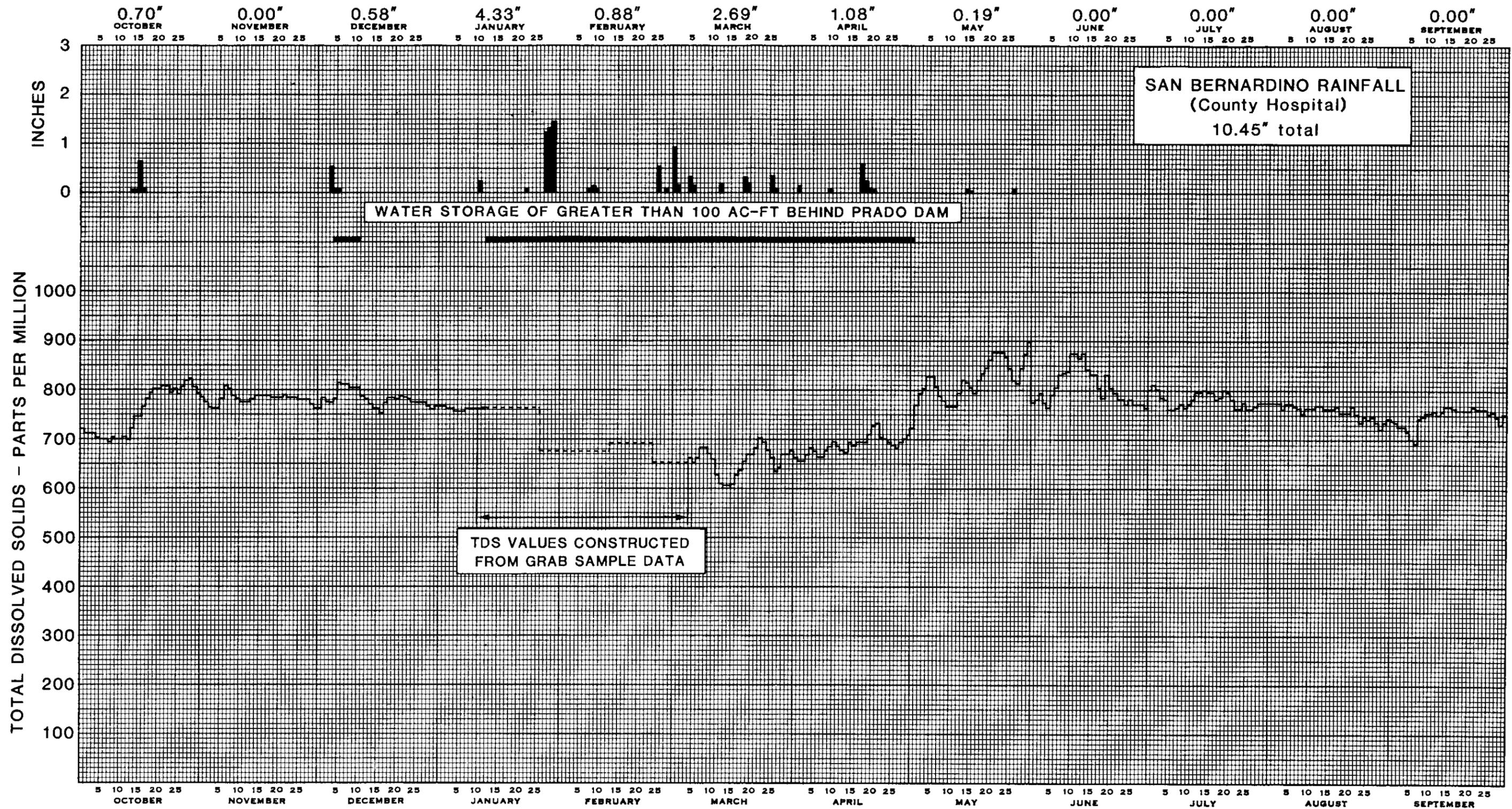


SANTA ANA RIVER WATERSHED



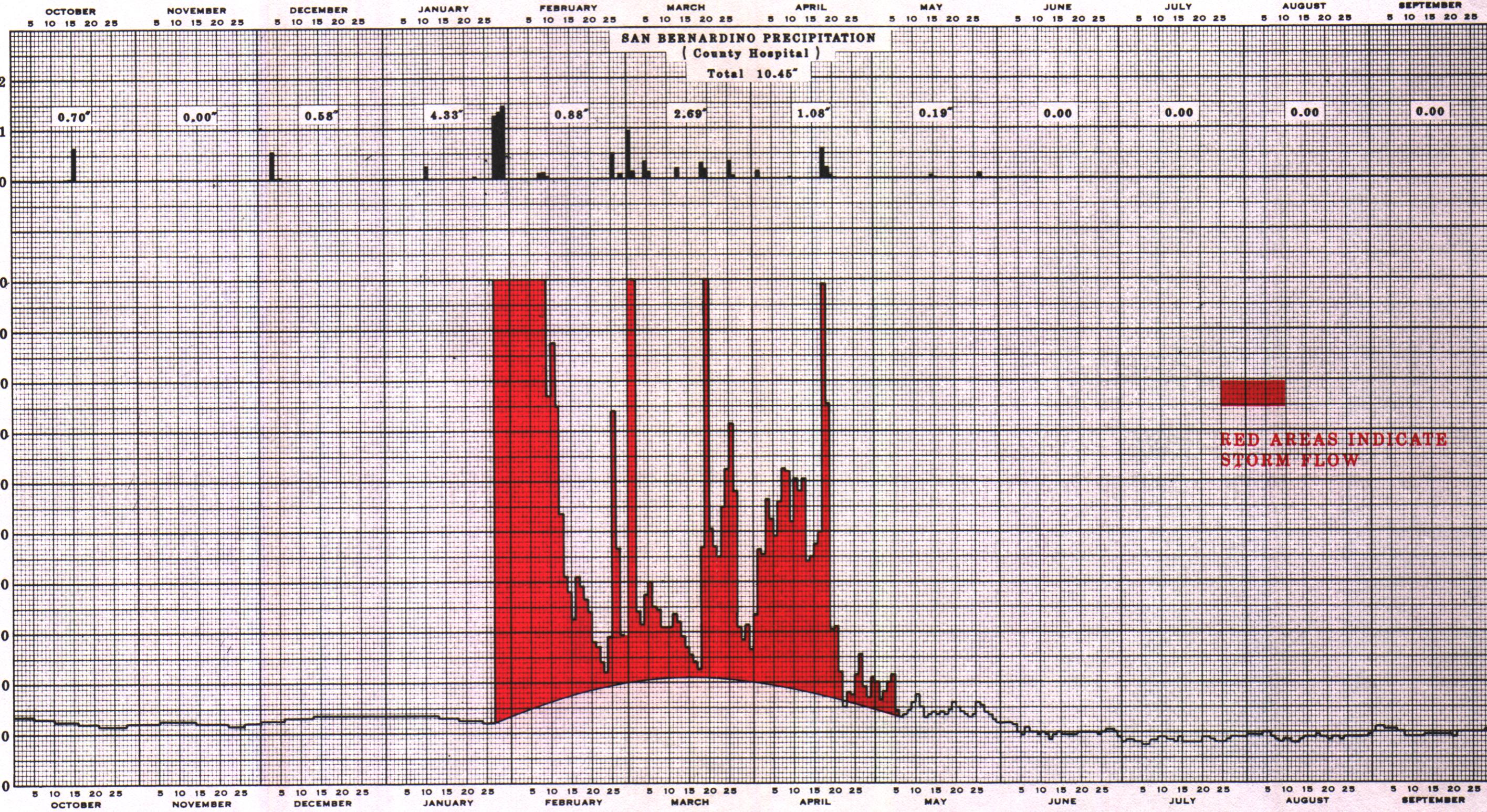


DISCHARGE OF SANTA ANA RIVER FLOW BELOW PRADO DAM  
WATER YEAR 1980-81



DISSOLVED SOLIDS IN SANTA ANA RIVER BELOW PRADO DAM  
WATER YEAR 1980-81

INCHES  
CUBIC FEET PER SECOND



DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS & SAN BERNARDINO PRECIPITATION  
WATER YEAR 1980-81