SANTA ANA RIVER WATERMASTER

FOR

ORANGE COUNTY WATER DISTRICT

VS. CITY OF CHINO, et al

CASE NO. 117628-COUNTY OF ORANGE

SIXTEENTH

ANNUAL REPORT

OF THE

SANTA ANA RIVER WATERMASTER

1985-86

MAY 1, 1987

SANTA ANA RIVER WATERMASTER

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

WATERMASTER
HARVEY O. BANKS
WILLIAM J. CARROLL
DONALD L. HARRIGER
WILLIAM R. MILLS, JR.
ROBERT L. REITER

MAILING ADDRESS
895 EAST YORBA LINDA BLVD.
SUITE J
PLACENTIA, CA 92670

May 1, 1987

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

Re: Watermaster Report for 1985-86

Gentlemen:

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

The principal findings of the Watermaster for the water year 1985-86 are as follows:

At Prado

(1)	Base Flow at Prado	127,215	acre-feet
(2)	Annual Weighted TDS of Base and Storm Flows	567	mg/l
(3)	Annual Adjusted Base Flow	141,315	acre-feet
(4)	Cumulative Adjusted Base Flow	1,294,499	acre-feet
(5)	Cumulative Entitlement of OCWD	672,000	acre-feet
(6)	Cumulative Credit	622,499	acre-feet
(7)	One-third of Cumulative Debit	0	acre-feet
(8)	Minimum Required Base Flow in 1986-87	34,000	acre-feet

At Riverside Narrows

(1)	Base Flow at Riverside Narrows	68,220	acre-feet
(2)	Annual Weighted TDS of Base Flow	624	mg/l
(3)	Annual Adjusted Base Flow	68,220	acre-feet
(4)	Cumulative Adjusted Base Flow	495,042	acre-feet
(5)	Cumulative Entitlement of CBMWD and WMWD	244,000	acre-feet
(6)	Cumulative Credit	251,042	acre-feet
(7)	One-third of Cumulative Debit	0	acre-feet
(8)	Minimum Required Base Flow in 1986-87	12,420	acre-feet

The above findings show that at the end of the 1985-86 water year, Chino Basin Municipal Water District and Western Municipal Water District have a cumulative credit of 622,499 acre-feet to their Base Flow obligation at Prado Dam. San Bernardino Valley Municipal Water District has a cumulative credit of 251,042 acre-feet to its Base Flow obligation at Riverside Narrows.

Two events of importance to the Watermaster that have continued this past year are the MWD Chino Basin Groundwater Storage Program and the pumping of water from the Artesian Zone of the San Bernardino Basin Area to the Santa Ana River in an effort to lower the level of groundwater in the area underlying a portion of the City of San Bernardino. Both of these projects are discussed in Chapter II, Water Supply Conditions. A new program, also discussed in Chapter II, involves an exchange of water within Chino Basin and the discharge of State Water to San Antonio Creek.

Sincerely yours,

SANTA ANA RIVER WATERMASTER

BY:

Harvey O. Banks

Donald L. Harriger

William J. Carroll

William R. Mills, Jr.

Robert L. Reiter

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CHAPTER I
WATERMASTER ACTIVITIES

This is the sixteenth 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 Basin; namely, the San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District (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 Litigation and the Summary of Judgment are included as Appendices F and G in the fifteenth annual report.

In order to administer the provisions of the Judgment, the court appointed a Watermaster composed of five persons. Since August 15, 1985, the Santa Ana River Watermaster Committee has consisted of Harvey O. Banks, William J. Carroll, William R. Mills, Jr., Donald L. Harriger and Robert L. Reiter. In 1985-86 Mr. Banks continued to serve as Chairman, and Mr. Mills continued to serve as Secretary. The office of the Santa Ana River Watermaster Committee is located at 895 East Yorba Linda Blvd., Suite J, Placentia, California, 92670.

The time for submission of the annual report is seven months after the end of the 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 is shared by the parties to the Judgment. These 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. Runoff data have also been 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, and for the Santa Ana River at E Street in San Bernardino and at Mission Boulevard in Riverside.

Precipitation during 1985-86 was slightly below normal and totaled 17.86 inches at San Bernardino County Hospital. Only 1.64 inches were recorded after April 7. In February and March 8.84 inches were measured. Significant amounts of storm runoff were recorded during the last three weeks of November and the first week in December at both Riverside Narrows and Prado. Storm runoff continued intermittently from about November 11 through April 17 at Prado and through April 20 at Riverside Narrows. A small amount of storm runoff occurred during the last week of September.

The 1985-86 discharge record for the USGS gaging station, "Santa Ana River below Prado" is considered by the USGS to be a "good" record. Thirteen (13) direct discharge measurements, which ranged from 4 to 2,070 cubic feet per second, were made during the year. Beginning on November 11, 1985, to June 9, 1986, the discharge was regulated by Prado Reservoir with a maximum of 10,438 acre-feet in storage at noon on February 16, 1986. Flow was again regulated by Prado Reservoir August 19-21, September 12-19 and September 24-30, inclusive, 1986. The maximum average daily discharge after regulation by Prado Reservoir occurred on February 16 and 17, 1986, and amounted to 2,320 cubic feet per second. The mean annual discharge was approximately 272 cubic feet per second.

Data related to the operation of Prado Reservoir were obtained from the Corps of Engineers. Water quality data were supplied to the Watermaster by the City of Riverside, City of Corona, Chino Basin Municipal Water District, Department of Water Resources (DWR), and the USGS.

TABLE 1

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

October 1, 1985 to September 30, 1986

SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT		
At Riverside Narrows (MWD Crossing)		
Water Quality Monitor/TDS Samples	$ 637	
Dozer	333	
At Mission Boulevard		
Surface Water Gage	468	$ 1,438
WESTERN MUNICIPAL WATER DISTRICT		
Same as SBVMWD	$ 1,438	
Cucamonga Creek Discharge	1,750	
Chino Creek Discharge	1,167	$ 4,355
CHINO BASIN MUNICIPAL WATER DISTRICT		
Same as WMWD		4,355
ORANGE COUNTY WATER DISTRICT		
At Prado Dam		
Water Quality Monitor/TDS Samples, Water Quality Sampling and Conductivity Programs	$ 12,140	
At Mission Boulevard		
Surface Water Gage	936	
Chino Creek		
Surface Water Gage	1,166	14,242
TOTAL FOR PARTIES		$ 24,390
UNITED STATES GEOLOGICAL SURVEY		21,210
GRAND TOTAL		$ 45,600

The overall 1985-86 discharge record for the USGS gaging station "Santa Ana River at MWD Crossing" is considered by the USGS to be a "poor" record at both low and high stages because of the shifting channel. The station was located at the MWD pipeline crossing for the entire year. The gage was inoperative or malfunctioning for most of the year, as shown on Plate 4. Control of the channel by bulldozing was not attempted. The continuous downstream movement of sand deposits affected the stage discharge relationship for the station. Twenty-five (25) direct discharge measurements which ranged from 55 to 3,642 cubic feet per second, were made during the year.

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, 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 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 WMWD, SBVMWD, and CBMWD 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 May 23, 1985, the Watermaster adopted a budget for the fiscal year 1985-86 in the amount of $16,000. At its meeting on May 6, 1986, the Watermaster adopted a budget for the fiscal year 1986-87 in the amount of $16,000. Table 2 shows the items and amounts included in said budgets together with actual expenses for the fiscal year 1985-86.

TABLE 2

SANTA ANA RIVER WATERMASTER BUDGET AND EXPENSES

	July 1, 1985 to June 30, 1986 Budget	July 1, 1985 to June 30, 1986 Expenses	July 1, 1986 to June 30, 1987 Budget
Administration	$ 5,000.00	$ 7,380.00	$ 5,000.00
Support Engineering Services	8,000.00	7,186.00	8,000.00
Reproduction of Annual Report	3,000.00	2,612.00	3,000.00
Total	$ 16,000.00	$ 17,178.00*	$ 16,000.00

* The amount over budget was due to additional work required to conform to revisions of USGS record at Riverside Narrows.

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 1985-86 is included herein as Appendix E.

Summary of Findings

A summary of findings by the Watermaster for the period 1970-71 through 1985-86 is presented in Table 3. 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 (in)[1]	Total Flow (ac-ft)[2]	Base Flow (ac-ft)	Weighted TDS (mg/l)[3]	Adjusted Base Flow (ac-ft)	Cumulative Credit (ac-ft)
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	63,620	43,106	633	45,513	7,862
1974-75	13.49	61,855	50,176	694	51,263	17,125
1975-76	15.86	59,209	45,627	635	48,098	23,223
1976-77	11.95	62,953	48,387	660	50,000	31,223
1977-78	30.47	252,837	58,501	383	73,955	63,178
1978-79	17.51	134,486	71,863	580	79,049	100,227
1979-80	30.93	527,760	82,509	351	106,505	164,732
1980-81	10.45	117,888 [4]	74,875 [5]	728	74,875 [5]	205,652 [6]
1981-82	18.34	143,702	81,548	584	89,431	253,083
1982-83	32.36	426,273 [4]	111,692 [5]	411	138,591 [5]	353,036 [6]
1983-84	10.81	178,395 [4]	109,231 [5]	627	115,876 [5]	431,514 [6]
1984-85	12.86	162,912	125,023 [8]	617	133,670	523,184
1985-86	17.86	196,565	127,215 [8]	567	141,315	622,499

AT RIVERSIDE NARROWS

Water Year	Rainfall (in)[1]	Total Flow (ac-ft)[2]	Base Flow (ac-ft)	Weighted TDS (mg/l)[3]	Adjusted Base Flow (ac-ft)	Cumulative Credit (ac-ft)
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	25,549 [7]	676	25,549	38,146
1980-81	10.45	34,278	19,764	715	19,550	42,446
1981-82	18.34	83,050	32,778	678	32,778	59,974
1982-83	32.36	279,987	57,128	610	57,128	101,852
1983-84	10.81	82,745	56,948	647	56,948	143,550
1984-85	12.86	78,771	69,772 [8]	633	69,772	198,072
1985-86	17.86	99,258	68,220 [8]	624	68,220	251,042

(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 in 1980-81; 7,720 acre-feet in 1982-83 and 12,550 acre-feet in 1983-84.
(5) Excludes water pumped from Lake Elsinore.
(6) Includes 8,045 acre-feet in 1979-80, 3,362 acre-feet in 1982-83, and 4,602 acre-feet in 1983-84 of Lake Elsinore discharge.
(7) Includes Rubidoux Wastewater in 1979-80 and subsequent years.
(8) The values shown include groundwater pumped from San Bernardino Basin and released to the river in accordance with Court Orders approving agreement and allowing temporary additional extractions of water from the San Bernardino Basin Area.

Note: For the years 1973-74 through 1979-80, a correction has been made for different losses of State water than assumed in reports published for these years. The values changed are Base Flow, weighted TDS, and adjusted Base F'ow. These changes, in turn, have changed the cumulative credit for these years. See Appendix C in the Twelth Annual Report, 1981-1982.

CHAPTER II
WATER SUPPLY CONDITIONS

The precipitation in the Santa Ana River Watershed during 1985-86, as represented by rainfall measured at San Bernardino County Hospital, was about 99.3 percent of normal in terms of the Base Period average. The total flow of the Santa Ana River below Prado Dam during the 1985-86 water year was 196,900 acre-feet as compared to a total flow of 163,247 acre-feet which occurred in the previous year. Despite normal rainfall in the Santa Ana River Watershed during 1985-86, the effects of the heavy rainfall which occurred in 1977-78, 1979-80 and 1982-83 continue to be felt with the Base Flow amounts at Riverside Narrows and Prado of 68,220 acre-feet and 127,215 acre-feet, respectively. The Base Flow at Prado is the highest to date since 1970-71. The values quoted include groundwater pumped from San Bernardino Basin during October and November and discharged to the river.

Chino Basin Groundwater Storage Program

Metropolitan Water District of Southern California (MWD) has approved the Chino Basin Groundwater Storage Program (Program) as an MWD project to augment the yield of the State Water Project (SWP) available to MWD and its member agencies during periods of SWP deficiency as first discussed in the fifteenth annual report. MWD proposes to store surplus State Water Project water when and as available underground in Chino Basin by artificial recharge for later extraction during subsequent periods of deficiency. It will also store water indirectly by furnishing State Water Project water directly to certain agencies overlying the Chino Basin and receive a right to the same amount of water in storage in the Basin. It is anticipated that this will gradually affect significantly both the quantity and quality of the flow of the Santa Ana River at Prado, particularly the Base Flow. This situation was not anticipated in the stipulated judgment in Orange County Water District vs. City of Chino, et al. The Watermaster will need to modify the scalped Base Flow each year for the estimated effects of the Program to determine the amount of Base Flow within the meaning and intent of the stipulated judgment.

MWD is now developing a groundwater monitoring program to provide the data necessary to refine the groundwater model of the Chino Basin, and then for use with the model each year to estimate the effects of the Program in Chino Basin and on the Santa Ana River. The Watermaster will be provided with the monitoring program data and the model formulation, and the results of its use.

A groundwater quality survey has been completed by MWD, and an environmental impact report is being prepared.

The Watermaster will monitor the Chino Basin Groundwater Storage Program and report annually on the Program, its progress, results and effects on the River. The groundwater monitoring program and groundwater model formulation will be reviewed and suggestions submitted as deemed appropriate. MWD's estimates of the effects on the Santa Ana River, once underground storage has begun, will be analyzed each year and appropriate modifications made to the scalped Base Flow.

Discharge of Groundwater From San Bernardino Basin Area To Santa Ana River

During October and November 1985, groundwater from the San Bernardino Basin Area was pumped directly to the Santa Ana River to lower groundwater levels in the area underlying portions of the City of San Bernardino, continuing from 1984-85, as discussed in the fifteenth annual report. This pumping was done in accordance with Riverside County Superior Court Orders modifying the Western Judgment (Case No. 78426) by approving the Temporary Additional Extraction Agreements between San Bernardino Valley and Western.

These agreements indicate that recently, the groundwater levels in the Artesian Zone of San Bernardino Basin Area have risen to, or nearly to, the surface of the ground. The recurrence of the high groundwater table has caused basement flooding and damage to buildings, pavement, and sewer lines, and in the event of an earthquake may create a threat of ground liquefaction. This constitutes a threat to public health, safety and welfare in the Artesian Zone.

San Bernardino Valley Municipal Water District and Western Municipal Water District initiated a program for additional extractions from San Bernardino Basin above the limits set in the judgment in Western Municipal Water District of Riverside County et al vs. East San Bernardino County Water District, et al. That judgment provides that additional extractions can be made under agreement

between San Bernardino Valley Municipal Water District and Western Municipal Water District approved by the Court under its continuing jurisdiction.

The previously listed agreement was entered into on February 25, 1985, among San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District (WMWD), Orange County Water District (OCWD), City of Riverside (Riverside), and City of San Bernardino (San Bernardino) providing for additional extractions from San Bernardino Basin to lower groundwater levels through June 30, 1985. The agreement was amended August 21, 1985, extending the time limit through December 31, 1985. East Valley Water District (EVWD) cooperated in the program in 1984-85.

The additional extractions by San Bernardino, 526 acre-feet in October 1985, were returned via storm channels to Santa Ana River above Riverside Narrows. The additional extractions by City of Riverside, 890 acre-feet in October and 946 acre-feet in November for a total of 1,836 acre-feet, were returned to the river below Riverside Narrows via the Riverside Canal.

Proposed Discharge of State Water Project Water Above Prado

Ontario/MWD Exchange Program

Metropolitan Water District of Southern California (MWD) is planning to build the Etiwanda Pipeline to introduce State Water Project (SWP) into MWD's Upper Feeder. Completion is scheduled for 1992. This will increase MWD capability to import SWP water after enlargement of the SWP East Branch is completed.

The City of Ontario (Ontario) is supplied now by MWD with Colorado River water from MWD's Upper Feeder. Ontario also pumps groundwater under its rights in the Chino Groundwater Basin.

Ontario must upgrade its water treatment to continue to take water from the Upper Feeder to meet requirements of the State Department of Health Services, once SWP water is introduced into the Upper Feeder, at considerable cost to Ontario.

MWD and Ontario have reached an agreement under which MWD would provide up to a total of 20,000 acre-feet of Colorado River water over the next four years until the Etiwanda Pipeline is in operation. In exchange, Ontario would assign an equal amount of Ontario's Chino Basin groundwater under its adjudicated rights to Chino Basin groundwater to MWD for MWD's Chino Basin Trust Storage Account to be extracted later during times of deficiency in SWP supply.

Through use of a greater amount of Colorado River Water, Ontario would save the cost of pumping the same amount of groundwater. The savings could be used by Ontario to finance the costs of improving the water treatment plant or for an alternative treated water supply.

The proposed use of the additional Colorado River water would increase the total dissolved solids (TDS) in Ontario's wastewater which flows to Chino Basin Municipal Water District (CBMWD) wastewater treatment plant, RP-1, for treatment and discharge to the Santa Ana River upstream of Prado Dam. The discharge to the River is under a NPDES permit which limits the concentration of TDS and certain other constituents in the effluent discharged to the River. The increased TDS in Ontario's wastewater could result in violation of the NPDES permit conditions.

MWD proposes to offset the increase in TDS by providing SWP water for dilution. This may be discharged from MWD's Rialto Pipeline at OC-59 to San Antonio Creek for flow to the Santa Ana River upstream of Prado Dam. There would be conveyance losses as the water flows down the channels, which MWD must take into account in the amounts to be discharged to San Antonio Creek.

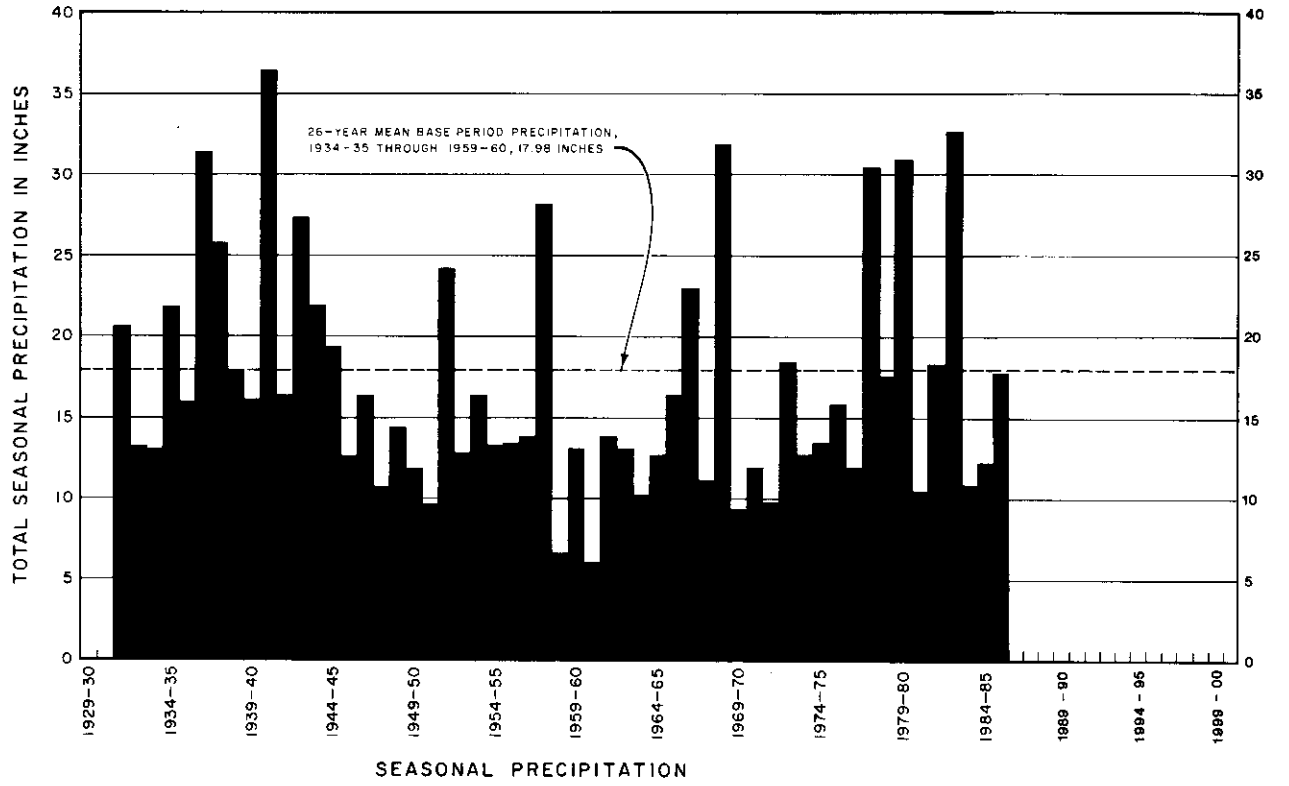
The SWP water would be charged to and paid for by Municipal Water District of Orange County (MWDOC) against MWDOC's scheduled interruptible water from MWD. Orange County Water District would spread the water for artificial recharge in Orange County.

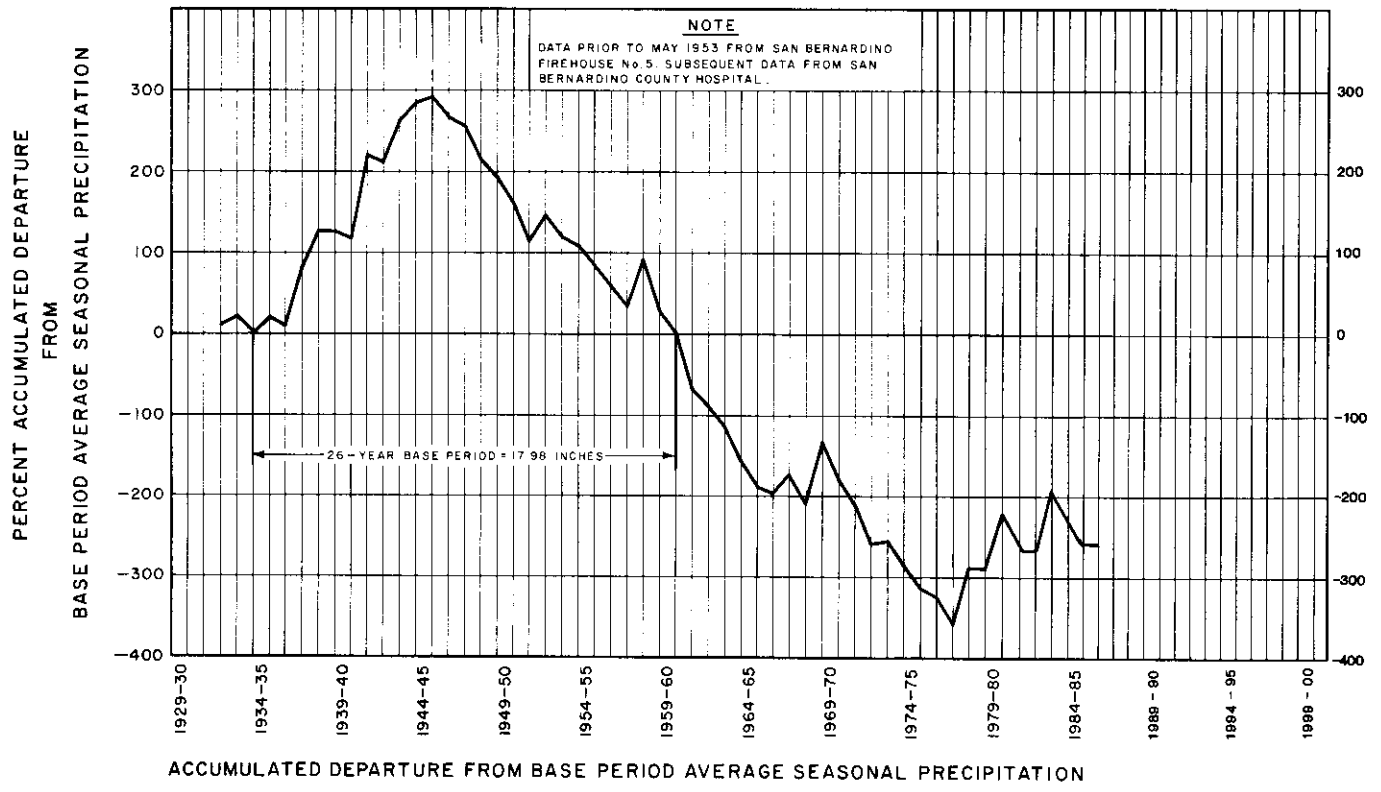
MWD has requested the Watermaster to work with MWD in developing the methodology to be used in estimating the conveyance losses, which the Watermaster has agreed to do. The Watermaster has been faced with a similar problem previously as discussed in the Twelth Annual Report.

It will be necessary for the Watermaster to take this increment of flow to the Santa Ana River into account in its annual estimates of the components of river flow at Prado.

Precipitation During 1985-86

During the 1985-86 water year, the precipitation at the San Bernardino County Hospital amounted to 17.86 inches, which is 99.3 percent of the Base Period average. Most of the precipitation, 83 percent, occurred during the months of November through March. The maximum monthly precipitation of 4.52 inches occurred during March.





VARIATION IN PRECIPITATION AT SAN BERNARDINO

FIGURE 1

Figure 1 shows the seasonal precipitation from 1931-32 through 1985-86 and the accumulated departure from the 1934-35 through 1959-60 Base Period average.

Runoff During 1985-86

Below Prado Dam

The total seasonal flow at Prado for the 1985-86 water year was nearly 200,000 acre-feet, well above the Base Period (1934-35 through 1959-60) average of 78,780 acre-feet per year.

After 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 substantially increased. During the 16-year period (1970-71 through 1985-86) since the Judgment went into effect, the Base Flow, unadjusted for quality, has averaged 72,348 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 1985-86 Base Flow amounted to 127,215 acre-feet, an increase of 54,867 acre-feet over the 16-year average. The Base Flow in 1985-86 includes an increase due to the direct discharge to the River of groundwater pumped from San Bernardino Basin Area by City of San Bernardino and City of Riverside.

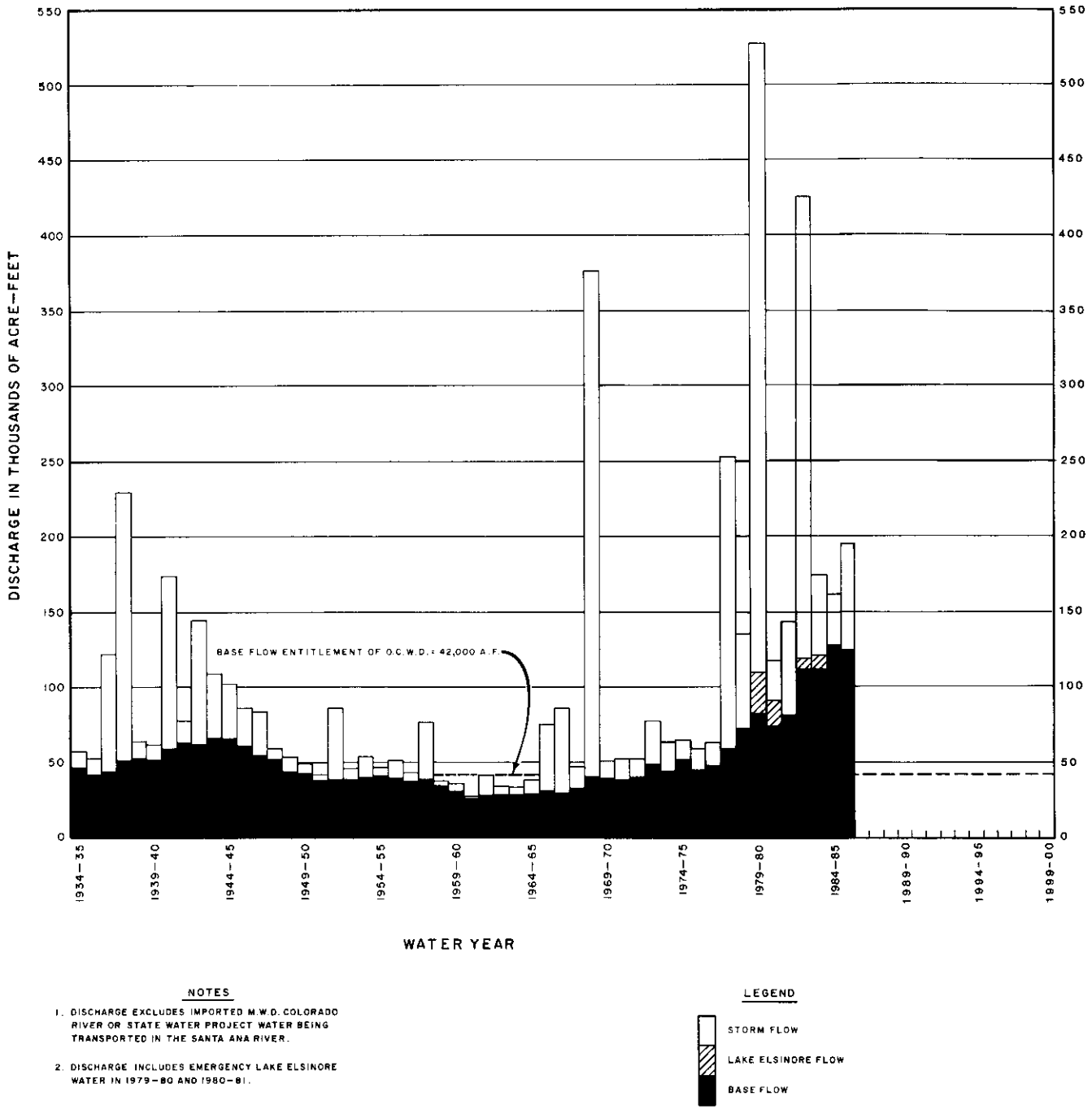
The calculated inflow to Prado Reservoir during the month of March amounts to 35,920 acre-feet, or 18 percent of the seasonal total. The recorded maximum storage in Prado Reservoir occurred at noon February 16, 1986, when 10,438 acre-feet (about 4 percent of the reservoir capacity at spillway level) was in storage. The maximum release of 2,320 cfs from Prado Reservoir occurred February 16 and 17, 1986.

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 1985-86.

At Riverside Narrows

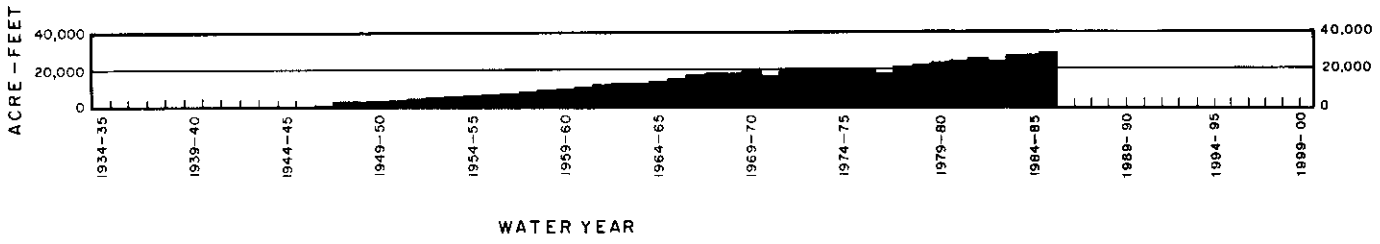
The Total Flow of the Santa Ana River at Riverside Narrows for the 1985-86 water year was about 100,000 acre-feet.

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 16-year period 1970-71 through 1985-86, the Base Flow has averaged 31,058 acre-feet per

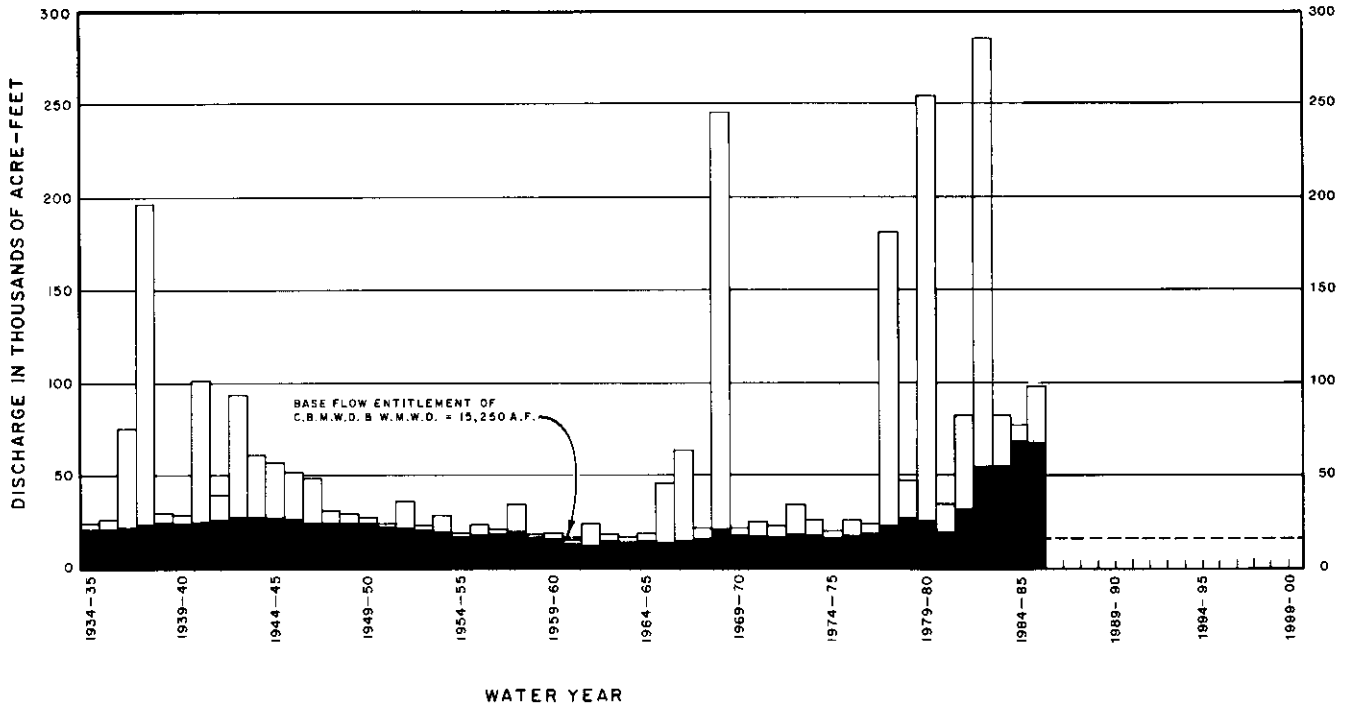


DISCHARGE OF SANTA ANA RIVER BELOW PRADO DAM

FIGURE 2



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

STORM FLOW

BASE FLOW

DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS

FIGURE 3

year. The 1985-86 Base Flow amounted to 68,220 acre-feet, an increase of 37,162 acre-feet over the 16-year average. The Base Flow in 1985-86 includes an increase due to the direct discharge to the River of groundwater from San Bernardino Basin Area by City of San Bernardino and the City of Riverside.

Figure 3 shows the components of Total Flow in the Santa Ana River at Riverside Narrows for the period from 1934-35 through 1985-86.

Wastewater Effluent Discharges

A portion of the Base Flow at Prado is made up of treated wastewater effluent discharged from a number of wastewater treatment plants located above Prado Dam.

The quantities discharged by the major agencies are shown in Table No. 4. For the year 1985-86, 104,270 acre-feet were discharged to the river above Prado Dam.

TABLE 4

WASTEWATER EFFLUENT DISCHARGED ABOVE PRADO BY MAJOR AGENCIES
(Acre-Feet)

Year	Redlands	San Berndno	Colton	Rialto	River-side	Corona	CBMWD #1	CBMWD #2	Total
1970-71	2,650	17,860	2,520	2,270	18,620	3,190	0	0	47,110
1971-72	2,830	16,020	2,230	2,400	19,010	3,230	6,740	0	52,460
1972-73	2,810	18,670	2,530	2,260	19,060	3,340	10,380	0	59,050
1973-74	2,770	17,680	2,350	2,320	19,560	3,510	11,440	2,320	61,950
1974-75	2,540	16,750	1,980	2,320	19,340	4,020	14,960	2,280	64,190
1975-76	2,450	17,250	2,540	2,240	19,580	4,700	15,450	2,950	67,160
1976-77	3,170	17,650	3,260	2,330	18,770	5,010	14,640	3,380	68,210
1977-78	3,280	18,590	3,810	2,380	20,310	5,200	14,650	4,060	72,280
1978-79	3,740	19,040	3,850	3,050	21,070	5,390	15,040	5,070	76,250
1979-80	4,190	20,360	4,190	2,990	22,910	5,360	14,410	5,520	79,930
1980-81	4,410	20,550	3,930	3,370	24,180	5,590	17,270	5,260	84,560
1981-82	4,420	23,340	3,780	3,470	25,640	5,410	19,580	5,360	91,000
1982-83	4,530	24,160	3,600	3,620	25,020	5,860	20,790	4,290	91,870
1983-84	5,150	22,080	3,700	3,830	26,090	6,200	20,950	3,950	91,950
1984-85	4,990	23,270	3,830	4,070	27,750	6,250	25,160	4,280	99,600
1985-86	5,200	24,720	4,010	4,720	28,820	5,900	28,240	2,660	104,270

The amounts shown in Table 4 were determined from data provided by the agencies.

CHAPTER III
BASE FLOW AT PRADO

This chapter deals with determinations of: 1) the components of flow at Prado Dam, which include Nontributary Flow, 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 196,900 acre-feet, measured at the USGS gaging station below Prado Dam. Additionally, 808 acre-feet remained in storage at the end of the water year. Separated into its components, Base Flow, including the groundwater pumped as described in Chapter II of this report, was 127,215 acre-feet and Storm Flow was 70,158 acre-feet. Nontributary Flow during 1985-86 due to the release of State water above Riverside Narrows during 1972-73 was 335 acre-feet. The components of flow of the Santa Ana River at Prado Dam for each month in the 1985-86 water year are listed in Table 5, and are shown graphically on Plate 2.

Nontributary Flow

Since May 1973, OCWD has from time to time 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 of 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 1985-86 the credit is 335 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 1985-86

(acre-feet)

Month	Prado Outflow	Storage Change (1)	Computed Inflow	Storm Flow	Base Flow (2)	Nontrib. Flow (3)
October	10,645	0	10,645	145	10,472	28
November	14,681	6,329	21,011	10,066	10,917	28
December	21,086	-6,234	14,852	3,748	11,075	28
January	14,533	1,801	16,334	4,044	12,262	28
February	34,014	791	34,806	22,875	11,903	28
March	35,413	508	35,920	22,669	13,224	28
April	16,683	306	16,988	4,784	12,176	28
May	14,265	-2,906	11,359	0	11,331	28
June	10,461	-595	9,866	0	9,838	28
July	8,588	0	8,588	0	8,560	28
August	7,735	0	7,735	0	7,707	28
September	8,796	808	9,604	1,827	7,750	27
Total	196,900	808	197,708	70,158	127,215	335

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

(2) Includes groundwater pumped from San Bernardino Basin Area.

(3) That portion of State water released during 1972-73 upstream of Riverside Narrows, determined to have reached Prado Dam in 1985-86.

Releases to San Antonio Creek

During water year 1985-86, 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 1985-86.

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 generally reduced by the controlled releases to the downstream water conservation facilities operated by OCWD. Monthly and annual quantities of Storm Flow are shown in Table 5.

The Orange County Water District continued its efforts to formalize water conservation as a part of the Prado Dam operations. The District entered into an agreement with the Corps of Engineers to conduct an 18-month water conservation study. The work was initiated by the Corps in May of 1986 and the report is scheduled to be finalized in October 1987. The study is aimed at evaluating a number of water storage pools of different volumes and related impacts in Prado Basin as well as impacts on down stream flooding. In addition, the District is cooperating with the County of San Bernardino Parks Department in relocating a trap and skeet facility that had been previously constructed at a very low elevation in Prado Basin.

In May of 1985, the U.S. Fish and Wildlife Service proposed to designate the Least Bell's Vireo as an endangered species and a major portion of the lands within the Prado Reservoir be designated as "critical habitat" for that species. The designation could adversely affect water conservation activities at Prado. In 1986 the Service officially designated the Vireo as an endangered species, however the Service deferred the decision on a critical habitat designation. Approximately half a dozen to a dozen nesting Vireo pairs have been located within Prado Basin and in 1986 efforts were initiated to protect the nesting areas and to trap cowbirds, which are responsible for reduction in nesting success of the Vireo.

On November 17, 1986, President Reagan signed HR6, authorizing the Mainstem Project which includes extensive flood control improvements along the Santa Ana River and the enlargement of Prado Dam and Reservoir. Included in the congressional authorization is the authorization for a water conservation

study at Prado and to look at the impact of water impoundments behind Prado on the oil leases.

During the 1985-86 water year, more than 100 acre-feet of water was stored behind Prado Dam during the periods November 11 to November 20, 1985, November 25 to December 30, 1985, January 30 to June 5, 1986, and September 25 to September 30, 1986. During those periods, the water stored in Prado Reservoir varied up to a maximum of 10,438 acre-feet and the maximum mean daily flow released to the Santa Ana River was 2,320 cfs.

Base Flow

The determination of Base Flow was affected by Nontributary Flow which had been released above Riverside Narrows. The general procedure used by the members of the Watermaster to separate the 1985-86 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 Dam, including Nontributary Flow released above Riverside Narrows was found to be 566 mg/l. This determination was based on records from a continuous monitoring device for electrical conductivity (EC) by the USGS of the Santa Ana River below Prado, supplemented by grab samples for EC and TDS determination, 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. The USGS, DWR and OCWD collected a total of 45 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. Data used for the statistical analysis are listed in Table B-1, Appendix B. The statistical analysis yields the best fit equation shown below:

$$TDS = EC/(1.8507 - 2.2742 \times 10^{-4} EC)$$

where: TDS = mg/l
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 flow of the Santa Ana River passing Prado Dam. The daily average TDS concentration was calculated from the hourly EC measurements and the correlation of EC and TDS. As daily TDS concentration could not be determined during the period when continuous EC data were not available, TDS was approximated by linearly interpolating between values immediately before and after the malfunction.

Water Quality Adjustment for Nontributary Flow

The weighted average annual TDS value of 566 mg/l, 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. 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 State water released above Riverside Narrows during 1972-73 was 235 mg/l and was adjusted to 242 mg/l to reflect a 3 percent evapotranspiration loss of the water released.

		Annual Flow (acre-feet)	Average TDS (mg/l)	Annual Flow X Average TDS (acre-feet x mg/l)
1.	Total Flow	196,900	566	111,445,400
2.	Nontributary Flow Riverside Narrows	335	242	81,070
3.	Total Base and Storm Flows	196,565		111,364,330
4.	Average TDS of Total Base and Storm Flows	111,364,330 ÷ 196,565 = 567 mg/l		

After adjusting for Nontributary Flows of State water from above Riverside Narrows, the weighted average annual TDS of Storm Flow and Base Flow for 1985-86 was 567 mg/l, as shown above.

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 mg/l	$Q - \frac{35}{42,000} Q\,(TDS-800)$
700 mg/l - 800 mg/l	Q
Less than 700 mg/l	$Q + \frac{35}{42,000} Q\,(700-TDS)$

Where: Q = Base Flow actually received."

The weighted average annual TDS of 567 mg/l is less than 700 mg/l. Therefore, the Base Flow must be adjusted by the above equation for TDS less than 700 mg/l. Thus the Adjusted Base Flow is as follows:

$$(127,215 \text{ ac-ft}) + \frac{35}{42,000} (127,215 \text{ ac-ft})(700-567) = 141,315 \text{ ac-ft}$$

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 Watermaster's findings at Prado for 1985-86 required under the Judgment are as follows:

1.	Total Flow at Prado	196,900	acre-feet
2.	Base Flow at Prado	127,215	acre-feet
3.	Annual Weighted TDS of Base and Storm Flows	567	mg/l
4.	Annual Adjusted Base Flow	141,315	acre-feet
5.	Cumulative Adjusted Base Flow	1,294,499	acre-feet
6.	Cumulative Entitlement of OCWD	672,000	acre-feet
7.	Cumulative Credit	622,499	acre-feet
8.	One-Third of Cumulative Debit	0	acre-feet
9.	Minimum Required Base Flow in 1986-87	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 99,600 acre-feet, measured at the USGS gaging station near the MWD Upper Feeder Crossing. Separated into its components, Base Flow was 68,220 acre-feet, Storm Flow was 34,969 acre-feet, and Nontributary Flow due to a prior release of State water above Riverside Narrows was 342 acre-feet. Included in Base Flow are 526 acre-feet of groundwater pumped from the San Bernardino Basin Area which was discharged to the river above Riverside Narrows and 2,095 acre-feet of wastewater from Rubidoux Community Services District and 1,836 acre-feet of groundwater pumped from the San Bernardino Basin Area which were discharged below the Riverside Narrows. The components of flow of the Santa Ana River at Riverside Narrows for each month in the 1985-86 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 1985-86 the amount of State water reaching Riverside Narrows has been agreed upon as 342 acre-feet.

TABLE 6

COMPONENTS OF FLOW AT RIVERSIDE NARROWS FOR WATER YEAR 1985-86

(acre-feet)

		Total Flow USGS Measurement	Storm Flow	Non-tributary Flow	Rubidoux Waste-water	Ground-water (2)	Base Flow (1)
1985	October	6,693	262	29	184	890	7,476
	November	9,939	4,088	29	168	946	6,936
	December	6,560	756	29	171	0	5,946
1986	January	7,289	1,214	29	175	0	6,221
	February	18,089	12,771	29	164	0	5,453
	March	18,607	12,750	29	184	0	6,012
	April	7,688	1,430	28	173	0	6,403
	May	6,089	0	28	183	0	6,244
	June	4,374	0	28	173	0	4,519
	July	4,132	0	28	175	0	4,279
	August	4,114	0	28	176	0	4,262
	September	6,026	1,698	28	169	0	4,469
Total		99,600	34,969	342	2,095	1,836	68,220

(1) Base Flow includes Rubidoux wastewater and groundwater pumped from the San Bernardino Basin Area and discharged above and below Riverside Narrows.

(2) Groundwater pumped from the San Bernardino Basin Area and discharged below Riverside Narrows.

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 (342 acre-feet divided by 12 months) and subtracted from the sum of the Base Flow and Nontributary Flow as shown on Table 6.

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. Wastewater from Rubidoux during water year 1985-86, in the amount of 2,095 acre-feet as shown in Appendix D, has been added to the streamflow as measured at the gaging station.

During 1985 two orders were signed in Superior Court, County of Riverside, modifying the Western Judgment (Case No. 78426) by approving the Temporary Additional Extraction Agreements between Valley District and Western and allowing temporary additional extractions of water from the San Bernardino Basin Area. Some of the water pumped under these agreements was delivered to the river above the Riverside Narrows and some below. The amount pumped and delivered above Riverside Narrows during water year 1985-86 was 526 acre-feet. Flow resulting from this pumping is included in the total flow measurement shown on Table 6. Since pumped groundwater in the amount of 1,836 acre-feet was discharged below the point of measurement, this amount has been added to the streamflow in Table 6. The Base Flow was determined to be 68,220 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, DWR and the City of Riverside. The results are summarized in Appendix C, Table C-1. Table C-2 shows the flow weighted quality of streamflow passing the gaging station which includes the nontributary flow and the pumped groundwater discharged above the Riverside Narrows.

The flow weighted quality of wastewater from Rubidoux is shown in Appendix D, Table D-1 as 735 g/l. The flow weighted quality of pumped ground water which was discharged below the Riverside Narrows was determined to be 316 mg/l. The Base Flow quality resulting from exclusion of the Nontributary Flow and inclusion of the Rubidoux wastewater and pumped groundwater is shown in the following table as 624 mg/l.

		Annual Flow (acre-feet)	Avg. TDS (mg/l)	(Annual Flow) x (Avg. TDS) (acre-feet x mg/l)
1.	Base Flow including Nontributary Flow and groundwater discharged above Riverside Narrows	64,631	627	40,538,134
2.	Less Nontributary Flow	342	237	81,054
3.	Plus Rubidoux Wastewater	2,095	735	1,539,962
4.	Plus pumped groundwater discharged below Riverside Narrows	1,836	316	580,176
5.	Base Flow	68,220	624	42,577,281

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 mg/l	$Q - \frac{11}{15,250} Q\ (TDS-700)$
600 mg/l - 700 mg/l	Q
Less than 600 mg/l	$Q + \frac{11}{15,250} Q\ (600-TDS)$

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 1985-86 was 624 mg/l. Therefore, no adjustment is necessary, and the Adjusted Base Flow for 1985-86 is 68,220.

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 1985-86 required under the Judgment are as follows:

1.	Base Flow at Riverside Narrows	68,220	acre-feet
2.	Annual Weighted TDS of Base Flow	624	mg/l
3.	Annual Adjusted Base Flow	68,220	acre-feet
4.	Cumulative Adjusted Base Flow	495,042	acre-feet
5.	Cumulative Entitlement of CBMWD and WMWD	244,000	acre-feet
6.	Cumulative Credit	251,042	acre-feet
7.	One-Third of Cumulative Debit	0	acre-feet
8.	Minimum Required Base Flow in 1986-87	12,420	acre-feet

APPENDIX A

STATE WATER RELEASED BY MWD TO SAN ANTONIO CREEK NEAR UPLAND

CONNECTION OC-59

1985-86

PREPARED BY

DONALD L. HARRIGER

TABLE A-1

NONTRIBUTARY WATER FROM OC-59
MONTHLY TOTALS
(Acre-Feet)

WATER YEAR 1985-86

No Water was released in Water Year 1985-86 from OC-59 for the Orange County Water District

APPENDIX B

WATER QUALITY - SANTA ANA RIVER BELOW PRADO DAM

1985-86

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 (EC) was calculated using the punched tape from the Prado water quality recorder, processed by a computer program designed by USGS. Input to the program included hourly EC data from the recorder tape, which was flow weighted using hourly discharge measurements from the water stage recorder. However, due to recorder malfunction, hourly EC data were not available for the periods from November 29 to December 2, 1986, December 18, 1985, July 3, 1986, August 7 and 8, 1986, September 15 and 16, 1986, September 24 to 26, 1986, and September 29, 1986.

2. Laboratory analyses of the 45 grab samples taken by the USGS, DWR and OCWD below Prado Dam during the 1985-86 season were run to determine both EC and TDS. Data from the grab samples are given in Table B-1. Results of these analyses were used to prepare a correlation between EC recorded on punched tape of the USGS at the times when the USGS grab samples were collected and the corresponding TDS. The EC values for OCWD and DWR TDS data represent the daily flow weighted EC for the day of sampling. 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 EC values for each day of the year except for the period when the recorder was not functioning.

4. The TDS for the period when EC data were not available was estimated by linearly interpolating between TDS values immediately before and after the malfunction.

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 566 mg/l of TDS for the 1985-86 water year. The weighted TDS calculation for the water year 1985-86 is shown in Table B-3.

TABLE B-1

WATER QUALITY ANALYSES BELOW PRADO DAM FOR WATER YEAR 1985-86

Date Sampled		EC[1] (micromhos/cm)	TDS[2] (mg/l)	Source
1985				
October	4	1,120	689	USGS
	7	1,100	689	DWR
	25	1,130	682	USGS
	29	1,100	672	OCWD
November	1	1,120	690	USGS
	7	1,080	654	DWR
	20	1,100	684	USGS
	20	1,110	686	USGS
	25	997	764	OCWD
December	6	778	450	USGS
	17	1,030	646	OCWD
	23	1,080	660	DWR
1986				
January	9	1,140	648	USGS
	13	1,100	703	DWR
	22	1,070	670	OCWD
	28	1,100	680	USGS
February	5	880	533	USGS
	17	478	267	DWR
	18	567	336	USGS
	25	916	580	OCWD
March	5	1,040	648	USGS
	10	853	552	DWR
	25	1,030	612	OCWD
	27	1,070	643	USGS
April	1	1,060	665	DWR
	24	1,040	626	USGS
	29	1,050	634	OCWD

(1) OCWD and DWR TDS lab results correlated with weighted daily field EC as recorded by USGS. USGS TDS results correlated with field EC recorded at time of sampling.

(2) Based on analysis of grab samples.

TABLE B-1

WATER QUALITY ANALYSES BELOW PRADO DAM FOR WATER YEAR 1985-86 (Continued)

Date Sampled		EC[1] (micromhos/cm)	TDS[2] (mg/l)	Source
May	5	1,010	682	USGS
	8	1,060	682	DWR
	13	1,090	653	USGS
June	3	1,100	677	USGS
	5	1,120	713	DWR
	16	1,100	686	USGS
	23	1,100	669	USGS
	24	1,090	646	OCWD
July	21	1,070	708	DWR
	29	1,040	674	OCWD
	30	1,040	650	USGS
August	5	1,050	682	OCWD
	5	1,060	654	USGS
	12	1,060	650	OCWD
	19	1,080	660	DWR
	26	1,090	646	OCWD
September	8	1,090	685	USGS
	11	1,100	679	DWR

(1) OCWD and DWR TDS lab results correlated with weighted daily field EC as recorded by USGS. USGS TDS results correlated with field EC recorded at time of sampling.

(2) Based on analysis of grab samples.

TABLE B-2

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

OCTOBER 1985

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
OCTOBER	1	137	1140	716	98137
	2	135	1130	709	95720
	3	137	1120	702	96141
	4	137	1110	695	95147
	5	141	1110	695	97925
	6	139	1100	687	95530
	7	144	1100	687	98967
	8	149	1100	687	102403
	9	157	1100	687	107901
	10	180	1110	695	125011
	11	181	1100	687	124396
	12	175	1110	695	121538
	13	178	1110	695	123622
	14	179	1100	687	123021
	15	171	1110	695	118760
	16	172	1100	687	118210
	17	175	1110	695	121538
	18	181	1110	695	125705
	19	178	1120	702	124913
	20	182	1120	702	127720
	21	183	1120	702	128422
	22	215	1070	666	143123
	23	199	1110	695	138206
	24	190	1130	709	134717
	25	189	1120	702	132632
	26	186	1110	695	129178
	27	188	1110	695	130567
	28	197	1100	687	135392
	29	196	1100	687	134705
	30	197	1110	695	136817
	31	199	1110	695	138206
TOTAL		5367			3724270
MONTHLY FLOW WEIGHTED TDS				694	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

NOVEMBER 1985

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1)(3) (mg/l)	OUTFLOW x TDS
NOVEMBER	1	193	1120	702	135439
	2	180	1110	695	125011
	3	179	1100	687	123021
	4	177	1100	687	121647
	5	181	1100	687	124396
	6	182	1100	687	125083
	7	194	1080	673	130535
	8	200	1070	666	133138
	9	211	1060	659	138951
	10	213	1060	659	140268
	11	251	894	543	136212
	12	154	1030	637	98128
	13	330	850	513	169242
	14	376	849	512	192580
	15	350	924	563	197127
	16	333	1000	616	205140
	17	327	1040	644	210682
	18	323	1040	644	208105
	19	315	1060	659	207438
	20	321	1100	687	220613
	21	305	1130	709	216256
	22	244	1120	702	171229
	23	217	1080	673	146011
	24	163	1040	644	105019
	25	92	997	614	56482
	26	278	869	526	146141
	27	372	774	462	171930
	28	366	820	493	180337
	29	184	(2)	472	86848
	30	191	(2)	451	86141
TOTAL		7402			4509150
MONTHLY FLOW WEIGHTED TDS				609	

1. TDS = EC/(1.8507-2.2742E-4*EC)
2. RECORDER MALFUNCTION
3. TDS values for non-record days are approximated.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

DECEMBER 1985

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1)(3) (mg/l)	OUTFLOW x TDS
DECEMBER	1	173	(2)	430	74390
	2	164	(2)	409	67076
	3	328	661	389	127506
	4	403	726	431	173576
	5	410	799	479	196280
	6	441	770	460	202657
	7	460	792	474	218080
	8	457	827	497	227315
	9	404	869	526	212378
	10	372	884	536	199343
	11	367	908	552	202673
	12	365	925	564	205827
	13	363	938	573	207951
	14	359	913	556	199485
	15	357	949	580	207228
	16	352	968	594	208969
	17	348	1030	637	221744
	18	265	(2)	633	167745
	19	262	1020	630	165092
	20	260	1010	623	161998
	21	259	1010	623	161375
	22	256	1080	673	172252
	23	329	1080	673	221371
	24	372	1100	687	255664
	25	366	1090	680	248900
	26	360	1090	680	244820
	27	373	1100	687	256351
	28	375	1120	702	263160
	29	361	1130	709	255962
	30	347	1150	724	251106
	31	323	1150	724	233739
TOTAL		10631			6212013
MONTHLY FLOW WEIGHTED TDS				584	

1. TDS = EC/(1.8507-2.2742E-4*EC)
2. RECORDER MALFUNCTION
3. TDS values for non-record days are approximated.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

JANUARY 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
JANUARY	1	287	1150	724	207687
	2	250	1130	709	177259
	3	244	1110	695	169459
	4	254	1100	687	174566
	5	261	1080	673	175617
	6	265	1080	673	178308
	7	245	1100	687	168381
	8	218	1130	709	154570
	9	230	1100	687	158072
	10	230	1100	687	158072
	11	223	1110	695	154874
	12	224	1100	687	153948
	13	243	1100	687	167006
	14	230	1080	673	154758
	15	235	1080	673	158122
	16	233	1070	666	155105
	17	225	1080	673	151394
	18	210	1100	687	144326
	19	219	1080	673	147357
	20	215	1080	673	144665
	21	225	1070	666	149780
	22	226	1070	666	150445
	23	223	1080	673	150048
	24	227	1090	680	154372
	25	227	1100	687	156010
	26	223	1100	687	153261
	27	223	1100	687	153261
	28	221	1100	687	151886
	29	225	1090	680	153012
	30	240	761	454	108868
	31	326	590	344	112052
TOTAL		7327			4846543
MONTHLY FLOW WEIGHTED TDS				661	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

FEBRUARY 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
FEBRUARY	1	432	681	402	173480
	2	406	642	377	152902
	3	348	699	413	143789
	4	334	762	454	151727
	5	329	911	554	182364
	6	310	925	564	174812
	7	297	965	592	175698
	8	296	988	608	179856
	9	297	963	590	175285
	10	296	944	577	170795
	11	294	978	601	176586
	12	373	991	610	227427
	13	553	1040	644	356292
	14	560	1000	616	344981
	15	1480	692	409	604822
	16	2320	480	276	639435
	17	2320	478	274	636604
	18	1710	548	317	542897
	19	847	657	386	327093
	20	844	761	454	382851
	21	625	768	458	286389
	22	340	794	475	161640
	23	336	844	509	170962
	24	297	886	537	159557
	25	275	916	558	153375
	26	274	950	581	159239
	27	200	974	598	119568
	28	156	1030	637	99403
TOTAL		17149			7229827
MONTHLY FLOW WEIGHTED TDS				422	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

MARCH 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
MARCH	1	155	1060	659	102073
	2	153	1080	673	102948
	3	150	1070	666	99853
	4	181	1070	666	120489
	5	222	1080	673	149375
	6	236	1080	673	158795
	7	235	1090	680	159813
	8	234	1080	673	157449
	9	604	1040	644	389150
	10	850	853	515	437644
	11	1290	735	437	563186
	12	1330	620	363	482307
	13	771	617	361	278129
	14	771	692	409	315079
	15	805	609	356	286324
	16	1630	661	389	633642
	17	2170	519	300	649997
	18	1380	543	314	433844
	19	710	572	332	236032
	20	435	692	409	177769
	21	490	769	459	224852
	22	555	850	513	284634
	23	548	920	560	307139
	24	376	892	541	203534
	25	228	1030	637	145281
	26	229	1050	651	149171
	27	224	1060	659	147512
	28	223	1060	659	146853
	29	223	1070	666	148448
	30	223	1080	673	150048
	31	223	1070	666	148448
TOTAL		17854			7989820
MONTHLY FLOW WEIGHTED TDS				448	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

APRIL 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
APRIL	1	243	1060	659	160024
	2	259	1060	659	170560
	3	258	1050	651	168062
	4	258	1060	659	169902
	5	257	1070	666	171082
	6	267	1050	651	173924
	7	607	906	551	334381
	8	879	756	450	395840
	9	513	819	492	252425
	10	231	889	539	124571
	11	232	871	527	122274
	12	231	903	549	126778
	13	230	929	567	130332
	14	229	962	589	134993
	15	229	975	599	137066
	16	228	993	611	139337
	17	228	1000	616	140456
	18	226	1010	623	140814
	19	226	1020	630	142408
	20	228	1030	637	145281
	21	231	1030	637	147192
	22	235	1020	630	148079
	23	234	1020	630	147449
	24	236	1040	644	152052
	25	237	1050	651	154382
	26	237	1060	659	156073
	27	237	1060	659	156073
	28	236	1060	659	155414
	29	235	1050	651	153079
	30	234	1050	651	152428
TOTAL		8411			5002730
MONTHLY FLOW WEIGHTED TDS				595	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

MAY 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
MAY	1	233	1050	651	151777
	2	231	1050	651	150474
	3	228	1040	644	146898
	4	225	1040	644	144965
	5	222	1040	644	143032
	6	219	1040	644	141099
	7	218	1050	651	142006
	8	217	1060	659	142902
	9	217	1060	659	142902
	10	217	1060	659	142902
	11	219	1060	659	144219
	12	219	1070	666	145786
	13	231	1080	673	155431
	14	248	1090	680	168654
	15	250	1090	680	170014
	16	250	1080	673	168215
	17	249	1070	666	165756
	18	248	1070	666	165091
	19	248	1080	673	166870
	20	245	1080	673	164851
	21	242	1100	687	166319
	22	239	1100	687	164257
	23	237	1100	687	162883
	24	236	1100	687	162195
	25	235	1090	680	159813
	26	234	1100	687	160821
	27	232	1110	695	161125
	28	229	1110	695	159041
	29	227	1110	695	157652
	30	225	1110	695	156263
	31	222	1110	695	154180
TOTAL		7192			4828391
MONTHLY FLOW WEIGHTED TDS				671	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

JUNE 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/l)	OUTFLOW x TDS
JUNE	1	219	1100	687	150512
	2	215	1090	680	146212
	3	245	1090	680	166613
	4	248	1090	680	168654
	5	258	1120	702	181054
	6	236	1160	731	172513
	7	200	1130	709	141807
	8	181	1120	702	127018
	9	175	1120	702	122808
	10	176	1120	702	123510
	11	166	1110	695	115288
	12	165	1110	695	114593
	13	161	1110	695	111815
	14	161	1100	687	110650
	15	159	1100	687	109276
	16	157	1100	687	107901
	17	161	1090	680	109489
	18	163	1100	687	112025
	19	164	1100	687	112712
	20	162	1100	687	111338
	21	156	1100	687	107214
	22	155	1110	695	107648
	23	156	1090	680	106089
	24	155	1090	680	105408
	25	150	1090	680	102008
	26	147	1080	673	98911
	27	149	1070	666	99187
	28	144	1070	666	95859
	29	143	1070	666	95193
	30	147	1060	659	96805
TOTAL		5274			3630109
MONTHLY FLOW WEIGHTED TDS				688	

1. TDS = EC/(1.8507-2.2742E-4*EC)

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

JULY 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1)(3) (mg/l)	OUTFLOW x TDS
JULY	1	139	1050	651	90545
	2	135	1050	651	87939
	3	137	(2)	640	87680
	4	137	1020	630	86327
	5	142	1010	623	88476
	6	139	1020	630	87587
	7	142	1010	623	88476
	8	141	1020	630	88847
	9	124	1020	630	78135
	10	116	1030	637	73915
	11	119	1030	637	75826
	12	124	1030	637	79012
	13	133	1030	637	84747
	14	137	1030	637	87296
	15	139	1040	644	89556
	16	145	1040	644	93422
	17	143	1050	651	93150
	18	143	1060	659	94170
	19	140	1070	666	93196
	20	135	1070	666	89868
	21	137	1070	666	91199
	22	149	1070	666	99187
	23	150	1070	666	99853
	24	151	1080	673	101602
	25	146	1070	666	97190
	26	152	1060	659	100097
	27	152	1050	651	99013
	28	149	1040	644	95999
	29	148	1040	644	95355
	30	144	1040	644	92778
	31	142	1040	644	91489
TOTAL		4330			2801934
MONTHLY FLOW WEIGHTED TDS				647	

1. TDS = EC/(1.8507-2.2742E-4*EC)
2. RECORDER MALFUNCTION
3. TDS values for non-record days are approximated.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

AUGUST 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1)(3) (mg/l)	OUTFLOW x TDS
AUGUST	1	137	1050	651	89242
	2	135	1050	651	87939
	3	137	1050	651	89242
	4	132	1050	651	85985
	5	122	1050	651	79471
	6	120	1060	659	79024
	7	123	(2)	659	81057
	8	121	(2)	659	79739
	9	118	1060	659	77707
	10	120	1070	666	79883
	11	122	1070	666	81214
	12	127	1060	659	83634
	13	126	1060	659	82975
	14	131	1070	666	87205
	15	130	1070	666	86539
	16	132	1080	673	88818
	17	137	1080	673	92182
	18	122	1080	673	82089
	19	103	1080	673	69305
	20	101	1080	673	67959
	21	144	1080	673	96892
	22	133	1090	680	90447
	23	123	1100	687	84534
	24	121	1100	687	83160
	25	124	1090	680	84327
	26	125	1090	680	85007
	27	127	1090	680	86367
	28	127	1090	680	86367
	29	126	1090	680	85687
	30	126	1090	680	85687
	31	128	1080	673	86126
TOTAL		3900			2605809
MONTHLY FLOW WEIGHTED TDS				668	

1. TDS = EC/(1.8507-2.2742E-4*EC)
2. RECORDER MALFUNCTION
3. TDS values for non-record days are approximated.

TABLE B-2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

SEPTEMBER 1986

DAY		PRADO OUTFLOW (cfs-day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1)(3) (mg/l)	OUTFLOW x TDS
SEPTEMBER	1	122	1080	673	82089
	2	124	1070	666	82545
	3	132	1080	673	88818
	4	131	1080	673	88145
	5	127	1090	680	86367
	6	124	1090	680	84327
	7	125	1090	680	85007
	8	125	1080	673	84108
	9	123	1080	673	82762
	10	120	1090	680	81607
	11	124	1100	687	85221
	12	118	1100	687	81098
	13	124	1090	680	84327
	14	124	1090	680	84327
	15	44	(2)	682	30008
	16	136	(2)	684	93024
	17	193	1100	687	132591
	18	167	1080	673	112368
	19	139	1110	695	96536
	20	135	1090	680	91807
	21	136	1090	680	92487
	22	142	1070	666	94528
	23	156	1050	651	101619
	24	141	(2)	609	85869
	25	160	(2)	567	90720
	26	174	(2)	525	91350
	27	251	804	482	120996
	28	249	888	539	134109
	29	173	(2)	577	99821
	30	296	1000	616	182347
TOTAL		4435			2830926
MONTHLY FLOW WEIGHTED TDS				638	

1. TDS = EC/(1.8507-2.2742E-4*EC)
2. RECORDER MALFUNCTION
3. TDS values for non-record days are approximated.

TABLE B-3

ANNUAL SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1985-86

MONTH	MONTHLY FLOW (cfs-day)	MONTHLY WEIGHTED TDS (mg/l)	MONTHLY FLOW TIMES TDS
1985			
OCTOBER	5367	694	3724270
NOVEMBER	7402	609	4509150
DECEMBER	10631	584	6212013
1986			
JANUARY	7327	661	4846543
FEBUARY	17149	422	7229827
MARCH	17854	448	7989820
APRIL	8411	595	5002730
MAY	7192	671	4828391
JUNE	5274	688	3630109
JULY	4330	647	2801934
AUGUST	3900	668	2605809
SEPTEMBER	4435	638	2830926
TOTAL	99272		56211522
1985-86 WATER YEAR WEIGHTED TDS		566	

APPENDIX C

WATER QUALITY - SANTA ANA RIVER AT RIVERSIDE NARROWS

1985-86

PREPARED BY

DONALD L. HARRIGER

TABLE C-1

WATER QUALITY ANALYSES
SANTA ANA RIVER AT RIVERSIDE NARROWS
WATER YEAR 1985-86

Date Sampled	EC (micromhos/cm)	TDS (mg/l)	Source
1985			
10-01	935	637	C of R
10-04	1,010	635	USGS
10-10	940	606	C of R
10-15	940	594	C of R
10-24	840	612	C of R
10-29	880	590	C of R
10-29	925	578	USGS
11-07	910	618	C of R
11-12	450	312*	C of R
11-21	980	622	C of R
11-26	640	420*	C of R
12-10	950	604	C of R
12-17	1,000	626	USGS
12-19	960	616	C of R
12-23	1,000	648	DWR
12-24	980	632	C of R
1986			
01-02	940	617	C of R
01-07	970	654	C of R
01-09	997	620	USGS
01-13	978	658	DWR
01-16	980	643	C of R
01-21	940	628	C of R
01-22	966	622	USGS
01-30	570	421*	C of R
02-04	990	624	USGS
02-04	975	616	C of R
02-13	838	505*	C of R
02-14	683	416*	USGS

* Storm flow, not used in determining monthly averages.

C of R - City of Riverside
USGS - United States Geological Survey
DWR - Department of Water Resources

TABLE C-1

WATER QUALITY ANALYSES
SANTA ANA RIVER AT RIVERSIDE NARROWS
WATER YEAR 1985-86
(Continued)

Date Sampled	EC (micromhos/cm)	TDS (mg/l)	Source
02-17	474	318*	DWR
02-18	645	380*	C of R
02-27	1,020	664	C of R
03-04	952	604	USGS
03-10	434	306*	DWR
03-13	710	470*	C of R
03-18	615	380*	C of R
03-27	960	638	C of R
04-01	110	678	DWR
04-01	980	650	C of R
04-09	923	624	USGS
04-10	950	576	C of R
04-15	960	614	C of R
04-24	960	597	C of R
04-29	960	626	C of R
05-08	1,000	677	DWR
05-08	820	586	C of R
05-09	955	626	USGS
05-13	880	620	C of R
05-22	880	619	C of R
05-27	860	632	C of R
06-04	973	639	USGS
06-05	1,010	674	DWR
06-05	980	632	C of R
06-10	990	661	C of R
06-16	722	605	USGS
06-19	720	631	C of R
06-24	800	664	C of R
06-26	895	614	USGS

* Storm flow, not used in determining monthly averages.

C of R - City of Riverside
USGS - United States Geological Survey
DWR - Department of Water Resources

TABLE C-1

WATER QUALITY ANALYSES
SANTA ANA RIVER AT RIVERSIDE NARROWS
WATER YEAR 1985-86
(Continued)

Date Sampled	EC (micromhos/cm)	TDS (mg/l)	Source
07-03	930	624	C of R
07-08	1,000	657	C of R
07-17	980	636	C of R
07-21	1,030	658	DWR
07-22	1,000	662	C of R
07-31	960	618	C of R
08-04	892	596	USGS
08-05	960	638	C of R
08-14	980	644	C of R
08-19	930	607	C of R
08-28	940	629	C of R
09-02	940	639	C of R
09-09	877	611	USGS
09-11	860	636	C of R
09-16	930	625	C of R
09-22	901	650	USGS
09-23	882	689	USGS
09-25	430	349*	C of R
09-30	920	623	C of R

* Storm flow, not used in determining monthly averages.

C of R - City of Riverside
USGS - United States Geological Survey
DWR - Department of Water Resources

TABLE C-2

FLOW WEIGHTED TDS OF BASE FLOW AT RIVERSIDE NARROWS
(Including Nontributary Flow and Pumped Groundwater Discharged Above the Narrows)

WATER YEAR 1985-86

Month		Acre Feet (1)	TDS (2) (mg/l)	Acre Feet Times TDS
1985	October	6,431	607	3,903,617
	November	5,851	620	3,617,620
	December	5,804	625	3,627,500
1986	January	6,075	635	3,857,625
	February	5,318	635	3,376,930
	March	5,857	621	3,637,197
	April	6,258	624	3,904,992
	May	6,089	627	3,817,803
	June	4,374	640	2,799,360
	July	4,132	643	2,656,876
	August	4,114	623	2,563,022
	September	4,328	639	2,765,592
	Total	64,631		40,538,134
	Flow Weighted TDS	$\frac{40,538,134}{64,632}$ = 627 mg/l		

(1) Total Flow minus Storm Flow from Table 6.

(2) Estimated average TDS based on water quality data from Table C-1.

APPENDIX D

QUANTITY AND QUALITY OF WASTEWATER FROM RUBIDOUX COMMUNITY SERVICES DISTRICT

1985-86

PREPARED BY

DONALD L. HARRIGER

TABLE D-1

QUANTITY AND QUALITY OF WASTEWATER FROM RUBIDOUX DISCHARGED BELOW THE RIVERSIDE NARROWS GAGING STATION

WATER YEAR 1985-86

Month	Acre-Feet	TDS (mg/l)	Acre-Feet Times TDS
October - 1985	184	714	131,376
November	168	730	122,640
December	171	740	126,540
January - 1986	175	727	127,225
February	164	726	119,064
March	184	755	138,920
April	173	752	130,096
May	183	696	127,368
June	173	718	124,214
July	175	752	131,600
August	176	746	131,296
September	169	767	129,623
Total	2,095	---	1,539,962

$$\frac{1,539,962}{2,095} = 735 \text{ mg/l}$$

Average Flow Weighted Quality of Wastewater = 735 mg/l.

APPENDIX E

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, 1986

*WIN G. PETERS, C.P.A.
*DONALD H. PETERSON, C.P.A.
*DONALD E. CALLAHAN, C.P.A.
*L. PETER SCHERER, C.P.A.
*RODNEY R. McDANIEL, C.P.A.
*RALPH H. WEINTRAUB, C.P.A.
*PHILIP H. HOLTKAMP, C.P.A.
*THOMAS M. PERLOWSKI, C.P.A.
EDWARD GRODSKY, C.P.A.

ELLIS C. DIEHL, C.P.A. (RETIRED)
BRYN B. EVANS, C.P.A. (RETIRED)

*A PROFESSIONAL CORPORATION

DIEHL, EVANS AND COMPANY
A PARTNERSHIP INCLUDING ACCOUNTANCY CORPORATIONS
CERTIFIED PUBLIC ACCOUNTANTS
1910 NORTH BUSH STREET
SANTA ANA, CALIFORNIA 92706-2894
(714) 542-4453

OTHER OFFICES AT:
2985 ROOSEVELT STREET
CARLSBAD, CALIFORNIA 92008-2389
(619) 729-2343
120 WEST WOODWARD AVENUE
ESCONDIDO, CALIFORNIA 92025-9990
(619) 741-3141
ONE CIVIC PLAZA, SUITE 269
NEWPORT BEACH, CALIFORNIA 92660
(714) 644-6156

September 15, 1986

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, 1986 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, 1986, 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, 1986

ASSETS

Cash in checking account	$ 501
Cash in savings account	7,026
TOTAL ASSETS	$ 7,527

LIABILITIES AND FUND BALANCE

Liabilities	$ -
Fund balance	7,527
TOTAL LIABILITIES AND FUND BALANCE	$ 7,527

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, 1986

		Actual	Budget	Over (Under) Budget
REVENUE COLLECTED:				
Water district contributions (Note 2):				
Orange County Water District		$ 6,400	$ 6,400	$ -
Chino Basin Municipal Water District		3,200	3,200	-
San Bernardino Valley Municipal Water District		3,200	3,200	-
Western Municipal Water District		3,200	3,200	-
Interest from savings account		512	-	512
TOTAL REVENUE COLLECTED		16,512	16,000	512
EXPENSES PAID:				
Professional engineering services		7,186	8,000	(814)
Administrative expenses:				
Office and secretarial expense	6,705			
Auditing services	675	7,380	5,000	2,380
Annual reports		2,612	3,000	(388)
TOTAL EXPENSES PAID		17,178	16,000	1,178
EXCESS OF EXPENSES PAID OVER REVENUE COLLECTED		(666)	$ -	$ (666)
FUND BALANCE AT JULY 1, 1985		8,193		
FUND BALANCE AT JUNE 30, 1986		$ 7,527		

See accountants' report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

NOTES TO FINANCIAL STATEMENTS

June 30, 1986

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:

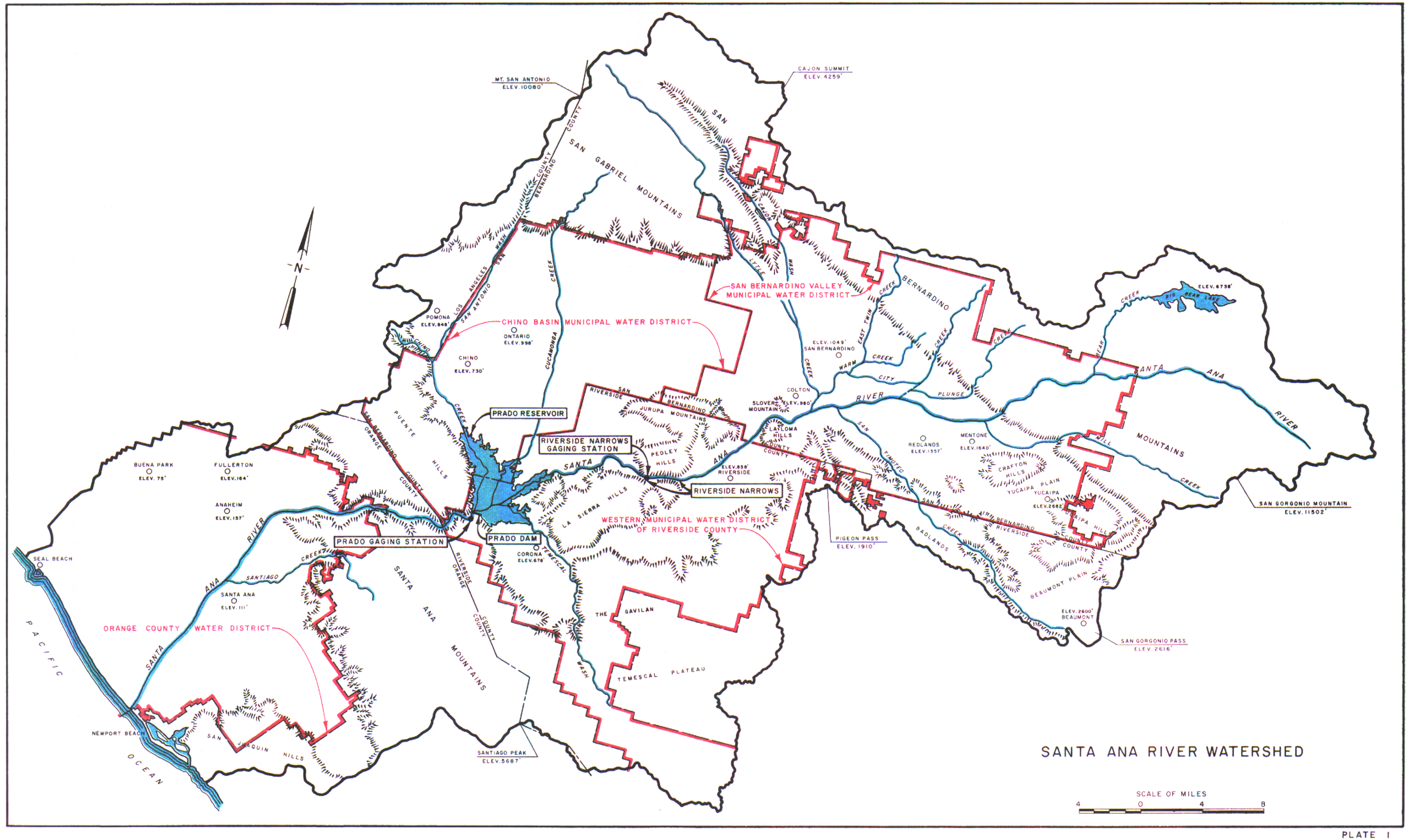
The Santa Ana River Watermaster is composed of a committee of five representatives of four water districts. Two representatives serve from Orange County Water District and one representative each serves from Chino Basin Municipal Water District, Western Municipal Water District and San Bernardino Valley 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	20
Total	100%

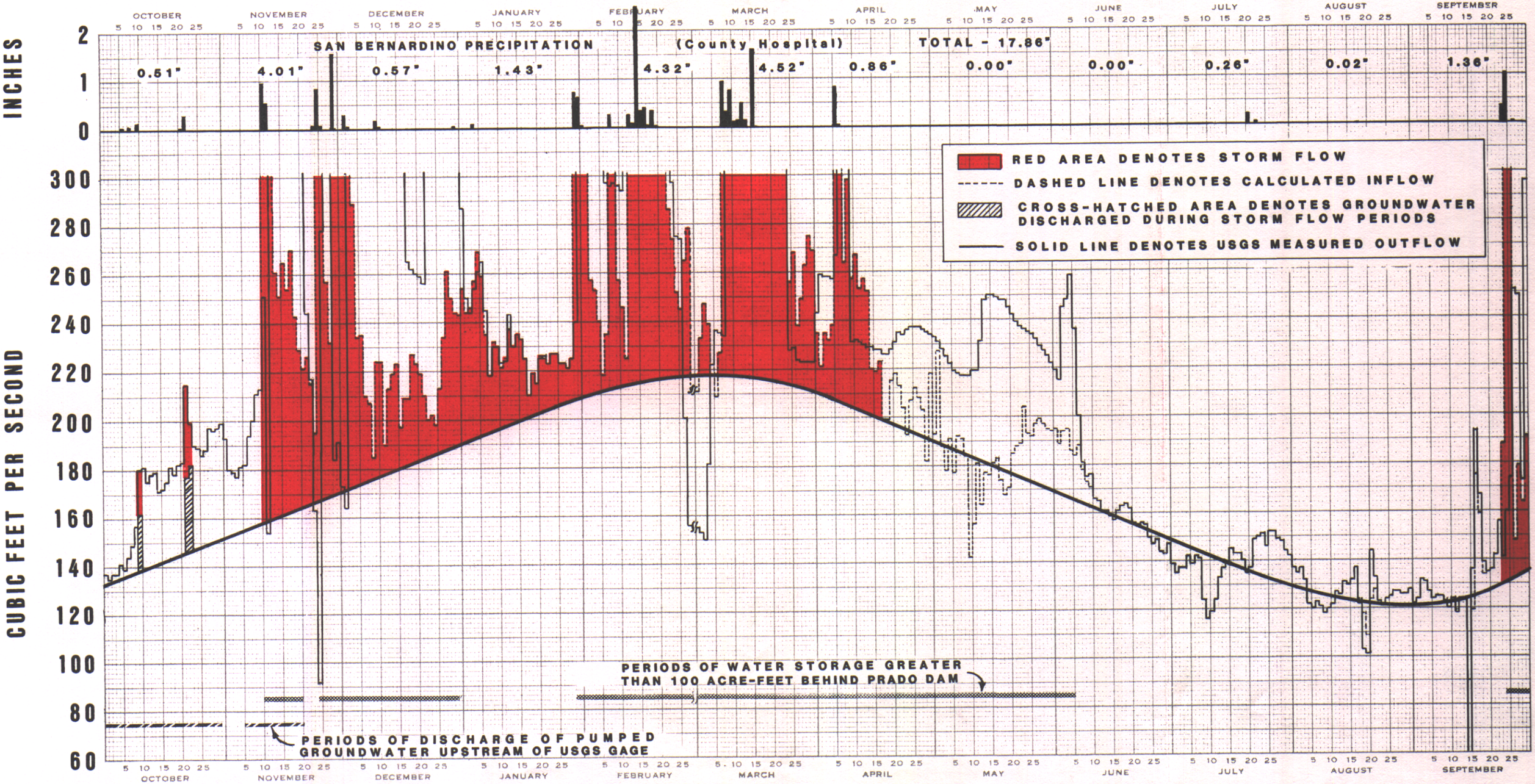
The Watermaster issues a report each year to satisfy its obligation to monitor and test water flows from the Upper Area to the Lower Area of the Santa Ana River.

See accountants' report.



SANTA ANA RIVER WATERSHED

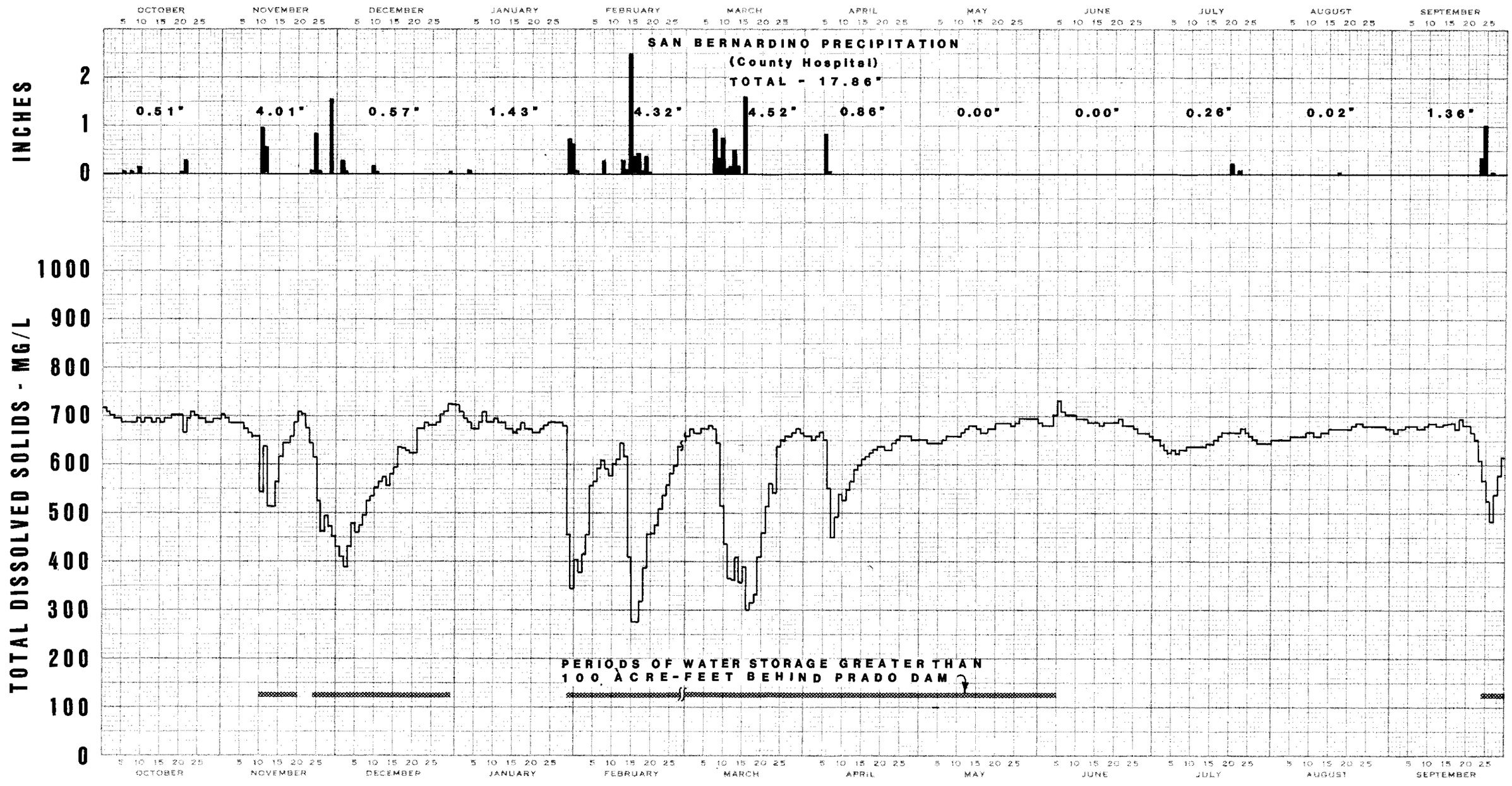
PLATE I



DISCHARGE OF SANTA ANA RIVER BELOW PRADO DAM & SAN BERNARDINO PRECIPITATION

WATER YEAR 1985-86

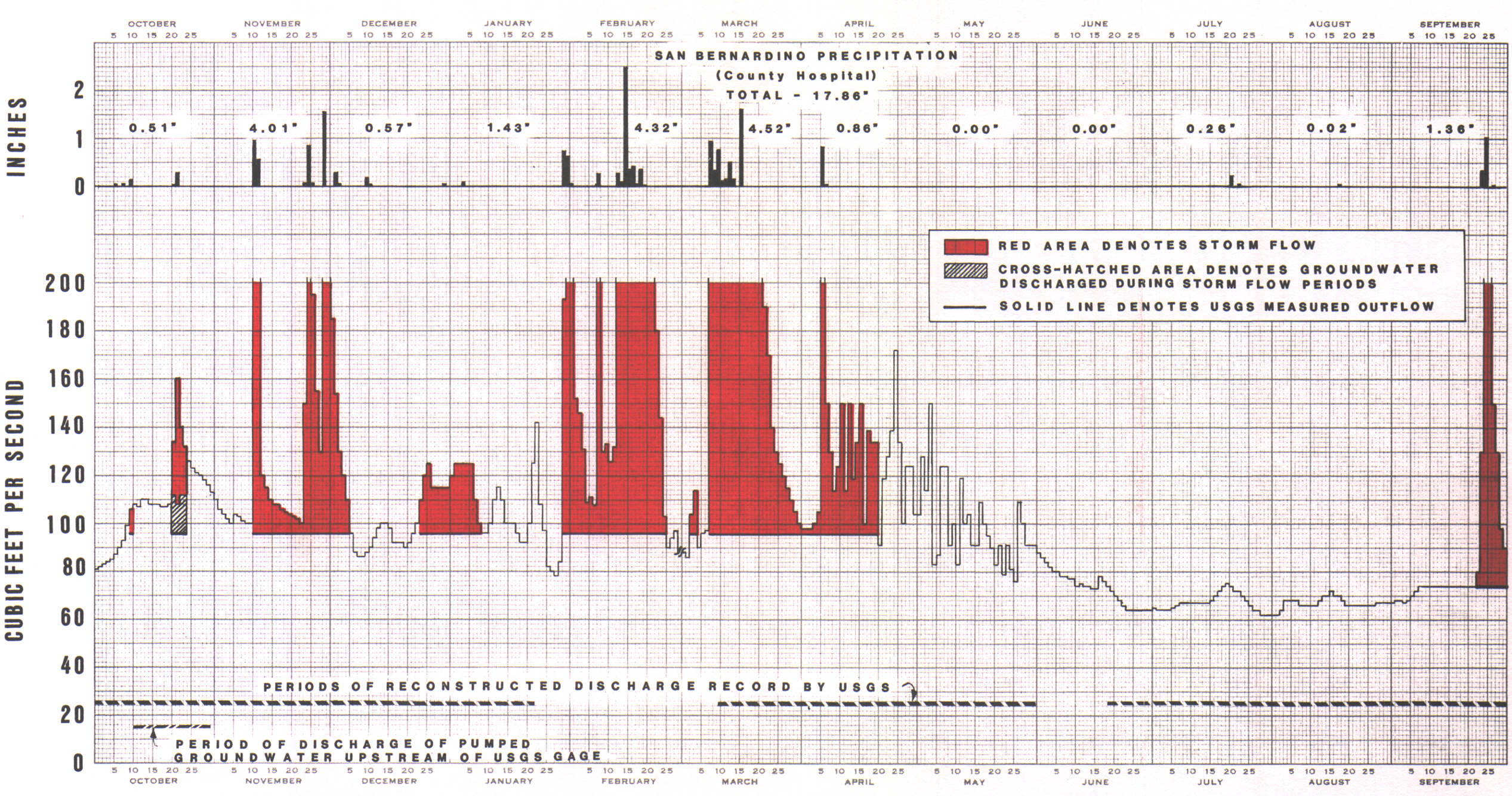
PLATE 2



DISSOLVED SOLIDS IN SANTA ANA RIVER BELOW PRADO DAM

WATER YEAR 1985-86

PLATE 3



DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS & SAN BERNARDINO PRECIPITATION

WATER YEAR 1985-86

PLATE 4