SANTA ANA RIVER WATERMASTER

FOR

ORANGE COUNTY WATER DISTRICT

VS. CITY OF CHINO, et al

CASE NO. 117628 - COUNTY OF ORANGE

TWENTIETH

ANNUAL REPORT

OF THE

SANTA ANA RIVER WATERMASTER

1989-1990

APRIL 30, 1991

SANTA ANA RIVER WATERMASTER

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

WATERMASTER
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April 30, 1991

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

RE: Watermaster Report for 1989-90

Gentlemen:

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

The principal findings of the Watermaster for the water year 1989-90 are as follows:

<u>At Prado</u>

1. Base Flow at Prado	119,149	acre-feet
2. Annual Weighted TDS of Base and Storm Flow	611	mg/L
3. Annual Adjusted Base Flow	127,986	acre-feet
4. Cumulative Adjusted Base Flow	1,817,661	acre-feet
5. Cumulative Entitlement of OCWD	840,000	acre-feet
6. Cumulative Credit	977,661	acre-feet
7. One-Third of Cumulative Debit	0	acre-feet
8. Minimum Required Base Flow in 1990-91	34,000	acre-feet

At Riverside Narrows

1. Base Flow at Riverside Narrows	53,199	acre-feet
2. Annual Weighted TDS of Base Flow	583	mg/L
3. Annual Adjusted Base Flow	53,544	acre-feet
4. Cumulative Adjusted Base Flow	715,977	acre-feet
5. Cumulative Entitlement of CBMWD and WMWD	305,000	acre-feet
6. Cumulative Credit	410,977	acre-feet
7. One-Third of Cumulative Debit	0	acre-feet
8. Minimum Required Base Flow in 1990-91	12,420	acre-feet

The above findings show that at the end of the 1989-90 water year, Chino Basin Municipal Water District and Western Municipal Water District have a cumulative credit of 977,661 acre-feet to their Base Flow obligation at Prado Dam. San Bernardino Valley Municipal Water District has a cumulative credit of 410,977 acre-feet to its Base Flow obligation at Riverside Narrows.

The Watermaster continued to exercise surveillance over the many projects within the watershed for their potential effect on Base Flow.

Sincerely yours,
SANTA ANA RIVER WATERMASTER

By: Harvey O. Banks

Harvey O. Banks

Donald L. Harriger

William J. Carroll

William J. Carroll

William R. Mills, Jr.

Robert L. Reiter

Robert L. Reiter

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CHAPTER I

WATERMASTER ACTIVITIES

This is the Twentieth 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 G and H .

In order to administer the provisions of the Stipulated Judgment, the court appointed a Watermaster composed of five persons. Since August 15, 1985, the Santa Ana Watermaster Committee has consisted of Harvey O. Banks, William J. Carroll, William R. Mills, Jr., Donald L. Harriger, and Robert L. Reiter. In 1989-90 Mr. Banks continued to serve as chairman, and Mr. Reiter served as secretary.

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 in 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 MWDSC Upper Feeder Crossing and below Prado Dam. Runoff data have also been provided for several small 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.

Precipitation during 1989-90 was below normal and totaled 8.53 inches at San Bernardino County Hospital, 47% of the 26 year base period average of 17.98 inches. In October and November, 1989, precipitation totaled 0.69 inches. There was no rain in December and in January 1.88 inches were recorded. In February and March a total of 3.99 inches was measured. In April 1.54 inches were recorded. Only 0.41 inches were measured in May and 0.02 inches in June. There was no precipitation in July, August, and September 1990.

Small amounts of runoff were recorded during October, minor amounts in November, and none during December at both Riverside Narrows and Prado. Storm runoff continued intermittently from about January 2 through June 3 at Prado and through June 2 at Riverside Narrows. No storm runoff occurred after June 3.

TABLE 1

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

October 1, 1989 to September 30, 1990

			USGS Costs
SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT			
At Riverside Narrows (MWD Crossing)			
Water Quality Monitor/TDS Samples	$742		$2,225
Surface Water Gage	1,350	$2,092	4,050
WESTERN MUNICIPAL WATER DISTRICT			
Same as SBVMWD	$2,092		
Cucamonga Creek Discharge	2,025		4,050
Chino Creek Discharge	1,350	5,467	4,050
CHINO BASIN MUNICIPAL WATER DISTRICT			
Same as WMWD		5,466	
ORANGE COUNTY WATER DISTRICT			
At Prado Dam			
Water Quality Monitor/TDS Samples			4,950
Water Quality Sampling & Conductivity Programs	5,900		
Chino Creek			
Surface Water Gage	1,350	7,250	4,950
TOTAL FOR PARTIES		20,275	
UNITED STATES GEOLOGICAL SURVEY			$19,325
GRAND TOTAL			$39,600

The 1989-90 discharge record for the USGS gaging station, "Santa Ana below Prado," is considered by the USGS to be a "good" record. Fifteen (15) direct discharge measurements, which ranged from about 135 to 2,480 cubic feet per second, were made during the year. For short, infrequent periods from October 21, 1989, through January 12, 1990, and May 28-29, 1990, minor amounts of water were stored in and released from Prado Reservoir; the maximum amount in storage was 144 acre-feet on May 28. From January 13, 1990, through May 10, 1990, the discharge was continuously regulated by Prado Reservoir with a maximum of 8,241 acre-feet in storage on February 19, 1990. The maximum average daily discharge after regulation by Prado Reservoir occurred on February 18, 1990, and amounted to 1,700 cubic feet per second. The mean annual discharge was approximately 200 cubic feet per second.

No State Water Project water was released by Metropolitan Water District of Southern California (MWDSC) from turnout OC-59 into San Antonio Creek.

The Arlington Desalter started operation in July 1990 and discharged 1,020 acre-feet of product water to the drainage tributary to the Santa Ana River below the Riverside Narrows.

The overall 1989-90 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 MWDSC Upper Feeder Crossing for the entire year. The continuous downstream movement of sand deposits affected the stage discharge relationship for the station. Twenty-one (21) direct discharge measurements, which ranged from about 58 to 109 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 Stipulated 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 Stipulated 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 Stipulated Judgment further provides that the Watermaster may from time to time, at its discretion, require advances of operating capital from the parties.

As requested by Chairman Banks, pursuant to a letter dated May 22, 1989 from Secretary Mills, the membership of the Santa Ana River Watermaster was polled and unanimously adopted a budget for fiscal year 1989-90 in the amount of $16,000. Table 2 shows the items and amounts included in said budget together with the actual expenses for the fiscal year 1989-90. At its meeting on June 7, 1990, the Watermaster adopted a budget for fiscal year 1990-91 in the amount of $16,000. The items and amounts of this budget are also shown in Table 2.

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 1989-90 is included here as Appendix F.

TABLE 2

SANTA ANA RIVER WATERMASTER BUDGET AND EXPENSES

	July 1, 1989 to June 30, 1990 Budget	July 1, 1989 to June 30, 1990 Expenses	July 1, 1990 to June 30, 1991 Budget
Administration	$ 5,000.00	$ 1,071.00	$ 3,000.00
Support Engineering Services	8,000.00	9,787.00	10,000.00
Reproduction of Annual Report	3,000.00	2,756.00	3,000.00
TOTAL	$ 16,000.00	$ 13,614.00	$ 16,000.00

Summary of Findings

A summary of findings by the Watermaster for the period 1970-71 through 1989-90 is presented in Table 3. The Base Flow obligations at both Riverside Narrows and Prado Dam provided for in the Stipulated 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
1986-87	8.08	140,538	119,848	622	127,638	708,137
1987-88	13.78	170,279 (9)	124,104 (9)	582	136,308	802,445
1988-89	12.64	152,743 (9)	119,572 (9)	583	131,230	891,675
1989-90	8.53	144,817	119,149 (10)	611	127,986	977,661

SUMMARY OF FINDINGS

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	17,021	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	5,377
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	79,771	69,772 (8)	633	69,772	198,072
1985-86	17.86	99,258	68,220 (8)	624	68,220	251,042
1986-87	8.08	77,752	59,808	649	59,808	295,600
1987-88	13.78	79,706	55,324	620	55,324	335,674
1988-89	12.64	62,376	52,259	607	52,259	372,683
1889-90	8.53	58,500	53,199	591	53,544	410,977

(1) Measured at San Bernardino County Hospital.
(2) Excludes 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) Includes groundwater pumped from San Bernardino Basin and released to the river in accordance with Court Orders approving agreement and allowing temporary additional extractins of water from the San Bernardino Basin Area.
(9) Excludes Nontributary Flow released to San Antonio Creek by MWDSC under the Ontario/MWDSC Exchange Program

(10) Excludes water discharged to Santa Ana River from Arlington Desalter in accordance with agreement between Orange County Water District, Western Municipal Water District, and Santa Ana Watershed Project Authority.

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 Flow. These changes, in turn, have changed the cumulative credit for these years. See Appendix C in the Twelfth Annual Report 1981-82.

CHAPTER II

WATER SUPPLY CONDITIONS

The precipitation in the Santa Ana River Watershed during 1989-90, as represented by rainfall measured at San Bernardino County Hospital, was about 47% of normal in terms of the Base Period average. The Total Flow of the Santa Ana River below Prado Dam during the 1989-90 water year was about 144,817 acre-feet as compared to a total flow of 152,743 acre-feet which occurred in the previous year. The unadjusted Base Flow amounts at both Riverside Narrows and Prado, were 53,199 acre-feet and 119,149 acre-feet, respectively, which are approximately the same as 1988-89 Base Flows.

Chino Basin Groundwater Storage Program

This program was described and its implications with respect to Watermaster responsibilities and activities were described in the Sixteenth Annual Report. No water was stored underground in 1989-90 or previously.

Discharge of Groundwater from San Bernardino Basin Area to Santa Ana River

This program also was described in the Sixteenth Annual Report. No ground water was pumped from San Bernardino Basin to the Santa Ana River in 1989-90.

Discharge of State Water Project Water Above Prado Ontario/MWD Exchange Program

The Sixteenth Annual Report presents a description of this program and its implications with respect to the responsibilities and activities of the Watermaster. During 1989-90 MWDSC did not deliver any Colorado River exchange water to the City of Ontario. No

State Water Project water was released to San Antonio Creek in 1989-90.

Santa Ana Watershed Project Authority Projects Affecting Base Flow in the Santa Ana River

The activities of the Santa Ana Watershed Project Authority of interest to the Watermaster in carrying out its responsibilities were discussed in the Seventeenth Annual Report.

Arlington Desalter

The objective of this project is to extract poor quality groundwater from the Arlington sub-basin and treat it by the reverse osmosis process (RO) to produce a usable water. The movement of the brackish water with its salt loads into adjacent groundwater sub-basins, and the Santa Ana River is reduced. Eventually, the Arlington sub-basin may be restored to a usable condition.

The Arlington Desalter is a joint project of Orange County Water District, Western Municipal Water District, and Santa Ana Watershed Project Project Authority pursuant to the terms of a Joint Participation Agreement dated July 6, 1988.

A well field of 5 wells produces 7 million gallons per day (mgd) from the Arlington sub-basin,the influent stream to the RO plant. The total dissolved solids concentration (TDS) is about 1100 mg/L and the nitrate concentration is about 90 mg/L, both in excess of public health standards.

The RO plant product stream is 6 million gallons daily, adjusted by blending to a TDS concentration of 450 mg/L and nitrate concentration of 40 mg/L. This is discharged to a tributary of the Santa Ana River and is diverted with other river flow downstream by Orange County Water District for groundwater recharge. Western Municipal Water District has the option of using the product water in

its service area upstream of Prado. The usable water production will be about 5,060 acre-feet per year.

The RO reject stream of brine, 1 mgd, is disposed of to the Santa Ana Regional Interceptor. This will remove some 5,700 tons of salt per year from the Basin.

The Arlington Desalter began operation in July 1990 and produced 139 ace-feet in July, 606 acre-feet in August and 275 acre-feet in September. This augmentation of the flow passing Prado is not considered as Base Flow under the provisions of the Joint Participation Agreement which were ratified by all four Parties to the Judgment.

Prado Reservoir Water Conservation Study
U.S. Army Corps of Engineers

In response to the request of Orange County Water District, the Corps has conducted a study of the potential for increasing the total amount of water conserved by raising the elevation of the conservation pool in Prado Reservoir from the present elevation of 490 feet to 505 feet. The increased conservation pool would be operated in conjunction with the groundwater artificial recharge operations by Orange County Water District downstream.

The Corps study results indicate that up to an annual average of 4,643 acre-feet per year of additional water could be conserved with a conservation pool elevation of 505 feet under the present conditions and up to 7,160 acre-feet per year under future conditions. The estimated annual benefits substantially exceed the estimated annual costs.

Any adverse environmental impacts could be mitigated.

Precipitation During 1989-90

During the 1989-90 water year, the precipitation at the San Bernardino County Hospital amounted to 8.53 inches, which is 47% of the Base Period average. Most of the precipitation, 7.41 inches, 87%, occurred during the months of January through April. In October and November precipitation totaled 0.69 inches. No precipitation occurred in December. The maximum monthly precipitation of 3.16 inches occurred during February. In May, 0.41 inches were measured. There was no precipitation in June, July, August, or September.

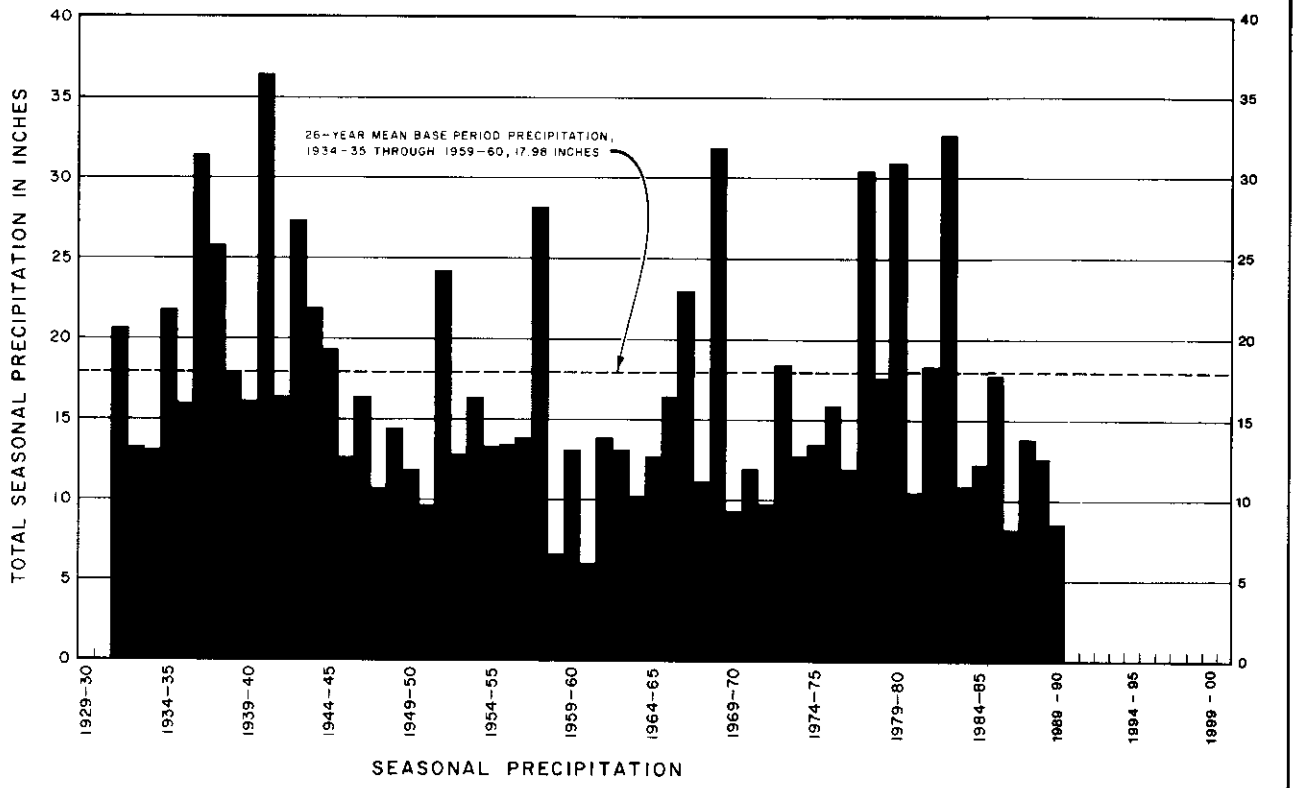
Figure 1 shows the seasonal precipitation from 1931-32 through 1989-90 and the accumulated departure from the 1934-35 through 1959-60 Base Period average.

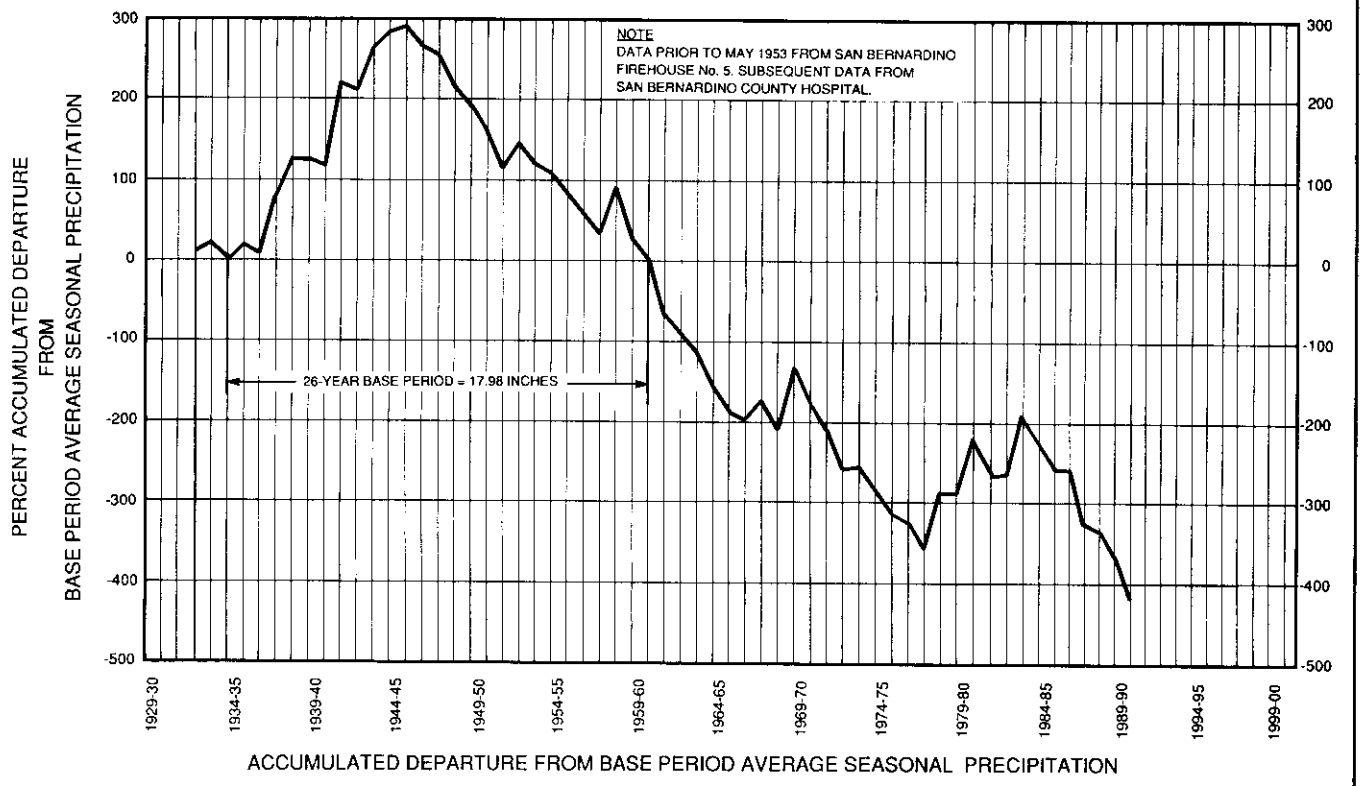
Runoff During 1989-90

Below Prado

The calculated total seasonal inflow to Prado in 1989-90 was 144,817 acre-feet, well above the Base Period (1934-35 through 1959-60) average of 78,780 acre-feet per year. During the month of February 1990, inflow amounted to 26,390, or 18% of the seasonal total. The recorded maximum storage in Prado Reservoir occurred on February 19, 1989, when 8,241 acre-feet (about 2% of the reservoir capacity at spillway level) was in storage. The maximum release of 1,700 cfs from Prado Reservoir occurred February 18, 1989.

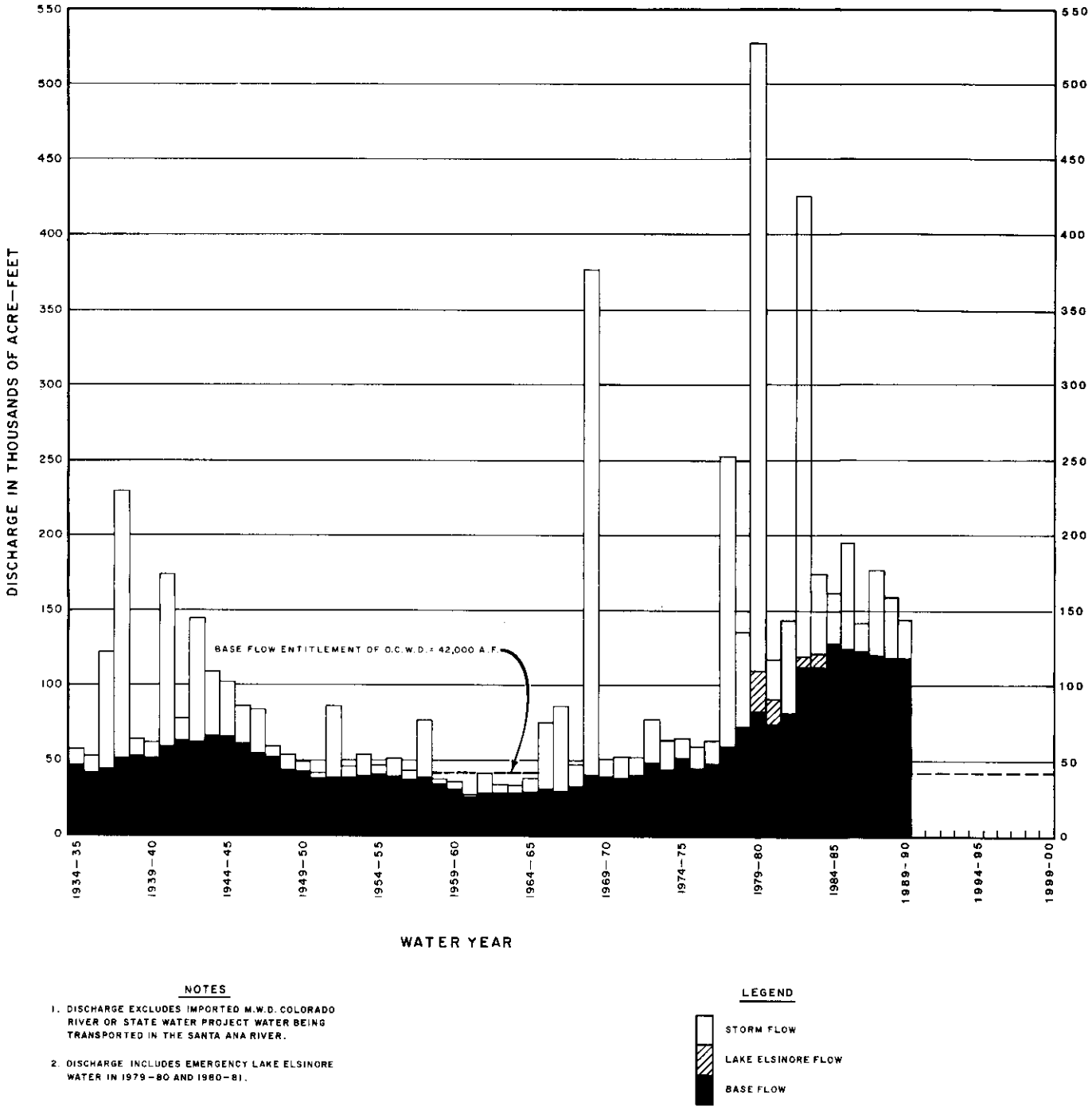
After 1943-44 the Base Flow at Prado Dam progressively decreased and reached a low in 1960-61 of 26,160 acre-feet. Since that year, the Base Flow has substantially increased. During the 20-year period (1970-71 through 1989-90) since the Stipulated Judgment went into effect, the Base Flow, unadjusted for quality, has averaged 82,013 acre-feet per year. This compares to the 26-year Base Period average of 47,470 acre-feet and the Base Flow requirements under





VARIATION IN PRECIPITATION AT SAN BERNARDINO

FIGURE 1



NOTES

1. DISCHARGE EXCLUDES IMPORTED M.W.D. COLORADO RIVER OR STATE WATER PROJECT WATER BEING TRANSPORTED IN THE SANTA ANA RIVER.

2. DISCHARGE INCLUDES EMERGENCY LAKE ELSINORE WATER IN 1979-80 AND 1980-81.

LEGEND

- STORM FLOW
- LAKE ELSINORE FLOW
- BASE FLOW

DISCHARGE OF SANTA ANA RIVER BELOW PRADO DAM

FIGURE 2

the Stipulated Judgment of 42,000 acre-feet. The 1989-90 unadjusted Base Flow amounts to 119,149 acre-feet, an increase of 37,146 acre-feet over the 20-year average.

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 1989-90.

At Riverside Narrows

The total Flow of the Santa Ana River at Riverside Narrows for the 1989-90 water year was 58,500 acre-feet.

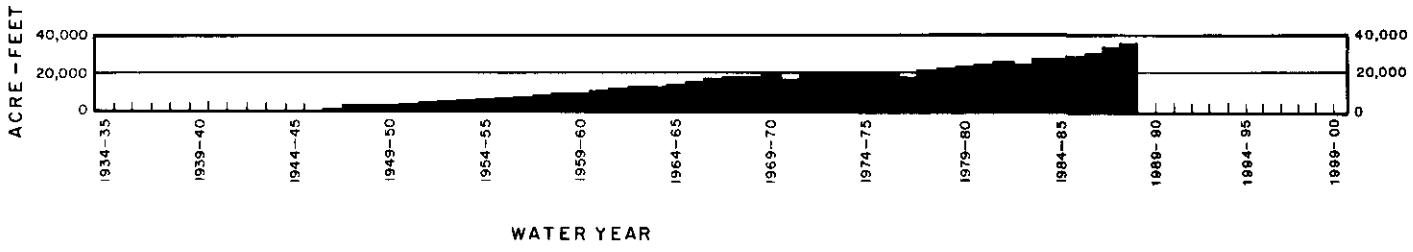
The unadjusted Base Flow at Riverside Narrows decreased from 27,120 acre-feet in 1943-44 to an all-time low of 13,450 acre-feet in 1965-66. Since that time, the Base Flow at Riverside Narrows has substantially increased. During the 20-year period 1970-71 through 1989-90, the Base Flow has averaged 35,876 acre-feet per year. The 1989-90 unadjusted Base Flow amounted to 53,199 acre-feet, an increase of 17,323 acre-feet over the 20-year average.

Figure 3 shows the components of Total Flow in the Santa Ana River at Riverside Narrows for the period from 1934-45 through 1989-90.

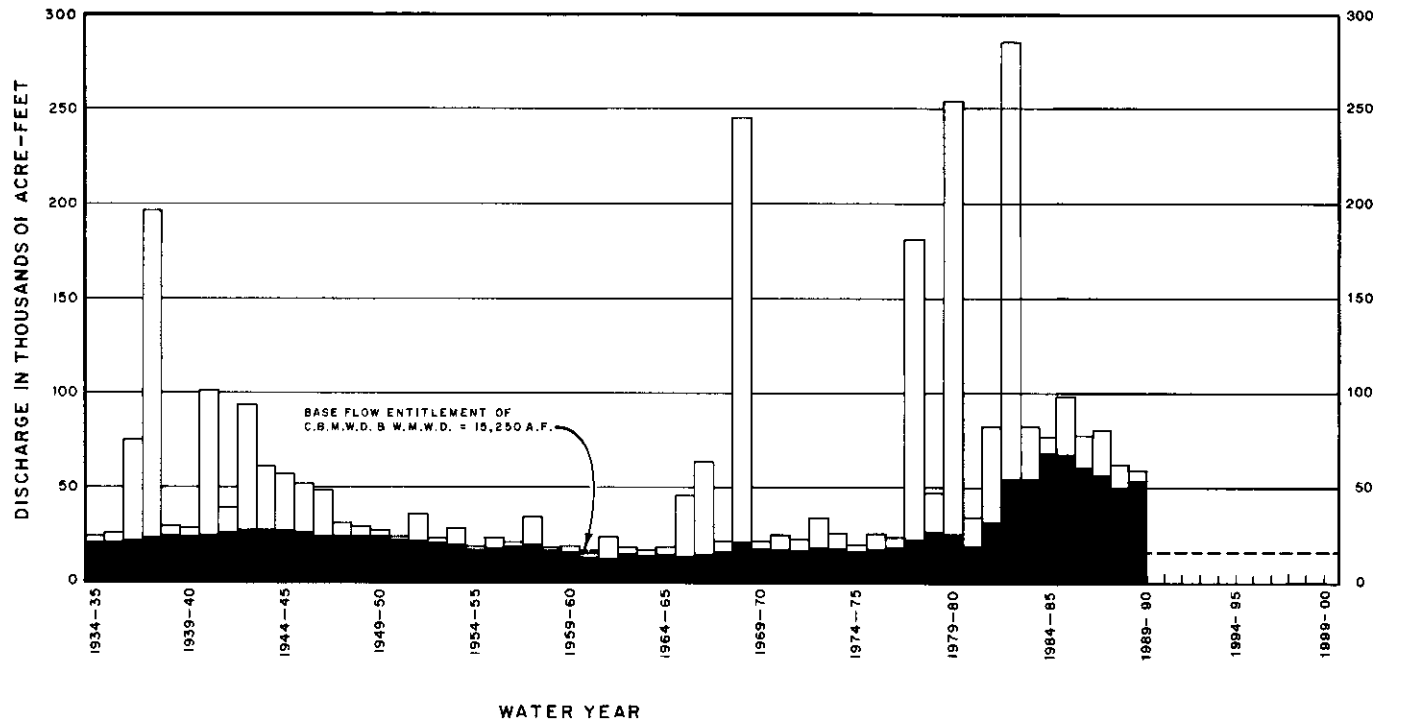
Wastewater Effluent Discharge

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 on Table 4. For the year 1989-90, about 129,620 acre-feet were discharged to the River above 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

STORM FLOW

BASE FLOW

DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS

FIGURE 3

TABLE 4

WASTEWATER EFFLUENT DISCHARGED ABOVE PRADO BY MAJOR AGENCIES (acre-feet)

Year	Red-lands	San Bern.	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
1986-87	5,780	26,810	4,170	5,350	30,340	6,170	27,160	5,000	110,780
1987-88	6,060	27,880	5,240	6,040	34,660	6,050	31,290	5,500	122,720
1988-89	5,250	27,640	5,550	6,280	35,490	8,080	35,510	6,180	129,980
1989-90	6,360	28,350	5,810	6,260	33,210	9,140	34,760	5,730	129,620

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, which include Nontributary Flow, Arlington Desalter 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 below Prado amounted to 144,817 acre-feet, measured at the USGS gaging station below Prado. There was no storage behind Prado Dam at the beginning of the year. No water was in storage at the end of the water year. The inflow into the reservoir, comprised 119,149 acre-feet of Base Flow and 24,314 acre-feet of Storm Flow. Nontributary Flow during 1989-90 due to the release of State Water Project water above Riverside Narrows during 1972-73 was 334 acre-feet. Other flow due to Arlington Desalter Product water releases to Temescal Creek during 1989-90 was 1,020 acre-feet. The components of flow of the Santa Ana River at Prado for each month in the 1989-90 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 Project 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 (1972-73 only) and San Antonio Creek near Upland.

TABLE 5
COMPONENTS OF FLOW AT PRADO DAM
FOR WATER YEAR 1989-90

Month	USGS Measured Outflow	Storage Change(1)	Computed Inflow	Storm Flow	Nontributary Water Riverside Narrows(2)	Arlington Desalter	Base Flow
October	10,144	0	10,144	365	28	0	9,751
November	11,074	1	11,075	534	28	0	10,513
December	12,311	0	12,312	340	28	0	11,944
January	16,479	510	16,988	4,518	28	0	12,422
February	19,987	6,403	26,390	15,197	28	0	11,165
March	16,038	-3,748	12,290	488	28	0	11,774
April	14,170	-2,563	11,607	1,073	28	0	10,506
May	12,137	-603	11,534	1,551	28	0	9,955
June	8,735	0	8,735	248	28	0	8,459
July	7,769	0	7,769	0	28	139	7,602
August	8,295	0	8,295	0	27	605	7,663
September	7,678	0	7,678	0	27	276	7,375
Total	144,817	0	144,817	24,314	334	1,020	119,149

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

(2) That portion of State Water Project water released during 1972-73 upstream of Riverside Narrows, determined to have reached Prado in 1989-90.

Releases Above Riverside Narrows

As fully discussed in Appendix F of the Fifth Annual Report, the Watermaster Committee determined a schedule of credits to OCWD for State Water Project water which was released above Riverside Narrows during 1972-73; for 1989-90 the credit is 334 acre-feet, assumed to be distributed uniformly throughout the year, as shown in Table 5. A portion of this water, because it percolated in the basin above Narrows, did not reach the Narrows in 1972-73 and the schedule as developed in the Fifth Annual Report, is the best estimate of the amount that reaches Riverside Narrows each year.

Releases to San Antonio Creek

There were no releases from OC-59 into San Antonio Creek during the water year 1989-90.

Arlington Desalter

The underflow from the Arlington groundwater sub-basin has historically been a component of the Santa Ana River flow. These groundwaters have increasingly been degraded through agricultural and other uses. Two participants to the Stipulated Judgment, Western Municipal Water District and Orange County Water District, as members of the Santa Ana Watershed Project Authority, constructed a groundwater cleanup project which is designed to eliminate the poor quality underflow from the sub-basin. This project is known as the Arlington Desalter and consists of five extraction wells and a treatment facility which reduces concentrations of salinity, nitrates and an agricultural chemical (DBCP). The capacity of he facility is approximately 6 mgd. During July 1990, this facility began operation, with OCWD buying the product water delivered through the Santa Ana River.

All parties to the Stipulated Judgment agreed that the product water from this facility would not be considered as Santa Ana River Base Flow.

Storm Flow

Portions of storm flows are retained behind Prado Dam for regulation of downstream flows and for water conservation purposes. The U.S. Army Corps of Engineers (Corps) owns and operates Prado Dam and operates according to a release schedule utilizing a debris pool elevation of 490 feet which impounds about 5,000 acre-feet. Storm flows captured within the reservoir are released following the storm to downstream groundwater recharge facilities. Monthly and annual quantities of storm flow are shown in Table 5.

During the year, the Corps dedicated about 50 acres of Prado lands to least Bell's vireo habitat in exchange for OCWD's right to allow the water conservation pool to expand to elevation 494 (9500 AF) during the non-vireo season. After March 15, the pool is reduced to elevation 490.

At the end of the water year the Corps was nearing completion of a federally funded Environmental Impact Study and Statement on seasonal water conservation at Prado. The study will evaluate the impacts of a seasonal water conservation program, beginning in March of each year on all existing uses within Prado Reservoir at various elevations up to a maximum of 505 feet. Preliminary drafts indicate the study will conclude that a seasonal water conservation operating plan at Prado Dam would be consistent with sound flood control practices, is viable, and has a positive benefit cost ratio at all elevations up to 505 feet. However, the District must secure all necessary agreements and would be responsible for all implementation and operational costs. The primary factor which must be resolved is related to the least Bell's vireo, an endangered species.

During the spring of 1990, the cowbird trapping program in Prado Basin was continued. The Orange County Water District funded cowbird trapping program was intended to enhance the environment for the least Bell's vireo. The cowbird is a marauder of the vireo. During the four year program, the number of least Bell's vireos dramatically increased and it is believed that the cowbird trapping program was primarily responsible.

Congress continued to appropriate funds for further study and design of the Santa Ana River Mainstream project and designated the project as a "construction start" in the federal 1990-91 budget.

During the 1989-90 water year, more than 100 acre-feet of water were stored behind Prado during the periods January 14 - May 4 and May 28. During those periods, the water stored in Prado Reservoir varied up to a maximum of 8,241 acre-feet and the maximum daily flow released to the Santa Ana River was 1,700 cfs.

Base Flow

The Base Flow is affected by Nontributary Flow which had been released previously above Riverside Narrows. The general procedure used by the Watermaster to separate the 1989-90 flow components was the same as used for previous years and is fully described in the Fifth Annual Report, and the Twelfth 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 and Arlington Desalter output was found to be 609 mg/L. This determination was based on records from a continuous monitoring device, operated by the USGS for electrical conductivity (EC) of the Santa Ana River flow 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 was recorded hourly on a punched tape by the USGS. The USGS collected a total of 24 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 field EC recorded by the technician 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 as follows:

$$TDS = EC/[1.399 + (2.397 \times 10^{-4} \times EC)]$$

where: TDS = mg/L
EC = micromhos/cm

Application of the equation 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 flow passing Prado Dam. The daily average TDS concentration was calculated from the hourly EC measurements and the correlation of EC and TDS. The daily TDS concentration could not be determined during the period when continuous EC data were not available. TDS was approximated by using best available data.

Water Quality Adjustment for Nontributary Flow

The weighted average annual TDS value of 609 mg/L, shown in Table B-3, Appendix B, represents the quality of Total Flow which includes Nontributary Flow from release of State Water Project water to

Santa Ana River above Riverside Narrows. The Stipulated 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 Project water released above Riverside Narrows during 1972-73 was 235 mg/L and was adjusted to 242 mg/L to reflect a 3% evapotranspiration loss of the water released.

Water Quality Adjustment for Arlington Desalter

During July of the 1989-90 water year, Arlington Desalter went into operation and began to discharge product water into a storm channel tributary to the Santa Ana River. The amount of product water discharged to the Santa Ana River during the 1989-90 water year totaled 1,020 acre-feet at an average TDS of 445 mg/L (Appendix E). The flow weighted TDS of 445 mg/L was estimated from daily EC readings measured from the discharge into the channel.

	Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (acre-feet x mg/L)
1. Total Flow	144,817	609	88,193,553
2. Nontributary Flow a. Riverside Narrows	334	242	80,828
3. Arlington Desalter	1,020	445	453,900
4. Total Flow Less Nontributary Flow,and Arlington Desalter Flow	143,463	611	87,658,825
Average TDS of Total Base and Storm Flows			87,658,825 ÷ 143,463 = 611 mg/L

After adjusting for Nontributary Flow of State Water Project water from above Riverside Narrows and the Arlington Desalter flows, the weighted average annual TDS of Storm Flow and Base Flow for 1989-90 was 611 mg/L, as shown above.

Adjusted Base Flow at Prado

The Stipulated Judgment provides that the amount of Base Flow at Prado received during any year shall be subjected to adjustment based on weighted average annual TDS of the 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 to 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 611 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:

$$(119,149 \text{ ac-ft}) + \frac{35}{42,000}(119,149 \text{ ac-ft})(700 - 611) = 127,986 \text{ ac-ft.}$$

Entitlement and Credit or Debit

From pages 12 and 13 of the Stipulated 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 concerning flow at Prado for 1989-90 required under the Stipulated Judgment are as follows:

1.	Total Flow at Prado	144,817	acre-feet
2.	Base Flow at Prado	119,149	acre-feet
3.	Annual Weighted TDS of Base and Storm Flow	611	mg/L
4.	Annual Adjusted Base Flow	127,986	acre-feet
5.	Cumulative Adjusted Base Flow	1,817,661	acre-feet
6.	Cumulative Entitlement of OCWD	840,000	acre-feet
7.	Cumulative Credit	977,661	acre-feet
8.	One-Third of Cumulative Debit	0	acre-feet
9.	Minimum Required Base Flow in 1990-91	34,000	acre-feet

CHAPTER IV

BASE FLOW AT RIVERSIDE NARROWS

This chapter deals with determinations 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 58,500 acre-feet, measured at the USGS gaging station near the MWDSC Upper Feeder Crossing. Separated into its components, Base Flow was 53,199 acre-feet, Storm Flow was 7,000 acre-feet, and Nontributary Flow due to a prior release of State Water Project water above Riverside Narrows was 341 acre-feet. Included in Base Flow are 2,040 acre-feet of wastewater from Rubidoux Community Services District which now bypasses the USGS gaging station. The components of flow of the Santa Ana River at Riverside Narrows for each month in the 1989-90 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 Project water from the East Branch of the California Aqueduct were purchased by the Orange County Water District and released into the Santa Ana River in the vicinity of Colton.

TABLE 6

COMPONENTS OF FLOW AT RIVERSIDE NARROWS FOR WATER YEAR 1989-90 (acre-feet)

		Total Flow USGS Measurement	Storm Flow	Non-tributary Flow	Rubidoux Wastewater	Base Flow(1)
1989	October	4,306	242	29	215	4,250
	November	4,790	198	29	167	4,730
	December	4,982	0	29	170	5,123
1990	January	7,127	1,910	29	175	5,363
	February	7,666	3,055	29	159	4,741
	March	5,379	391	28	139	5,099
	April	5,510	863	28	118	4,737
	May	4,945	317	28	161	4,761
	June	3,959	24	28	175	4,082
	July	3,171	0	28	181	3,324
	August	3,507	0	28	182	3,661
	September	3,158	0	28	198	3,328
Total		58,500	7,000	341	2,040	53,199

(1) Base Flow includes Rubidoux wastewater discharged below Riverside Narrows.

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 1989-90 the amount of State Water Project water reaching Riverside Narrows has been agreed upon as 341 acre-feet.

Base Flow

Based on the hydrograph shown on Plate 4 and utilizing in general the procedures reflected in the Work Papers of the engineers (as referenced in Paragraph 2 of the Engineering Appendix of the Stipulated 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 (341 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 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 1989-90, in the amount of 2,040 acre-feet as shown in Appendix D, has been added to the streamflow as measured at the gaging station.

Water Quality

The determination of quality 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.

The flow weighted quality of wastewater from Rubidoux is shown in Appendix D, Table D-1 as 719 mg/L. The Base Flow quality resulting from exclusion of the Nontributary Flow and inclusion of the Rubidoux wastewater is shown in the following table as 590 mg/L.

	Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (ac-ft x mg/L)
1. Base Flow including Nontributary Flow	51,500	583	30,024,500
2. Less Nontributary Flow	341	237	80,817
3. Plus Rubidoux Wastewater	2,040	719	1,466,760
4. Average TDS of Base Flow	31,410,443 ÷ 53,199 = 590 mg/L		

Adjusted Base Flow at Riverside Narrows

The Stipulated 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 of the Base Flow as follows:

If the Weighted Average TDS in Base Flow at Riverside Narrows is:	Then the Adjusted Base shall be determined by the formula.
Greater than 700 mg/L	$Q - \frac{11}{15{,}250} Q(TDS-700)$
600 mg/L to 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 1989-90 was 590 mg/L. Therefore, an adjustment of 384 acre-feet is necessary, and the Adjusted Base Flow for 1989-90 is 53,583

Entitlement and Credit or Debit

Paragraph 5(b) of the Stipulated 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 1989-90 required under the Stipulated Judgment are as follows:

1.	Base Flow at Riverside Narrows	53,199	acre-feet
2.	Annual Weighted TDS of Base Flow	590	mg/L
3.	Annual Adjusted Base Flow	53,583	acre-feet
4.	Cumulative Adjusted Base Flow	716,016	acre-feet
5.	Cumulative Entitlement of CBMWD and WMWD	305,000	acre-feet
6.	Cumulative Credit	411,016	acre-feet
7.	One-Third of Cumulative Debit	0	acre-feet
8.	Minimum Required Base Flow in 1990-91	12,420	acre-feet

APPENDIX A

NONTRIBUTARY WATER RELEASED BY MWDSC TO SAN ANTONIO CREEK NEAR UPLAND

CONNECTION OC-59

1989-90

PREPARED BY

DONALD L. HARRINGER

TABLE A-1

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

WATER YEAR 1989-90

No water released during Water Year 1989-90
for the Orange County Water District.

APPENDIX B

WATER QUALITY
SANTA ANA RIVER BELOW PRADO DAM

1989-90

PREPARED BY

WILLIAM R. MILLS, JR.

TABLE B–1

USGS WATER QUALITY SAMPLES BELOW PRADO DAM

FOR WATER YEAR 1989–90

DATE	EC (micromhos/cm)	TDS (mg/l)	SOURCE
10/03	1100	640	USGS
10/27	1090	651	USGS
11/24	1060	653	USGS
12/05	1080	674	USGS
12/14	1110	683	USGS
1/04	1080	667	USGS
1/18	750	479	USGS
1/25	1100	697	USGS
2/02	872	543	USGS
2/13	1100	687	USGS
3/05	946	569	USGS
3/20	1080	657	USGS
3/27	1090	670	USGS
4/12	1080	659	USGS
4/25	1050	636	USGS
5/07	1110	652	USGS
5/23	1100	664	USGS
5/31	1090	652	USGS
7/09	1090	620	USGS
7/31	1060	628	USGS
8/20	1070	624	USGS
9/04	1050	634	USGS
9/19	1060	640	USGS
9/27	1050	620	USGS

TABLE B–2

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

OCTOBER 1989

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	144	1120	672	96722
2	150	1110	667	99996
3	154	1080	651	100321
4	155	1080	651	100973
5	152	1090	657	99791
6	148	1090	657	97165
7	149	1110	667	99329
8	154	1110	667	102663
9	153	1130	677	103536
10	155	1140	682	105666
11	153	1130	677	103536
12	159	1120	672	106797
13	163	1130	677	110303
14	163	1140	682	111119
15	162	1130	677	109626
16	168	1120	672	112842
17	172	1110	667	114662
18	164	1100	662	108500
19	159	1090	657	104386
20	154	1090	657	101104
21	158	1090	657	103730
22	208	1060	641	133375
23	210	1040	631	132501
24	186	1070	646	120219
25	184	1070	646	118926
26	165	1070	646	106646
27	179	1090	657	117517
28	180	1090	657	118173
29	175	1090	657	114891
30	166	1090	657	108982
31	172	1070	646	111170
TOTAL	5114			3375165
MONTHLY FLOW WEIGHTED TDS			660	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

NOVEMBER 1989

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	171	1070	646	110524
2	161	1070	646	104061
3	161	1060	641	103237
4	161	1060	641	103237
5	171	1060	641	109650
6	172	1040	631	108525
7	172	1050	636	109409
8	175	1050	636	111317
9	173	1050	636	110045
10	176	1050	636	111954
11	174	1050	636	110681
12	181	1050	636	115134
13	180	1060	641	115421
14	183	1060	641	117344
15	188	1050	636	119587
16	178	1060	641	114138
17	182	1070	646	117634
18	180	1070	646	116341
19	176	1070	646	113756
20	176	1070	646	113756
21	176	1070	646	113756
22	174	1070	646	112463
23	186	1070	646	120219
24	192	1070	646	124097
25	187	1090	657	122769
26	301	868	540	162575
27	258	943	580	149716
28	210	1060	641	134658
29	201	1070	646	129914
30	207	1070	646	133792
TOTAL	5583			3539709
MONTHLY FLOW WEIGHTED TDS			634	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

DECEMBER 1989

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	210	1060	641	134658
2	201	1070	646	129914
3	207	1070	646	133792
4	206	1070	646	133146
5	196	1080	651	127681
6	203	1080	651	132241
7	203	1070	646	131207
8	203	1060	641	130169
9	208	1060	641	133375
10	204	1060	641	130810
11	175	1090	657	114891
12	166	1120	672	111499
13	176	1120	672	118215
14	180	1110	667	119995
15	187	1110	667	124662
16	205	1090	657	134586
17	206	1090	657	135243
18	195	1090	657	128021
19	201	1090	657	131960
20	206	1090	657	135243
21	188	1100	662	124378
22	198	1100	662	130994
23	200	1100	662	132317
24	203	1110	667	135328
25	207	1110	667	137994
26	201	1110	667	133995
27	200	1110	667	133328
28	207	1110	667	137994
29	233	1070	646	150597
30	220	1100	662	145549
31	212	1110	667	141328
TOTAL	6207			4075111
MONTHLY FLOW WEIGHTED TDS			657	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

JANUARY 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	207	1120	672	139037
2	307	869	541	165982
3	290	1020	621	179982
4	228	1050	636	145031
5	208	1080	651	135499
6	201	1080	651	130939
7	203	1070	646	131207
8	213	1060	641	136581
9	219	1050	636	139306
10	209	1040	631	131870
11	209	1040	631	131870
12	201	1030	626	125786
13	250	835	522	130538
14	272	670	430	116851
15	340	727	462	157113
16	320	764	483	154526
17	298	837	523	155927
18	378	777	490	185275
19	345	699	446	153940
20	302	722	459	138699
21	297	821	514	152800
22	295	916	566	166950
23	292	976	598	174526
24	302	1060	641	193650
25	308	1080	651	200642
26	304	1100	662	201122
27	292	1110	667	194659
28	281	1120	672	188742
29	273	1130	677	184740
30	224	1110	667	149327
31	240	947	582	139779
TOTAL	8308			4832897
MONTHLY FLOW WEIGHTED TDS			582	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

FEBRUARY 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	278	779	491	136570
2	272	865	538	146470
3	251	874	543	136384
4	247	969	594	146722
5	253	973	596	150818
6	254	867	540	137052
7	288	836	523	150537
8	328	931	574	188248
9	340	1010	615	209250
10	326	1060	641	209040
11	310	1090	657	203521
12	251	1040	631	158370
13	210	1110	667	139994
14	211	1110	667	140661
15	212	1090	657	139182
16	211	1090	657	138525
17	305	913	564	172121
18	1700	499	329	558603
19	794	479	316	251237
20	426	515	338	144104
21	408	526	345	140719
22	315	590	383	120649
23	273	715	455	124298
24	283	760	481	136026
25	280	753	477	133486
26	331	726	462	152767
27	361	685	438	158192
28	359	713	454	163046
TOTAL	10077			4786590
MONTHLY FLOW WEIGHTED TDS			475	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

MARCH 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	331	803	505	167010
2	326	867	540	175901
3	338	902	558	188753
4	336	931	574	192839
5	334	924	570	190447
6	331	876	544	180211
7	323	906	561	181069
8	321	952	585	187803
9	318	960	589	187390
10	317	970	595	188470
11	314	982	601	188663
12	314	991	606	190141
13	280	990	605	169406
14	254	1010	615	156322
15	252	1020	621	156399
16	251	1030	626	157076
17	250	1040	631	157739
18	250	1050	636	159025
19	228	1060	641	146200
20	207	1080	651	134847
21	205	1080	651	133544
22	204	1070	646	131853
23	203	1080	651	132241
24	202	1070	646	130560
25	202	1070	646	130560
26	201	1080	651	130939
27	200	1070	646	129268
28	199	1050	636	126584
29	199	1070	646	128621
30	198	1080	651	128984
31	198	1070	646	127975
TOTAL	8086			4886843
MONTHLY FLOW WEIGHTED TDS			604	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

APRIL 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	198	1070	646	127975
2	177	1070	646	114402
3	135	1090	657	88630
4	136	1080	651	88595
5	136	1070	646	87902
6	136	1080	651	88595
7	136	1080	651	88595
8	137	1080	651	89247
9	162	1080	651	105533
10	176	1090	657	115547
11	176	1090	657	115547
12	177	1080	651	115304
13	179	1080	651	116607
14	179	1080	651	116607
15	178	1080	651	115956
16	177	1090	657	116204
17	181	1110	667	120662
18	260	1110	667	173326
19	324	1090	657	212712
20	357	1070	646	230743
21	355	1060	641	227635
22	354	1050	636	225179
23	351	1050	636	223271
24	348	1060	641	223147
25	345	1060	641	221223
26	341	1060	641	218658
27	339	1060	641	217376
28	338	1070	646	218462
29	332	1080	651	216277
30	324	1090	657	212712
TOTAL	7144			4632630
MONTHLY FLOW WEIGHTED TDS			648	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

MAY 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	316	1090	657	207460
2	306	1080	651	199339
3	289	1100	662	191198
4	262	1110	667	174660
5	222	1120	672	149113
6	187	1120	672	125604
7	182	1110	667	121328
8	174	1120	672	116872
9	186	1120	672	124932
10	170	1130	677	115040
11	170	1120	672	114185
12	175	1090	657	114891
13	167	1090	657	109639
14	164	1100	662	108500
15	165	1100	662	109162
16	168	1100	662	111147
17	157	1100	662	103869
18	160	1100	662	105854
19	161	1100	662	106515
20	163	1100	662	107839
21	162	1100	662	107177
22	159	1100	662	105192
23	156	1090	657	102417
24	155	1080	651	100973
25	157	1080	651	102275
26	160	1080	651	104230
27	161	1080	651	104881
28	301	751	476	143160
29	368	682	436	160627
30	214	831	520	111272
31	182	1050	636	115770
TOTAL	6119			3875120
MONTHLY FLOW WEIGHTED TDS			633	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

JUNE 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	174	1070	646	112463
2	168	1070	646	108585
3	160	1070	646	103414
4	150	1070	646	96951
5	144	1070	646	93073
6	148	1060	641	94902
7	141	1070	646	91134
8	144	1070	646	93073
9	147	1070	646	95012
10	168	1050	636	106865
11	158	1040	631	99691
12	154	1050	636	97959
13	148	1050	636	94143
14	138	(2)	637	87858
15	150	(2)	637	95582
16	156	(2)	638	99492
17	160	(2)	638	102131
18	152	(2)	639	97109
19	149	(2)	639	95276
20	141	(2)	640	90238
21	141	(2)	641	90317
22	141	(2)	641	90395
23	139	(2)	642	89190
24	141	(2)	642	90552
25	138	(2)	643	88702
26	132	(2)	643	84918
27	131	(2)	644	84348
28	129	(2)	644	83132
29	129	(2)	645	83204
30	133	(2)	646	85857
TOTAL	4404			2825564
MONTHLY FLOW WEIGHTED TDS			642	

1. TDS = EC/[1.399+(2.397E–4 x EC)]
2. EC recorder malfunction. TDS values approximated.

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

JULY 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	129	(2)	646	83347
2	129	(2)	647	83419
3	128	(2)	647	82843
4	128	(2)	648	82914
5	125	(2)	648	81040
6	119	(2)	649	77216
7	122	(2)	649	79231
8	127	(2)	650	82549
9	128	(2)	651	83270
10	123	1080	651	80127
11	124	1090	657	81408
12	122	1080	651	79475
13	117	1090	657	76813
14	120	1090	657	78782
15	122	1070	646	78853
16	120	1080	651	78172
17	126	1100	662	83360
18	128	1110	667	85330
19	126	1100	662	83360
20	131	1100	662	86668
21	131	1100	662	86668
22	125	1080	651	81429
23	124	1070	646	80146
24	125	1060	641	80153
25	131	1060	641	84001
26	132	1060	641	84642
27	133	1050	636	84601
28	130	1050	636	82693
29	128	1050	636	81421
30	134	1050	636	85237
31	130	1050	636	82693
TOTAL	3917			2541861
MONTHLY FLOW WEIGHTED TDS			649	

1. TDS = EC/[1.399+(2.397E–4 x EC)]
2. EC recorder malfunction. TDS values approximated.

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

AUGUST 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	132	1050	636	83965
2	135	1050	636	85873
3	139	1050	636	88418
4	136	1060	641	87207
5	136	1060	641	87207
6	136	1060	641	87207
7	136	1050	636	86510
8	132	1060	641	84642
9	131	1060	641	84001
10	131	1050	636	83329
11	130	1060	641	83359
12	127	1060	641	81436
13	132	1050	636	83965
14	134	1060	641	85924
15	143	1060	641	91695
16	139	1060	641	89130
17	136	1060	641	87207
18	143	1070	646	92426
19	147	1070	646	95012
20	144	1070	646	93073
21	142	1070	646	91780
22	138	1070	646	89195
23	138	1070	646	89195
24	136	1060	641	87207
25	133	1060	641	85283
26	134	1050	636	85237
27	134	1050	636	85237
28	126	1060	641	80795
29	125	1060	641	80153
30	126	1050	636	80149
31	131	1040	631	82655
TOTAL	4182			2678472
MONTHLY FLOW WEIGHTED TDS			640	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–2 (continued)

SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

SEPTEMBER 1990

DAY	PRADO OUTFLOW (cfs–day)	DAILY MEAN EC (micromhos/cm)	COMPUTED TDS (1) (mg/L)	OUTFLOW x TDS
1	132	1040	631	83286
2	131	1040	631	82655
3	128	1040	631	80763
4	128	1040	631	80763
5	128	1050	636	81421
6	124	1050	636	78876
7	121	1050	636	76968
8	123	1040	631	77608
9	126	1040	631	79501
10	125	1040	631	78870
11	115	1070	646	74329
12	121	1040	631	76346
13	120	1030	626	75096
14	124	1030	626	77599
15	122	1020	621	75717
16	123	1020	621	76337
17	126	1030	626	78851
18	126	1030	626	78851
19	127	1050	636	80785
20	133	1060	641	85283
21	132	1070	646	85317
22	136	1060	641	87207
23	137	1060	641	87848
24	141	1050	636	89690
25	135	1050	636	85873
26	132	1050	636	83965
27	139	1040	631	87703
28	137	1040	631	86441
29	138	1040	631	87072
30	141	1050	636	89690
TOTAL	3871			2450711
MONTHLY FLOW WEIGHTED TDS			633	

1. TDS = EC/[1.399+(2.397E–4 x EC)]

TABLE B–3

ANNUAL SUMMARY OF WEIGHTED TDS BELOW PRADO DAM

WATER YEAR 1989–90

MONTH	MONTHLY FLOW (cfs–days)	MONTHLY WEIGHTED TDS (mg/L)	MONTHLY FLOW TIMES TDS
OCTOBER	5114	660	3375165
NOVEMBER	5583	634	3539709
DECEMBER	6207	657	4075111
JANUARY	8308	582	4832897
FEBRUARY	10077	475	4786590
MARCH	8086	604	4886843
APRIL	7144	648	4632630
MAY	6119	633	3875120
JUNE	4404	642	2825564
JULY	3917	649	2541861
AUGUST	4182	640	2678472
SEPTEMBER	3871	633	2450711
TOTAL	73012		44500674
WATER YEAR WEIGHTED TDS		609	

APPENDIX C

WATER QUALITY
SANTA ANA RIVER AT RIVERSIDE NARROWS

1989-90

PREPARED BY

DONALD L. HARRIGER

TABLE C-1

WATER QUALITY ANALYSES
SANTA ANA RIVER AT RIVERSIDE NARROWS

WATER YEAR 1989-90

Date Sampled	EC Micromhos/cm	TDS mg/L	Source
1989			
10-02	866	601	DWR
10-02	920	515	USGS
10-03	910	582	C OF R
10-12	900	575	C OF R
10-17	890	578	C OF R
10-26	880	562	C OF R
10-31	880	571	C OF R
11-07	855	586	DWR
11-09	920	584	C OF R
11-14	890	570	C OF R
11-22	922	594	USGS
11-23	940	556	C OF R
11-28	890	537	C OF R
12-04	935	589	USGS
12-07	910	570	C OF R
12-12	900	567	C OF R
12-12	879	607	DWR
12-21	900	555	C OF R
12-26	900	559	C OF R
1990			
01-04	936	567	USGS
01-05	869	642	DWR
01-09	930	565	C OF R
01-18*	800	514	C OF R
01-18*	764	485	USGS
01-23	940	591	C OF R
02-01*	880	536	C OF R
02-06	956	591	USGS
02-08	960	578	C OF R
02-08	923	650	DWR
02-13	957	613	USGS
02-15	960	582	C OF R
02-20	900	560	C OF R

* Data not used in determining monthly averages, storm flow.
C of R City of Riverside
USGS United States Geological Survey
DWR Department of Water Resources

Date Sampled	EC Micromhos/cm	TDS mg/L	Source
1990			
03-01	1000	624	C OF R
03-05	877	581	USGS
03-06	1000	614	C OF R
03-15	1000	602	C OF R
03-20	1000	632	C OF R
03-20	955	608	USGS
03-29	780	549	C OF R
04-03	1040	596	C OF R
04-11	924	590	USGS
04-12	950	574	C OF R
04-25	909	568	USGS
05-01	980	572	C OF R
05-14	916	564	USGS
05-23	938	576	USGS
06-07	970	572	C OF R
06-12	920	556	C OF R
06-13	908	579	USGS
06-21	940	589	C OF R
06-26	930	603	C OF R
07-05	960	622	C OF R
07-09	928	575	USGS
07-19	940	590	C OF R
07-24	820	617	C OF R
08-02	760	596	C OF R
08-02	919	578	USGS
08-07	910	575	C OF R
08-15	860	603	C OF R
08-20	897	578	USGS
08-21	850	552	C OF R
08-30	860	585	C OF R
09-04	850	642	C OF R
09-04	912	517	USGS
09-18	870	592	C OF R
09-19	922	570	USGS
09-27	890	581	C OF R

* Data not used in determining monthly averages, storm flow.
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)
Discharged Above the Narrows

WATER YEAR 1989-90

Month	Acre-feet (1)	TDS (2) mg/L	Acre-feet times TDS
1989			
October	4,064	569	2,312,416
November	4,592	571	2,622,032
December	4,982	575	2,864,650
1990			
January	5,217	591	3,083,247
February	4,612	596	2,748,752
March	4,988	601	2,997,788
April	4,647	582	2,704,554
May	4,627	571	2,642,017
June	3,935	580	2,282,300
July	3,172	601	1,906,372
August	3,507	581	2,037,567
September	3,157	580	1,831,060
	51,500		30,032,755

Flow weighted TDS $\frac{30,032,755}{51,500} = 583$ 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 DISCHARGED BELOW THE RIVERSIDE NARROWS GAGING STATION

1989-90

PREPARED BY

DONALD L. HARRIGER

TABLE D-1

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

WATER YEAR 1989-90

Month	Acre-feet	TDS mg/L	Acre-feet times TDS
1989			
October	215	734	157,810
November	167	727	121,662
December	170	729	124,301
1990			
January	175	731	127,738
February	159	727	115,348
March	139	717	99,810
April	118	710	83,518
May	161	755	121,551
June	175	713	125,139
July	181	675	122,302
August	182	694	126,085
September	198	714	141,372
	2,040		1,466,636

$$\frac{1,466,636}{2,040} = 719 \text{ mg/L}$$

Flow Weighted TDS of Wastewater = 719 mg/L

APPENDIX E

WATER RELEASED FROM THE ARLINGTON DESALTER TO THE ARLINGTON VALLEY DRAIN

1989-90

PREPARED BY

DONALD L. HARRIGER

TABLE E-1

WATER RELEASED FROM THE
ARLINGTON DESALTER

MONTHLY TOTALS
(Acre-Feet)

WATER YEAR 1989-90

1989	Acre Feet Released
October	0
November	0
December	0
1990	
January	0
February	0
March	0
April	0
May	0
June	0
July	139
August	606
September	275
Total	1,020

TABLE E-2

WATER RELEASED FROM THE
ARLINGTON DESALTER

JULY 1990
IN CFS-DAYS

Day	Released to the Santa Ana River
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	10
26	10
27	10
28	10
29	10
30	10
31	10
Total in CFS DAYS	70
Total AF	139

TABLE E-2

WATER RELEASED FROM THE
ARLINGTON DESALTER

AUGUST 1990
IN CFS-DAYS

Day	Released to the Santa Ana River
1	8
2	10
3	10
4	10
5	10
6	11
7	10
8	10
9	10
10	10
11	11
12	10
13	10
14	10
15	10
16	11
17	10
18	10
19	10
20	10
21	10
22	8
23	10
24	11
25	10
26	10
27	8
28	7
29	10
30	10
31	10
Total in CFS DAYS	305
Total AF	606

TABLE E-2

WATER RELEASED FROM THE
ARLINGTON DESALTER

SEPTEMBER 1990
IN CFS-DAYS

Day	Released to the Santa Ana River
1	10
2	10
3	10
4	9
5	9
6	7
7	7
8	9
9	10
10	3
11	5
12	9
13	10
14	10
15	10
16	10
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
26	0
27	0
28	0
29	0
30	0
31	0
Total in CFS DAYS	138
Total AF	275

TABLE E-2

QUALITY OF WATER RELEASED FROM THE
ARLINGTON DESALTER
TO THE
SANTA ANA RIVER BELOW THE RIVERSIDE NARROWS
VIA THE ARLINGTON DRAIN

WATER YEAR 1989-90

Month	Acre-feet	TDS mg/L	Acre-feet times TDS
1989			
October	0	0	0
November	0	0	0
December	0	0	0
1990			
January	0	0	0
February	0	0	0
March	0	0	0
April	0	0	0
May	0	0	0
June	0	0	0
July	139	441	61,299
August	606	448	271,488
September	275	442	121,468
	1,020		454,255

$$\frac{454,255}{1,020} = 445 \text{ mg/L}$$

Flow Weighted TDS of Desalter Releases to the river = 445 mg/L

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 AUDIT BY CERTIFIED PUBLIC ACCOUNTANTS

JUNE 30, 1990

DIEHL, EVANS
&COMPANY
CERTIFIED PUBLIC ACCOUNTANTS

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December 19, 1990

INDEPENDENT AUDITORS' REPORT

Santa Ana River Watermaster
San Bernardino, California

We have audited the accompanying statement of assets and liabilities arising from cash transactions of Santa Ana River Watermaster as of June 30, 1990, and the related statement of revenue collected, expenses paid and changes in fund balance for the year then ended. These financial statements are the responsibility of the Watermaster's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

As described in Note 1, these financial statements were prepared on the basis of cash receipts and disbursements, which is a comprehensive basis of accounting other than generally accepted accounting principles.

In our opinion, the financial statements referred to above present fairly, in all material respects, the assets and liabilities arising from cash transactions of Santa Ana River Watermaster as of June 30, 1990, and its revenue collected, expenses paid, and changes in fund balance during the year then ended, on the basis of accounting described in Note 1.

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SANTA ANA RIVER WATERMASTER

STATEMENT OF ASSETS AND LIABILITIES
ARISING FROM CASH TRANSACTIONS

June 30, 1990

ASSETS

Cash in savings account (Note 3)	$ 10,704
TOTAL ASSETS	$ 10,704

LIABILITIES AND FUND BALANCE

Current liability for bank demand account overdraft	$ 5,981
Fund balance	4,723
TOTAL LIABILITIES AND FUND BALANCE	$ 10,704

See independent auditors' 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, 1990

		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		412	-	412
TOTAL REVENUE COLLECTED		16,412	16,000	412
EXPENSES PAID:				
Professional engineering services		9,787	8,000	1,787
Administrative expenses:				
Office and bank service charges	$ 96			
Auditing services	975	1,071	5,000	(3,929)
Annual reports		2,756	3,000	(244)
TOTAL EXPENSES PAID		13,614	16,000	(2,386)
EXCESS OF REVENUE COLLECTED OVER EXPENSES PAID		2,798	$ -	$ 2,798
FUND BALANCE AT JULY 1, 1989		1,925		
FUND BALANCE AT JUNE 30, 1990		$ 4,723		

See independent auditors' report and notes to financial statements.

SANTA ANA RIVER WATERMASTER

NOTES TO FINANCIAL STATEMENTS

June 30, 1990

1. SIGNIFICANT ACCOUNTING POLICIES:

Basis of Accounting:

The Santa Ana River Watermaster's ("Watermaster") policy is to prepare its financial statements on the cash basis of accounting; consequently, certain revenues are recognized when received rather than when earned, and certain expenses are recognized when cash is disbursed rather than when the obligation is incurred.

2. ORGANIZATION AND HISTORY:

The Santa Ana River Watermaster is composed of a committee of five representatives from 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 the 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.

3. CASH IN BANK:

The following disclosures are made in accordance with Statement No. 3 of the Governmental Accounting Standards Board (GASB 3):

Cash at June 30, 1990 consisted of the following:

Security Pacific National Bank:	
Savings account	$ 10,704

See independent auditors' report.

APPENDIX G

HISTORY OF LITIGATION

HISTORY OF LITIGATION

The complaint in this case was filed by the Orange County Water District on October 18, 1963 seeking an adjudication of water rights against more than 2,500 water users in the area tributary to Prado Dam within the Santa Ana River Watershed. Thirteen cross-complaints were filed in 1968 extending the adjudication to include an additional 1,500 water users in the area downstream from Prado Dam. Thus, there were involved in this case some 4,000 parties. It became obvious that every effort should be made to arrive at a settlement and a physical solution in order to avoid the enormous and unwieldy litigation that would be involved.

Efforts to arrive at a settlement and a physical solution were pursued by public officials, individuals, attorneys, and engineers. Attorneys for the parties organized in order to further this objective. Among other things, they provided guidance for the formation and activities of an engineering committee to provide them with information on the physical facts.

An initial meeting of the engineers representing the parties was held on January 10, 1964. Agreement was reached that it would be beneficial to jointly undertake the compilation of basic data. Liaison was established with the Department of Water Resources, State of California, on requests for information to be obtained from the State's studies for use by the parties. Engineers representing the parties were divided into sub-committees which were given the responsibility of investigating such things as the boundary of the Santa Ana River Watershed and its subareas, standardization of the terminology, the location and description of wells and diversion facilities, waste disposal and transfers of water between subareas.

On April 30, 1964, the joint engineering committee prepared a list of preliminary engineering studies directed toward settlement of the Santa Ana River water rights litigation. This list of basic information was in response to a request from the attorney's committee at a meeting held April 17, 1964. Special assignments were made on selected items to individual engineers to provide information requested by the attorneys' committee.

The attorneys and engineers for the defendants then commenced a series of meetings separate from the representatives of the plaintiff in order to consolidate their position and to determine their course of action. On October 7, 1964, engineers for the defendants presented the results of the studies made by the joint engineering committee. The defendants' attorneys requested that additional information be provided on the methods of measuring flow at Prado and the historical supply and disposal of water passing Prado Dam segregated into the components of flow and designating the amount of supply which was usable by the downstream area. On December 11, 1964, this supplemental information was presented to the defendants' attorneys.

During 1965, engineers and attorneys for the defendants held numerous conferences and conducted additional studies in an attempt to determine their respective positions in the case. Early in 1966, the plaintiff and defendants exchanged drafts of possible principles of settlement. Commencing March 22 and ending April 13, 1966, four meetings were held by engineers to discuss the draft of principles for settlement.

On February 25, 1968, the defendants submitted a request to the Court tha^ an Crder of Reference be issued requesting the State Department of Water Resources to determine the physical facts. On May 9, 1968, the plaintiff's attorney submitted motions opposing the Order of Reference and requesting that a preliminary injunction be issued. In the meantime, every effort was being made to come to an agreement on a stipulated judgment. Commencing on February 28,

1968 and extending until May 14, 1968, six meetings were held to determine the scope of physical facts on which agreement could be reached so that if an Order of Reference were to be approved by the Court, the work under the proposed reference would not repeat the extensive basic data collection and compilation which had already been completed and on which engineers for both plaintiffs and defendants had reached substantial agreement. Such basic data were compiled and published in two volumes under date of May 14, 1968 entitled "Appendix A, Basic Data."

On May 21, 1968, an outline of a proposal for settlement of the case was prepared and a committee of attorneys and engineers for the parties commenced preparation of the settlement documents. On June 16, 1968, the Court held a hearing on the motions it had received requesting a preliminary injunction and an Order of Reference. The parties requested that the Court delay the hearings on these motions in view of the efforts toward settlement that were underway. The plaintiff, however, was concerned regarding the necessity of bringing the case to trial within the statutory limitation and, accordingly, on July 15, 1968 submitted a motion to set the complaint in the case for trial. On October 15, 1968, the trial was commenced and was adjourned after one-half day of testimony on behalf of the plaintiff. Thereafter, the parties filed with the Court the necessary Settlement Documents including a Stipulation for Judgment. The Court entered the Judgment on April 17, 1969. This terminated the many years of controversy over water rights along the Santa Ana River involving the issues and parties embraced in Orange County Water District versus City of Chino, et al.

APPENDIX H

SUMMARY OF JUDGMENT

SUMMARY OF JUDGMENT

Provisions of the Judgment became effective on October 1, 1970. The Judgment does not define the water rights of the individual claimants. Instead, it provides for a regional allocation of the water supply of the Santa Ana River system and establishes entitlements and obligations among the four existing major public water districts overlying the aggregate of substantially all of the major areas of water use in the watershed. Dismissals were entered as to all defendants and cross defendants other than these four major public water districts. These districts, the locations of which are shown on Plate 1, "Santa Ana River Watershed," are the remaining parties to the Judgment and are as follows:

(1) Orange County Water District (OCWD), representing all lower basin entities which are located within Orange County downstream from Prado Dam.

(2) Western Municipal Water District (WMWD), representing middle basin entities located within Riverside County on both sides of the Santa Ana River primarily upstream from Prado Dam.

(3) Chino Basin Municipal Water District (CBMWD), located in San Bernardino County Chino Basin area, representing middle basin entities within its boundaries and located primarily upstream from Prado Dam.

(4) San Bernardino Valley Municipal Water District (SBVMWD), representing all entities within its boundaries, and embraced within the upper portion of the Riverside Basin area, the Colton Basin area (being an upstream portion of the middle basin) and the San Bernardino Basin area, being essentially the upper basin.

A physical solution under the stipulated Judgment provides, in general, that SBVMWD shall be responsible for the delivery of an average annual amount of Base Flow at Riverside Narrows and CBMWD and WMWD shall jointly be responsible for an average annual amount of Base Flow at Prado. Essential to the understanding of the provisions of the Judgment is the definition of certain important terms. The total surface flow passing a point of measurement is divided into components, which are defined in the Judgment as follows:

"(1) Storm Flow - That portion of the total surface flow passing a point of measurement, which originates from precipitation and runoff without having first percolated to groundwater storage in the zone of saturation, calculated in accordance with procedures referred to in Exhibit B.

(2) Base Flow - That portion of the total surface flow passing a point of measurement which remains after deduction of storm flow.

(3) Adjusted Base Flow - Actual Base Flow in each year adjusted for quality as provided.."

The Judgment sets forth a declaration of rights. Briefly stated, the Judgment provided that the water users in the area downstream from Prado Dam have rights, as against the upstream users, to receive an average annual supply of 42,000 acre-feet of Base Flow at Prado Dam, together with the right to all Storm Flow reaching Prado Dam. Water users in the area upstream of Prado Dam, as against the downstream users, have the right to divert, pump, extract, conserve, store and use all surface and groundwater supplies originating within the upper area, so long as the lower area receives the water to which it is entitled.

The physical solution set forth in the Judgment requires the SBVMWD shall be responsible for an average annual Adjusted Base Flow of 15,250 acre-feet at Riverside Narrows subject each year to the following:

(1) A minimum Base Flow of 13,420 acre-feet plus one-third of any cumulated debit.

(2) After October 1, 1986, if no cumulated debit exists, the minimum quantity shall be 12,420 acre-feet.

(3) Prior to 1986, if the cumulated credit exceeds 10,000 acre-feet the minimum quantity shall be 12,420 acre-feet.

(4) All cumulated debits shall be removed by the discharge of a sufficient Base Flow at Riverside Narrows at least once in every ten consecutive years following October 1, 1976. Any accumulated credits shall remain on the books of account until used to offset any subsequent debits or until otherwise disposed of by SBVMWD.

(5) The Base Flow at Riverside Narrows shall be adjusted using weighted average annual TDS in such Base Flow in accordance with the formula set forth in the Judgment.

The obligations under the physical solutions for meeting the Adjusted Base Flow of 42,000 acre-feet at Prado Dam for the benefit of the downstream water users as shared by CBMWD and WMWD are as follows:

(1) Minimum Base Flow at Prado shall not be less than 37,000 acre-feet plus one-third of any cumulated debit.

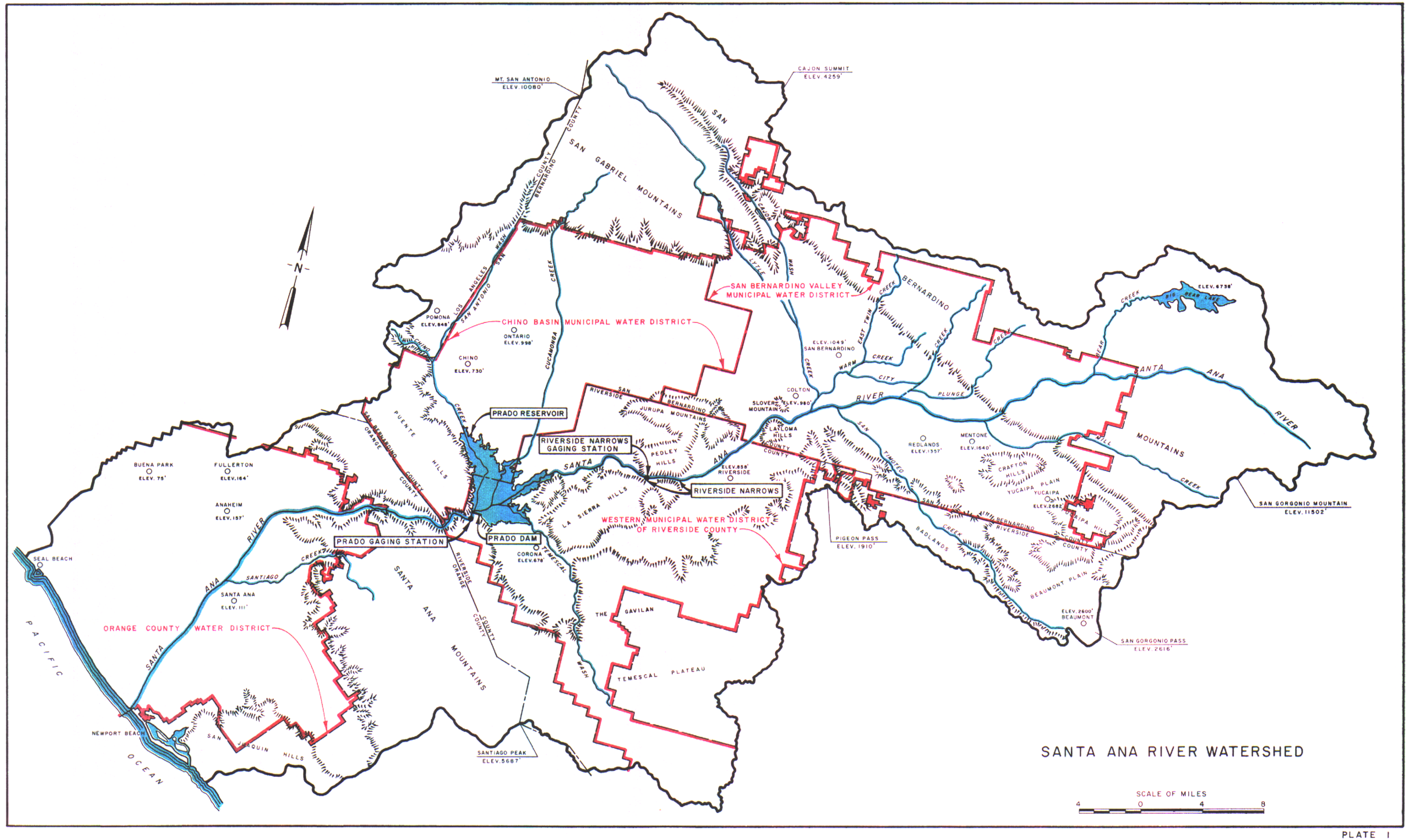
(2) After October 1, 1986, if no cumulated debit exists, the minimum quantity shall be 34,00 acre-feet.

(3) Prior to 1986, if the cumulated credit exceeds 30,000 acre-feet, the minimum quantity shall be 34,000 acre-feet.

(4) Sufficient quantities of Base Flow shall be provided at Prado to discharge completely any cumulated debits at least once in any ten consecutive years following October 1, 1976. Any cumulative credits shall remain on the books of account until used to offset any subsequent debits, or until otherwise disposed of by CBMWD and WMWD.

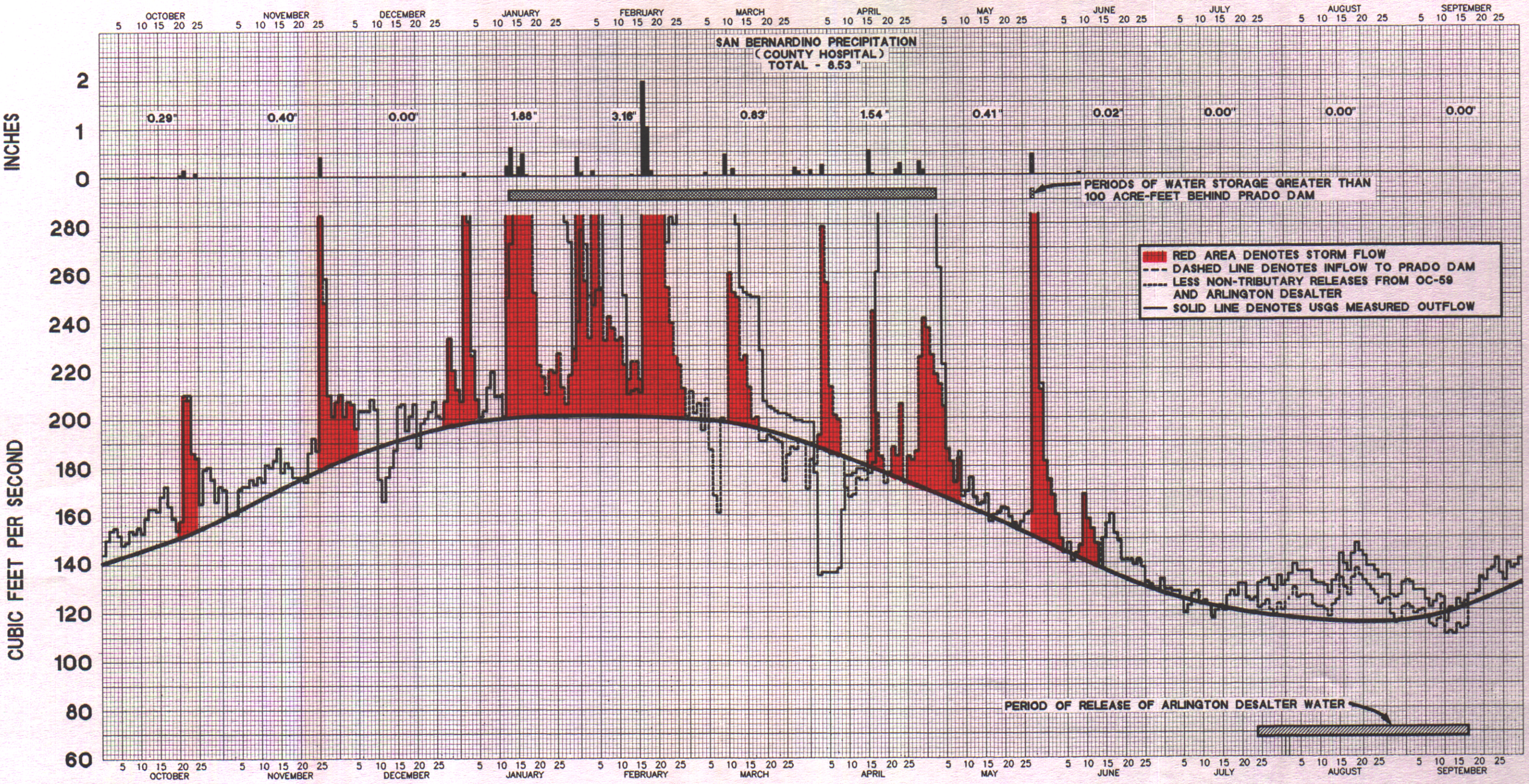
(5) The Base Flow at Prado during any year shall be adjusted using the weighted average annual TDS in the total flow at Prado (Base Flow plus Storm Flow) in accordance with the formula set forth in the Judgment.

The accounting provided for under the Judgment allows credit to be earned when the average annual Adjusted Base Flow exceeds 15,240 acre-feet at Riverside Narrows and 42,000 acre-feet at Prado. Debits accrue when the average annual Adjusted Base Flow falls below the above quantities at the respective locations. The adjustment of Base Flow for water quality is to provide an incentive to maintain a better quality water as a result of implementation of the physical solution. That is, when the water quality is improved over a certain amount, the quantitative amount of the obligation is decreased; but when that water quality is impaired beyond a specified limit, the quantity of the obligation is increased. This is one of the first comprehensive adjudications in Southern California which includes provisions applicable to the quality of water in addition to the determination of quantitative rights.



SANTA ANA RIVER WATERSHED

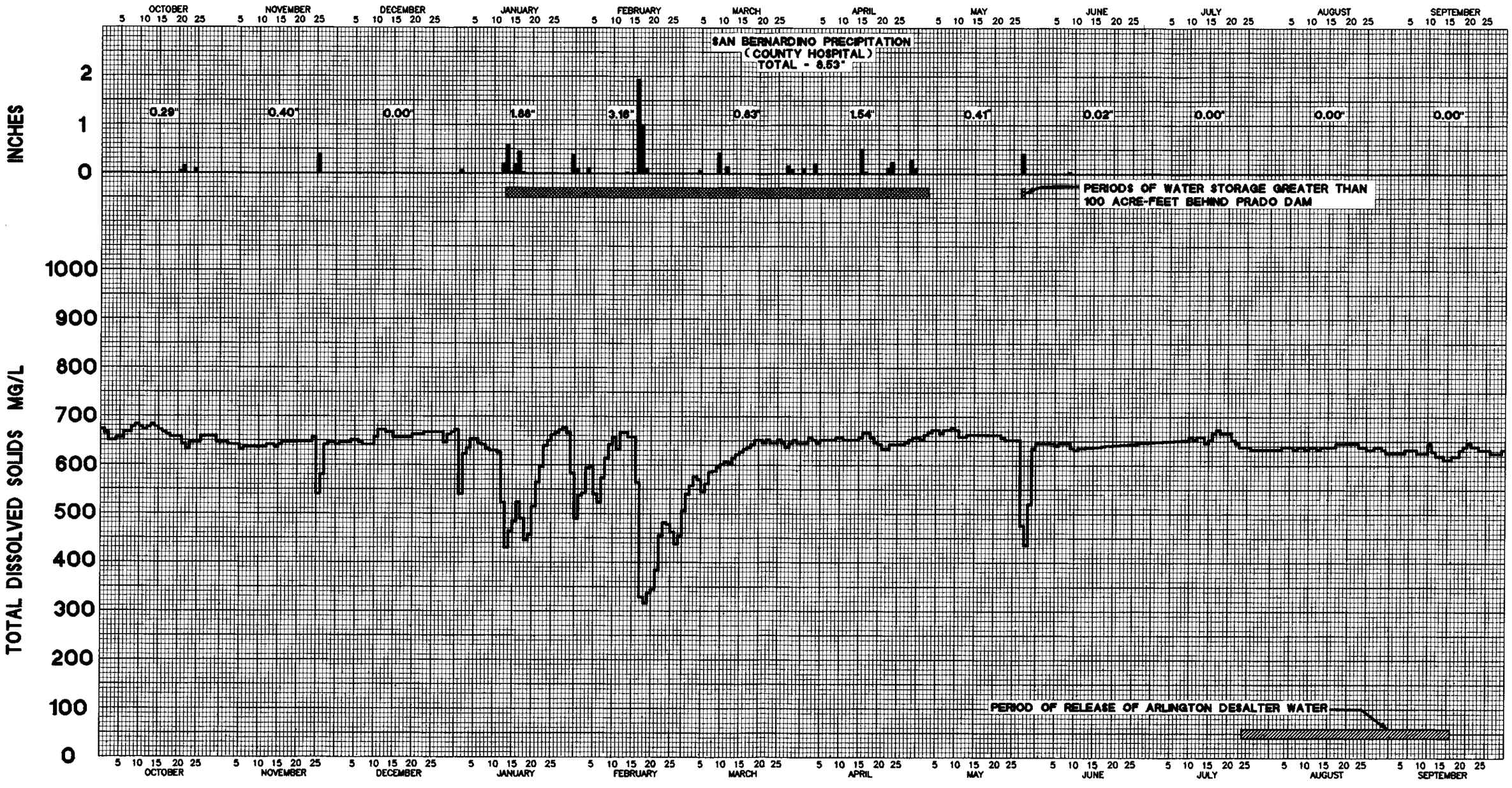
PLATE I



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

WATER YEAR 1989-90

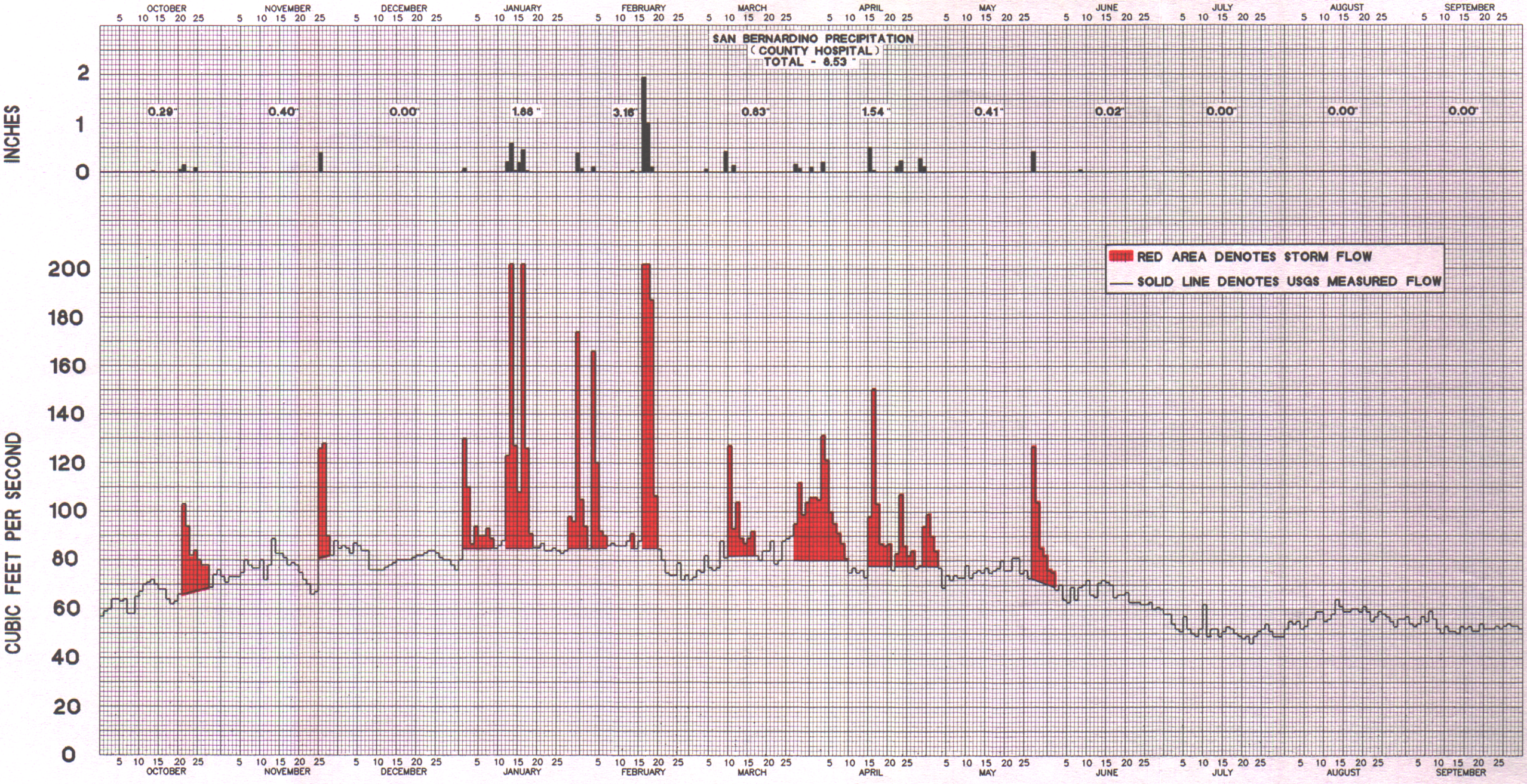
PLATE 2



DISSOLVED SOLIDS IN SANTA ANA RIVER BELOW PRADO DAM

WATER YEAR 1989-90

PLATE 3



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

WATER YEAR 1989-90

PLATE 4