

OCWD
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ORANGE COUNTY WATER DISTRICT
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8 STATE WATER RESOURCES CONTROL BOARD
9 OF THE STATE OF CALIFORNIA

10 _____)
11 In the Matter of the Petition of) PETITION FOR LIMITED
) REVISION OF DECLARATION OF
12 ORANGE COUNTY WATER DISTRICT) FULL APPROPRIATION OF THE
) SANTA ANA RIVER
13 For an Order Revising the)
Declaration of Full Appropriation)
14 of the Santa Ana River)
15 _____)

16
17 Petitioner, ORANGE COUNTY WATER DISTRICT ("OCWD"),
18 hereby petitions the State Water Resources Control Board
19 ("SWRCB") to revise the 1989 Declaration of Full
20 Appropriation of the Santa Ana River to the limited extent
21 necessary to enable SWRCB to process and grant OCWD's
22 Application No. X000206 ("Application") to appropriate water
23 from the Santa Ana River.

24 I. BASIS OF THIS PETITION.

25 The 1969 Stipulated Judgment between OCWD and upstream
26 appropriators ("Judgment") states that OCWD has a right to
27 42,000 acre feet per year ("AFA") of base flow in the
28 Santa Ana River, as well as the right to all storm flows

1 reaching Prado Dam. In reliance on this Judgment, OCWD
2 invested many millions of dollars after 1989 to capture and
3 use storm flows that otherwise would be wasted to the ocean.

4 Moreover, increasing urbanization upstream has resulted
5 in a significant increase in return flows in the Santa Ana
6 River. These flows ultimately make their way to Prado Dam,
7 where they are conserved by OCWD. This is consistent with
8 the law of return flows, which states that natural waters
9 must be kept in the stream system for subsequent use by
10 downstream entities. In reliance upon these flows, OCWD has
11 invested many millions of dollars after 1989 to capture
12 return flows that otherwise would be wasted to the ocean.

13 It does not appear that these increased storm and
14 return flows were recognized and accounted for in the 1989
15 Declaration. Moreover, OCWD's significant efforts and
16 investment to capture such flows and return them to
17 beneficial use were not considered in the 1989 Declaration.
18 These flows and conservation projects, described in more
19 detail below, constitute a "change of circumstances"
20 warranting a revision to the Declaration.

21 In order to ensure that such waters are accounted for,
22 and to perfect OCWD's rights based on its unique investments
23 and conservation procedures, OCWD submits this Petition for
24 a limited revision to the Declaration. The sole purpose of
25 this Petition is to enable SWRCB to accept and ultimately
26 grant OCWD's Application which was filed on November 15,
27 1992, and supplemented on August 21, 1998.

28

1 II. OCWD'S APPLICATION.

2 OCWD's Application is part of its effort to maximize
3 the beneficial use of the Santa Ana River Watershed. OCWD
4 feels that it is very important that all entities which
5 divert water in this intensively used watershed cooperate to
6 ensure maximum beneficial use of this valuable resource. It
7 also is important that there be certainty as to water
8 rights, in order to protect prior investments and promote
9 future investments for conservation and beneficial use.
10 OCWD's Application is not intended to disrupt existing
11 rights of upstream entities as established by the Judgment.
12 Its purpose is to establish that, subject to those existing
13 rights, OCWD is entitled to maximize the beneficial use of
14 these water resources through its conservation programs.
15 OCWD's Application is consistent with the fundamental State
16 policy to maximize the beneficial use of the waters of the
17 State, and with OCWD's mandate to protect and conserve the
18 waters and water rights of Orange County.

19 III. OCWD'S CONSERVATION OPERATIONS.

20 OCWD was formed in 1933 and now serves over 2 million
21 people. A map of OCWD's boundaries is attached as
22 Exhibit 1.

23 Historically OCWD's operations have been based on
24 rights to use Santa Ana River water which date back to the
25 mid-1800's. At the time that OCWD was formed, the Anaheim
26 Union Water Company ("AUWC") and the Santa Ana Valley
27 Irrigation Company ("SAVI") owned water rights dating back
28 to the 1870's, which entitled each of them to take one-half

1 of the normal surface flow of the Santa Ana River below the
2 present location of Prado Dam. (See Orange County Water
3 District vs. City of Riverside (1959) 173 Cal. App. 2d 137,
4 175; Yorba vs. Anaheim Union Water Company (1953) 41 Cal. 2d
5 265, 272.) OCWD acquired the water rights held by AUWC and
6 SAVI by condemnation of AUWC's water rights in 1967 and
7 purchase of SAVI's water rights in 1968. It now owns pre-
8 1914 rights to divert the surface flow of the Santa Ana
9 River once it reaches Prado Dam. In addition, OCWD has the
10 right to defend all water rights within its boundaries.
11 (Orange County Water District vs. Riverside, supra.)

12 In reliance on the rights which it obtained from AUWC,
13 SAVI and others, and on its own conservation investments,
14 OCWD, like its predecessors, has diverted virtually all of
15 the base flows entering Orange County. OCWD also has
16 developed the storage capacity of the underground aquifers
17 in Orange County to percolate and reclaim vast quantities of
18 Santa Ana River water for future use. As the flows of the
19 Santa Ana River have increased in recent decades, OCWD has
20 reclaimed these surplus waters, employing state-of-the-art
21 technology to prevent the waste of these flows to the ocean.

22 OCWD's Application encompasses these current projects,
23 as well as near-term and long-term conservation projects,
24 none of which were part of the record for the 1989
25 Declaration. Some of OCWD's newer projects include the
26 addition of seven miles of large-diameter conveyance pipe
27 and installation of two 7-foot diameter and 320-foot long
28 inflatable dams. OCWD also added 183,000 gallons per minute

1 of pumping capacity in five locations in and after 1989. In
2 fact, in order to conserve and convert Santa Ana River
3 waters to beneficial use, OCWD has invested over \$50 million
4 in recharge facilities in the last decade. A list of some
5 of those efforts is set forth at Exhibit 2.

6 OCWD's Application also includes near-term future
7 projects. These include the Basin Cleaning Device, a
8 \$10 million project which will increase the percolation
9 rates of OCWD's recharge basins. They also include
10 increases to the water conservation pool elevation at Prado
11 Basin to 508 feet.

12 Further, OCWD's Application includes long-term future
13 projects. These include another increase to the water
14 conservation pool elevation at Prado Basin to 514 feet.
15 They also include increases to OCWD's off-river storage and
16 recharge capacity.

17 Beyond these conservation efforts, OCWD has invested
18 heavily in land and infrastructure to capture wastewater
19 which is of poor quality and unfit for domestic or municipal
20 use when discharged to the Santa Ana River. OCWD diverts
21 some of those waters through its constructed wetlands
22 project, where nitrates and other contaminants are removed.
23 These and other waters are diverted into infiltration beds
24 for blending with stormwater and imported water and for
25 natural purification by percolation through soil and aquifer
26 materials. These quality improvements enable OCWD to return
27 the water to beneficial use.

28

1 Although these conservation measures were not part of
2 the record on the 1989 Declaration, they are well known to
3 upstream legal users. For example, OCWD participates in the
4 Santa Ana Water Project Association ("SAWPA"), which was
5 formed pursuant to the 1969 Judgment. The upstream water
6 districts also belong to SAWPA. OCWD nominees also serve on
7 the Santa Ana River Watermaster ("Watermaster") along with
8 nominees of the upstream districts. Through SAWPA, the
9 Watermaster and otherwise, the upstream members have been
10 apprised of OCWD's diversion and public use of all Santa Ana
11 River water entering Orange County.

12 Detailed illustrations of the nature and extent of
13 OCWD's diversion of storm flows and wastewater, and OCWD's
14 return of such waters to beneficial use are set forth in the
15 materials included at Exhibit 3. These flows and
16 conservation projects constitute a "change of circumstances"
17 within the meaning of 23 Cal. Code Regs. section 871, and
18 justify a revision of the 1989 Declaration.

19 IV. STORM FLOWS AND RETURN FLOWS REACHING PRADO DAM.

20 Storm runoff reaching Prado Dam has increased with
21 increased urbanization upstream. See Exhibit 4. Moreover,
22 wastewater discharges to the river system have caused the
23 base flow of the Santa Ana River to increase. Exhibit 5 to
24 this Petition is the 28th Annual Report of the Santa Ana
25 River Watermaster, for water year October 1, 1997 through
26 September 30, 1998. Table 3 of this Report (located at
27 page 5) confirms increased base flow, which includes return
28 flow, and increased total flow, which is base flow plus

1 storm flow. Table 5 (located at pages 14 and 15) confirms
2 increases in wastewater effluent discharged above Prado.
3 Tables 3 and 5 are incorporated herein by reference.

4 These increased flows reaching Prado Dam were not
5 considered in the record of the 1989 Declaration, and
6 justify a revision to the Declaration.

7 V. CONCLUSIONS.

8 Increased urbanization has increased the storm runoff
9 reaching Prado Dam. Moreover, the base flow of the
10 Santa Ana River has increased due to wastewater discharges
11 to the river system. OCWD has developed an optimal water
12 conservation program that minimizes losses to the ocean.
13 With this program in place, there is no surplus water in the
14 watershed except in extremely wet periods. Subsequent to
15 the 1989 Declaration of Full Appropriation, OCWD has

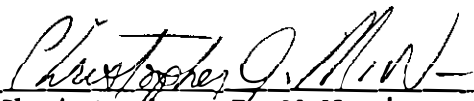
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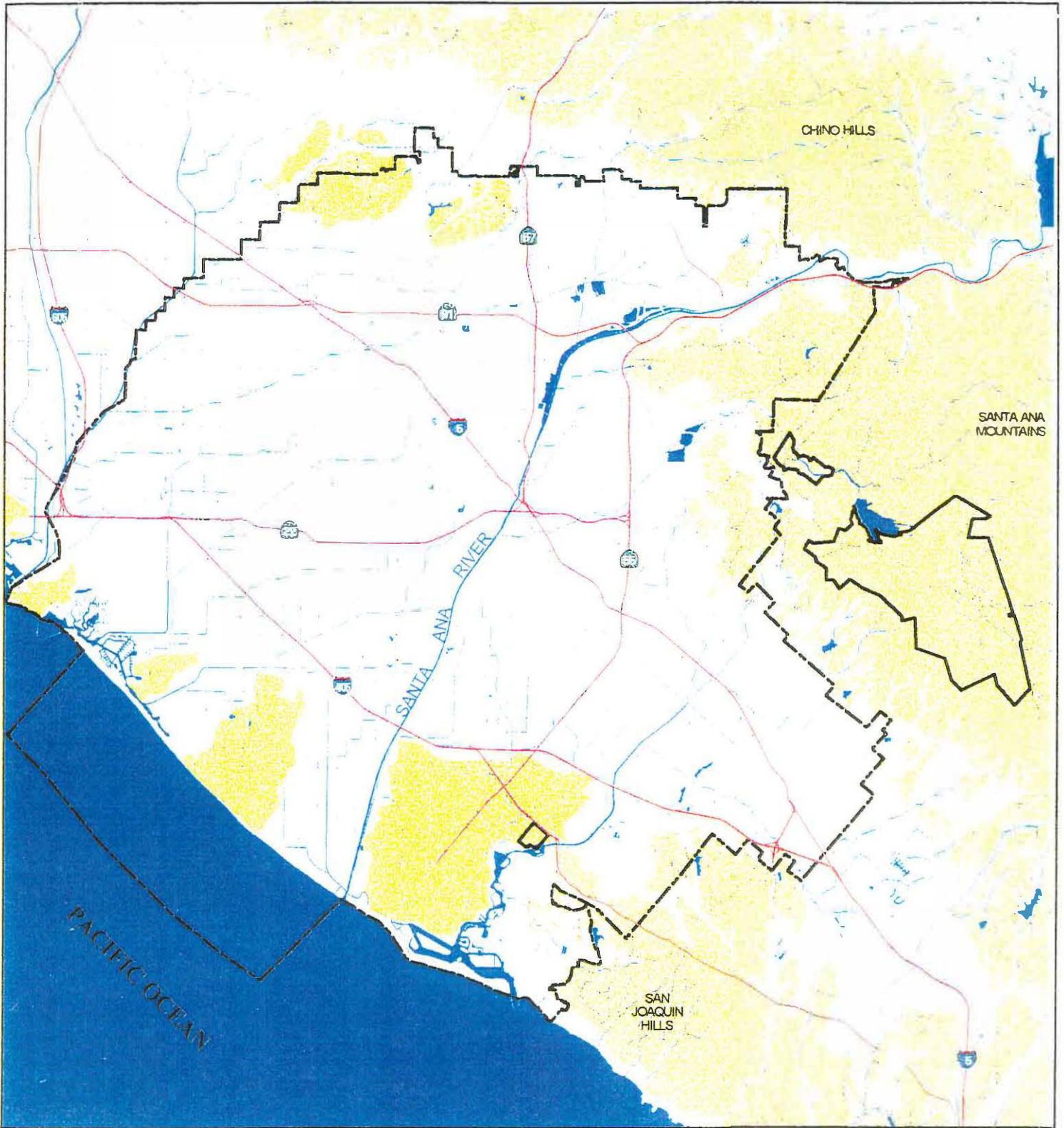
1 invested over \$50 million to increase its capture,
2 conservation and salvage capability.

3 WHEREFORE, Petitioner respectfully requests that the
4 SWRCB revise the Declaration of Full Appropriation to the
5 limited extent necessary to accept and grant OCWD's
6 Application.

7 Dated: September 2, 1999.

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14 By 
15 Christopher J. McNevin
16 Attorneys for Petitioner
17 ORANGE COUNTY WATER DISTRICT
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OCWD is responsible for managing the Orange County coastal plain groundwater basin and protecting Santa Ana River water rights

- Demand - 500,000 af/yr
- 75% supplied from groundwater



**Projects/Agreements/Measures
Undertaken by
Orange County Water District
to Conserve Additional Santa Ana River
Flows Since 1988**

- 1988 - The Kraemer Groundwater Recharge Basin was dedicated and put into operation. The basin added a minimum of 30,000 acre feet of water conservation capability.
- 1988 - The Anaheim Lake phase I by-pass pipeline was installed.
- 1989 - Installed 500 cfs transfer through Five Coves Basin and under Lincoln Ave. Improvements were for the Burris Pit pump station.
- 1990 - Installed 500 cfs transfer from end of Off River System to upper end of Five Coves.
- 1990 - The Burris Pit Pump Station, the pipeline to Santiago Pit and the pit improvements were dedicated, and the station and pit were put into operation. The facility added a minimum of 90,000 acre feet of yearly water conservation capability.
- 1990 - The Kraemer/Miller basin dewatering pumps were installed. Improvements added 3,000 acre feet of yearly water conservation capability.
- 1991 - Installed the Anaheim Lake dewatering pumps. Improvements added a minimum 14,000 acre feet of yearly water conservation capability.
- 1991-1993 Enhanced Prado Dam Water Conservation Program.
Under two separate four party agreements, increased the water conservation program at Prado Dam during the March 1 - August 31 timeframe each year to elevation 500' enhancing the conservation pool by 8,085 AF if sufficient storm flows occur, at a total cost of \$1 million.
- 1992 - Installed air inflatable rubber dam at Imperial Headgates.
- 1992 - Installed Anaheim Lake phase II pipeline.
- 1993 - Installed air inflatable rubber dam at Five Coves.
- 1993 - Installed the Warner Basin dewatering pumps. Facility added a minimum of 12,000 of water conservation capability.
- 1994 - Improved transfer capability through the Warner System.

1995 - Further enhanced the Prado Dam Water Conservation Program. Under another agreement, implemented an additional increase in the water conservation program at Prado Dam during the March 1 - August 31 timeframe each year to elevation 505' enhancing the conservation pool by an additional 9,230 AF if sufficient storm flows occur at a cost of \$1 million.

1996 - Installed the Warner by-pass pipeline.

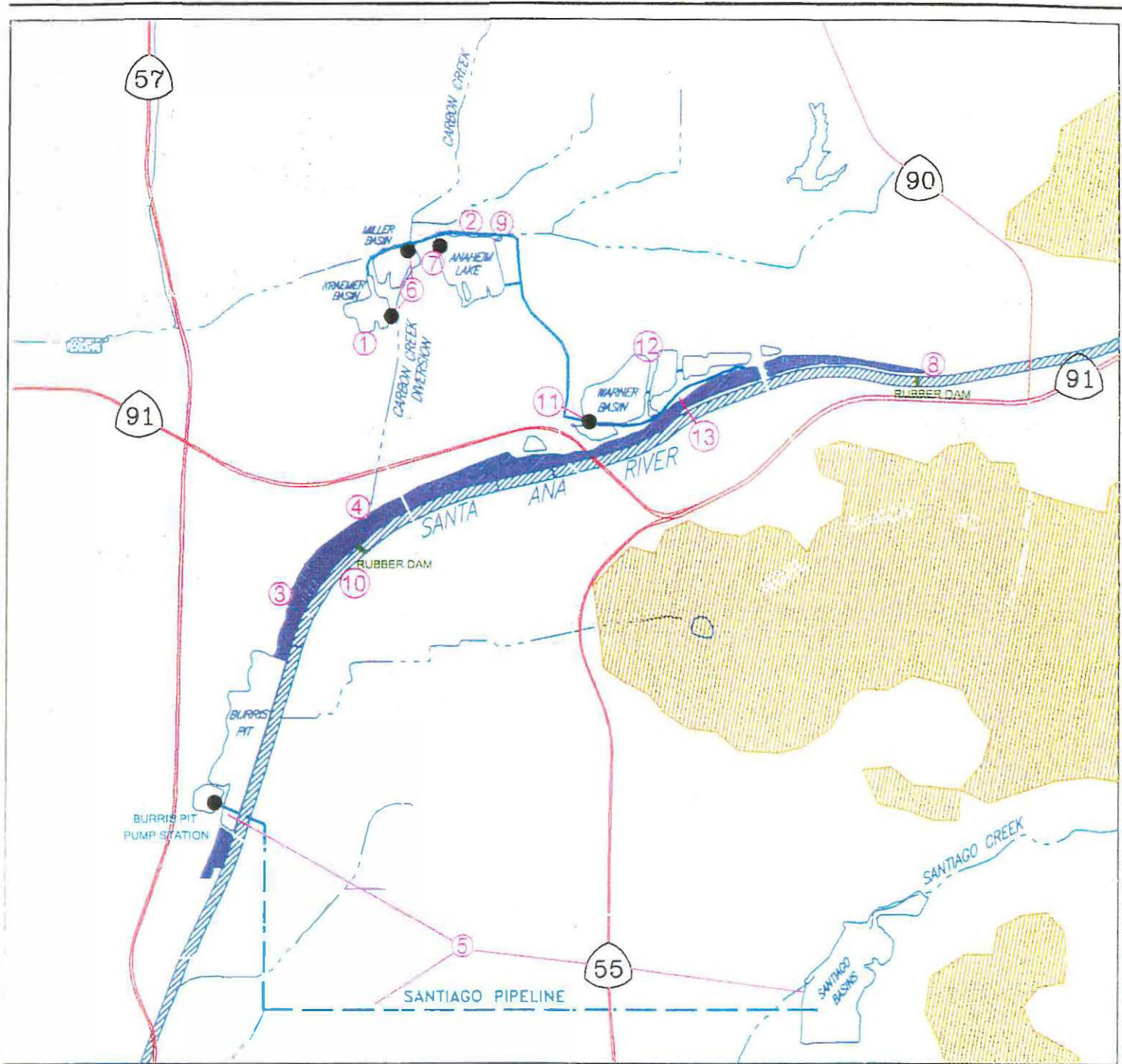
Orange County Water District has spent over 45 million dollars on capital projects to improve it's capability to capture and recharge Santa Ana river flow. Those improvements have increased the District's recharge capability from 190,000 acre feet to over 290,000 acre feet.

Additionally, OCWD's enhanced water conservation program at Prado Dam has increased the District's ability to capture storm flows by over 17,000 AF annually based on one time storm flow occurrences.

To conserve and convert these waters to beneficial use, OCWD has invested about \$52,000,000 in recharge facilities since 1988. These include:

- 7 miles of large diameter conveyance pipe
- 2 - 7' diameter 320' long inflatable dams
- 193,000 gpm of pumping capacity in 5 locations
- Under development - \$10,000,000 Basin Cleaning Device

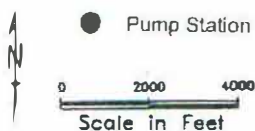
OCWD's recharge system includes six miles of river and several deep off-river percolation basins covering 1000 acres with a storage capacity of 27,000 AF and sustained percolation rate of 500 cfs.



KEY

- 1) Kraemer Basin Operational
- 2) Installed Anaheim Lake By-Pass Pipeline
- 3) Installed Five Coves Basin Transfer
- 4) Installed Off River to Five Coves Transfer
- 5) Burris Pit Pump and Pipeline Operational
- 6) Installed Kraemer/Miller Dewatering Pumps

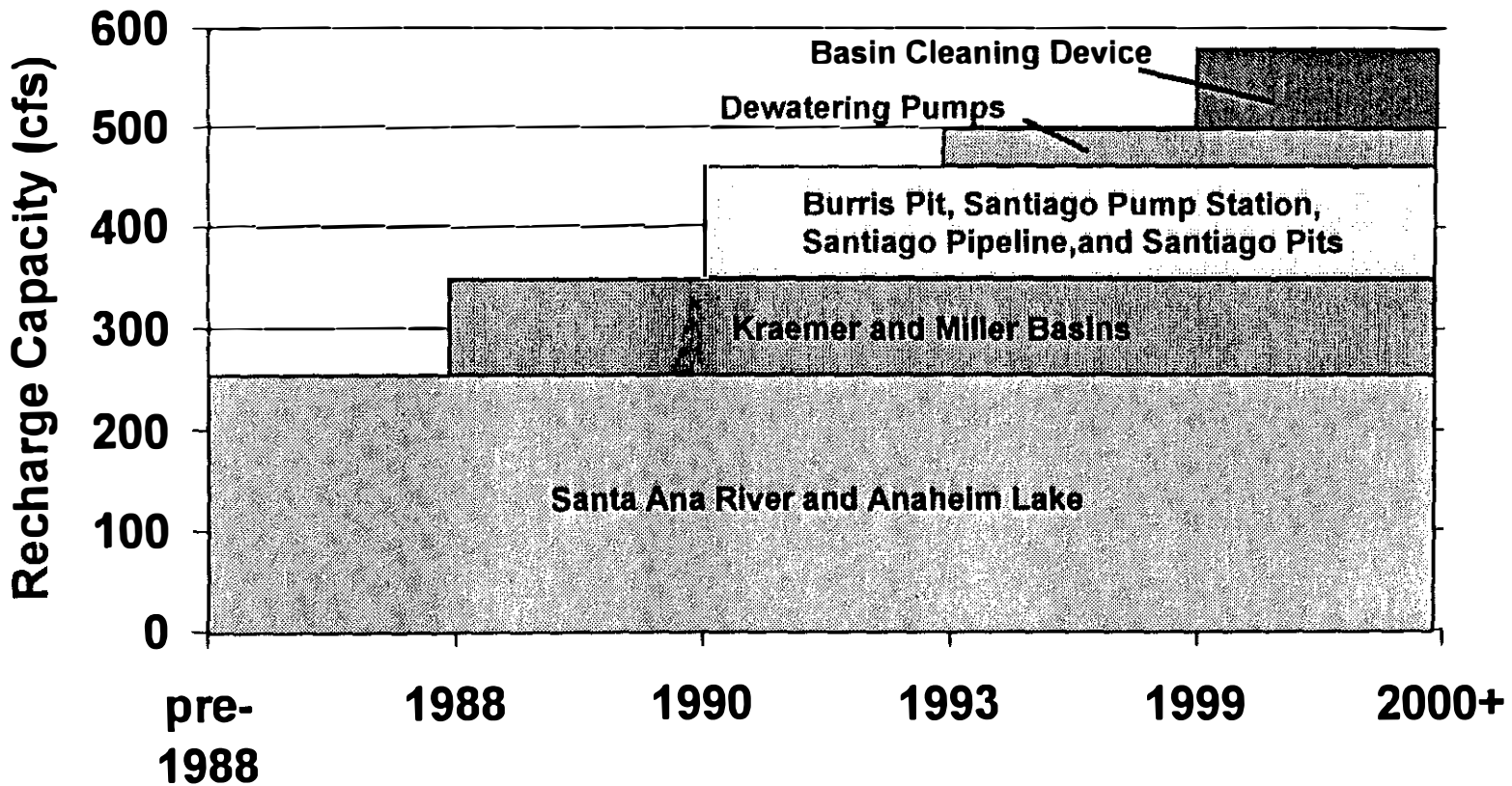
- 7) Anaheim Lake Dewatering Pumps
- 8) Installed Rubber Dam at Imperial Headgates
- 9) Anaheim Lake Phase II Pipeline
- 10) Installed Rubber Dam at Five Coves
- 11) Warner Basin Dewatering Pumps
- 12) Improved Transfer Capability - Warner System
- 13) Warner By-Pass Pipeline



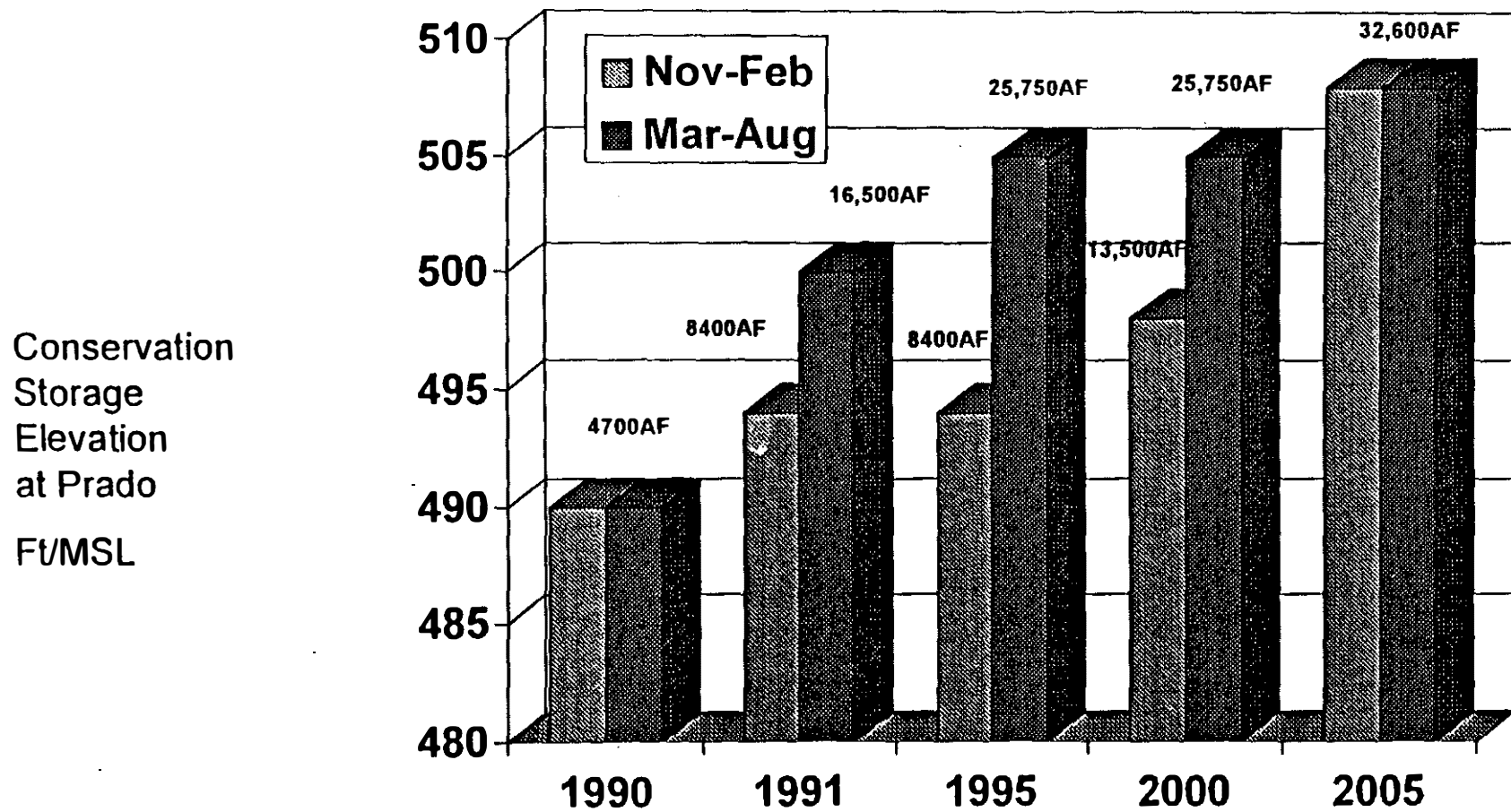
OCWD FOREBAY RECHARGE FACILITIES MAP



OCWD's sustained recharge capability has doubled since 1988.

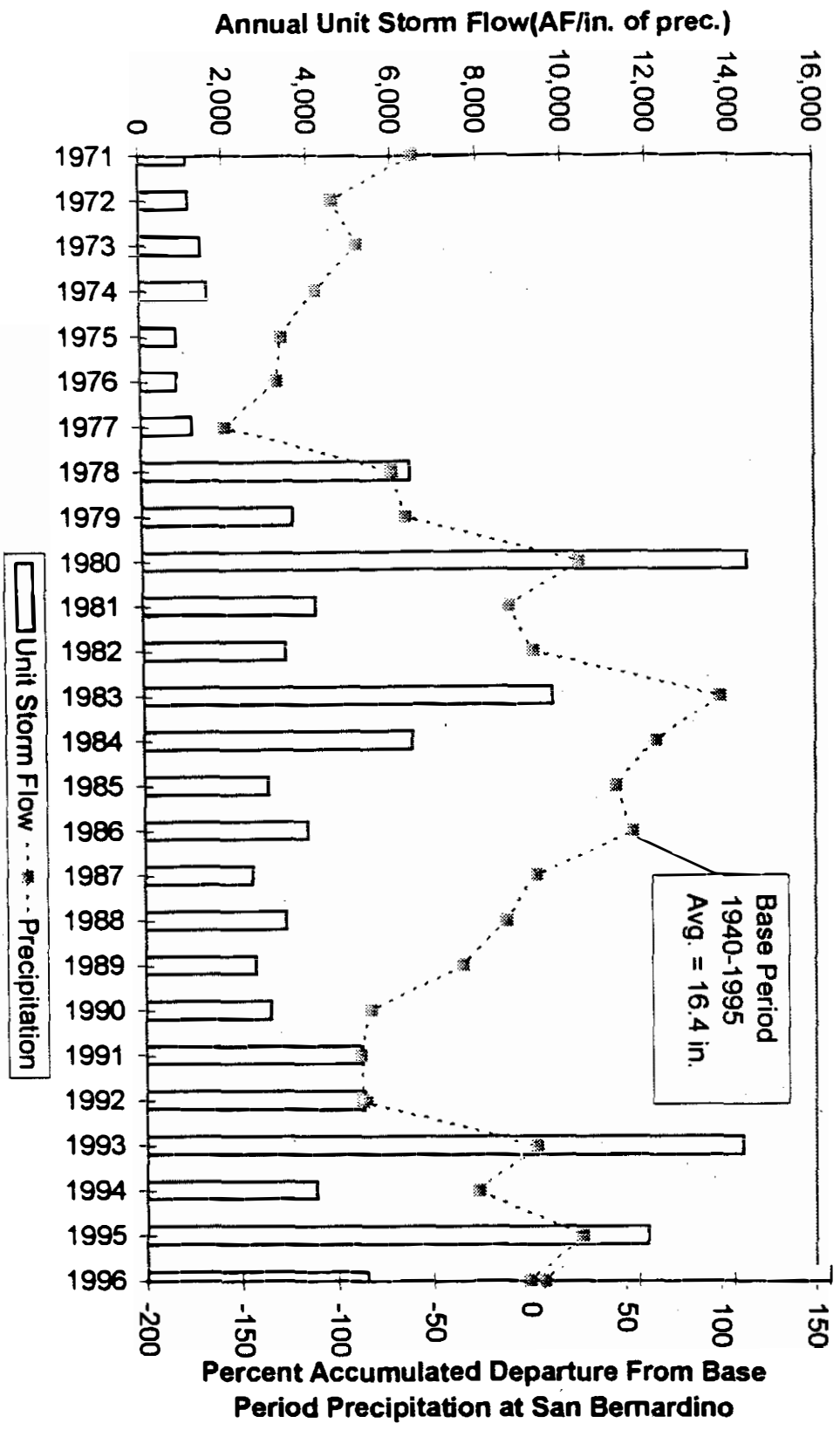


Water conservation at Prado Dam has allowed OCWD to capture more storm flows for basin replenishment



- \$2 Million spent to increase storm flow capture behind Prado
- 124 acres of OCWD land converted to Vireo habitat

Storm flows arriving at Prado Dam have increased with upstream urbanization (increased impervious area and lined flood channel facilities)



Data Source: Santa Ana River Watermaster

**SANTA ANA RIVER WATERMASTER
FOR
ORANGE COUNTY WATER DISTRICT
VS. CITY OF CHINO et al.
CASE NO. 117628 - COUNTY OF ORANGE**

**TWENTY-EIGHTH
ANNUAL REPORT
OF THE
SANTA ANA RIVER WATERMASTER
FOR WATER YEAR
OCTOBER 1, 1997 - SEPTEMBER 30, 1998**

APRIL 30, 1999

SANTA ANA RIVER WATERMASTER

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

WATERMASTER

Bill B. Dendy
Donald L. Harriger
William R. Mills, Jr.
Robb D. Quincey
Robert L. Reiter

MAILING ADDRESS

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April 30, 1999

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

Re: Watermaster Report for Water Year October 1, 1997 - September 30, 1998

Ladies and Gentlemen:

We have the honor of submitting herewith the Twenty-eighth Annual Report of the Santa Ana River Watermaster. We wish to point out that the supporting basic data heretofore presented as Appendices are bound separately.

The principal findings of the Watermaster for the water year 1997-98 are as follows:

At Prado

1	Base Flow at Prado	155,711 acre-feet
2	Annual Weighted TDS in Base and Storm Flows	392 mg/L
3	Annual Adjusted Base Flow	195,677 acre-feet
4	Cumulative Adjusted Base Flow	3,014,231 acre-feet
5	One-half San Jacinto watershed discharge reaching Prado Dam and Recharging Orange County Groundwater Basin	0 acre-feet
6	Cumulative Entitlement of OCWD	1,176,000 acre-feet
7	Cumulative Credit	1,838,231 acre-feet
8	One-third of Cumulative Debit	0 acre-feet
9	Minimum Required Base Flow in 1998-99	34,000 acre-feet

At Riverside Narrows

1	Base Flow at Riverside Narrows	65,013 acre-feet
2	Annual Weighted TDS in Base Flow	601 mg/L
3	Annual Adjusted Base Flow	65,013 acre-feet
4	Cumulative Adjusted Base Flow	1,101,816 acre-feet
5	Cumulative Entitlement of IEUA and WMWD	427,000 acre-feet
6	Cumulative Credit	674,816 acre-feet
7	One-third of Cumulative Debit	0 acre-feet
8	Minimum Required Base Flow in 1998-99	12,420 acre-feet

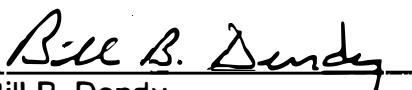
The above findings show that at the end of the 1997-98 water year, Inland Empire Utilities Agency (formerly Chino Basin Municipal Water District) and Western Municipal Water District have a cumulative credit of 1,838,231 acre-feet to their Base Flow obligation at Prado Dam. San Bernardino Valley Municipal Water District has a cumulative credit of 674,816 acre-feet to its Base Flow obligation at Riverside Narrows.

Based on these findings, the Watermaster concludes that there was full compliance with the provisions of the Stipulated Judgment in 1997-98.

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

Sincerely yours,

Santa Ana River Watermaster

By: 
Bill B. Dendy


Donald L. Harriger


William R. Mills, Jr.


Robb D. Quincey


Robert L. Reiter

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APPENDICES

The following appendices are bound separately and available for review at the office of the Secretary of the Santa Ana River Watermaster.

- A USGS Flow Measurements of the Santa Ana River Flows below Prado, at MWD Crossing, and at E Street, of Temescal Creek above Main Street (at Corona), and Chino Creek at Schaefer Avenue (near Chino)
- B Daily Precipitation Data at San Bernardino County Hospital
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CHAPTER I

WATERMASTER ACTIVITIES AND WATER CONDITIONS

Introduction

This Twenty-eighth Annual Report of the Santa Ana River Watermaster covers water year 1997-98. The annual report is required by the Stipulated Judgment (Judgment) in the case of Orange County Water District vs. City of Chino et al., entered by the court on April 17, 1969 (Case No. 117628-County of Orange). The Stipulated Judgment became effective on October 1, 1970. It contains a declaration of rights of the water users and other entities in the Lower Area of the Santa Ana River Basin downstream of Prado Dam as against those in the Upper Area tributary to Prado Dam, and provides a physical solution to satisfy those rights. Chapter IV presents a history of the litigation and a summary of the Judgment.

The physical solution accomplishes, in general, a regional intrabasin allocation of the surface flow of the Santa Ana River System. The Judgment leaves to each of the major hydrologic units within the basin the determination and regulation of individual rights therein and the development and implementation of its own water management plan subject only to compliance with the physical solution.

The Judgment designates four public agencies to represent the interests of the Upper and Lower Areas and gives them the responsibility to fulfill the obligations set forth in the Judgment, including the implementation of the physical solution. The Lower Area is represented by Orange County Water District (OCWD). The Upper Area is represented by San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District of Riverside County (WMWD) and Inland Empire Utilities Agency (IEUA), formerly the Chino Basin Municipal Water District (CBMWD).

The court appoints a five-member Watermaster Committee to administer the provisions of the Judgment. The Watermaster's duty is to maintain a continuous accounting of each of the items listed in the letter of transmittal hereof and to report thereon annually for each water year to the court and the parties. The time for submission of the annual report is April 30, seven months after the end of the water year.

For the 1997-98 water year the Watermaster Committee consisted of Donald L. Harriger, William R. Mills, Jr., Robert L. Reiter, Bill B. Dendy and Robb D. Quincey. Mr. Mills served as Chairman and Mr. Reiter served as Secretary. Dr. Quincey was appointed on July 15, 1998 to replace William J. Carroll. Mr. Carroll was a member of the original Watermaster Committee and had served continuously until his retirement. Chapter IV presents the history of Watermaster Committee membership.

Watermaster Service Expenses

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 parties by whom they were nominated. All other Watermaster service expenses are shared by the parties, with OCWD paying 40% of the cost and WMWD, SBVMWD, and IEUA each paying 20% of the cost.

Stream flow measurements and water quality data required by the Watermaster are, for the most part, furnished by the U.S. Geological Survey (USGS) through a cooperative monitoring program. The costs of the cooperative monitoring program for the 1997-98 water year, and each party's share of the costs, are set forth in Table 1.

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

October 1, 1997 to September 30, 1998

	<u>Total Cost</u>	<u>USGS Share</u>	<u>Parties' Share</u>
USGS GAGING STATION			
Santa Ana River at MWD Crossing (Riverside Narrows)			
Surface Water Gage	\$19,650	\$9,825	\$9,825
Water Quality Monitoring/TDS Sampling	8,050	4,025	4,025
Chino Creek at Schaefer	14,000	7,000	7,000
Cucamonga Creek at Mira Loma	14,000	7,000	7,000
Santa Ana River below Prado Dam			
Surface Water Gage	14,000	7,000	7,000
Water Quality Monitoring/TDS Sampling	17,000	8,500	8,500
Water Quality Conductance Program	<u>1,600</u>	<u>0</u>	<u>1,600</u>
TOTAL COST AND SHARES	\$88,300	\$43,350	\$44,950
COST DISTRIBUTION AMONG PARTIES			
Inland Empire Utilities Agency	20%		\$8,990
Orange County Water District	40%		\$17,980
San Bernardino Valley Municipal Water District	20%		\$8,990
Western Municipal Water District	20%		\$8,990

The Watermaster annually adopts an expense budget. Table 2 shows the budget and actual expenses incurred for the 1997-98 fiscal year as well as the budget adopted for the 1998-99 fiscal year. A financial review was performed by OCWD and is reported in Appendix C.

TABLE 2
WATERMASTER SERVICE BUDGET AND EXPENSES

Budget Item	July 1, 1997 to June 30, 1998 Budget	July 1, 1997 to June 30, 1998 Expenses	July 1, 1998 to June 30, 1999 Budget
Support Services	\$9,500.00	\$9,090.82	\$9,500.00
Reproduction of Annual Report	<u>2,500.00</u>	<u>2,526.92</u>	<u>2,500.00</u>
TOTAL	\$12,000.00	\$11,617.74	\$12,000.00

Compilation and Analysis of Basic Data

The Watermaster has established procedures for annually compiling and analyzing the basic data necessary to monitor compliance with the provisions of the Judgment. The procedures are used to make determinations, at Prado Dam and at Riverside Narrows, of the Base Flow, Storm Flow, Nontributary Flow, and the relationships between electrical conductivity (EC), [measured as specific conductance and expressed in microsiemens per centimeter ($\mu\text{s}/\text{cm}$)], and total dissolved solids (TDS) concentrations. The determinations for the 1997-98 water year are explained in detail for Prado Dam in Chapter II and for Riverside Narrows in Chapter III.

Hydrologic and Water Quality Data for the 1997-98 Water Year

The USGS provided flow and water quality data for the Santa Ana River at two gaging stations, "Santa Ana River Below Prado" (Prado) and "Santa Ana River at Metropolitan Water District (MWD) Crossing" (Riverside Narrows). The flow data consists of computed mean daily discharges based on continuous recordings. The water quality data at Prado consists of daily maximum and minimum values for EC based on a continuous recording and twice-monthly values for TDS. The water quality data at Riverside Narrows consists of twice-monthly values for both EC and TDS. The USGS also provided discharge data for the Santa Ana River at E Street in San Bernardino, Chino Creek at Schaefer Avenue, Cucamonga Creek near Mira Loma, and Temescal Wash in the City of Corona (see Appendix A).

The 1997-98 daily mean discharge record at Prado is considered by the USGS to be an "excellent" record for flows up to 2,500 cubic feet per second (cfs) and "fair" for flows higher than that. Daily mean discharges at the station are controlled at times by storage operations in the reservoir behind Prado Dam just upstream. The maximum and minimum daily mean discharge values during the water year were, respectively, 6,170 cubic feet per second (cfs) on February 24, 1998, and 50 cfs on October 22, 1997. The maximum and minimum daily mean EC values were, respectively, 1050 $\mu\text{s}/\text{cm}$ on December 24, 1997, and 286 $\mu\text{s}/\text{cm}$ on January 10, 1998. The respective corresponding calculated TDS concentrations were 650 and 177 milligrams per liter (mg/L).

The 1997-98 daily mean discharge record at Riverside Narrows is considered by the USGS to be "poor". The maximum and minimum daily mean discharge values during the year were, respectively, 10,800 cfs on February 24, 1998, and 69 cfs on October 17, 1997. The maximum and minimum daily mean EC values were, respectively, 965 $\mu\text{s}/\text{cm}$ on July 13, 1998, and 312 $\mu\text{s}/\text{cm}$ on May 13, 1998. The respective corresponding measured TDS concentrations were 590 and 193 mg/L.

During the year there were three sources of non-storm flow in the river that the Watermaster has not included in Base Flow. A total of 3,018 acre-feet of Nontributary Flow attributable to State Water Project water, purchased by OCWD and released at the OC-59 turnout from MWD's Foothill Feeder into San Antonio Creek, was calculated to have reached Prado Dam with an estimated average TDS concentration of 247 mg/L. At its Arlington Desalter in Riverside the Santa Ana Watershed Project Authority (SAWPA) produced and delivered to a channel tributary to the Santa Ana River 1,957 acre-feet of water having an average TDS concentration of 404 mg/L. The discharge above Riverside Narrows of MWD Demonstration Program water (Exchange Water) totaled 1,342 acre-feet with an average TDS concentration of 533 mg/L.

Precipitation during 1997-98 totaled 33.41 inches (see Appendix B). Except for July through September the rainfall was measured as usual at the manual gage at the San Bernardino County Hospital and reported by the National Oceanic and Atmospheric Administration. Data from that gage were not reported for July, August, and September so the record for a nearby automatic gage owned by the San Bernardino County Flood Control District was used. The rainfall total was 186% of the average of 17.98 inches per year that occurred during the 26-year base period (1934-35 through 1959-60) that was used in the formulation of the physical solution. Plate 2 shows annual precipitation from 1934-35 through 1997-98.

Summary of Findings

A summary of findings by the Watermaster for the period 1970-71 through 1997-98 is presented in Table 3. Note that the Base Flow obligations set forth in the Judgment at both Prado Dam and Riverside Narrows have been met and cumulative credits have accrued to the Upper Area.

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	76,375	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	143,367	81,548	584	89,431	253,083
1982-83	32.36	425,938 ⁽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	144,483	119,149 ⁽¹⁰⁾	611	127,986	977,611
1990-91	15.48	191,321	111,151 ⁽¹¹⁾	514	128,379	1,064,040
1991-92	16.54	193,225	106,948 ⁽¹¹⁾	499	124,869	1,146,909
1992-93	30.92	568,677	128,068 ⁽¹¹⁾	368	163,499	1,268,408
1993-94	11.62	158,241	111,186 ⁽¹¹⁾	611	119,432	1,345,840
1994-95	25.14	424,017 ⁽⁴⁾	123,468 ⁽¹¹⁾	415	152,792 ⁽⁵⁾	1,458,394 ⁽⁶⁾
1995-96	11.92	194,797	131,861 ⁽¹¹⁾	514	152,299	1,568,693
1996-97	18.64	204,610	136,676 ⁽¹¹⁾	514	157,861	1,684,554
1997-98	33.41	462,633 ⁽⁴⁾	155,711 ⁽¹¹⁾	392	195,677	1,838,231

TABLE 3 (Continued)

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	5,337
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	253,817	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	82,708	32,778	678	32,778	59,974
1982-83	32.36	279,645	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	69,722 ⁽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
1989-90	8.53	58,159	53,199	590	53,583	411,016
1990-91	15.48	73,790	45,041 ⁽¹¹⁾	616	45,041	440,807
1991-92	16.54	71,427	40,306	620	40,306	465,863
1992-93	30.92	267,043	41,434	634	41,434	492,047
1993-94	11.62	45,006	31,278 ⁽¹¹⁾	677	31,278	508,075
1994-95	25.14	243,411	45,562 ⁽¹¹⁾	646	45,562	538,387
1995-96	11.92	81,786	54,548 ⁽¹¹⁾	625	54,548	577,685
1996-97	18.64	104,518	62,618 ⁽¹¹⁾	624	62,618	625,053
1997-98	33.41	214,375	65,013 ⁽¹¹⁾	601	65,013	674,816

TABLE 3 (Continued)

- (1) Measured at San Bernardino County Hospital.
- (2) Excludes Nontributary Flow and Exchange Waters.
- (3) For Base and Storm Flow at Prado and Base Flow only at Riverside Narrows.
- (4) Includes San Jacinto Watershed discharges which passed Prado Dam totaling 16,090 acre-feet in 1980-81; 7,720 acre-feet in 1982-83; 12,550 acre-feet in 1983-84, 4,697 acre-feet in 1994-95; and 1,690 acre-feet in 1997-98.
- (5) Excludes water discharged from the San Jacinto Watershed.
- (6) Includes a credit for a portion of San Jacinto Watershed discharges totaling 8,045 acre-feet in 1980-81; 3,362 acre-feet in 1982-83; 4,602 acre-feet in 1983-84; and 1,762 acre-feet in 1994-95.
- (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 extractions 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 1989-90 and subsequent years in accordance with an agreement between OCWD, WMWD, and Santa Ana Watershed Project Authority.
- (11) Excludes groundwater pumped from San Bernardino, Colton, and Riverside Basins and discharged to the Santa Ana River to flow to OCWD under the Exchange Water agreements.

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

BASE FLOW AT PRADO

This chapter deals with determinations of 1) the components of flow at Prado, which include Nontributary Flow, Arlington Desalter discharge, Exchange Water, Storm Flow and Base Flow and 2) the Adjusted Base Flow at Prado credited to IEUA and WMWD.

Flow at Prado

During the 1997-98 water year, the flow of the Santa Ana River as measured at the USGS gaging station below Prado Dam amounted to 462,646 acre-feet. There was nine acre-feet of storage behind the dam at the beginning of the year. Storage at the end of the water year was four acre-feet. Inflow to the reservoir included 155,711 acre-feet of Base Flow and 300,604 acre-feet of Storm Flow, based on an adjusted Prado Reservoir storage-elevation curve described in the following section. Of the nontributary flow due to State Water Project water released to San Antonio Creek at turnout OC-59, 3,018 acre-feet were calculated to have reached Prado Reservoir during 1997-98. Nontributary flows due to the Arlington Desalter and Exchange programs totaled 1,957 acre-feet and 1,342 acre-feet, respectively. The monthly components of flow of the Santa Ana River at Prado Dam for 1997-98 are listed in Table 4 and are shown graphically on Plate 3. Historical Base and Storm Flows of the Santa Ana River below Prado during the period 1934-35 through 1997-98 are presented on Plate 4.

Prado Reservoir Storage-Elevation Curve Adjustment

The Watermaster calculates inflow to Prado Reservoir by adjusting outflow data using change in reservoir storage. Reservoir storage is based on a storage-elevation curve last updated by the U.S. Army Corps of Engineers (ACOE) in 1988. The ACOE reports that sedimentation averaged about 200 acre-feet per year between 1969 and 1979. Such sedimentation affects the accuracy of the storage-elevation curve when the storage in the reservoir is low. This inaccuracy results in anomalies in the calculated inflow near the end of each period of reservoir storage.

In 1997, the Watermaster adjusted the Prado Reservoir storage-elevation curve to improve the calculated Santa Ana River inflow hydrograph from which Base Flow and Storm Flow are determined. Assuming an average sedimentation rate of 200 acre-feet per year from 1988 through 1996, the portion of the ACOE storage-elevation curve below elevation 520 feet was adjusted to include a 1,600 acre-feet reservoir storage loss. Elevation 520 feet represents the approximate maximum flood storage elevation attained behind Prado Dam in the last several years where most sedimentation would likely have occurred. The new storage-elevation curve was developed by distributing the 1,600 acre-feet storage loss until the curve produced inflow values without significant anomalies.

TABLE 4
 COMPONENTS OF FLOW AT PRADO DAM
 WATER YEAR 1997-98
 (acre-feet)

Month	USGS Measured Outflow	+ Storage Change (1)	= Computed Inflow	San Jacinto Watershed Flows at Prado Dam	- Exchange Water (2)	- San Antonio Creek (3)	- Arlington Desalter	- Storm Flow	= Base Flow
<u>1997</u>									
October	14,525	2	14,527	0	190	2,304	499	704	10,830
November	15,205	1,431	16,636	0	156	0	456	4,700	11,324
December	29,262	(1,450)	27,812	0	0	0	115	15,132	12,566
<u>1998</u>									
January	27,761	1,450	29,211	0	0	0	0	15,791	13,420
February	151,793	27,930	179,723	0	0	0	0	166,184	13,539
March	46,147	(6,280)	39,867	1,087	0	0	0	24,330	15,538
April	34,381	(2,405)	31,976	603	0	0	0	16,977	14,999
May	56,267	2,545	58,812	0	0	0	0	44,258	14,554
June	30,458	(8,489)	21,969	0	0	0	0	9,274	12,695
July	27,441	(13,649)	13,792	0	522	486	84	452	12,247
August	15,416	(1,102)	14,314	0	403	228	361	1,425	11,897
September	13,989	4	13,993	0	71	0	443	1,377	12,103
Total	462,646	(13)	462,633	1,690	1,342	3,018	1,957	300,604	155,711

- (1) The monthly change in storage is included in the monthly components of flow.
- (2) Exchange Water pumped from the San Bernardino, Colton, and Riverside groundwater basins and discharged into the Santa Ana River less an estimated 5% loss.
- (3) State Water Project water released into San Antonio Creek from turnout OC-59 during 1997-98 and calculated to have reached Prado Dam in the 1997-98 water year.

Exchange Programs

On two occasions, WMWD and OCWD have agreed to exchange imported water from MWDSC for pumped groundwater. The pumped groundwater, hereafter referred to as Exchange Water, is delivered via the Santa Ana River, and since it is exchanged for imported water, it is accounted for as Nontributary Water. Because these exchanges are delivered upstream of Prado Dam and are effectively Nontributary Water, the amount of Exchange Water reaching Prado Dam is excluded from the computation of Base Flow and Base Flow quality. This section describes past and current exchange programs. A monthly summary of the 1997-98 Exchange Water deliveries is contained in Appendix D.

Releases of Exchange Water from Riverside Canal

In 1993, OCWD and WMWD entered into an agreement to participate in MWDSC's Demonstration Local Storage (DLS) Program. The agreement provides for delivery of MWDSC water to WMWD with WMWD causing a like amount of groundwater, pumped from the basins above the Riverside Narrows, to be delivered to OCWD via the Riverside Canal and into the Santa Ana River. Because the mechanism is identical to the Drought Emergency Exchange Program, waters discharged to the river under these two programs are combined and termed Exchange Waters.

The Drought Emergency Exchange Program is more fully described in Chapter II of the Twenty-first Annual Report (1990-91). No water under the Drought Emergency Exchange Program was delivered during 1997-98.

During the 1997-98 water year, WMWD delivered 1,342 acre-feet to the Santa Ana River upstream of Prado Dam under the DLS Program. This amount reflects an agreed upon 5% evapotranspiration loss between the point of delivery and Prado Dam. The amount of Exchange Water delivered during the 1997-98 water year completes the agreed upon quantities under both Exchange Programs.

Nontributary Flow

Since May 1973, OCWD has from time to time purchased State Water Project water for the replenishment of the groundwater basin 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 the City of Upland.

Releases to San Antonio Creek

During the 1997-98 water year, 2,877 acre-feet of State Water Project water were released into San Antonio Creek from the Foothill Feeder at turnout OC-59 near Upland. Total monthly deliveries and daily flow rates were provided by the MWDSC. Water losses between OC-59 and Prado Dam were calculated per the procedures set forth in the Twelfth Annual Report (1981-82), Appendix C. Using these procedures, it

was determined that 193 acre-feet of OC-59 water released at the end of the previous water year was in transit due to the 12-hour delay from the time of release until the water reaches Prado Dam. A total of 3,018 acre-feet of the water released from OC-59 were determined to have reached Prado Dam during the 1997-98 water year. Of the amount released and in transit, 52 acre-feet (1.7%) were lost to evapotranspiration. A monthly summary of Nontributary Flow released from OC-59 into San Antonio Creek is contained in Appendix E.

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 parties to the Stipulated Judgment, WMWD and OCWD, as members of the Santa Ana Watershed Project Authority, constructed a groundwater cleanup project which is designed to reduce 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 salinity. The capacity of the facility is approximately 6 million gallons per day (mgd). The facility began operations in July 1990, 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 be excluded from the computation of Santa Ana River Base Flow and Base Flow quality. During the 1997-98 water year, 1,957 acre-feet of water discharged from the Arlington Desalter was determined to have reached Prado Dam. Daily discharge rates and electrical conductance of product water were provided by OCWD Operations. A summary of Arlington Desalter discharges is contained in Appendix F.

San Jacinto Watershed Discharge

Prior to the 1997-98 water year, discharges from the San Jacinto Watershed reaching Prado Dam were due to discharges from Lake Elsinore, and had been accounted for as "Lake Elsinore Discharge." In February of 1998 Eastern Municipal Water District (EMWD) completed its Reach 4 discharge pipeline to Wasson Canyon, which is tributary to Temescal Wash. This pipeline discharges tertiary-treated wastewater to Temescal Wash above Lee Lake when flows exceed EMWD's storage facility capacity. The collective discharges from Lake Elsinore and EMWD to Temescal Wash are referred to herein as San Jacinto Watershed discharges.

During the 1997-98 water year, discharges from the San Jacinto Watershed totaled 1,779 acre-feet of wastewater by EMWD to Temescal Wash. There were no discharges from Lake Elsinore. To determine the amount of San Jacinto Watershed discharge reaching Prado Dam during the 1997-98 water year, discharge data from Lee Lake were compared to wastewater discharge data reported by EMWD. The lesser of the daily measured discharges, less a five percent evapotranspiration loss, was assumed to represent the volume of San Jacinto Watershed outflow reaching Prado Dam. Lee Lake spill data were provided by Elsinore Valley Municipal Water District. As

shown in Table 4, the total San Jacinto Watershed discharge reaching Prado Dam in 1997-98 was calculated to be 1,690 acre-feet. A summary of San Jacinto Watershed discharges is shown in Appendix G.

Storm Flow

Portions of storm flows are retained behind Prado Dam for regulation of downstream flows and for water conservation purposes. The ACOE owns Prado Dam and operates it according to a release schedule utilizing a buffer pool elevation of 494 feet until March 1 of each year. In 1994 an agreement was signed by OCWD, ACOE, and the U.S. Fish and Wildlife Service, which provides that between March 1 and August 30 the pool would be raised, given sufficient flows, to elevation 497 feet. This elevation would be increased year by year, as additional biological habitat mitigation by OCWD comes on line, to a maximum elevation of 505 feet. On April 12, 1995, the ACOE, the U.S. Fish and Wildlife Service, and OCWD reached an agreement to accelerate immediately the raising of the seasonal water conservation pool to elevation 505 feet, in exchange for a \$1 million contribution by OCWD to the U.S. Fish and Wildlife Service to be used to develop Least Bell's vireo habitat by the removal of a non-native plant, *Arundo donax*. 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 4.

During the 1997-98 water year, the maximum volume of water stored in Prado Reservoir reached 50,265 acre-feet on February 24, 1998. The maximum daily mean flow released from Prado Dam to the Santa Ana River was 6,170 cfs on the same day.

During the year, construction continued on elements of the Santa Ana River Mainstem flood control project, including the Seven Oaks Dam, located on the Santa Ana River above the community of Mentone.

Base Flow

The Base Flow is affected by Nontributary Flow releases to San Antonio Creek, discharges from the Arlington Desalter, deliveries of Exchange Water, and discharges from the San Jacinto Watershed. The general procedure used by the Watermaster to separate the 1997-98 flow components was the same as used for previous years and is fully described in the Fifth (1974-75) and the Twelfth (1981-82) Annual Reports. The monthly and annual quantities of Base Flow are shown in Table 4.

Wastewater Effluent Discharges

A portion of the Base Flow at Prado is made up of treated wastewater effluent discharged from a number of municipal wastewater treatment plants located above Prado Dam. During the 1997-98 water year, about 173,014 acre-feet of effluent were discharged above Prado Dam by major agencies as shown in Table 5.

Water Quality Adjustments

The flow-weighted average TDS for the total flow passing Prado Dam, including Nontributary Flow released above Riverside Narrows, Exchange Water and Arlington Desalter discharge, was found to be 392 milligrams per liter (mg/L). This determination was based on records from a continuous monitoring device operated by the USGS for EC of the Santa Ana River flow below Prado Dam. This record was supplemented by twenty-four (24) grab samples for EC collected by the USGS and analyzed for TDS.

A correlation between TDS and EC yields the following best fit equation:

$$\text{TDS} = \text{EC} \times 0.618778$$

(where the units of TDS and EC are mg/L and microsiemens/centimeter, respectively)

Using the daily EC data, flow-weighted average daily values for TDS were calculated using the above equation. The plot of TDS on Plate 5 shows the daily average TDS concentration of the Santa Ana River flow passing Prado Dam. A summary of daily TDS and EC of the Santa Ana River below Prado Dam is contained in Appendix H.

At Prado Dam, the flow-weighted average annual TDS value of 392 mg/L represents the quality of the total flow including releases to San Antonio Creek, Exchange Water, Arlington Desalter, and San Jacinto Watershed discharge. The Stipulated Judgment requires that Base Flow shall be subject to adjustment based on the TDS of Base Flow and Storm Flow only. Hence, a determination of the TDS of Base Flow plus Storm Flow only, is detailed in the following paragraphs.

Adjustment for Exchange Water

The City of Riverside continued to pump groundwater which was discharged into the Riverside Canal for delivery to OCWD. The amount of water discharged to the Santa Ana River during the 1997-98 water year was 1,342 acre-feet after taking into account losses of 5%. Using monthly TDS grab samples collected from Riverside Canal at the Tava Lanes turnout and monthly flow values, a flow-weighted average TDS of 533 mg/L was calculated. A summary of Exchange Water quality is contained in Appendix D.

Adjustment for Flow to San Antonio Creek

During the 1997-98 water year, 3,018 acre-feet of water released from OC-59 was calculated to have reached Prado Dam. A flow-weighted average TDS of 209 mg/L was calculated for State Water Project water delivered from OC-59 to San Antonio Creek. As discussed in the Twelfth Annual Report, studies have indicated that leaching of salts from soils to the OC-59 water occurred as it flowed along Chino Creek to Prado Dam. Therefore, the TDS of the OC-59 water reaching Prado Dam was recalculated to be 247 mg/L, as described in Appendix E.

TABLE 5

**MUNICIPAL WASTEWATER EFFLUENT
DISCHARGED ABOVE PRADO
(acre-feet)**

Year	Redlands	Beaumont	Yucaipa	San Bernardino	Colton	Rialto	RIX ¹	Riverside	Corona	IEUA #1 ²	IEUA #2	CCWRF ³	WRCR ⁴	Total
1970-71	2,650	no record	--	17,860	2,520	2,270	--	18,620	3,190	--	--	--	--	47,110
1971-72	2,830	no record	--	16,020	2,230	2,400	--	19,010	3,230	6,740	--	--	--	52,460
1972-73	2,810	450	--	18,670	2,530	2,260	--	19,060	3,340	10,380	--	--	--	59,500
1973-74	2,770	600	--	17,680	2,530	2,320	--	19,560	3,510	11,440	2,320	--	--	62,730
1974-75	2,540	570	--	16,750	1,980	2,320	--	19,340	4,020	14,960	2,280	--	--	64,760
1975-76	2,450	620	--	17,250	2,540	2,240	--	19,580	4,700	15,450	2,950	--	--	67,780
1976-77	3,170	580	--	17,650	3,260	2,330	--	18,770	5,010	14,640	3,380	--	--	68,790
1977-78	3,280	620	--	18,590	3,810	2,380	--	20,310	5,200	14,650	4,060	--	--	72,900
1978-79	3,740	670	--	19,040	3,850	3,050	--	21,070	5,390	15,040	5,070	--	--	76,920
1979-80	4,190	690	--	20,360	4,190	2,990	--	22,910	5,360	14,410	5,520	--	--	80,620
1980-81	4,410	690	--	20,550	3,930	3,370	--	24,180	5,590	17,270	5,260	--	--	85,250
1981-82	4,420	700	--	23,340	3,780	3,470	--	25,640	5,410	19,580	5,360	--	--	91,700
1982-83	4,530	710	--	24,160	3,600	3,620	--	25,020	5,860	20,790	4,290	--	--	92,580
1983-84	5,150	800	--	22,080	3,700	3,830	--	26,090	6,200	20,950	3,950	--	--	92,750
1984-85	4,990	840	--	23,270	3,830	4,070	--	27,750	6,250	25,160	4,280	--	--	100,440
1985-86	5,200	820	--	24,720	4,010	4,720	--	28,820	5,900	28,240	2,660	--	--	105,090
1986-87	5,780	880	800	26,810	4,170	5,350	--	30,340	6,170	27,160	5,000	--	--	112,460

(continued on next page)

TABLE 5 (continued)

**MUNICIPAL WASTEWATER EFFLUENT
DISCHARGED ABOVE PRADO
(acre-feet)**

Year	Redlands	Beaumont	Yucaipa	San Bernardino	Colton	Rialto	RIX ¹	Riverside	Corona	IEUA #1 ²	IEUA #2	IEUA CCWRF ³	WRCR ⁴	Total
1987-88	6,060	940	1,850	27,880	5,240	6,040	--	34,660	6,050	31,290	5,500	--	--	125,510
1988-89	5,250	1,030	2,260	27,640	5,550	6,280	--	35,490	8,080	35,510	6,180	--	--	133,270
1989-90	6,360	1,100	2,370	28,350	5,810	6,260	--	33,210	9,140	34,760	5,730	--	--	133,090
1990-91	6,690	1,120	2,490	27,570	5,670	6,290	--	32,180	9,110	36,840	6,100	--	--	134,060
1991-92	6,230	1,150	2,580	25,060	5,660	6,360	--	32,660	9,010	40,360	5,780	1,550	--	136,400
1992-93	6,880	1,180	2,580	25,550	6,210	6,460	--	34,100	9,600	41,510	5,640	4,720	--	144,430
1993-94	6,440	1,150	2,710	23,800	5,830	6,540	--	32,640	7,790	37,310	5,430	7,010	--	136,650
1994-95	6,720	1,180	2,560	26,330	5,500	6,820	--	33,950	7,340	39,680	5,360	8,690	--	144,130
1995-96	6,550	1,260	2,640	13,240	2,770	6,890	20,760	33,960	7,850	39,590	4,810	9,060	--	149,380
1996-97	6,510	1,280	2,780	--	--	7,160	42,800	34,240	5,040	39,940	4,790	9,750	--	154,290
1997-98	7,022	1,356	3,116	--	--	7,063	49,683	35,422	8,718	44,940	4,969	9,264	1,461	173,014

¹RIX = Rapid Infiltration and Extraction Facility for San Bernadino and Colton, including over-extraction of groundwater

²Includes flows from IEUA Plant #4 beginning in 1997-98.

³CCWRF = Carbon Canyon Water Reclamation Facility

⁴WRCR = Western Riverside County Regional Wastewater Treatment Plant

The amounts shown in this table were determined from data provided by the agencies.

Adjustment for Arlington Desalter

The amount of product water discharged to the Santa Ana River during the 1997-98 water year totaled 1,957 acre-feet. Using daily EC, a 0.64 conversion factor, and daily flow values, a flow-weighted average TDS of 404 mg/L was calculated. A summary of these calculations is contained in Appendix F.

Adjustment for San Jacinto Watershed Discharges

During the 1997-98 water year, discharge from the San Jacinto Watershed determined to have reached Prado Dam totaled 1,690 acre-feet. Using EMWD monthly average TDS data and monthly discharge volumes, a flow-weighted average TDS of 645 mg/L was calculated. A summary of these calculations is contained in Appendix G.

Flow Component	Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (acre-feet x mg/L)
1. Measured Outflow	462,646	392	181,357,232
2. Less Exchange Water	1,342	533	715,286
3. Less Nontributary Flow			
San Antonio Creek	3,018	247	745,446
4. Less Arlington Desalter	1,957	404	790,628
5. Less San Jacinto Watershed	1,690	645	1,090,050
6. Measured Outflow less lines 2, 3, 4, and 5	454,639		178,015,822
Average TDS in total Base and Storm Flow			$178,015,822 \div 454,639 = 392 \text{ mg/L}$

After adjusting for Exchange Water, Nontributary Flow, Arlington Desalter discharges, and San Jacinto Watershed outflow, the weighted average annual TDS of Storm Flow and Base Flow for 1997-98 is 392 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 392 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:

$$(155,711 \text{ acre-feet}) + \frac{35}{42,000} (155,711 \text{ acre-feet}) (700 - 392) = 195,677 \text{ acre-feet}$$

Entitlement and Credit or Debit

Paragraph 5(c) of the Stipulated Judgment states that "CBMWD [now IEUA] and WMWD shall be responsible for an average annual Adjusted Base Flow of 42,000 acre-feet at Prado. CBMWD [IEUA] 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 no cumulative debit, or for any year prior to 1986 whenever the cumulative credit exceeds 30,000 acre-feet, said minimum shall be 34,000 acre-feet."

The Watermasters agreed that San Jacinto Watershed discharges were not envisioned during the formation of the Judgment. In the past when discharge from the San Jacinto Watershed has reached Prado Dam, the Watermaster has credited one-half of the amount of San Jacinto Watershed flow recharging the groundwater basin in Orange County against the Base Flow obligation at Prado Dam. All of the 1,690 acre-feet of

San Jacinto Watershed flow reaching Prado Dam this water year were determined to have passed the gage in the Santa Ana River at Ball Road, and were considered lost to the ocean. Therefore, no San Jacinto Watershed flow was calculated to have recharged the groundwater basin in Orange County in 1997-98. Consequently, none of the flow has been considered a credit against the Upper Area Base Flow obligation at Prado Dam.

The Watermaster's findings concerning flow at Prado for 1997-98 required under the Stipulated Judgment are as follows:

1. Measured Outflow at Prado	462,646 acre-feet
2. Base Flow at Prado	155,711 acre-feet
3. Annual Weighted TDS of Base and Storm Flow	392 mg/L
4. Annual Adjusted Base Flow	195,677 acre-feet
5. One-half San Jacinto Watershed Discharge Reaching Prado and Recharging Orange County Groundwater Basin	0 acre-feet
6. Cumulative Adjusted Base Flow	3,014,231 acre-feet
7. Cumulative Entitlement of OCWD	1,176,000 acre-feet
8. Cumulative Credit	1,838,231 acre-feet
9. One-Third of Cumulative Debit	0 acre-feet
10. Minimum Required Base Flow in 1998-99	34,000 acre-feet

CHAPTER III

BASE FLOW AT RIVERSIDE NARROWS

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

Flow at Riverside Narrows

The flow of the Santa Ana River at Riverside Narrows amounted to 214,375 acre-feet, measured at the USGS gaging station near the MWDSC Upper Feeder Crossing. Separated into its components, Base Flow was 65,013 acre-feet, Storm Flow was 150,228 acre-feet, and Nontributary Flow of 1,342 acre-feet was in the form of Exchange Water. Included in Base Flow are 2,208 acre-feet of wastewater from Rubidoux Community Services District which now by-passes the USGS gaging station. The Storm and Base Flow components of the flow of the Santa Ana River at Riverside Narrows for each month in the 1997-98 water year are listed in Table 6 and graphically shown on Plate 6. The components of flow of the Santa Ana River at Riverside Narrows during the period 1934-35 through 1997-98 are presented on Plate 7.

Release of Exchange Water

During 1997-98 water year, 1,342 acre-feet of Exchange Water were delivered to the Santa Ana River upstream of the Riverside Narrows. A more complete explanation of the release is described in Chapter II.

Base Flow

Based on the hydrograph shown on Plate 6 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.

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 1997-98, in the amount of 2,208 acre-feet, has been added to the stream flow as measured at the gaging station.

Water Quality

The determination of water quality at the Riverside Narrows Gaging Station was made using periodic grab samples taken and analyzed for TDS by the USGS and the City of Riverside. Water quality data based on samples taken during storm flow periods were not used in the calculations.

TABLE 6
 COMPONENTS OF FLOW AT RIVERSIDE NARROWS
 WATER YEAR 1997-98
 (acre-feet)

Month	USGS Measured Flow	-	Storm Flow	-	Exchange Water (1)	+	Rubidoux Waste- water	=	Base Flow
<u>1997</u>									
October	5,492		888		190		178		4,592
November	6,662		1,798		156		165		4,873
December	11,808		6,700		0		159		5,266
<u>1998</u>									
January	12,113		6,984		0		163		5,291
February	73,888		68,843		0		168		5,213
March	16,614		10,675		0		210		6,149
April	19,775		14,001		0		201		5,974
May	34,737		28,867		0		207		6,077
June	12,682		7,237		0		194		5,640
July	5,861		229		522		201		5,311
August	7,660		2,068		403		186		5,375
September	7,083		1,938		71		178		5,252
Total	214,375		150,228		1,342		2,208		65,013

(1) Exchange Water pumped from the San Bernardino, Colton, and Riverside ground-water basins and discharged into the Santa Ana River, less an estimated 5% loss.

The flow-weighted quality of wastewater from Rubidoux was 636 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 601 mg/L.

Flow Component	Annual Flow (acre-feet)	Average TDS (mg/L)	Annual Flow x Average TDS (acre-feet x mg/L)
1. Base Flow including Nontributary Flow	64,147	598	38,359,906
2. Less Nontributary Flow MWD Exchange Water	1,342	533	715,286
3. Plus Rubidoux Wastewater	2,208	636	1,404,288
4. Base Flow less line 2 plus line 3	65,013		39,048,908
Average TDS of Base Flow		$39,048,908 \div 65,013 = 601 \text{ mg/L}$	

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 subjected to adjustment based on weighted average annual TDS in the Base Flow as follows:

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

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 1997-98 was 601 mg/L. Therefore, no adjustment is necessary, and the Adjusted Base Flow for 1997-98 is 65,013 acre-feet.

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 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 concerning flow at Riverside Narrows for 1997-98 required under the Stipulated Judgment are as follows:

1. Base Flow at Riverside Narrows	65,013 acre-feet
2. Annual Weighted TDS of Base Flow	601 mg/L
3. Annual Adjusted Base Flow	65,013 acre-feet
4. Cumulative Adjusted Base Flow	1,101,816 acre-feet
5. Cumulative Entitlement of CBMWD and WMWD	427,000 acre-feet
6. Cumulative Credit	674,816 acre-feet
7. One-Third of Cumulative Debit	0 acre-feet
8. Minimum Required Base Flow in 1998-99	12,420 acre-feet

CHAPTER IV

HISTORY AND SUMMARY OF THE JUDGMENT

History of Litigation

The complaint in the case was filed by Orange County Water District on October 18, 1963, seeking an adjudication of water rights against substantially all water users in the area tributary to Prado Dam within the Santa Ana River Watershed, but excluding the area tributary to Lake Elsinore. Thirteen cross-complaints were filed in 1968, extending the adjudication to include substantially all water users in the area downstream from Prado Dam. With some 4,000 parties involved in the case (2,500 from the Upper Area and 1,500 from the Lower Area), it became obvious that every effort should be made to arrive at a settlement and physical solution in order to avoid enormous and unwieldy litigation.

Efforts to arrive at a settlement and physical solution were pursued by public officials, individuals, attorneys, and engineers. Attorneys for the parties organized in order to facilitate settlement discussions and, among other things, provided guidance for the formation and activities of an engineering committee to provide 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 undertake jointly the compilation of basic data. Liaison was established with the Department of Water Resources, State of California, to expedite the acquisition of data. Engineers representing the parties were divided into subcommittees 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 transfer of water between subareas.

In response to a request from the attorneys' committee at a meeting held April 17, 1964, 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. Special assignments were made to individual engineers on selected items requested by the attorneys' committee.

The attorneys and engineers for the defendants then commenced a series of meetings separate from the representatives of the plaintiffs in order to consolidate their positions and to determine a 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 Dam, the historical supply and disposal of water passing Prado Dam, segregation of flow into components, and determination of the amount of

supply which was usable by the downstream area. On December 11, 1964, the 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 for settlement. Commencing March 22 and ending April 13, 1966, four meetings were held by the engineers to discuss the draft of principles for settlement.

On February 25, 1968, the defendants submitted a request to the Court that the Order of Reference be issued requesting the California Department of Water Resources to determine the physical facts. On May 9, 1968, the plaintiffs' attorney submitted motions opposing the Order of Reference and requested that a preliminary injunction be issued. In the meantime, every effort was being made to come to an agreement on the 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 preliminary 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, along with Stipulations and Orders dismissing all defendants and cross-defendants except for the four major public water districts overlying, in aggregate, substantially all of the major areas of water use in the watershed. The districts, the locations of which are shown on Plate 1, "Santa Ana River Watershed", are as follows:

- (1) Orange County Water District (OCWD), representing all lower basin entities located within Orange County downstream of 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) Inland Empire Utilities Agency (IEUA), formerly Chino Basin Municipal Water District (CBMWD), located in the 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.

Summary of Judgment

Declaration of Rights. The Judgment sets forth a declaration of rights. Briefly stated, the Judgment provides that the water users in the Lower Area have rights, as against the water users in the Upper Area, to receive certain average and minimum annual amounts of non-storm flow ("base flow") at Prado Dam, together with the right to all storm flow reaching Prado Dam. The amount of the Lower Area entitlement is variable based on the quality of the water received by the Lower Area. Water users in the Upper Area have the right as against the water users in the Lower Area 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 under the Judgment and there is compliance with all of its provisions.

Physical Solution. The Judgment also sets forth a comprehensive "physical solution" for satisfying the rights of the Lower Area. To understand the physical solution it is necessary to understand the following terms that are used in the Judgment:

Storm Flow – That portion of the total flow which originates from precipitation and runoff and which passes a point of measurement (either Riverside Narrows or Prado Dam) without having first percolated to groundwater storage in the zone of saturation, calculated in accordance with procedures referred to in the Judgment.

Base Flow - That portion of the total surface flow passing a point of measurement (either Riverside Narrows or Prado Dam) which remains after deduction of storm flow, nontributary flows, exchange water purchased by OCWD, and certain other flows as determined by the Watermaster.

Adjusted Base Flow - Actual base flow in each year adjusted for water quality

pursuant to formulas specified in the Judgment. The adjustment of Base Flow for water quality is intended to provide an incentive to the Upper Area to maintain a better quality of water in the river. When the total dissolved solids (TDS) is lower than a specified value at one of the measuring points, the water quantity obligation is lower. When the TDS is higher than a specified value, the water quantity obligation is higher. This is the first comprehensive adjudication in Southern California in which the quality of water is taken into consideration in the quantification of water rights.

Credits and Debits - Under the accounting procedures provided for in the Judgment, credits accrue to SBVMWD in any year when the Adjusted Base Flow exceeds 15,250 acre-feet at Riverside Narrows and jointly to IEUA and WMWD when the Adjusted Base Flow exceeds 42,000 acre-feet at Prado Dam. Debits accrue in any year when the Adjusted Base Flows falls below those levels. Credits or debits accumulate year to year.

Obligation at Riverside Narrows. SBVMWD has an obligation to assure an average annual Adjusted Base Flow of 15,250 acre-feet at Riverside Narrows, subject to the following:

- (1) A minimum Adjusted Base Flow of 13,420 acre-feet plus one-third of any cumulative debit.
- (2) After October 1, 1986, if no cumulative debit exists, the minimum Adjusted Base Flow shall be 12,420 acre-feet.
- (3) Prior to 1986, if the cumulative credits exceed 10,000 acre-feet, the minimum Adjusted Base Flow shall be 12,420 acre-feet.
- (4) All cumulative debits shall be removed by the discharge of a sufficient Base Flow at Riverside Narrows 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 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.

Obligation at Prado Dam. IEUA and WMWD have a joint obligation to assure an average annual Adjusted Base Flow of 42,000 acre-feet at Prado Dam, subject to the following:

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

- (2) After October 1, 1986, if no cumulative debit exists, the minimum Adjusted Base Flow quantity shall be 34,000 acre-feet.
- (3) Prior to 1986, if the cumulative credit exceeds 30,000 acre-feet, the minimum Adjusted Base Flow shall be 34,000 acre-feet.
- (4) Sufficient quantities of Base Flow shall be provided at Prado to discharge completely any cumulative 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 debits, or until otherwise disposed of by IEUA 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.

Other Provisions. SBVMWD, IEUA and WMWD are enjoined from exporting water from the Lower Area to the Upper Area. OCWD is enjoined from exporting or "causing water to flow" from the Upper Area to the Lower Area. Any inter-basin acquisition of water rights will have no effect on Lower Area entitlements. OCWD is prohibited from enforcing two prior judgments so long as the Upper Area Districts are in compliance with the physical solution. The composition of the Watermaster and the nomination and appointment process for members are described along with a definition of the Watermaster's duties and a formula for sharing its costs. The court retains continuing jurisdiction over the case. There are provisions for appointment of successor parties and rules for dealing with future actions that might conflict with the physical solution.

History of Watermaster Committee Membership

The Santa Ana River Watermaster is a committee composed of five members nominated by the parties and appointed by the court. SBVMWD, IEUA (formerly CBMWD), and WMWD nominate one member each and OCWD nominates two. The Watermaster members annually elect two officers: chairman and secretary.

The original five members were appointed at the time of entry of the judgment. They prepared a *pro forma* annual report for the 1969-70 water year. The first annual report required by the judgment was prepared for the 1970-71 water year and reports have been prepared annually since then.

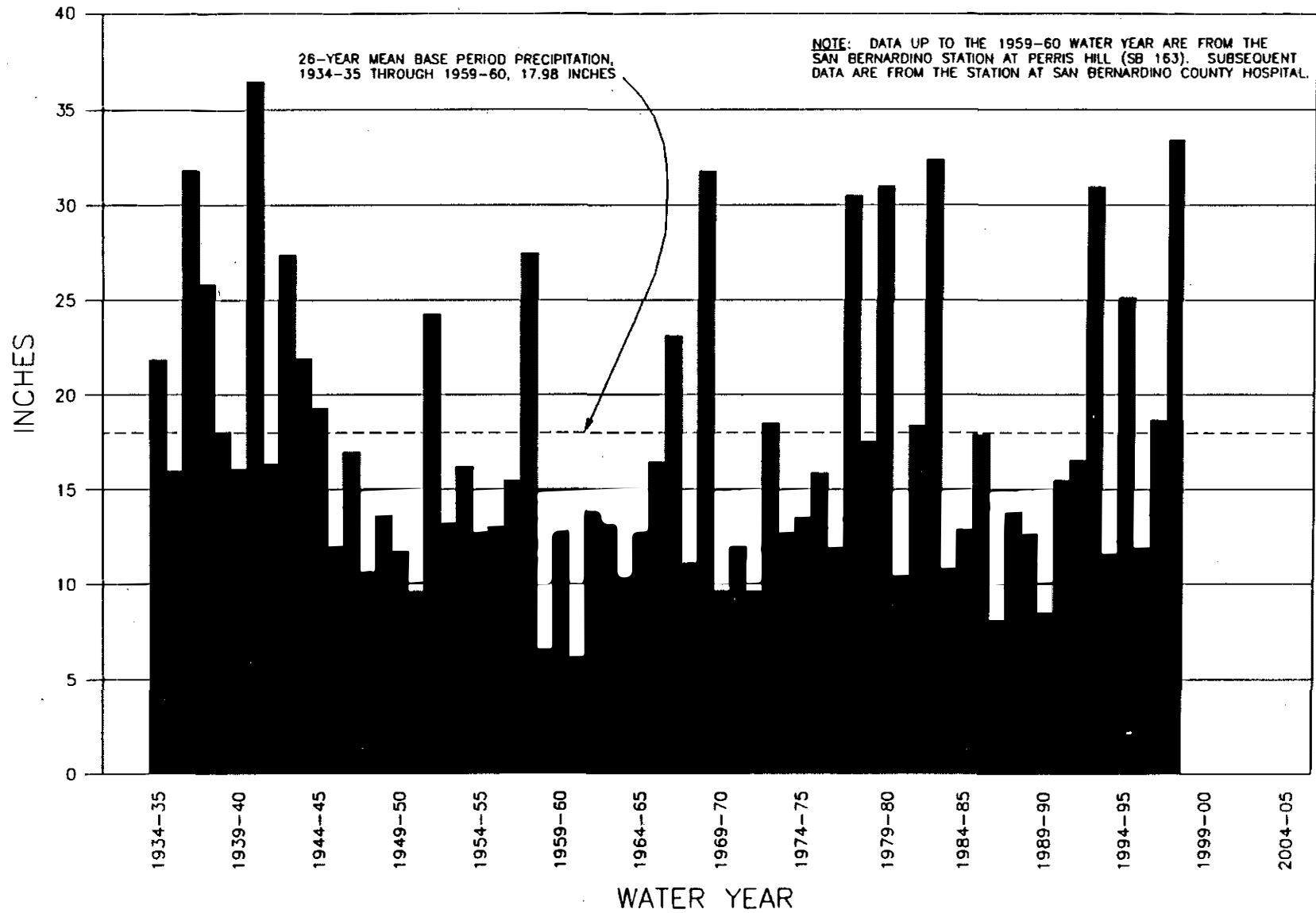
The membership of the Watermaster has changed over the years. The historical listing of members and officers shown in Table 7 reflects the signatories to each annual report prior to this year.

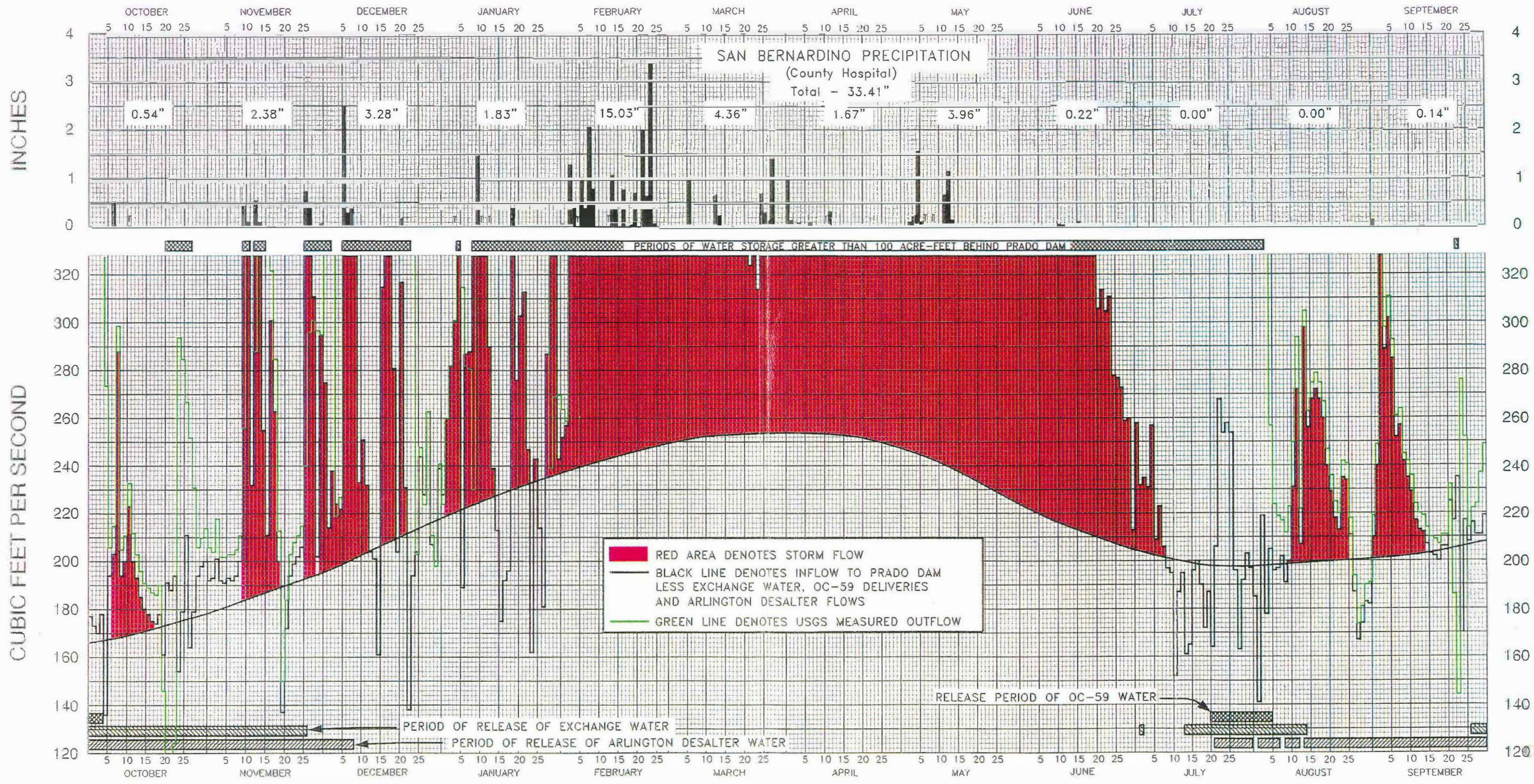
TABLE 7

HISTORY OF WATERMASTER COMMITTEE MEMBERSHIP

Water Year	SBVMWD	IEUA	WMWD	OCWD	OCWD
1969-70	Clinton O. Henning	William J. Carroll	Albert A. Webb, Secretary	Max Bookman, Chairman	John M. Toups
1970-71 through 1973-74	James C. Hanson	William J. Carroll	Albert A. Webb, Secretary	Max Bookman, Chairman	John M. Toups
1974-75 through 1977-78	James C. Hanson	William J. Carroll	Donald L. Harriger	Max Bookman, Chairman	John M. Toups, Secretary
1978-79 through 1981-82	James C. Hanson	William J. Carroll	Donald L. Harriger	Max Bookman, Chairman	William R. Mills, Jr., Secretary
1982-83 through 1983-84	James C. Hanson	William J. Carroll	Donald L. Harriger	Harvey O. Banks, Chairman	William R. Mills, Jr., Secretary
1984-85 through 1988-89	Robert L. Reiter	William J. Carroll	Donald L. Harriger	Harvey O. Banks, Chairman	William R. Mills, Jr., Secretary
1989-90 through 1994-95	Robert L. Reiter, Secretary	William J. Carroll	Donald L. Harriger	Harvey O. Banks, Chairman	William R. Mills, Jr.
1995-96	Robert L. Reiter, Secretary	William J. Carroll, Chairman	Donald L. Harriger	Bill B. Dendy	William R. Mills, Jr.
1996-97	Robert L. Reiter, Secretary	William J. Carroll	Donald L. Harriger	Bill B. Dendy	William R. Mills, Jr., Chairman

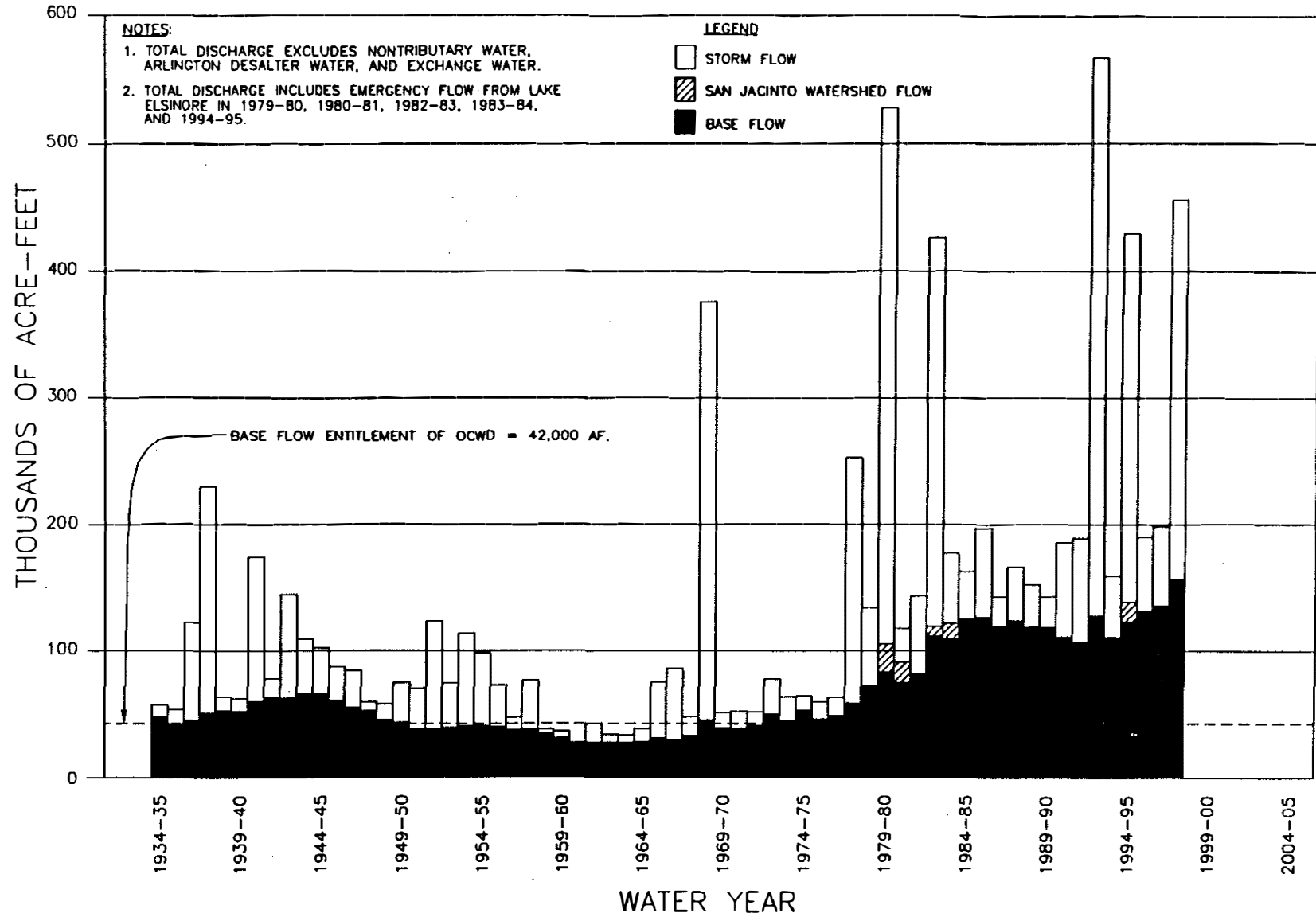
PRECIPITATION AT SAN BERNARDINO SINCE 1934-35

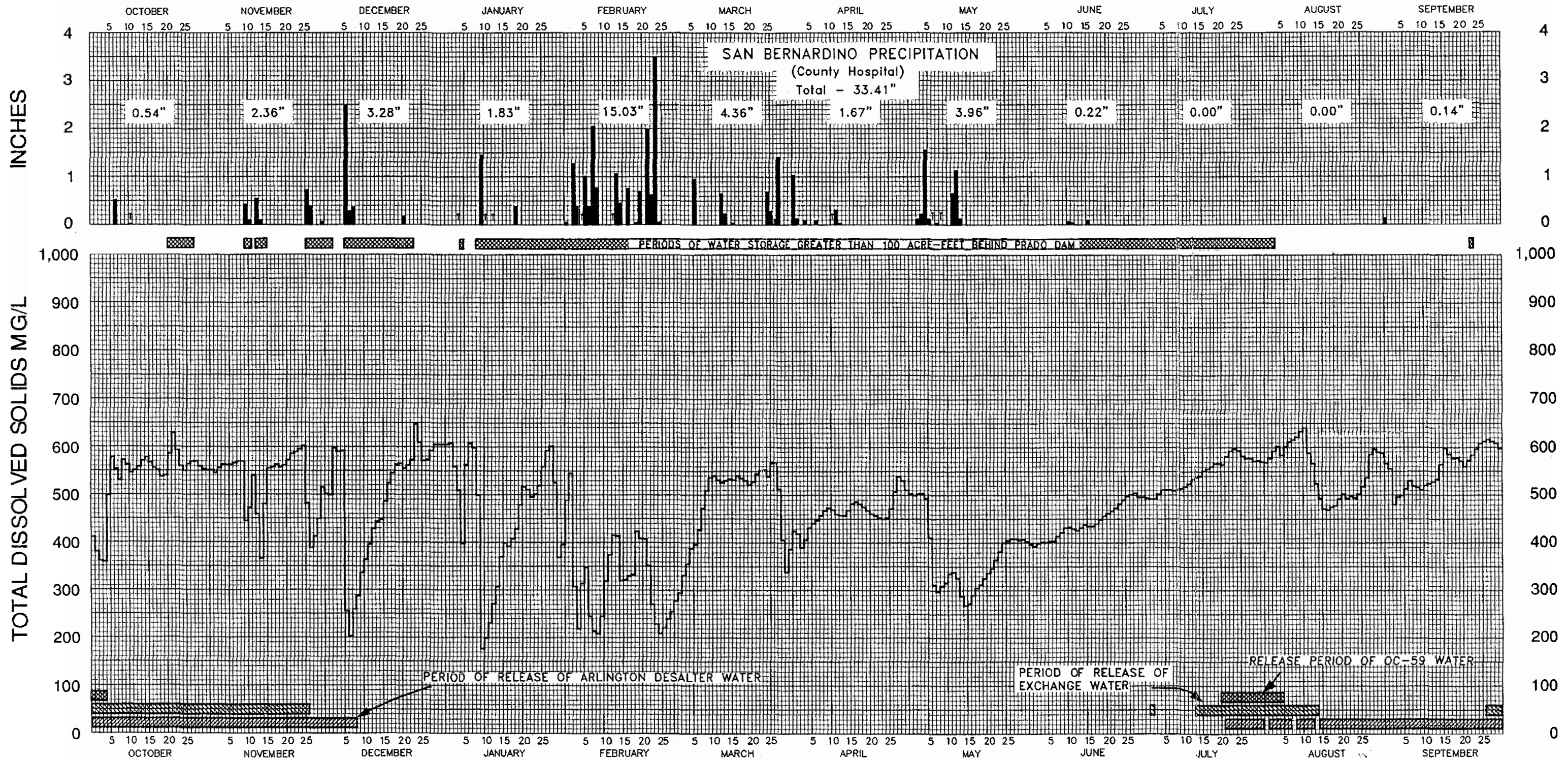




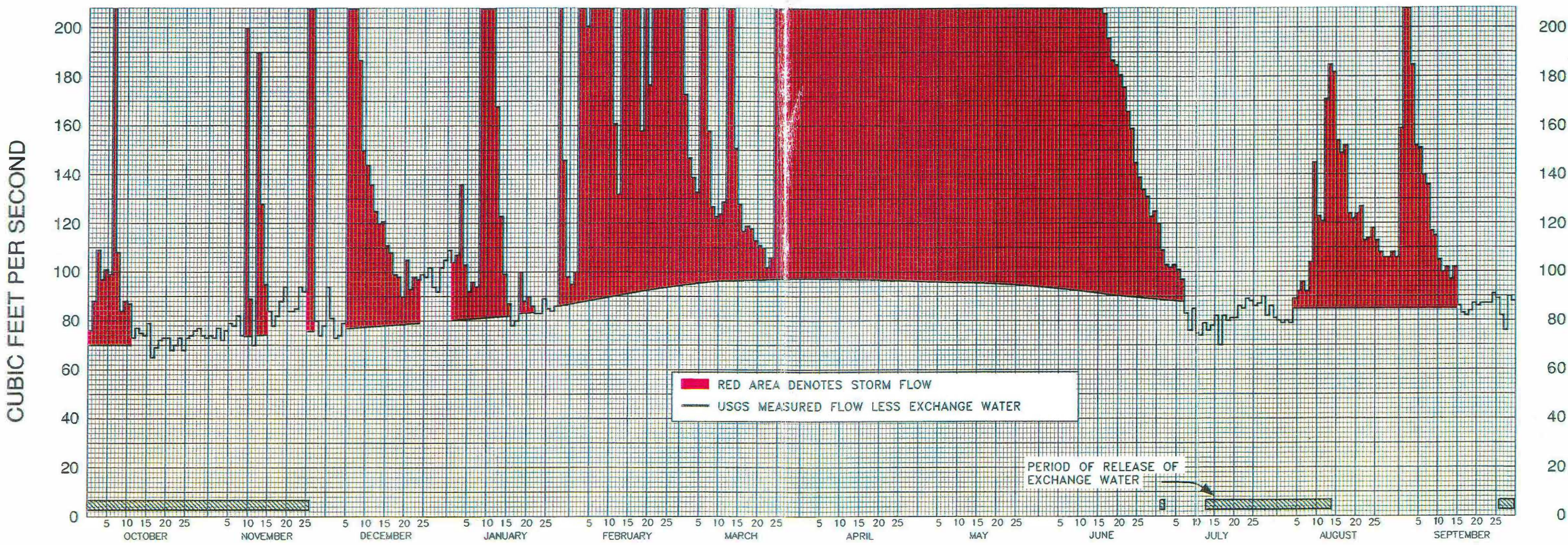
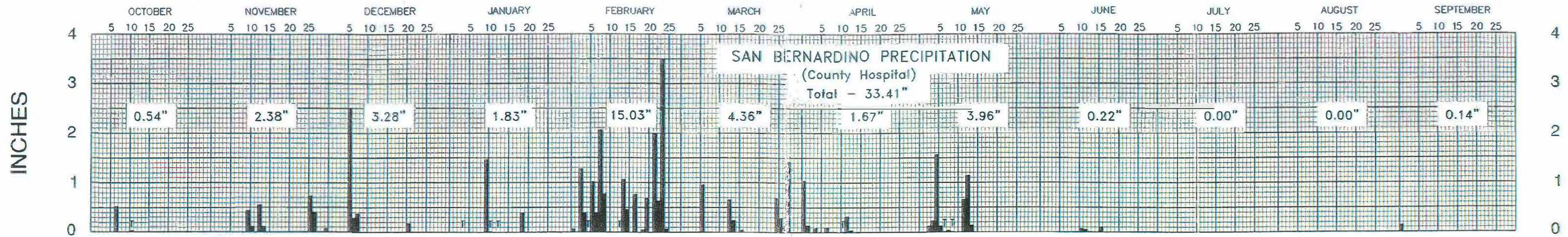
DISCHARGE OF SANTA ANA RIVER AT PRADO DAM & SAN BERNARDINO PRECIPITATION
WATER YEAR 1997-98

DISCHARGE OF SANTA ANA RIVER AT PRADO SINCE 1934-35





DISSOLVED SOLIDS IN SANTA ANA RIVER BELOW PRADO DAM
WATER YEAR 1997-98



DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS & SAN BERNARDINO PRECIPITATION
WATER YEAR 1997-98

DISCHARGE OF SANTA ANA RIVER AT RIVERSIDE NARROWS SINCE 1934-35

