WATER SUPPLY IMPACTS
Rebuttal Testimony of Ali Shahroody

1. CALCULATION OF RELEASE REQUIREMENTS FOR CALTROUT'S "3A2" AND "3A2 ADJUSTED FOR DRY YEARS"

The Cachuma Contract Renewal EIR/EIS (1995) states that Alternative 3A2 involves operations of Lake Cachuma to provide the following flows in the downstream areas:

- 48 cfs February 15 to April 14, then
- 20 cfs to June 1, then
- 25 cfs for one week, then
- ramp releases to 10 cfs by June 30, then
- hold at 10 cfs to October 1, then
- 5 cfs for the rest of the year (until February 14).

The above flows are to be maintained at both San Lucas and Alisal Bridges under Alternative 3A2. CalTrout recommends Alternative 3A2 with a modification for dry years. The adjustment for dry years described in the written testimony of Mr. Jim Edmonston (Exhibit CT90, Appendix 1) as reducing the passage flows of 20-48 cfs to 5 cfs in the "dry years" which are defined as occurring 20% of the time. Figure 1-1 and Figure 1-2 show the flow requirements for "3A2" and "3A2" in dry years, respectively. In the written testimony of Mr. Edmonston, they are referred to as "3A2 Normal" and "3A2 Dry", respectively.

The average annual amounts of Project water needed to meet the "3A2 Normal" and "3A2 Dry" are estimated by CalTrout to be 7,878 and 3,766 acre-feet per year, respectively (Exhibit CT90). These estimates contain several errors and they are discussed below:

1. Conversions from cfs to acre-feet underestimate the required volume of water by using a factor of 1.9 instead of 1.9835. In addition, corrections were made for number of days for flow intervals and ramping for June.

2. CalTrout overestimates the percent of years with water rights releases. The calculation is based on the occurrence of water rights releases in 92% of years, which includes releases made under WR73-37 from 1974 through 1988 and releases made under WR89-18 from 1989 through 2000. The current releases are made under WR89-18. In using the WR89-18 release period for calendar years 1989 through 2002, the water rights releases occurred in 64% of years instead of 92% used in the CalTrout calculations.

3. Similarly, the occurrence of spill years in 37% of years (1953-2001) is overstated in the CalTrout calculation. After correcting for years 1959 and 1974 with negligible amount of spills and six days of spill in 1984, the occurrence of spills would be reduced to 30% of years (1953-2002).

4. CalTrout erroneously assumed the releases at Bradbury Dam to be the same as the flow requirements at San Lucas and Alisal Bridges. It did not account for net losses between Bradbury Dam and Alisal Bridge.

Table 1-1 shows the corrected amounts for "3A2 Normal" and "3A2 Dry" using the CalTrout methodology to be 9,324 and 4,578 acre-feet per year, respectively.

Table 1-1
Evaluation of CalTrout Estimate of Cachuma Project Water Needed for Fish Flows under 3A2 with Dry Year Adjustment

	Column A 3A2 Normal AF	Column B 3A2 Dry AF
CalTrout Estimate of Average Annual Project Water Released for Fish	7,878	3,766
Correction for Conversions, Number of Days, and Ramping	709	468
Correction for Occurrence of Downstream Water Rights	344	344
Correction for Occurrence of Spills	393	0
Corrected Estimate of Average Annual Project Water Released for Fish	9,324	4,578

Column A X 8	74,588
Column B X 2	9,156
10 Year Avg. AF	8,374

CalTrout 10 year average	**7,056**
Corrected 10 year average	**8,374**
Corrected average to include net losses between Bradbury Dam and Alisal Bridge	**9,445**

The above table indicates that CalTrout underestimated the average annual Project water releases for fish by about 33%. This methodology for estimating flow requirements from the Project supply using a 10-year average is useful in its simplistic approach to obtain a rough estimate. However, the use of average annual numbers is also very misleading because the actual annual releases would vary based on rainfall and riparian losses between Bradbury Dam and Alisal Bridge. The effects of an "average" release also do not mean much when assessing impacts in drought periods. The Santa Ynez River Hydrology Model is currently the best method to assess the impacts to Cachuma Project water supply. Results of preliminary model runs for "3A2" and "3A2 adjusted for dry years" are described below.

2. HYDROLOGIC ANALYSES OF "3A2" ALTERNATIVES

Two alternatives were analyzed for the purpose of determining the impacts on Cachuma Project water supply. They consist of the following alternatives:

- 3A2 from Contract Renewal
- 3A2 adjusted for dry years

The dry year adjustment for flow requirements was made for 20% of years representing low storage conditions in Cachuma Reservoir. The Santa Ynez River Hydrology Model (SYRHM) was used to analyze the hydrologic impacts of the releases for downstream flow requirements on Project water supply. Key results are summarized in the following sections of this testimony.

IMPACTS ON PROJECT WATER SUPPLY

The results of analyses from the Santa Ynez River Hydrology Model indicate that the proposed "3A2" and "3A2 adjusted for dry years" would produce substantially greater shortages in water supply during droughts in comparison with the State Board EIR alternatives. Table 2-1 indicates that the shortages in critical drought year (1951) would be 96% and 84% for "3A2" and "3A2 adjusted for dry years", respectively. Similarly, shortages to water supply during the worst three years of the drought period (1949-1951) would be 80% and 67% for "3A2" and "3A2 adjusted for dry years", respectively.

TABLE 2-1 IMPACTS OF FISH RELEASES ON PROJECT WATER SUPPLY IN CRITICAL DROUGHT PERIOD, 1949 THROUGH 1951 (ACRE-FEET)

EIR Alternative	Shortage in Critical Drought Year (1951)	Shortage as Percentage of Annual Draft	Cumulative Shortage in Critical Drought Period (1949-1951)	Shortage as Percentage of Annual Draft for Three Years
1	7,070	27	14,210	18%
2	9,810	38	20,130	26%
3A	11,810	46	24,850	32%
3B	11,260	44	23,270	30%
3C	9,890	38	19,920	26%
4A&B	9,350	36	17,470	23%
3A2	24,740	96	61,810	80%
3A2 adjusted for dry years	21,700	84	51,570	67%

Note: Annual draft from Cachuma Project is 25,714 acre-feet.

The impacts of "3A2" and "3A2 adjusted for dry years" on Project water supply are not limited to the critical drought period (1949-1951). The shortages would occur in other drought periods. For the purpose of comparison, Project shortages are shown in Figures 2-1, 2-2, and 2-3 for EIR 3C, "3A2", and "3A2 adjusted for dry years", respectively, for the hydrologic period 1918-1993. Figures 2-2 and 2-3 show that reservoir operations under "3A2" and "3A2 adjusted for dry years" would not only produce severe shortages during the critical drought period (1949-1951) but increases the frequency and magnitude of shortages in other drought periods as well.

As demonstrated in Table 2-1 and Figures 2-2 and 2-3, reservoir operations under "3A2" and "3A2 adjusted for dry years" would produce such large shortages that the Project water users would most likely reduce their annual draft of 25,714 acre-feet per year to a more reliable yield for each year. Additional analysis was performed with a reduced Cachuma annual draft. The analysis was based upon reducing the Cachuma annual draft so that the maximum allowable shortage would be limited to 20 percent in any single year and maintaining a minimum pool of 12,000 acre-feet. This analysis indicates that

the annual draft from Cachuma Project would be reduced from 25,714 to 13,000 acre-feet per year for "3A2" and to 16,400 acre-feet per year for "3A2 adjusted for dry years". Figures 2-4 and 2-5 show the annual yields and shortages when reducing the annual draft every year.

IMPACTS ON STATE WATER PROJECT DELIVERIES

State Water Project deliveries to South Coast contractors would be reduced for reservoir operations under "3A2" and "3A2 adjusted for dry years". This is because the high rates of releases for fish would require releases through the outlet works at Bradbury Dam in addition to releases made through the Hilton Creek watering facility. This would conflict with the operation of outlet works for delivery of State Water Project (SWP) water due to restrictions of releasing SWP water into the river. Table 2-2 shows the impacts to SWP imports to the South Coast. The total amounts of imported water shown include the ID No. 1 exchange with the South Coast Member Units. The total amount of SWP water to the South Coast would be reduced from about 10,200 to 7,944 and 8,372 acre-feet per year for "3A2" and "3A2 adjusted for dry years", respectively. These additional shortages in SWP deliveries would further exacerbate the extremely high shortages of Cachuma Project supply under 3A2 scenarios.

TABLE 2-2 SUMMARY OF STATE WATER PROJECT DELIVERIES AVERAGE FOR PERIOD 1942-1993 (ACRE-FEET/YEAR)

Alternative	Total Imports under South Coast Contracts	Shortage as Percentage of 13,750 AF
1	0	0%
2	10,135	74%
3A	10,152	74%
3B	10,167	74%
3C	10,199	74%
4A&B	10,369	75%
3A2	7,944	58%
3A2 adjusted for dry years	8,372	61%

ADDITIONAL HYDROLOGIC IMPACTS

- Lake Storage Levels
- Water rights releases
- Water Quality at Lompoc

Figures 2-6A – B show the intra-annual variations in reservoir storage for "3A2" and "3A2 adjusted for dry years" in comparison with EIR Alternative 3C. The incidental recreational benefits of Lake Cachuma would be impacted due to larger drawdowns from reservoir.

Table 2-3 shows the impacts to water rights releases for the various alternatives as determined by the Santa Ynez River Hydrology Model. The average annual reductions in water right releases under Alternatives 3A, 3B, 3C, and 4A-B compared to Alternative1 would be about 10 percent; however for "3A2" and "3A2 adjusted for dry years" reductions would be about 27 to 30 percent.

TABLE 2-3 SIMULATED IMPACTS TO WATER RIGHT RELEASES FOR WATER YEARS 1918-1993 (ACRE-FEET/YEAR)

	Alt 1	Alt 2	Alt 3A	Alt 3B	Alt 3C	Alt 4 A&B	3A2	3A2 adjusted for dry years
WR89-18 Releases	6,322	6,023	5,658	5,682	5,737	5,711	4,439	4,621
Difference in WR89-18 Releases	---	-299	-660	-640	-590	-611	-1,883	-1,701
Percent Reduction in WR89-18 Releases	---	4.7%	10.4%	10.1%	9.3%	9.7%	29.7%	26.9%

That means, on average, there would be about 27 to 30 percent less water available for releases to downstream water users under "3A2" and "3A2 adjusted for dry years" scenarios. To the extent water rights releases are managed to meet the needs of downstream users, this reduction may negatively impact some of the users in the lower

Santa Ynez River basin in drought periods, including reducing flexibility to convey BNA credits to the Lompoc Plain.

Additionally, reservoir operations under "3A2" and "3A2 adjusted for dry years" would negate the efforts of the Settlement Agreement regarding the improvement of water quality for the Lompoc Plain. Figures 2-7A-B show the simulated monthly mean flow-weighted total dissolved solids (TDS) of the surface water at the Lompoc Narrows for "3A2" and "3A2 adjusted for dry years" in comparison with EIR Alternative 3C. Due to overall reductions in SWP deliveries to Cachuma Reservoir and an increase in low flow-high salinity fluxes at the Narrows, the potential for further degradation of the water quality in the Lompoc Plain is likely under the 3A2 scenarios.

Cachuma Contract Renewal Alternative 3A2
Flow Requirements at Highway 154 and Alisal Bridges

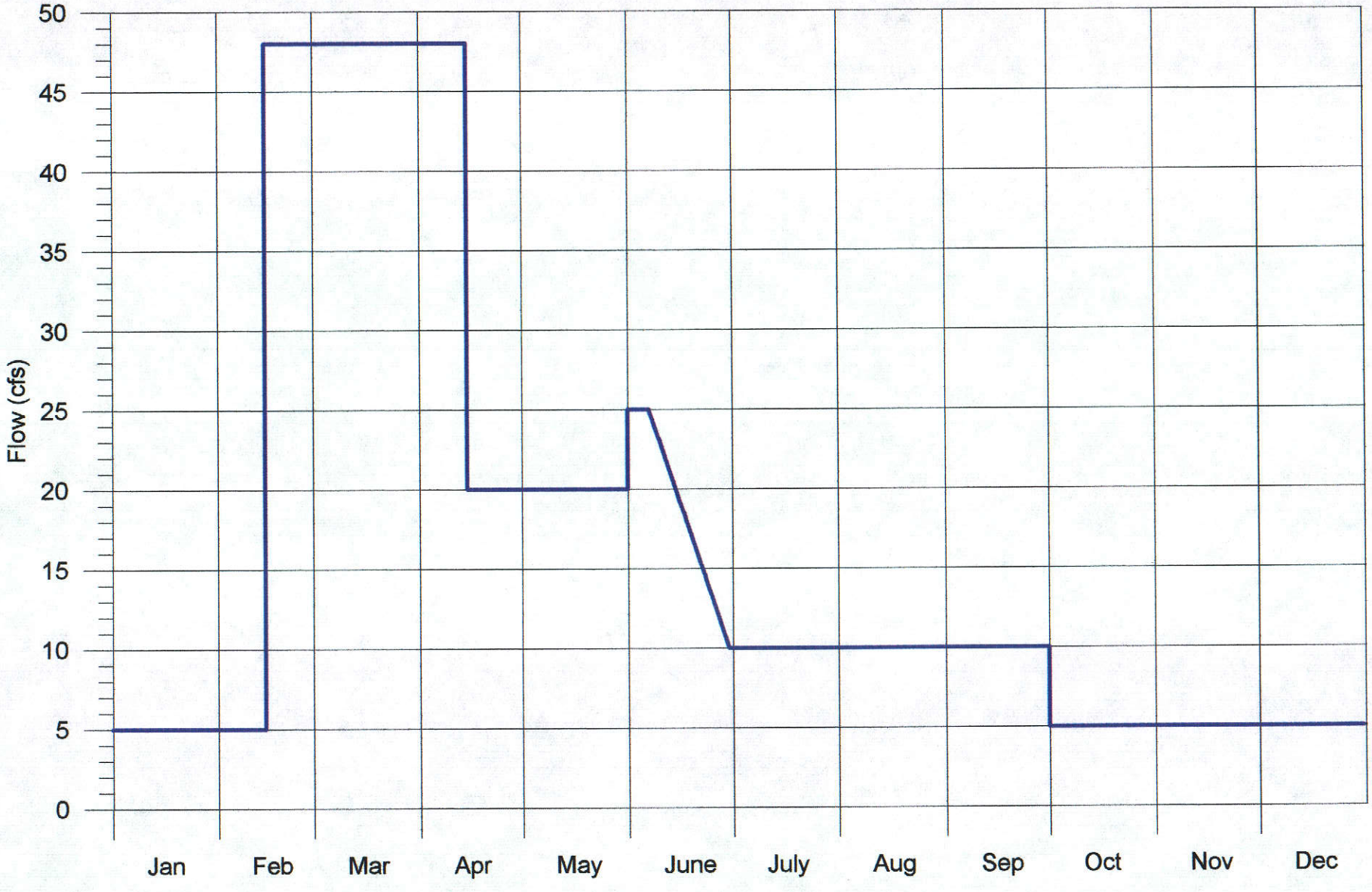


FIGURE 1-1

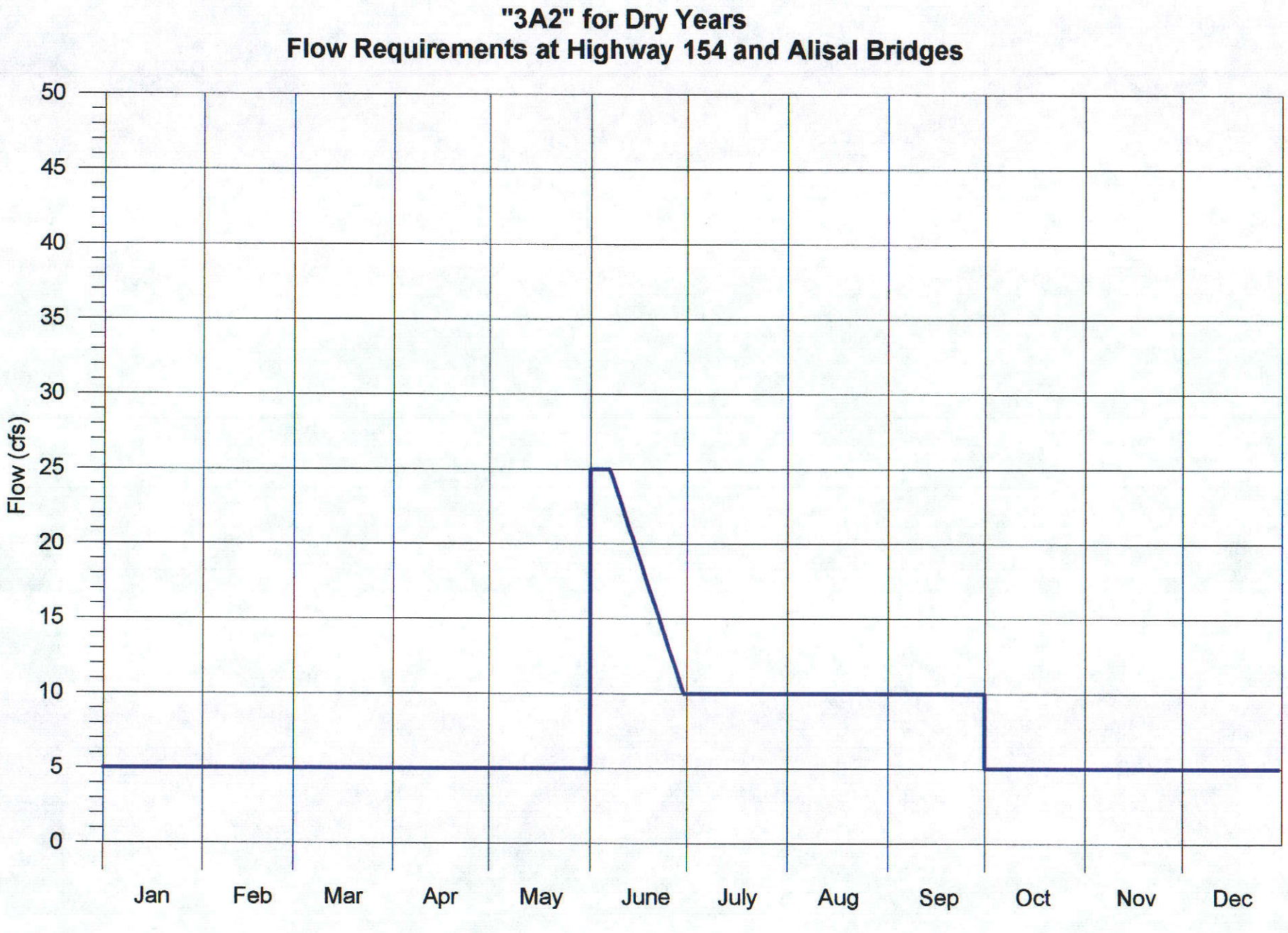

"3A2" for Dry Years
Flow Requirements at Highway 154 and Alisal Bridges
Flow (cfs)
50
45
40
35
30
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec

FIGURE 1-2

Cachuma Project Water Supply
Under EIR Alternative 3C

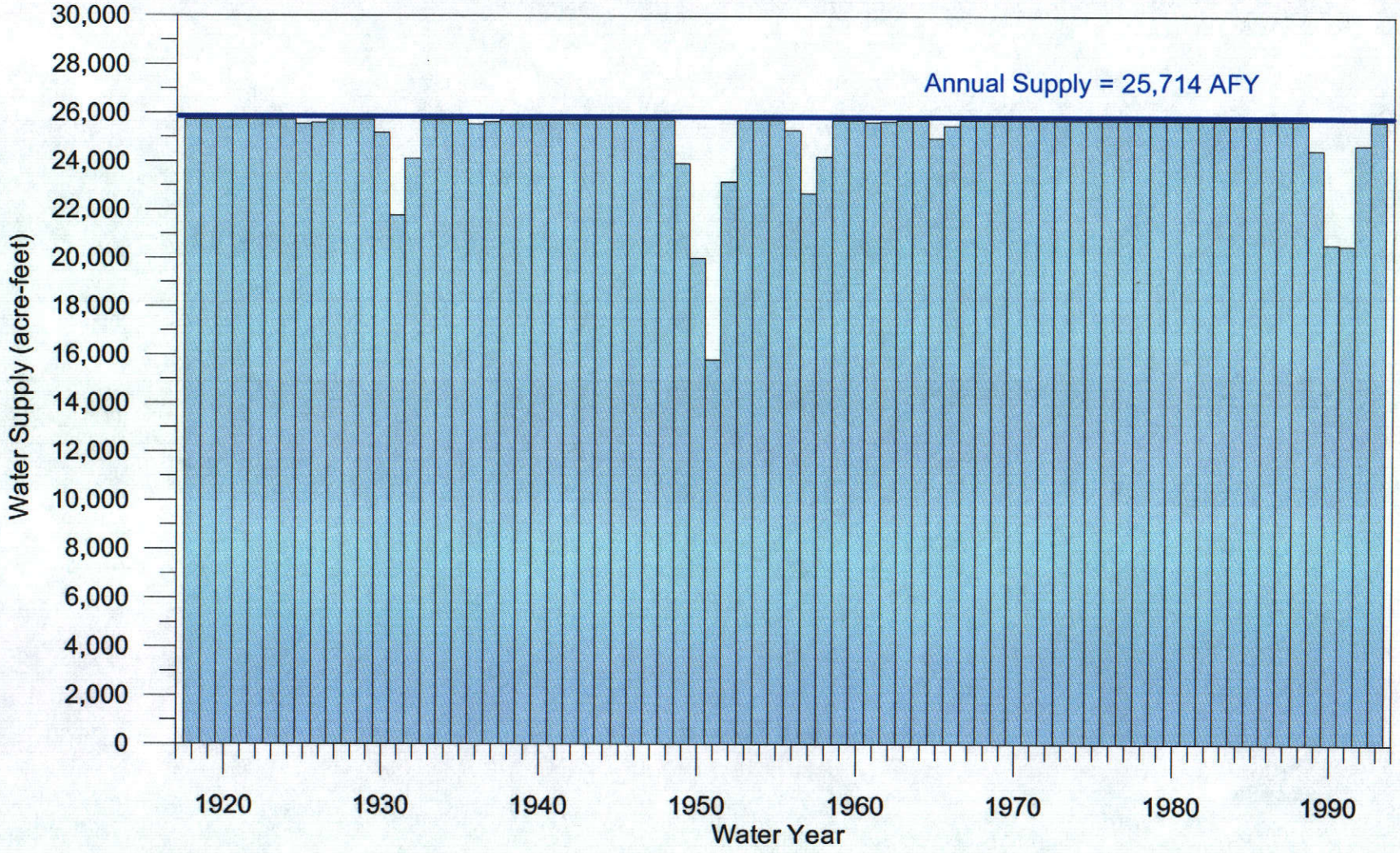


FIGURE 2-1

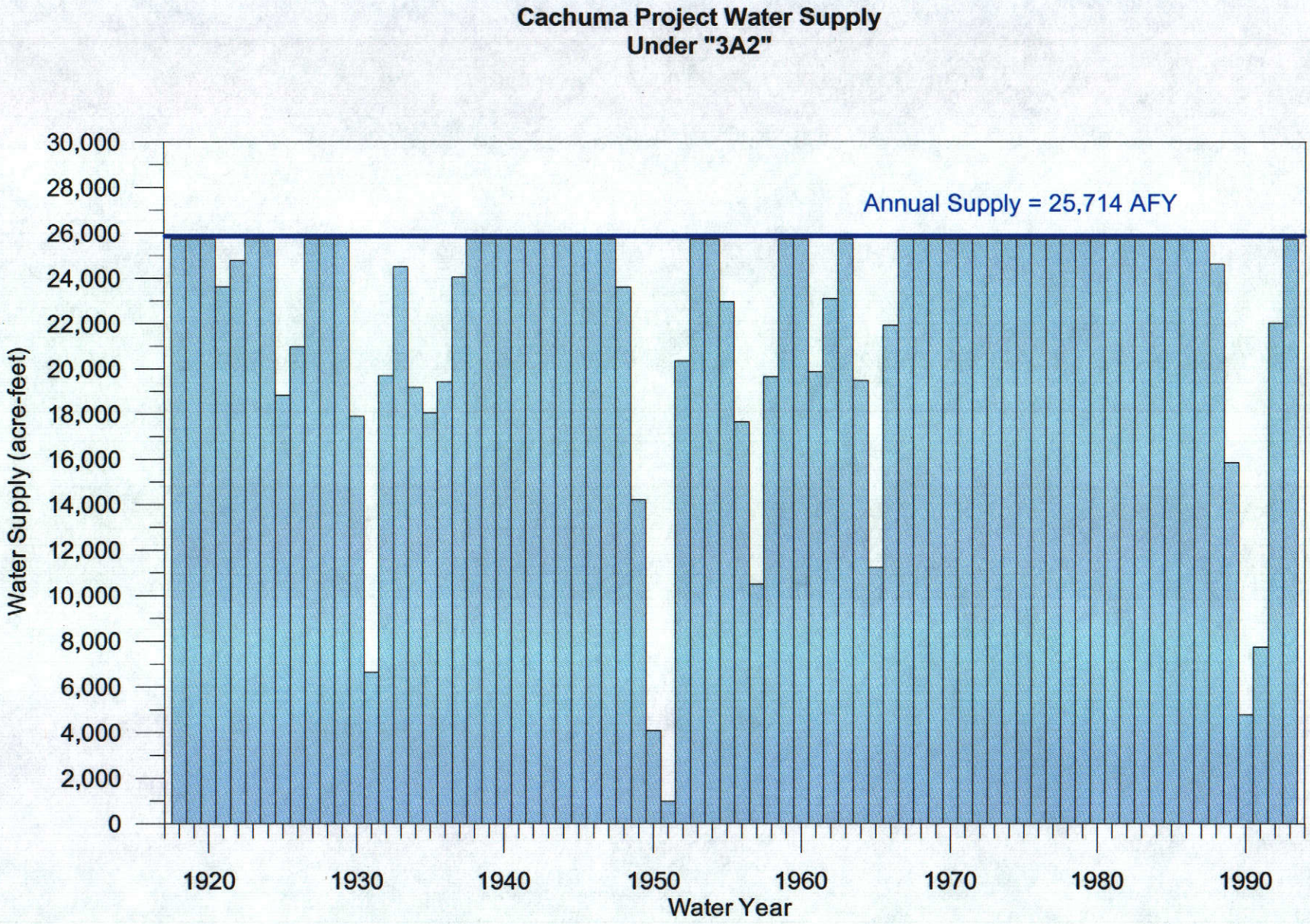

Cachuma Project Water Supply
Under "3A2"
Annual Supply = 25,714 AFY
Water Supply (acre-feet)
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1920
1930
1940
1950
1960
1970
1980
1990
Water Year

FIGURE 2-2

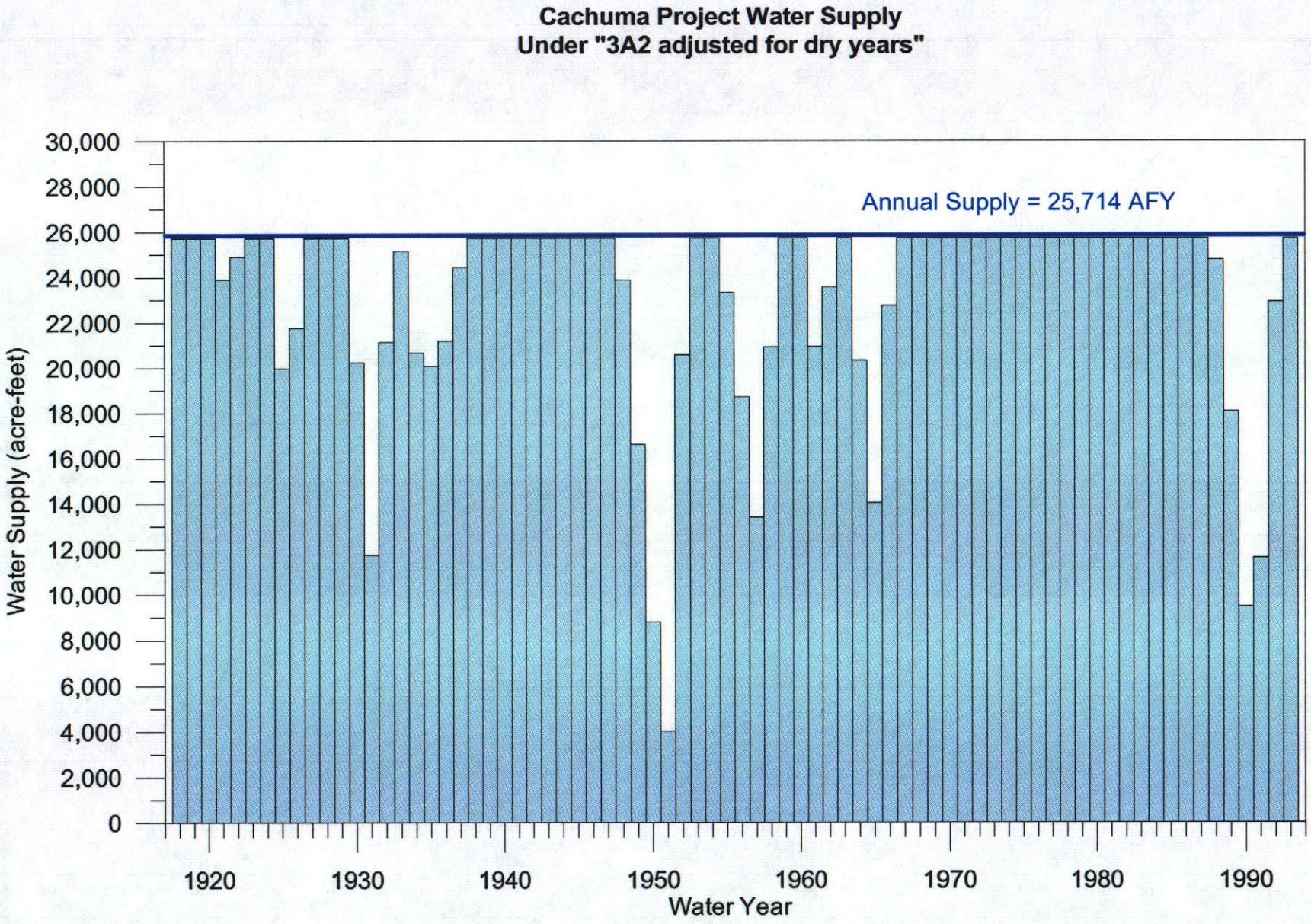

Cachuma Project Water Supply
Under "3A2 adjusted for dry years"
Annual Supply = 25,714 AFY
Water Supply (acre-feet)
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1920
1930
1940
1950
1960
1970
1980
1990
Water Year

FIGURE 2-3

Cachuma Project Water Supply
Under "3A2" with Reduced Cachuma Annual Draft

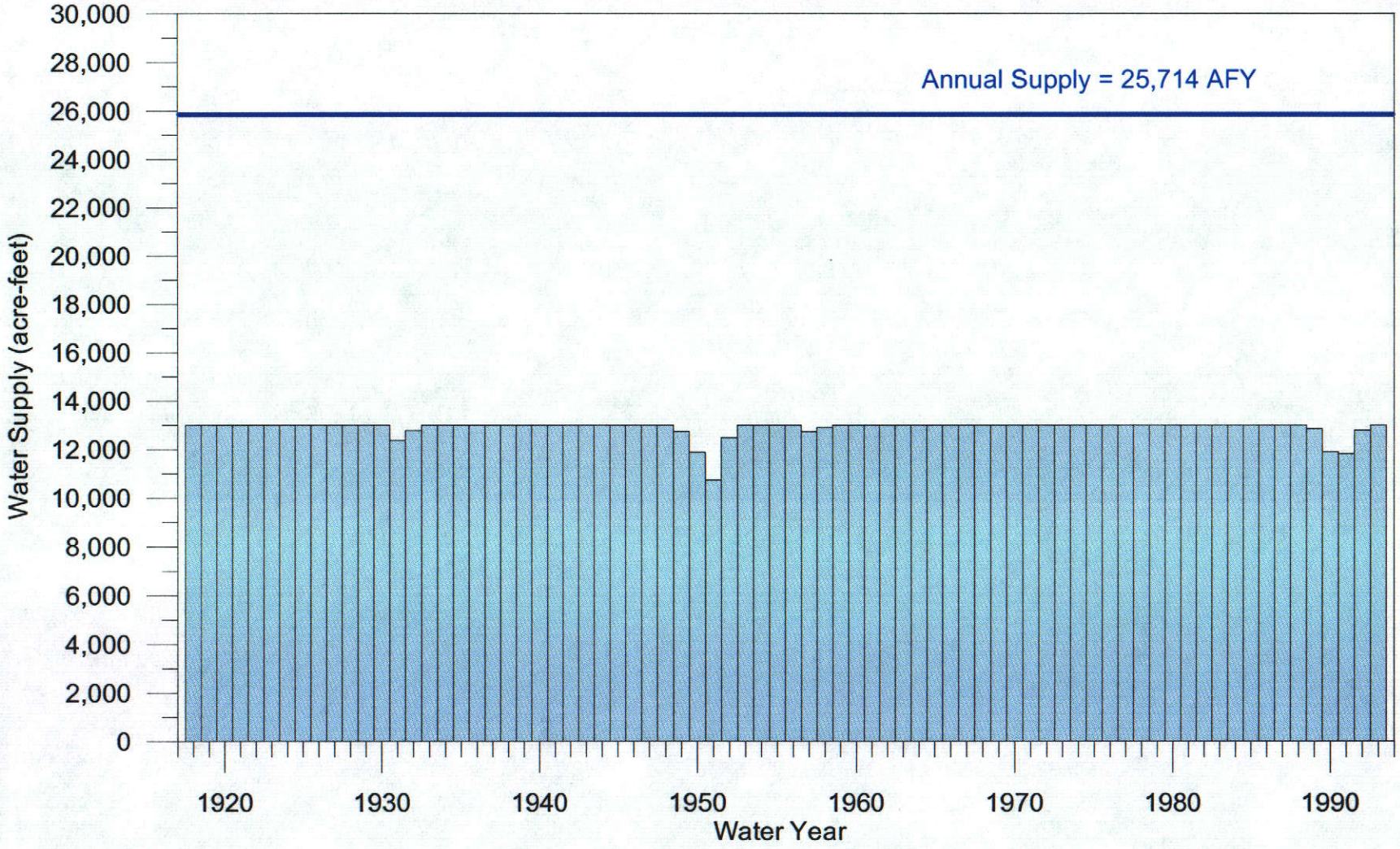


FIGURE 2-4

Cachuma Project Water Supply
Under "3A2 adjusted for dry years" and Reduced Cachuma Annual Draft

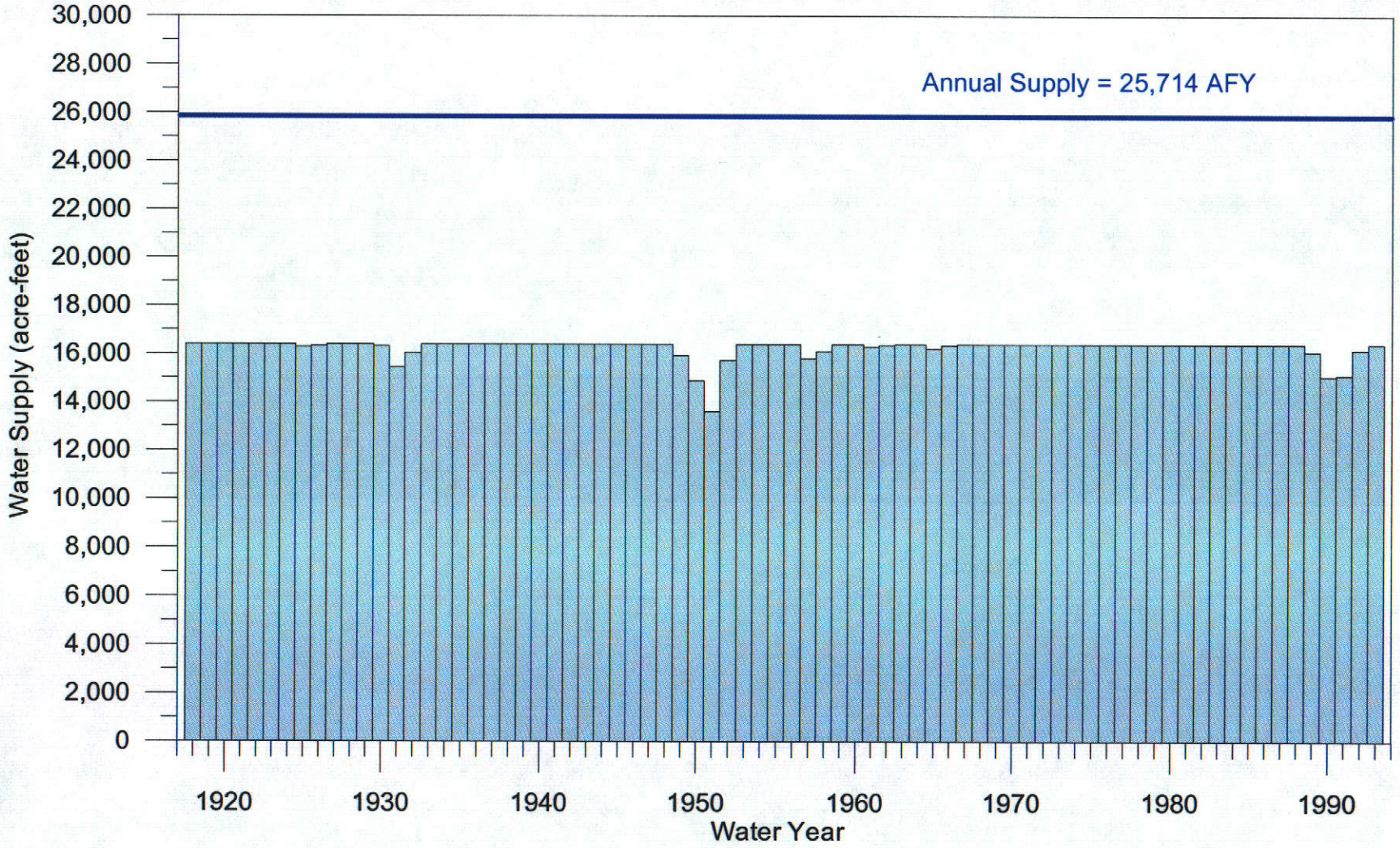
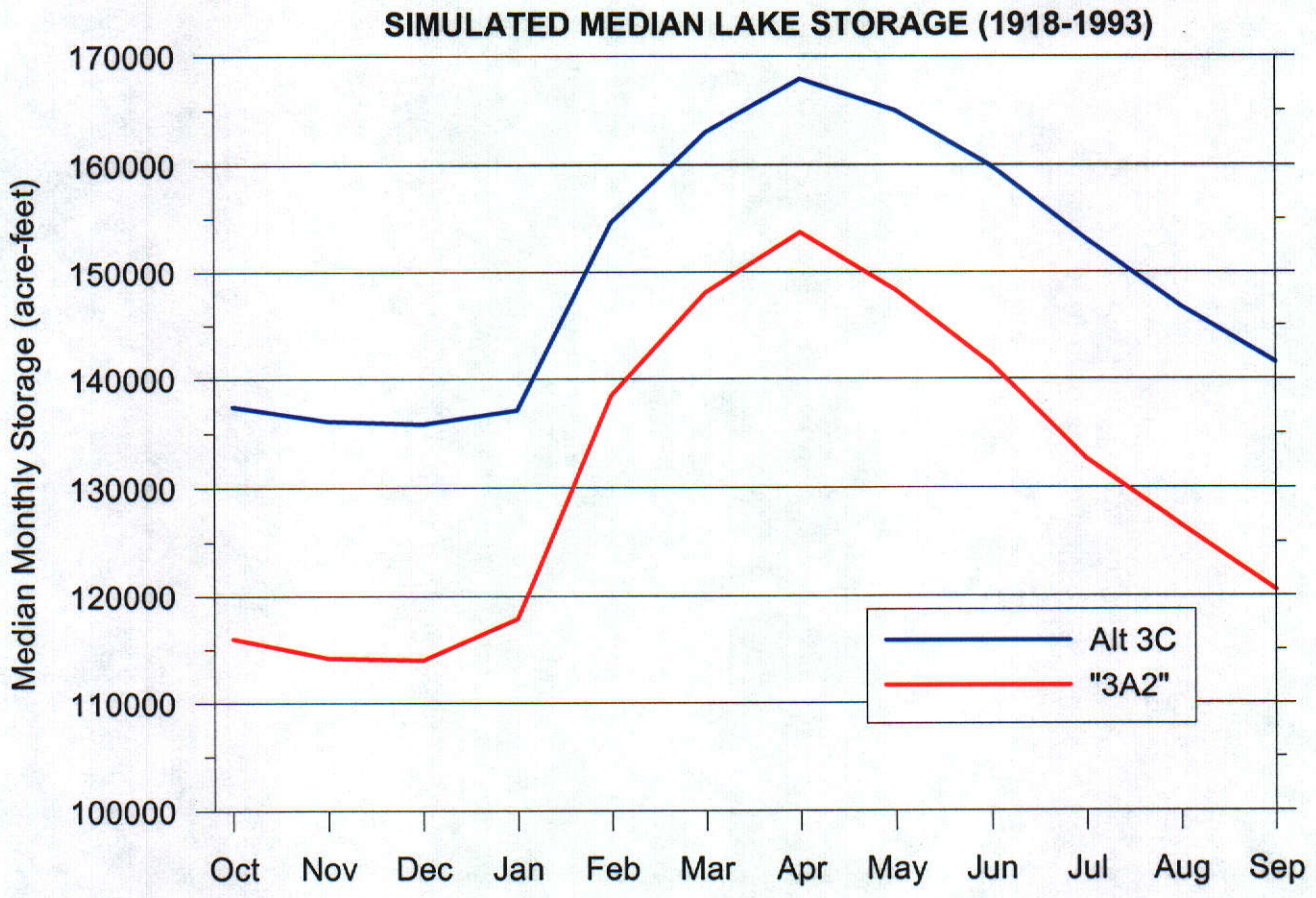


FIGURE 2-5

FIGURE 2-6 A-B


SIMULATED MEDIAN LAKE STORAGE (1918-1993)
Median Monthly Storage (acre-feet)
170000
160000
150000
140000
130000
120000
110000
100000
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Alt 3C
"3A2"

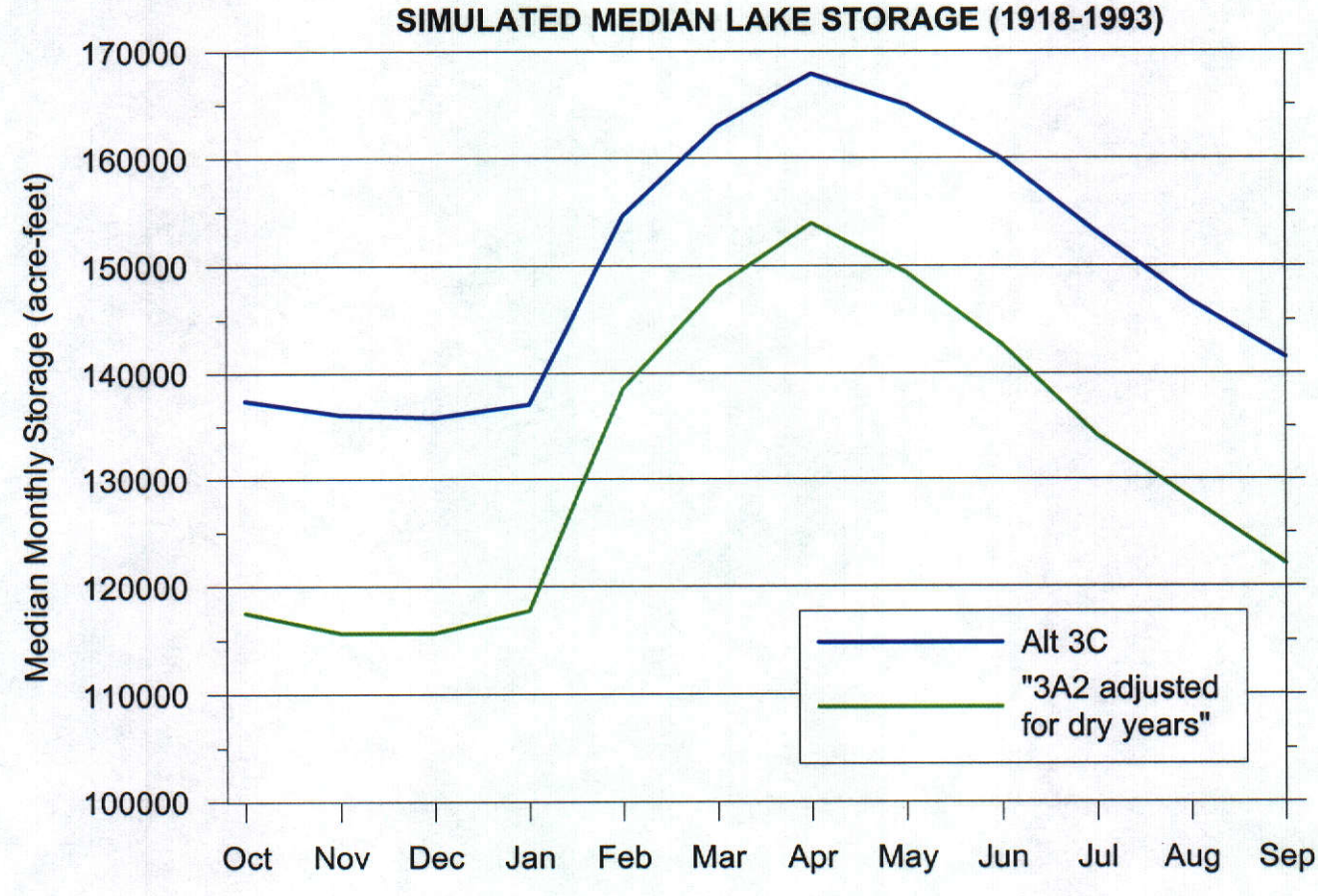

SIMULATED MEDIAN LAKE STORAGE (1918-1993)
Median Monthly Storage (acre-feet)
170000
160000
150000
140000
130000
120000
110000
100000
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Alt 3C
"3A2 adjusted for dry years"

Figure 2-7A

SIMULATED MONTHLY MEAN FLOW WEIGHTED TOTAL DISSOLVED SOLIDS AT LOMPOC NARROWS (1942-1988)

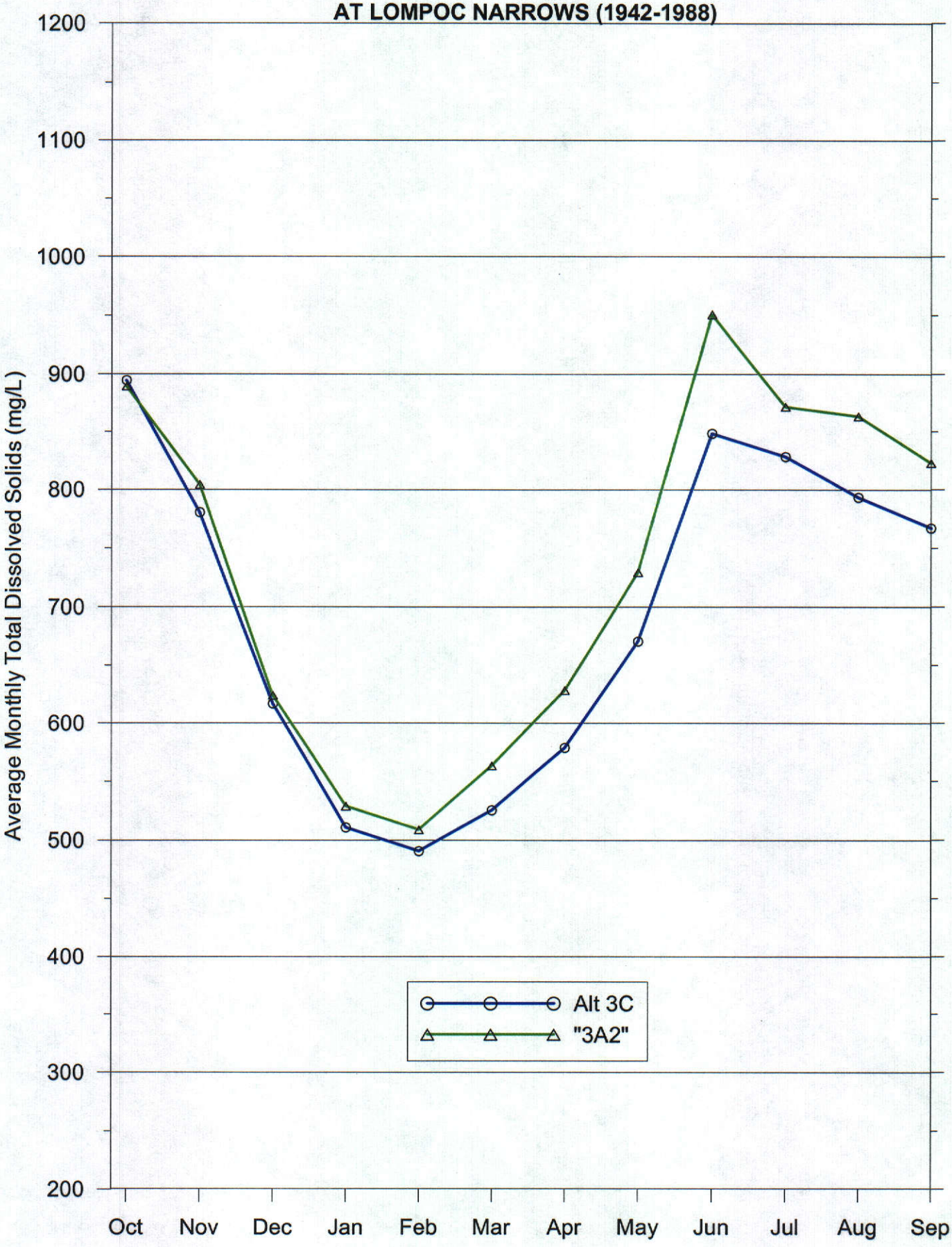
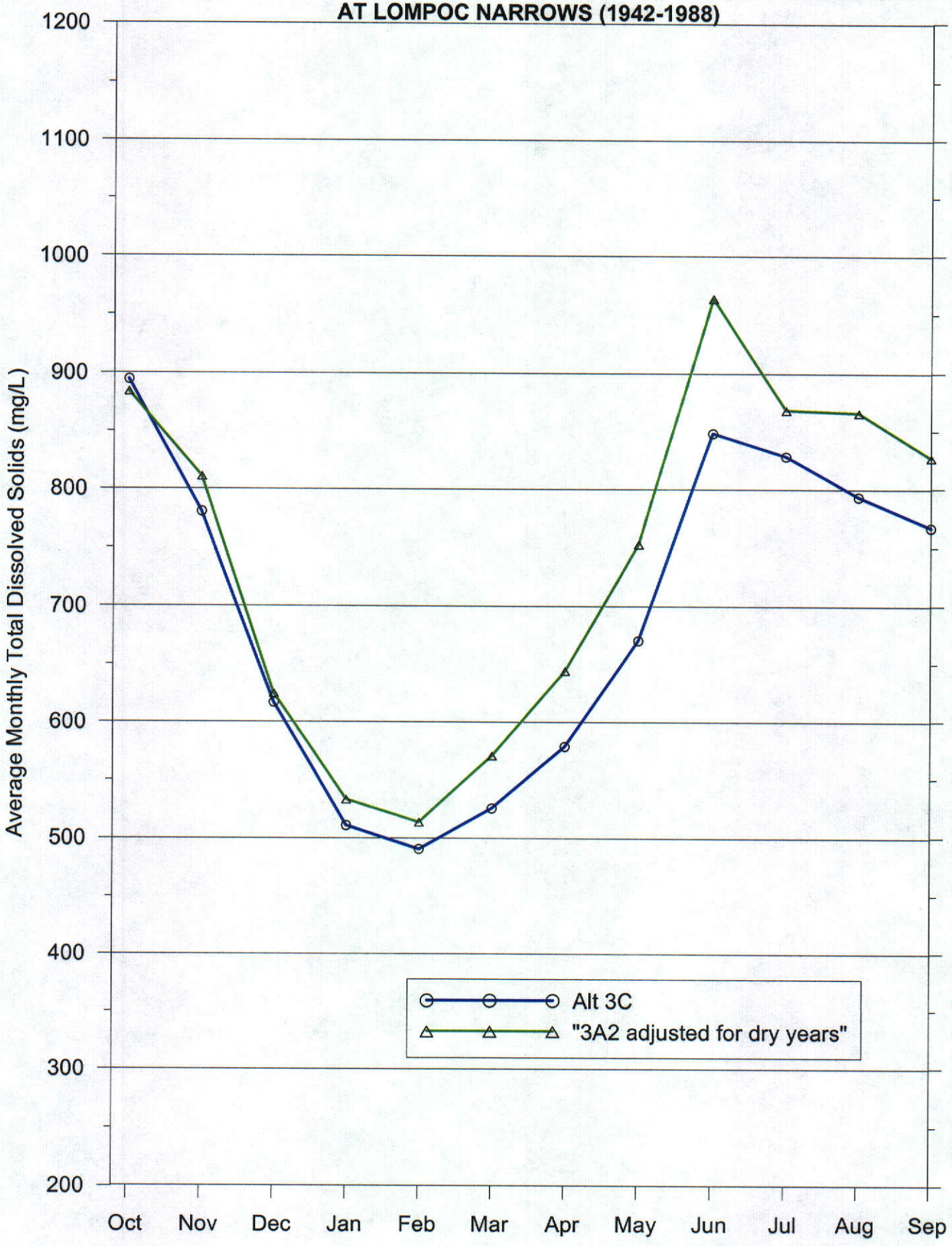


Figure 2-7B

SIMULATED MONTHLY MEAN FLOW WEIGHTED TOTAL DISSOLVED SOLIDS AT LOMPOC NARROWS (1942-1988)



Rebuttal Testimony of Ali Shahroody

3.0 Downstream Water Rights Releases

It is stated in Mr. Keegan's written testimony that (a) WR89-18 releases should occur over a more continuous nature than occur under present operations – in CalTrout's documents sometimes referred to as a so-called "maximum beneficial use" alternative, (b) dry river conditions are necessary to trigger water rights releases which he alleges is not conducive to improving mainstream rearing habitat, and (c) WR89-18 releases should be used in tandem with other releases.

Overview of Water Rights Releases

The objective is to percolate the quantity of water which would have occurred from unregulated flow, so that operation of the Cachuma Project shall not reduce natural recharge of groundwater from the Santa Ynez River, as described in various Board Orders starting with D886. In order to recharge the amount of water associated with the impairment of percolation caused by the Cachuma Project, downstream water rights releases are usually made when the released water can be fully percolated through the Santa Ynez River bed. That means the river bed in the targeted areas is dry. As shown in Figure 3-1, there are a number of separate basins that require deliveries of water depending upon hydrologic conditions and seasonal demand.

Water rights releases are made from the Above Narrows Account (ANA) for the above Narrows areas, and the point of ANA delivery (measurement) is at Bradbury Dam. Water rights releases are also made from both the Above and Below Narrows Accounts, combined, and the point of delivery (measurement) for the Below Narrows Account

(BNA) water is the USGS gage at the Lompoc Narrows (not Bradbury Dam). In delivering water for recharge in the Lompoc Plain, any percolation occurring in the above Narrows area is debited against the Above Narrows Account. That means, enough water has to be reserved in the Above Narrows Account in order to deliver water to the Lompoc Plain. The ANA water is also used to meet the needs of water users in the above Narrows area, specifically during dry periods. Since the credits are limited, they must be conserved for dry periods, otherwise the rights of the downstream water users will not be satisfied. That is why we generally do not make releases in wet periods or when the dewatered storage is less than 10,000 acre-feet.

CONTINUOUS RELEASE

With that background, the reasons why we do not and cannot make what Mr. Keegan describes as a release of continuous nature are briefly discussed below.

1. If we made releases at, say, 30 cfs continuously, rather than starting at 150 cfs when making releases to both above and below Narrows areas, we would expend considerably more ANA water before any water is delivered to the Lompoc Narrows. If we did that, there would not be enough water left in the ANA to serve the above Narrows areas during drought periods. Furthermore, there would not be enough ANA water to deliver BNA water to the Lompoc Narrows in that year and subsequent years, resulting in stranding the Lompoc's water in Cachuma Reservoir.

   For example, during 1996 (July 19 to October 31), water was initially released at the rate of about 135 cfs for 11 days before it reached Lompoc Narrows; after that releases were maintained at an average rate of about

65 cfs for another 30 days. During this 30-day period the flow at Lompoc Narrows averaged about 25 cfs. That means 40 cfs of the released water did not reach the Narrows during the 30-day period. If the releases had been made at the rate of 30 cfs instead of 135 cfs, and continued at the 30 cfs rate, it may have taken 40 to 60 days before an appreciable amount of water had flowed at the Narrows. This would have reduced the recharge period in the Lompoc Plain by about 30 to 50 days.

In 1996, releases outside the rampdown period extended for a period of 94 days, at a rate averaging about 55 cfs as shown in Table 3-1. The BNA water delivered to the Narrows averaged about 20 cfs. That means it took 35 cfs of ANA water to deliver 20 cfs at Lompoc Narrows when averaged over the delivery period of 94 days. If water rights releases are made at a rate of 30 cfs, the amount of BNA water delivered to the Lompoc Narrows would not be appreciable. This would cause an impairment of downstream water rights and deterioration of water quality in the Lompoc groundwater basin. It would also result in stranding the BNA water in Cachuma Reservoir and reducing the Cachuma yield.

Table 3-1. Water Rights Releases from Bradbury Dam July 19 - October 31, 1996 (94 days)*

Total Release from Bradbury Dam		**Flow at Narrows (Below Narrows Account)**		**Above Narrows Percolation (Above Narrows Account)**	
Total Volume (af)	Average Release (cfs)	Total Volume (af)	Average Release (cfs)	Total Volume (af)	Average Release (cfs)
10,778	55	3,459	20	7,319	35

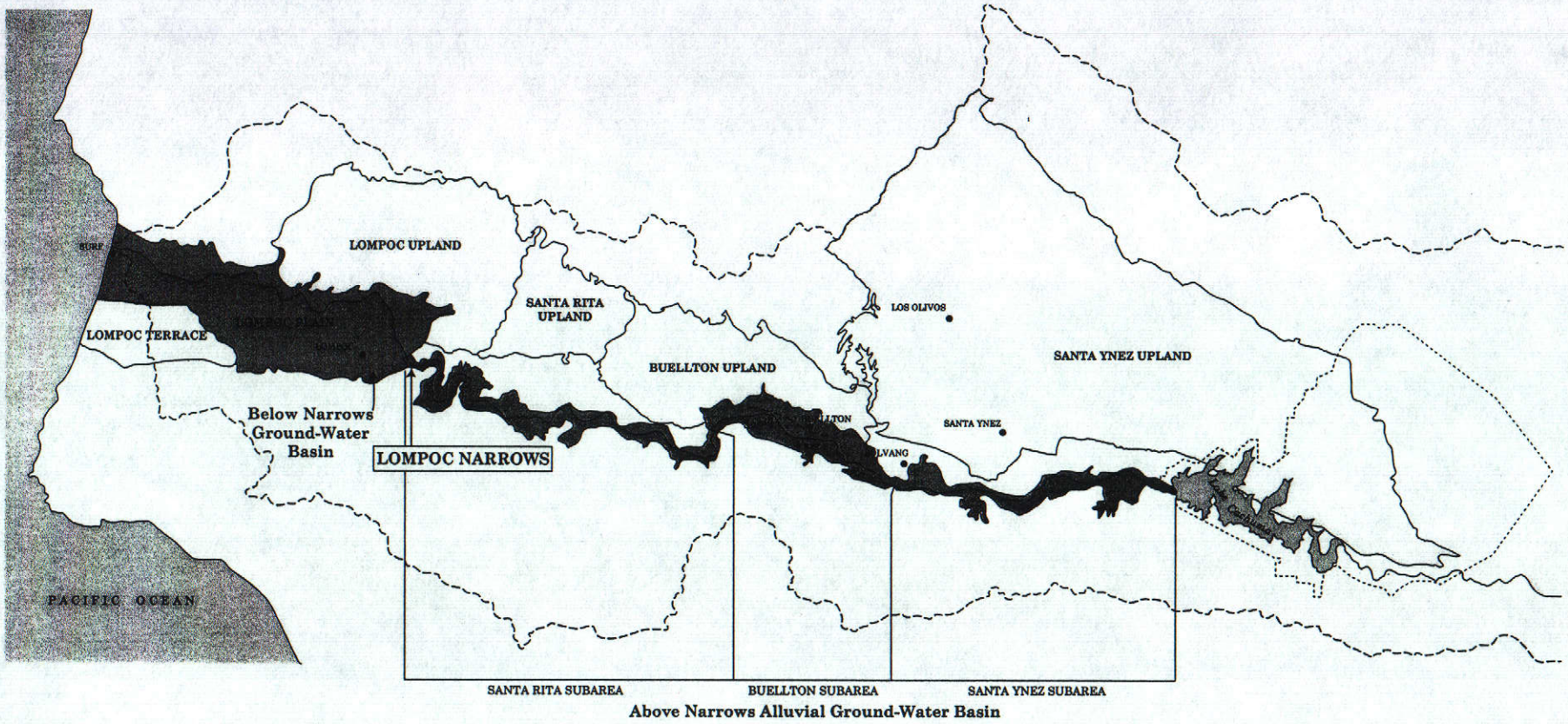
**Rampdown period excluded*

2. If water rights releases are made continuously when such releases are not needed in the downstream areas, it would result in depleting the downstream account water prematurely without providing drought protection for the downstream water users. If water rights releases are made when water cannot be recharged effectively, then most of those releases would flow beyond the recharge areas. This would also result in depleting the account water stored in Cachuma Reservoir for drought protection and depriving the Lompoc Plain from the needed recharge water.

COORDINATED RELEASE

I do also note that we make water rights releases in tandem with other releases for fish. That is how the Conjunctive Use Program works as recognized in the Biological Opinion and the Settlement Agreement. On average, about 31% of the long-term releases for fishery purposes, as required by the BO, actually come from water rights releases. The Settlement Agreement assures the coordination of scheduling for tandem releases with fish water and requires water rights releases for a specified period of time.

Figure 3-1



LEGEND

- Santa Ynez River Basin Boundary
- Ground-Water Basins
- Above Narrows Alluvial Ground-Water Basin
- Below Narrows Ground-Water (Lompoc Plain)

N W E S

0 5 10
MILES

STETSON ENGINEERS INC.

MAJOR GROUND-WATER UNITS OF THE SANTA YNEZ RIVER BASIN