State of California
The Resources Agency

DEPARTMENT OF WATER RESOURCES
Division of Operations and Maintenance

STATE WATER PROJECT ANNUAL REPORT OF OPERATIONS 1993

June 1998

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Table Of Contents

Tables

Figures

Maps

Appendix Summary of Aqueduct Operations

Glossary

Abbreviations and Units

The following abbreviations, commonly used throughout this report, are defined here.

AF	acre-feet
Banks	Harvey O. Banks Delta Pumping Plant
California Aqueduct	Governor Edmund G. Brown California Aqueduct
CVP	Central Valley Project
cfs	cubic feet per second
D-1485	Water Rights Decision 1485
DOI	Delta Outflow Index
DWR	Department of Water Resources
DO	dissolved oxygen
EC	electrical conductivity
ft	feet
Kv	kilovolt
KW	kilowatt
KWh	kilowatt-hour
LADWP	Los Angeles Department of Water and Power
MAF	million acre-feet
MW	megawatt
MWh	megawatt-hour
MWDSC	Metropolitan Water District of Southern California
PG&E	Pacific Gas and Electric Company
SCE	Southern California Edison
SDWA	South Delta Water Agency
SRI	Sacramento River Index
SWP	State Water Project
SWRCB	State Water Resources Control Board
USBR	United States Bureau of Reclamation

Introduction

The 1993 Annual Report of Operations for the State Water Project is divided into seven parts. The first two parts, "Highlights of 1993 Operation" and "Project Status in 1993," cover conditions and events of statewide significance. The next three sections cover water conditions, water operations, and energy operations in 1993. The sixth part, "Sacramento-San Joaquin Delta Operations," gives special emphasis to Delta operations, a key aspect of the SWP. The last part, "Project Operations By Field Division," provides further detail on operational conditions and activities by field division as outlined on Map 2.

The report also includes an appendix that covers the operations of the California Aqueduct in 1993.

Highlights of 1993 Operation

Managing available water supplies during the recent drought required activities designed to make the most beneficial use of water available to SWP. DWR initially structured its plan of operations according to the concept of a firm yield. Firm yield is the quantity of water that can be made available on a firm annual basis to water contractors during a drought period. DWR changed its method of determining delivery amounts and replaced the concept of firm yield with the concept of variable yield. Operating on the basis of a variable yield makes efficient use of available water supplies during a drought. When DWR changed the basis of operations from a firm yield to a variable yield, it also developed programs to compensate for the lack of storage facilities. Those programs include water transfers, exchanges, loans, storage, purchases, and carry-over for delivery at a later date.

Total requests for 1993 entitlement water were originally about 3.85 MAF. The initial allocation in December 1992 was very conservative and provided for 10 percent of requests for municipal, industrial, and agricultural uses. Because of above-average rain and snowfall, SWP was able to increase the allocation to 40 percent of requested amounts in January 1993 and to 70 percent in March. By April 16, because additional local water had become available for the first time in several years, some contractors were able to revise their demand downward. With the revised total of requests for entitlement water at 2.8 MAF, SWP announced the allocation of 100 percent of the requests.

During 1993, a total of 125,033 AF of entitlement water and 197 AF of carryover entitlement water was transferred between seven long-term SWP contractors and one non-SWP contractor.

Programs permitting agencies to exchange, loan, store, and purchase water from the SWP allowed contractors to pump water directly into the California Aqueduct. To preserve water quality, DWR normally does not allow water to be pumped directly into the Aqueduct. But because of the severity of the drought, DWR approved the pump-ins after establishing a comprehensive program to check and monitor the quality of water introduced into the Aqueduct. Pump-in agreement details are discussed further in the *"Water Deliveries and Aqueduct Operations"* section.

In 1993, DWR delivered 219,585 AF of entitlement water that seven long-term contractors carried over from 1992.

DWR and USBR declared balanced Delta water conditions four times during 1993: from January 3 to January 5, from February 1 to February 9, from July 1 to September 1, and from November 8 to December 10. This was the tenth consecutive year in which balanced water conditions were declared.

There are 19 plants along the SWP with pumping capabilities. These include 2 State-federal facilities, 1 federal facility, and 16 State facilities. Plants used for federal pumping are Banks, O'Neill, Gianelli, and Dos Amigos. A detailed list of all project pumping is shown on Table 1.

Energy resources totaled 9,081,985 MWh which includes generation of 6,027,528 MWh of energy at SWP locations, purchases of 675,393 MWh, other resources of 106,081 MWh, and 2,272,983 MWh of SCE return additional (see Figure 4). Energy loads of 9,081,985 MWh include sales of 4,074,215 MWh, 4,779,098 MWh used to deliver water to SWP contractors, 219,266 MWh of losses, and 9,406 MWh of deviation (see Figure 6).

SWP facilities delivered 3,999,899 AF water to 40 agencies in 1993 as shown in Table 2. This amount is approximately 1.3 MAF more than the total State and federal water deliveries from the SWP in 1992. State contractors received 2,219,453 AF; including 2,190,202 AF of entitlement water and 29,251 AF of other water. See the *"Water Deliveries and Aqueduct Operations"* section for more details on water deliveries.

Project Status in 1993

Project Facilities

The SWP conserves water for distribution to much of California's population and to irrigated agriculture. It also provides flood control, water quality control, electrical power generation, new recreational opportunities, and sport fisheries and wildlife habitat enhancement.

SWP facilities in operation during 1993 included: 28 water storage facilities with a gross capacity of 6,768,792 AF; 7 power plants with a total output capacity of 1,686 MW; 16 pumping plants housing 112 units with a total motor rating of 2,768 MW; and 537 miles of aqueduct. A detailed description of the SWP follows.

The SWP begins with three small lakes on the Feather River tributaries: Lake Davis, Frenchman Lake, and Antelope Lake. The branches and forks of the Feather River flow into Lake Oroville, SWP's principal reservoir which has a capacity of about 3.5 MAF. From Lake Oroville, water flows through three hydroelectric powerplants, then down the Feather River into the Sacramento River before reaching the Delta. From the northern Delta, the North Bay Aqueduct supplies water to Napa and Solano counties.

The Delta Pumping Plant lifts water into Bethany Reservoir. It is then lifted by the South Bay Pumping Plant into the South Bay Aqueduct. The South Bay Aqueduct supplies water to Alameda and Santa Clara counties. Most of the water from Bethany Reservoir, however, flows into the Governor Edmund G. Brown California Aqueduct. At O'Neill Forebay, part of the water is pumped through the Gianelli Pumping-Generating Plant for storage in San Luis Reservoir until needed. DWR's share of storage in the reservoir is 1,062,183 AF.

Water not stored in San Luis Reservoir continues to flow south down the valley and is raised 1,069 ft by four pumping plants: Dos Amigos, Buena Vista, Teerink, and Chrisman. In the southern San Joaquin Valley, the Coastal Branch Aqueduct serves agricultural areas west of the California Aqueduct. At the Tehachapi Mountains, Edmonston Pumping Plant raises the water 1,926 ft and the water enters 8.5 miles of tunnels and siphons. Once the water has crossed the Tehachapi Mountains, it flows through the California Aqueduct into the Antelope Valley.

The California Aqueduct then divides into two branches, the East Branch and West Branch. The East Branch carries water through the Antelope Valley into Silverwood Lake. From Silverwood Lake, the water enters the San Bernardino Tunnel and drops 1,418 ft into Devil Canyon Powerplant, then flows to Lake Perris, the SWP's southernmost reservoir.

Water in the West Branch is raised by Oso Pumping Plant to Quail Lake and from there flows through Warne Powerplant into Pyramid Lake. From Pyramid Lake the water flows through the Angeles Tunnel and Castaic Powerplant into Castaic Lake, terminus of the West Branch. For the location of facilities cited here, see Map 1.

SWP facilities include 22 dams and reservoirs. Lake Oroville and San Luis Reservoir are the primary conservation facilities. The remaining 20 dams and reservoirs are used principally to regulate the conserved supply into water delivery patterns designed to fit local needs. Of those 20, the 5 largest are Lake Del Valle, located in Alameda County; and Pyramid Lake, Castaic Lake, Silverwood Lake, and Lake Perris, in Southern California. Lake Del Valle is approximately four miles from the city of Livermore. The four southern reservoirs--Pyramid Lake, Castaic Lake, Silverwood Lake, and Lake Perris--are near the metropolitan areas of southern California, whose water supplies are mainly imported. Information about these reservoirs, including amounts of unimpaired runoff to Lake Oroville and storage levels for SWP's conservation, and other storage facilities are summarized in this report.

In 1993, DWR was involved in planning an additional surface reservoir, Los Banos Grandes, and developing a significant groundwater storage program, Kern Water Bank. Los Banos Grandes, authorized by the California Legislature in 1984, is designed to be the primary south-of-the-Delta water storage facility for DWR. The facilities--consisting of a dam, an offstream storage reservoir, several saddle dams, and two pumping-generating plants--will be located in Merced County on Los Banos Creek. The pumping-generating system would fill the reservoir from the California Aqueduct and recover energy when releases are made. To be effective, Los Banos Grandes must be linked with an efficient Delta transfer facility.

The Kern Water Bank, a subsurface reservoir, is designed to store SWP water in the ground during

wet years. Later, during dry periods, water can be withdrawn by pumping to the California Aqueduct or substituted for entitlement water that ordinarily would be delivered to Kern County. The water bank currently consists of eight separate projects or elements. The initial element, the Kern Fan Element, was proposed by DWR. To build the Kern Fan Element, DWR plans to construct recharge basins and extraction wells and use similar facilities that have been constructed as part of the La Hacienda Groundwater Program. DWR signed a contract to purchase recharged groundwater from La Hacienda, Inc., in 1990. To extract the water, DWR rehabilitated existing wells and built conveyance facilities.

Outages and Limitations

During 1993, the following units were out of service for maintenance or repair.

January

- Alamo Unit 1 (January 4 to August 20) Replaced support bearings and replaced seal on turbines.
- Las Perillas Unit 3 (January 7 to March 5) Modified unit trash racks.
- Las Perillas Unit 5 (January 19 to April 13) Annual and electric preventive maintenance.
- South Bay Unit 5 (January 27 to June 25) Replaced motor.
- Thermalito Unit 3 (January 19 to February 10) Annual preventive maintenance.

February

- Teerink Unit 5 (February 25 to March 11) Annual preventive maintenance.
- Teerink Unit 6 (February 3 to February 19) Annual preventive maintenance.
- Teerink Unit 8 (February 26 to March 31) Tested unit efficiency.
- Thermalito Unit 4 (February 16 to March 19) Annual preventive maintenance.
- Warne Unit 1 (February 16 to October 15) Annual preventive maintenance.

March

- Chrisman Unit 4 (March 1 to May 20) Replaced hot water bypass and back fill line piping and valves.
- Edmonston Unit 4 (March 8 to March 17) Relay preventive maintenance.
- Hyatt Unit 2 (March 4 to March 18) Annual preventive maintenance.
- South Bay Unit 1 (March 5 to March 24) Remedied high vibrations.
- Teerink Unit 4 (March 17 to March 24) Annual preventive maintenance.

April

- Dos Amigos Unit 1 (April 25 to May 5) Replaced hub to shaft wedges.
- Edmonston Unit 6 (April 27 to May 10) Annual preventive maintenance.
- Edmonston Unit 8 (April 13 to April 30) Annual preventive maintenance and remove trash rack and install new anodes.
- Edmonston Unit 12 (April 1 to April 70 Remove trash rack and install new anodes.
- Hyatt Unit 1 (April 5 to April 20) Annual preventive maintenance.
- Las Perillas Unit 6 (April 14 to April 20) Annual preventive maintenance.
- Teerink Unit 3 (April 20 to May 4) Annual preventive maintenance.

May

- Banks Unit 8 (May 22 to June 3) Remedied exciter field ground.
- Del Valle Unit 2 (May 7 to November 30) Installed new mechanical shields on the shaft.
- South Bay Unit 3 (May 20 to May 26) Replaced pump air release valve and shutoff valve.
- Teerink Unit 1 (May 20 to June 4) Annual preventive maintenance.
- Teerink Unit 2 (May 5 to May 18) Annual preventive maintenance.

June

- Banks Unit 5 (June 1 to June 24) Tested for efficiency .
- California Aqueduct, Check 38, Gate 2 (June 28 to September 8) Removed, repaired, sandblasted, recoated, and reinstalled gate.
- Edmonston Unit 10 (June 21 to July 8) Annual preventive maintenance.
- Gianelli Unit 7 (June 10 to June 15) Repacked stuffing box.

July

- California Aqueduct, Check 34, Gate 2 (July 7 to September 7) Removed, repaired, sandblasted, recoated, and reinstalled gate.

- Dos Amigos Unit 5 (July 13 to July 22) Inspected windings and measured between rotor arm and stator.
- Pearblossom Units 7 and 8 (July 6 to July 31) Coupled, but unwatered, test runs.

August

- California Aqueduct Check 39 (August 9 to August 23 Installed and tested new remote telemetering unit.
- Edmonston Unit 3 (August 23 to November 5) Rewedged and repaired the stator.

September

- Banks Unit 9 (September 14 to September 25) Replaced upstream seat "O" ring.

October

- California Aqueduct, Check 28, Gate 1 (October 22 to October 29) Installed new gate anodes.
- Coastal Aqueduct Check 5 (October 18 to October 27) Replaced and tested remote telemetering unit.
- Hyatt Unit 5 (October 6 to December 23) Annual preventive maintenance and to rewedged the stator.
- Las Perillas Unit 1 (October 5 to November 12) Annual preventive maintenance.
- Pearblossom Unit 7 (October 5 to October 12) Resurfaced pump extension.

November

- Banks Unit 4 (November 20 to December 3) Cleared water from discharge valve hydraulic oil system.
- California Aqueduct Check 28, Gate 3 (November 4 to November 11) Installed new gate anodes.
- California Aqueduct Pool 53 (November 4 to November 19) Repaired damaged lining.
- Edmonston Units 2, 4, 6, 8, 10, 12, and 14 (November 29 to December 17) Inspected discharge lines (west units), and installed flow meters.
- Devil Canyon Unit 1 (November 1 to November 19) Annual preventive maintenance.
- Las Perillas Unit 2 (November 22 to December 17) Annual electric preventive maintenance.

December

- Buena Vista Unit 1 (December 22 to December 30) Measured motor lower guide bearing clearance.
- California Aqueduct Check 24, all gates (December 6 to December 20) Installed new anodes.
- Pine Flat Unit 2 (December 13 to December 30) Annual maintenance.

Water Supply Conditions

The SWP meets its contractual obligations by monitoring precipitation and calculating runoff to coordinate operation of the complex system of dams and reservoirs. Information on those activities is based on the water supply conditions of the 1992-93 water year and the 1993 calendar year.

In a typical year, California receives approximately 193 MAF of water as rain or snow. Of this amount, about 107 MAF falls in northern California. However, nearly 75 percent of the demand for water originates in highly populated southern California. About 30 MAF runs off into streams or rivers that eventually flow into the Sacramento-San Joaquin Delta.

Water year 1992-93 was a welcome contrast to the preceding six years of drought. During the third week of February, after two weeks of dry weather and with reservoir storage only 75 percent of average, a series of storms brought much rain and snow to California. For many of the major reservoirs in the foothills of the Sierra Nevada, flood control became an operational factor for the first time since fall 1986. A heavy snowpack assured a good runoff year which relieved the Department's concerns about a possible seventh year of drought. On February 24, 1993, Governor Pete Wilson officially declared the drought over.

By the end of the water year on September 30, storage at major in-state reservoirs was 24 MAF, about 110 percent of average and nearly twice the 12.7 MAF (58 percent of average) in storage on September 30, 1992.

The water year started out poorly, with precipitation about 20 percent of average during the month of November. But the following four months were wet, especially December and February, with about twice the normal amount of precipitation. By April 1 precipitation was 150 percent of average, compared with 90 percent the previous year. Although June was unseasonably wet, the last three months of the water year were unusually dry, without many of the usual mountain and desert showers.

Precipitation statewide was about 140 percent of average during water year 1992-93. As in the previous year, the southern portion of California was wetter, receiving a higher percentage of average precipitation than the north. But all regions shared in the bounty with statewide rainfall well above normal.

Snowpack water content in the mountains increased to above-average levels late in December 1992, when a major snowstorm hit northern California. By April 1, the snowpack stood at 150 percent of average, the most since 1983. This large snowpack produced enough snowmelt to refill most of the major reservoirs.

A water year classification is used to set water quality and flow requirements for the Delta according to standards included in D-1485. In cooperation with the Central Valley Project, SWP monitors water quality and modifies releases and exports when necessary to ensure D-1485 standards are met. SRI runoff during water year 1992-93 was 22.2 AF, up greatly from the 8.9 MAF in the 1991-92 water year. This classified the 1992-93 water year as "above average" under the SWRCB D-1485 criteria for the Delta. If the preceding year had not been defined as "critical," the 1992-93 water year would have been in the "wet" category.

Water Operations

Reservoir Operations

Lake Oroville and San Luis Reservoir are the two conservation facilities for SWP water supplies. Table 8 and Table 13 summarize the operations of these reservoirs during the 1993 calendar years.

Lake Oroville began 1993 with 1,402,048 AF of storage, 136,314 AF more than it held at the beginning of 1992. Computed inflow peaked in March. Storage in Lake Oroville peaked on June 6,1993, at 3,521,797 AF (99 percent of normal maximum operat-ing capacity) and dropped to 2,429,938 AF (69 percent of normal maximum operating capacity) by December 31. The net effect of operations and water conditions at Lake Oroville resulted in a storage change of 1,027,890 AF.

At the beginning of 1993, Lake Del Valle held 26,439 AF (66 percent of normal maximum operating capacity). Almost all of Lake Del Valle's natural inflow for the year, 45,885 AF, occurred in the months of January, February, and March.

At the start of 1993, San Luis Reservoir held 524,416 AF, 27 percent of its normal maximum capacity (2,027,835 AF); the SWP held only 383,191 AF of its maximum capacity (1,062,183 AF). SWP storage at the end of 1993 increased to 1,062,560 AF. End-of-year federal storage was 922,989 AF, for an end-of-year total of 1,985,549 AF.

SWP southern reservoirs (Pyramid, Elderberry, Castaic, Silverwood, and Perris) have a combined maximum storage capacity of 701,320 AF. This total combined storage went from 580,804 AF at the beginning of 1993 to 565,372 AF by the end of the year.

The following tabulation compares normal operating capacity in the principal SWP reservoirs with end-of-year storage for 1992 and 1993:

Reservoir	Normal Maximum Operating Capacity	End-of-year Storage 1992	End-of-year Storage 1993
Lake Oroville	3,537,577	1,402,048	2,429,938
Lake Del Valle	40,000	25,922	24,926
San Luis Reservoir	1,062,000	383,191	1,062,560
Pyramid Lake	171,196	161,221	160,299
Silverwood Lake	74,970	65,138	58,730
Lake Perris	131,452	115,004	120,597
Castaic Lake	323,702	239,421	225,746
Totals	5,340,897	2,533,170	4,082,796

Water Deliveries and Aqueduct Operations

Water diverted from the Sacramento-San Joaquin Delta is delivered to SWP storage facilities and to contractors through Banks Pumping Plant and Barker Slough Pumping Plant for a variety of beneficial uses. In addition to delivering entitlement water to long-term water supply contractors, SWP transports water to other public agencies through exchanges or purchases, provides water for wildlife and recreational uses, and conveys water to meet local water rights agreements. Specific information about water deliveries made to long-term contractors and other agencies has been organized in Table 2.

For several years, DWR has offered contractors the opportunity to carry over a portion of their current entitlement water for delivery in the next year. The carry-over program was designed to encourage the most effective use of water, and to avoid obligating the contractors to use the water by December 31 or lose it. Because operational constraints may change from year to year, participating contractors sign an agreement in which the conditions of the approval are listed each year. In 1993, a total of 219,782 AF of entitlement water was carried over from 1992.

Make-up water is allocated to contractors according to Article 12(d) and Article 14(b) of the long-term water supply contracts. According to Article 12(d), if for some reason beyond DWR's control, water is not available for delivery according to the established schedule for that year, the water may be delivered at a later date. Article 14(b) of the long-term water supply contracts provides for the delivery of water at a later time if water is not delivered due to necessary investigations, inspections, maintenance, repairs, or replacement of SWP facilities. No make-up water as defined by Article 12(d) or Article 14(b) was delivered in 1993. Long-term contractors have earned credits for make-up water according to Article 12(d) and Article 14(b) of the long-term contracts. However, the exact amount of those credits is being negotiated.

Under provisions of their water supply contracts, South Bay and San Joaquin Valley contractors may reduce entitlement water deliveries during years in which above-average amounts of local water are available and increase deliveries by an equal amount in later years. No additional credits for wet-weather water were acquired during 1993.

The Department did not approve 1993 entitlement for carryover and delivery in 1994. However, 259 AF of 1993 entitlement water was approved for delivery to Empire West Side Irrigation District in 1994. This amount of entitlement water was previously classified as wet-weather carryover water as defined in a letter of agreement dated October 1, 1979.

During 1993, SWP provided water service to 40 agencies, including 27 long-term water contractors. SWP facilities were used to convey non-project water for other agencies, including the CVP. In addition, SWP facilities were used to deliver water transfers from one agency to another. Transfers were accomplished according to wheeling agreements and with participants of existing three-party contracts for the use of the Cross Valley Canal, a water conveyance facility that connects with the California Aqueduct in Kern County.

The Cross Valley Canal in Kern County is used by nine water or irrigation districts and two counties to obtain water from the California Aqueduct. Those districts and counties include Ducor, Hills Valley, Lower Tule River, and Pixley Irrigation districts; Kern-Tulare, Rag Gulch, and Tri-Valley Water districts; and Fresno and Tulare counties. All contractors, except Ducor Irrigation District, received USBR water either through a water exchange with another agency or through deliveries made from the canal. DWR provided the water by conveying USBR water through the California Aqueduct directly from the Delta and from storage in San Luis Reservoir.

Total Project (State and federal) deliveries for 1993 totaled 3,999,899 AF. This total includes State contract deliveries of 2,219,453 AF, federal deliveries of 956,036 AF, Oroville Complex diversions of 822,589 AF, and Upper Feather River deliveries of 1,821 AF. State contract deliveries included a total of 2,190,202 AF of entitlement and entitlement-related

water to 27 long-term contractors, plus 29,251 AF of other water. A graph showing the highest and lowest annual total deliveries from SWP facilities is shown in Figure 1. Amounts of 1993 water deliveries are shown by field division on Map 3, and include entitlement water, permit water, local supply, recreation, purchases, wheeling, and water transfers. Totals by agency are shown in Table 2.

The following table is a summary of deliveries to State contractors by water type in 1993 in acre-feet:

Entitlement Water		Other Water	
M & I	654,009	Recreation (State)	2,609
Agricultural	1,095,865	Operational Release	1,347
Groundwater	203,153	Oper. Flood Release	895
Bypass	64	1992 Drought Bank	5,219
Carryover	219,585	Local	16,416
12D M&I	1,999	General Wheeling	600
Transfer Carryover	197	Vallejo Permit	26
Vallejo	4,618	SWP Delivery	625
Benicia	9,266	Transfer	1,514
Total	**2,190,202**	**Total**	**29,251**
Total Water		**2,218,453**	

Significant Operational Activities

January

- As a result of the SWP's projected water supply condition, on January 31 SWP increased its projected deliveries to 40 percent of the amounts requested by its water contractors.
- The statewide water supply outlook continued to improve. The mountain snowpack and the water content reached the April 1 average with about 35 percent of the snow accumulation season left.
- Banks Pumping Plant operated all 11 units for 22 hours on January 15 and 16 to determine if the California Aqueduct could handle the full output at Banks. The test was successful.

February

- Governor Pete Wilson declared an end to the California drought on February 24, 1993.
- Pumping at Banks was temporarily shut down on February 24 due to concerns over the increased number of 1992 winter-run size salmon being recovered at the Skinner Fish Facility.
- Runoff from the continuing storms required substantial releases of natural inflow from Lake Del Valle, Pyramid Lake, Castaic Lake, and Silverwood Lake.

March

- Pumping at Banks was halted from February 24 through March 7 to protect 1992 winter-run size salmon. Pumping was resumed on March 8 at a reduced rate of 2,260 cfs, and increased to 3,390 cfs on March 23.
- Releases from Lake Oroville increased beginning on March 15, in anticipation of increased runoff from additional storms and melt of the snowpack. Lake Oroville reached the maximum flood control storage level for the first time since 1986 and released water through the spillway on March 23 for the first time in seven years.
- Total storage in the major SWP reservoirs was approximately 4.72 MAF at the end of the month, which is about 1.27 MAF more than the storage at this same time in 1992. SWP contractors were apportioned up to 85 percent of their original requests by the end of March.

April

- Abundant rainfall in Southern California provided enough local water to meet much of the local demand, resulting in substantial reductions to earlier requests which totaled 3.85 MAF.
- Total storage in the major SWP reservoirs was 5.00 MAF on April 30 which is about 1.35 MAF more than the storage at this time in 1992.
- On April 16, the Department announced that SWP deliveries of 2.8 MAF were approved for 1993. This amount would meet the projected needs of the 29 agencies who receive Project water.

May

- Total storage in the major SWP reservoirs was 5.15 MAF on May 31, which is about 1.73 MAF more than the storage at this same time in 1992.
- Storage in Lake Oroville on May 31 was 3.52 MAF as compared to 1.88 MAF in 1992.
- The State share of San Luis Reservoir storage on May 31 was about 940,000 AF compared to 829,000 AF at this time in 1992.
- The combined storage of the Project's southern reservoirs on May 31 was about 668,000 AF compared with 691,000 AF at this time last year.
- Banks Pumping Plant exports were voluntarily limited to 750 cfs to assist the SWP's San Joaquin

River salmon out migrant flush from April 26 to May 16.

- The State and Federal Fish Facilities Salvage and Loss Report indicates that no winter-run size salmon were lost during May.

June

- Lake Oroville filled to its normal maximum elevation of 899 ft with a storage of 3.52 MAF. This was the first time since 1983 that Lake Oroville has been filled to water supply capacity.
- Banks pumping remained below 2,000 cfs (from 2,500 cfs) most of June due to the USFWS Delta smelt biological opinion daily take criteria. Pumping resumed at 2,500 cfs on June 26.

July

- The USFWS listed the Delta Smelt as threatened in April 1992 and issued a biological opinion in late May that has had an impact on project operations since that time. Two rovisions of the federal opinion have affected SWP's ability to divert water from the Delta. The first provision, the take limit, caused the USBR and DWR to curtail pumping in May when unexpectedly high numbers of juvenile smelt were salvaged at the two facilities. The second provision which affected pumping was the -1,000 cfs limit for QWest.

August

- SWP storage in San Luis Reservoir reached its minimum for the year (723,206 AF) on July 31 and refill was started. The State share of San Luis Reservoir storage was about 786,000 AF on August 31, compared to about 354,000 AF at this time in 1992.
- The combined storage of the Project's southern reservoirs was about 656,000 AF on August 31, compared with 643,000 AF at this time in 1992.

September

- Runoff for water year 1992-93 remained about 125 percent of average statewide.

October

- The Delta remained in excess conditions throughout October. At Banks Pumping Plant, SWP pumped 70,000 of the 195,000 AF of CVP water that the USBR had refrained from pumping last spring to comply with D-1485 Delta water quality standards for fish and wildlife.
- The combined storage of southern SWP reservoirs was about 629,000 AF on October 31 compared with 609,000 AF at this time last year.

November

- DWR cooperated with DFG on a winter-run salmon predation test in Clifton Court Forebay from November 21 through November 30. This test used hatchery-reared fall-run salmon as a surrogate for winter-run and was carried out while maintaining a higher pumping rate at the Banks Pumping Plant than utilized in previous predation tests.
- After the discovery of canal seepage at mile 344, Pool 53 was dewatered and temporary repairs were made. Additional lining damage was discovered downstream of Check 52.

December

- The first 1993 winter-run size salmon were salvaged at Skinner Fish Facility beginning on December 25. The incidental take for this season, as described in the National Marine Fisheries Service's Biological Opinion, is 905. The preliminary estimated take to date is 110.
- The East Branch of the California Aqueduct was shut down on December 6, 1993, to dewater pools 48 and 60 to repair cracked canal lining.

Energy Operations

Energy Sources

Energy sources include generation from SWP's seven hydroelectric plants (Hyatt, Thermalito, Gianelli, Warne, Castaic, Alamo, and Devil Canyon) totaling 3,639,614 MWh, as illustrated in Figure 3. Other sources include Reid Gardner, Pine Flat, MWD, CEA, and Tera Power Corp., totaling 2,387,914 MWh.

SWP receives energy under contract from five hydroelectric facilities (total capacity of 30 MW) owned and operated by MWDSC. In 1993, these plants furnished 159,939 MWh of energy to the SWP. DWR has exchange arrangements with Southern California Edison and the Los Angeles Department of Water and Power to provide transmission of this energy.

The DWR-SCE Power Contract has been in effect since April 1983. Under this contract, part of the Hyatt and Thermalito Powerplants' generation and all of the output of Devil Canyon Powerplant and Alamo Power- plant are delivered to SCE. The energy is generally delivered during on-peak periods and a greater amount of energy is returned during off-peak periods. SCE combined return and additional to the SWP during 1993 was 2,272,983 MWh.

Long-term contracted energy purchases, such as Tera Corp. and MWD Hydro, are itemized separately in Table 3. Other purchases totaled 675,393 MWh from various utilities, such as Montana Power Company and Arizona Public Service Company.

Energy Loads

Energy load data (total energy used by the SWP) is summarized in able 4, and Figures 5 and 6. For the purpose of balancing energy resources and loads, this report itemizes those amounts required to meet SWP supplies and demands separately from those amounts required to meet total DWR supplies and demands. Besides SWP energy loads of 4,779,098 MWh, total DWR energy loads include sales of 4,074,215 MWh, losses of 219,266 MWh, and deviation adjustments of 9,406 MWh.

The San Joaquin Field Division, which includes the only stretch of Aqueduct with no reservoirs, accounted for over half of the total project energy load. Edmonston Pumping Plant, in the San Joaquin Field Division, used 1,459,281 MWh with peak pumping occurring in May and June. Project energy loads also include amounts that DWR is committed to supplying to agencies such as SCE, LADWP, PG&E, and the Bonneville Power Authority.

In 1993, the Department had contracts with 30 utilities for the sale of excess power. The Department sold power to 25 of these agencies, resulting in revenues of over $93 million. The largest sale was 986,082 MWh to Portland General Electric.

Sacramento - San Joaquin Delta Operations

The Sacramento-San Joaquin Delta provides an estimated one-half of the State's water supply. In addition, the Delta is an estuary, a constantly changing area where tidal and river currents meet, and where salinity is between the extremes of saline and fresh waters. The Delta provides habitat for fish and wildlife, including waterfowl on the Pacific Flyway.

Many of the problems facing the Delta today, such as saltwater intrusion and oxidation of peat soil, have plagued the area for many years. Originally a tidal marshland covered with tules, the Delta, during dry summer months, is subject to intrusions of seawater from the San Francisco Bay.

Dams upstream of the Delta, including SWP's Oroville Dam and CVP's Shasta Dam, help control the intrusion of salt water by releasing fresh water into the Delta during dry periods in summer-time. However, problems with salinity in the Delta still exist

Since SWP began operating in 1967, DWR has been actively involved in protecting Delta resources. Currently, DWR is reviewing its Delta water management programs in light of the Governor's California water policy. Particular attention is being paid to developing both long-term and interim solutions for water quality, fisheries, wildlife, wetlands, subsidence, and erosion.

See Chapter 11 of DWR's *Bulletin 132-94, "Preserving Delta Resources,"* and Chapter 12, *"Managing Delta Resources,"* for additional information about DWR's Delta water management programs and the effects of the Governor's water policy on those programs.

Delta Outflow Index

Direct measurements of net Delta outflow are impractical because of huge tidal flows. However, since net outflow is one of the primary factors in controlling Delta water quality, a calculated value known as the Delta Outflow Index has been developed. The DOI represents the daily mean net flow of Delta water into Suisun Bay. Table 5 shows the daily DOI calculations for 1993.

Several surface inflows--notably the Cosumnes, Mokelumne, and Calaveras rivers, and the Yolo Bypass flood control channel--are not included. Furthermore, the channel depletion factors in the calculation are based on daily increments of long-term averages, whereas Delta inflow estimates represent mean flows for that entire day. A comparison of Delta Inflow and DOI is plotted on Figure 7. Gross channel depletion is the sum of evapotranspiration and net increase in soil moisture of Delta lands plus evaporation from Delta channels.

The DOI is calculated daily from the sum of Sacramento River inflow, San Joaquin River inflow, and Sacramento Treatment Plant discharge minus the Delta consumptive use estimates and the water exported by the SWP, CVP, and Contra Costa Canal. The Delta consumptive use variable used in the DOI calculation is based on daily increments of long-term averages. Daily inflow estimates are based on either the daily mean of hourly measurements or on an instantaneous flow measurement that represents the entire day.

The 1993 daily DOI averaged 22,287 cfs for the year and was 15,410 cfs more than the 1992 daily average. The greatest mean monthly and daily DOI's occurred in March, at 46,366 cfs and 79,435 cfs. The highest flows were generated during the period of March 20 through April 12. During the first six months of 1993, 82 percent of the years total outflow occurred. The lowest monthly DOI occurred in October (4,496 cfs) and the year's lowest daily DOI was on October 27 with only 965 cfs.

D-1485 standards set a minimum DOI at Chipps Island for adequate water for fisheries. All DOI and river flow standards were met in 1993.

Project Operations By Field Division

Oroville Field Division

Water Storage

SWP water storage facilities in the Oroville Field Division include Lake Oroville; Thermalito Forebay and Afterbay (Oroville-Thermalito Complex); and Upper Feather River reservoirs consisting of Lake Davis, Frenchman Lake, and Antelope Lake. Lake Oroville operations store winter and spring runoff for later SWP use for water supply, power generation, flood control, recreation, and fish and wildlife enhancement.

The Upper Feather River Reservoirs have a combined capacity of 162,000 AF. Antelope Lake was the only one of these reservoirs to spill in 1993; it released a total of 27,314 AF between April and July. Monthly operations for the three Upper Feather River reservoirs are presented in Table 7. The table below compares storage capacity with the largest end-of-month storage for each reservoir for the last five years:

	Antelope	Frenchman	Davis
	(all values in acre-ft)		
Capacity	22,566	55,477	84,371
1993	(Apr) 23,895	(May) 39,814	(Jun) 68,908
1992	(Apr) 17,596	(Feb) 15,580	(Mar) 40,008
1991	(May) 22,048	(Apr) 22,590	(Apr) 48,902
1990	(May) 22,007	(Apr) 28,207	(Apr) 55,713
1989	(May) 23,125	(Apr) 37,031	(Apr) 61,015

The amount of unimpaired runoff to Lake Oroville for the 1992-93 water year totaled about 5.22 MAF, 119 percent of average. Lake Oroville storage was at its lowest for 1993 on January 1 at 1,422,401 AF. Storage peaked on June 6, 1993, at 3,521,797 AF, 100 percent of normal maximum operating capacity. By December 31, 1993, storage declined to 2,429,938 AF, 69 percent of normal maximum operating capacity. A controlled seven day spill released 253,534 AF at the end of March. The 1993 storage levels were the highest since 1989.

Lake Oroville's computed inflow is tabulated in Table 8 and plotted along with releases, diversions, and storage withdrawals on Figure 11. A ten-year historical summary of Lake Oroville's storage and inflow is illustrated on Figure 12.

Water temperatures on and below the lake's surface are monitored very closely throughout the year at various locations around the lake. Two intakes to the powerplant have shutters that control the depth from which water enters the plant. The temperature of water entering the fish hatchery can then be controlled by adding or removing shutters as necessary. A complete illustration of water temperature and intake operation is shown on Figure 14.

Water Deliveries

Project water stored in the Upper Feather Area lakes flows into Lake Oroville through the North and Middle Forks of the Feather River. Contract deliveries totaled 11,323 AF to three agencies. Of these lakes, Lake Davis made the only release of non-project water totaling 1,821 AF.

Water stored in Lake Oroville is released into the Thermalito Diversion Dam Pool, from which specified quantities are released into both the Feather River and the Thermalito Power Canal. The power canal supplies water first to the Thermalito Forebay and then to Thermalito Afterbay. From the Thermalito Afterbay, additional water is released to the Feather River and several local distribution systems used to deliver water to prior water right holders. These deliveries are collectively called the Feather River Service Area diversions and flow through the Sutter Butte Canal, Richvale Canal, Sunset Pumps, Western Canal Lateral, Western Canal, Tudor Mutual, Garden Highway, Plumas Mutual, Oswald Water District, and Palermo Canal outlets. FRSA diversions are not considered SWP benefits, as they predate the SWP construction, and would have occurred in the absence of the SWP to the limit of available natural river flows. Nearly all FRSA diver-sions are for agricultural use. These diversions totaled 809,614 AF in 1993, an increase of 202,939 AF over 1992. All FRSA diversions are detailed below:

Sutter Butte Canal	448,310
Richvale Canal	94,493
Sunset Pumps	9,186
Western Canal Lateral	3,398
Western Canal	219,382
Tudor Mutual	4,199
Garden Highway	16,705
Plumas Mutual	5,765
Oswald Water District	1,484
Palermo Canal	6,692
Total in AF	809,614

Delta Field Division

Water Storage

The Delta Field Division consists of the North Bay Aqueduct, the South Bay Aqueduct, and the California Aqueduct from Clifton Court Forebay to Check 8. Along these waterways, water storage operations take place at Clifton Court Forebay, Bethany Reservoir, Travis Tank, Napa Terminal Tank, and Lake Del Valle

Pumping back into the Aqueduct from Lake Del Valle usually occurs in the fall and is detailed in Table 11. Inflow and storage changes for the last ten years at Lake Del Valle are shown on Figure 15.

Water flows from the Delta into Clifton Court Forebay through the Clifton Court control gates. A schedule of daily gate operation is published in the *SWP Monthly Report of Operations.* Monthly inflows to Clifton Court Forebay, along with corresponding storage changes, are shown in Table 12.

Water Deliveries

The Delta Field Division delivered 163,884 AF of water in 1993. These and other deliveries are summarized in Table 2.

The North Bay Aqueduct system, completed in May 1988, begins in the North Delta at the Barker Slough Facilities. Sacramento River water is conveyed through Cache, Lindsey, and Barker Sloughs to the Barker Slough Pumping Plant. From the pumping plant, water is conveyed by pipe 24 miles northwest to contractors in Napa and Solano counties and to the Cordelia Pumping Plant. Deliveries are made to Solano County water users via turnouts along the pipe's length. From the Cordelia Pumping Plant, the North Bay Aqueduct continues to the Napa Terminal Tank. The Aqueduct supplied 35,092 AF to Napa and Solano counties in 1993.

A division-wide total of 163,533 AF went to SWP entitlement contractors. This includes 140,970 AF of 1993 entitlement deliveries; 2,325 AF of carryover entitlement; and 20,238 AF of other water. Delivery of 5,219 AF of Drought Water Bank supply was conveyed to the city of San Francisco. Solano Flood Control and Water Conservation District received 26 AF of Vallejo Permit Water (local water right).

Pumping Plants

Delta Field Division pumping plants include Barker Slough and Cordelia on the North Bay Aqueduct; Banks on the California Aqueduct; and South Bay and Del Valle on the South Bay Aqueduct. Monthly pumping data is summarized for the year in Table 1.

Banks Pumping Plant was originally built to accommodate 11 units. Initially, seven pumps were constructed for a total pumping capacity of approximately 6,400 cfs. Construction of the final four pumps was completed in 1990, each with a design capacity of 1,067 cfs and a new total capacity of 10,500 cfs. Export pumping rates are increased on weekends to take advantage of less costly off-peak electricity. This produces sharp peaks in the export rate at about 7-day intervals.

There was 196,169 AF of federal pumping at Banks in 1993. The entire amount was pumped during October and November. Below is a five year summary of federal, State, and total pumping at Banks:

Pumping at Banks Pumping Plant

(in AF)

Year	Federal	State	Total
1993	196,169	3,013,955	3,210,124
1992	34,816	1,467,844	1,502,660
1991	51,642	1,643,819	1,695,461
1990	205,208	2,210,756	2,415,964
1989	373,209	3,409,326	3,782,535

San Luis Field Division

Water Storage

San Luis Reservoir reached its maximum end-of-month storage for the year, 1,985,549 AF, at the end of the calendar year. Maximum operating storage capacity in San Luis is 2,027,835 AF. Minimum end-of-month storage for the year, 1,040,364 AF, occurred in August. The State's share of San Luis Reservoir end-of-month storage reached the maximum of 1,064,110 AF in October, while the minimum of 723,206 AF was reached in July. Table 13 (below) and Figure 16 show San Luis Reservoir operations during 1993. Table 14 shows the monthly operation of O'Neill Forebay during 1993.

Pumping and Generating Plants

Total pumping in 1993 at Gianelli Pumping-Generating Plant was 2,697,215 AF. Total water released from San Luis Reservoir to O'Neill Forebay for generation was 1,063,245AF. Total pumping at Dos Amigos Pumping Plant was 2,998,644 AF in 1993, about 1,171,528 AF more than was pumped in 1992. Table 15 summarizes joint-use plant activity on a monthly basis.

Water Deliveries

SWP water deliveries in the San Luis Field Division during 1993 included 1,082 AF of State and federal deliveries to the DFG and the DPR from O'-Neill Forebay area (Reach 3) and 12 AF to the DPR from the San Luis Reservoir. Deliveries to DFG out of Reach 5 totaled 341 AF. The following tabulation details these recreation deliveries:

O'Neill Forebay and San Luis Reservoir (Reach 3)			
	DPR	DFG	Total
State	66	536	602
Federal	54	438	492
Sub-total	120	974	1094
Pools 16, 17, & 18 (Reach 5)			
	DPR	DFG	Total
State	0	188	188
Federal	0	153	153
Sub-total	0	341	341

Federal deliveries from the joint-use facilities in the San Luis Field Division during 1993 totaled 942,555 AF.

Table 13. San Luis Reservoir Monthly Operation 1993

(In acre-ft except as noted)

Month	Reservoir Storage			Inflow	Outflow			Gain (+) Loss (-)	Evaporation	Precipitation (in inches)
	Water Surface Elevation (in ft)	Storage	Storage Change	Gianelli P-G Plant Pumping	Gianelli P-G Plant Generation	Pacheco Tunnel	Deliveries			
Jan	471.24	1,190,213	665,797	673,258	0	2,804	0	-4,657	686	5.31
Feb	510.93	1,634,837	444,624	448,339	0	1,549	0	-2,166	1.454	3.51
Mar	525.09	1,804,747	169,910	197,991	20,065	4,329	0	-3,687	3,346	2.58
Apr	536.11	1,940,946	136,199	194,934	48,435	3,465	0	-6,835	6,405	0.20
May	513.74	1,668,093	-272,853	0	262,211	10,912	0	270	8,983	0.39
Jun	482.68	1,313,473	-354,620	0	343,869	11,963	0	1,212	11,425	0.12
Jul	459.19	1,064,794	-248,679	3,288	236,426	12,754	0	-2,787	12,371	0.00
Aug	456.79	1,040,364	-24,430	55,270	64,311	9,303	0	-6,086	10,511	0.00
Sep	480.92	1,294,245	253,881	284,796	3,669	11,655	0	-15,591	8,065	0.00
Oct	507.28	1,591,983	297,738	317,568	0	7,476	0	-12,354	4,933	0.07
Nov	515.81	1,692,739	100,756	208,702	84,259	13,454	0	-10,233	2,981	0.58
Dec	539.66	1,985,549	292,810	313,069	0	13,524	12	-6,723	1,226	0.93
Total			1,461,133	2,697,215	1,063,245	103,188	12	-69,637	72,386	13.69

San Joaquin Field Division

Water Deliveries

The San Joaquin Field Division delivered 1,302,014 AF of water in 1993. Seven State water service contractors took delivery of 1,289,462 AF. Water types include entitlement water, carryover entitlement, operational release, and SWP delivery. Kern County Water Agency represented 86 percent of the total SWP water delivered within the Division. In addition to State deliveries, 12,552 AF of federal deliveries were made in the San Joaquin Field Division. Map 2 and Table 2 break down water deliveries by agency and water type and show totals.

The San Joaquin Field Division is the only field division in the SWP where there are no water storage facilities. All deliveries are made from the Aqueduct and are summarized in the Appendix, Table 22.

Pumping Plants

Pumping plants in the San Joaquin Field Division include Las Perillas and Badger Hill on the Coastal Aqueduct, and Buena Vista, Teerink, Chrisman, and Edmonston on the California Aqueduct. A complete monthly summary of amounts pumped at all of these plants is shown on Table 1. A summary of energy used to pump at each plant is shown on Table 4.

During 1993, 2,014,436 AF of State water and 12,552 AF of federal water flowed past Check 21 into San Joaquin Field Division.

Southern Field Division

Water Storage

There are four storage reservoirs in the Southern Field Division with a combined storage capacity of 701,320 AF. Combined storage at the beginning of the year was 580,804 AF. End-of-year combined storage was 565,372 AF. Complete monthly operation tables for all five reservoirs, along with historical inflow and storage data for the last ten years, is summarized on pages 47 through 56.

Water Deliveries

SWP deliveries in the Southern Field Division totaled 764,079 AF. Twelve agencies received the water, which was almost all entitlement water. One exception was 1,676 AF of recreation water to the California Department of Parks and Recreation.

Pumping and Generating Plants

Pumping plants in the Southern Field Division include Oso and Castaic on the West Branch, and Pearblossom on the East Branch. SWP pumped 645,369 AF of water into the Southern Field Division in 1993. A complete monthly summary of amounts pumped is shown on Table 1. A summary of energy used to pump and of station service energy at each plant is shown on Table 4.

Generating plants in the Southern Field Division include Warne and Castaic on the West Branch, and Alamo and Devil Canyon on the East Branch. Energy available from each generating plant is summarized in Table 3. Combined generation at all four plants totaled 911,376 MWh.

Table 1. Project Pumping by Plant
1993
(in acre-feet)

Pumping Plants	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Hyatt*	30,469	47,069	34,614	0	0	0	0	673	0	0	25,829	0	138,654
Thermalito*	34,381	63,954	54,049	0	0	0	0	0	0	0	28,771	0	181,155
Barker Slough	1,919	1,501	1,549	2,159	3,247	3,755	3,818	5,156	4,296	3,329	3,224	2,293	36,246
Cordelia	917	690	507	1,092	1,896	2,182	2,641	2,542	1,966	1,649	2,076	1,626	19,784
Banks													
State	464,832	283,745	119,532	160,903	105,348	120,503	257,115	381,850	380,984	324,011	29,709	385,423	3,013,955
Federal	0	0	0	0	0	0	0	0	0	72,148	124,021	0	196,169
Total	464,832	283,745	119,532	160,903	105,348	120,503	257,115	381,850	380,984	396,159	153,730	385,423	3,210,124
South Bay	3,330	721	1,744	5,011	10,693	12,899	14,774	13,533	6,921	4,414	8,920	10,262	93,222
Del Valle	0	0	0	0	0	0	0	0	0	0	0	0	0
O'Neill 2/													
State	0	0	0	0	0	0	0	0	0	0	0	0	0
Federal	246,169	206,582	202,679	145,888	21,431	18,230	58,866	60,138	117,509	141,182	189,257	220,684	1,628,615
Total	246,169	206,582	202,679	145,888	21,431	18,230	58,866	60,138	117,509	141,182	189,257	220,684	1,628,615
Gianelli 1/													
State	421,070	198,977	28,931	79,158	0	0	3,288	38,530	169,816	128,831	-398	159,195	1,227,398
Federal	252,188	249,362	169,060	115,776	0	0	0	16,740	114,980	188,737	209,100	153,874	1,469,817
Total	673,258	448,339	197,991	194,934	0	0	3,288	55,270	284,796	317,568	208,702	313,069	2,697,215
Dos Amigos 1/													
State	39,906	37,511	102,725	87,182	199,748	248,264	304,119	298,755	185,638	172,582	167,973	200,782	2,045,185
Federal	-2,817	5,476	33,892	56,014	114,370	173,618	223,630	149,198	41,456	45,039	44,936	68,647	953,459
Total	37,089	42,987	136,617	143,196	314,118	421,882	527,749	447,953	227,094	217,621	212,909	269,429	2,998,644
Buena Vista	46,199	23,976	24,765	29,963	89,177	101,160	108,936	105,667	85,909	79,825	38,642	62,125	796,344
Teerink	47,178	22,999	16,442	24,257	78,368	85,114	86,783	84,653	81,269	78,245	36,303	58,645	700,256
Chrisman	48,081	23,338	15,770	21,701	74,011	80,463	79,555	81,027	81,026	74,760	36,498	57,485	673,715
Las Perillas	321	917	4,971	6,748	14,542	16,093	21,220	14,832	7,653	8,858	2,288	5,760	104,203
Badger Hill	314	944	5,185	6,925	15,879	17,772	22,955	15,824	7,778	9,024	2,359	5,813	110,772
Edmonston	46,464	22,596	14,696	20,597	70,414	76,707	75,249	77,324	76,865	72,195	35,535	56,727	645,369
Pearblossom	0	0	0	0	0	0	0	0	0	0	0	0	0
Oso	0	0	0	0	0	0	0	0	0	0	0	0	0
Castaic* 3/	97,226	104,127	76,643	80,569	97,483	118,928	111,588	124,022	119,070	88,341	64,054	88,085	1,170,136

1/ Joint State-federal facility.
2/ O'Neill Pumping Plant is a federal facility
3/ Castaic Pumping Plant pumps water for the city of Los Angeles.
* Pumping-generating plants. This table includes only the pumping portion of operations of these plants.

Table 2. Water Deliveries 1962-1993

(in acre-feet)

Agency	1962-1988	1989	1990	1991	1992	1993	TOTALS
Oroville Field Divisior							
Last Chance Creek W.D. (Local Supply)	173,073	11,487	7,046	7,010	4,988	10,879	214,483
Plumas Co. F.C. & W.C.D.	6,698	486	548	420	485	444	9,081
County of Butte	5,714	300	380	328	117	256	7,095
Thermalito I.D. (Local Supply)	19,516	2,152	2,272	2,124	2,315	2,096	30,475
Prior Water Rights Deliveries 1/	16,773,465	810,458	867,623	558,143	608,692	811,435	20,429,816
Yuba City	889	403	494	265	642	746	3,439
Delta Field Division							
Napa CO. F.C. & W.C.D. (Local Supply)	101,592	10,153	13,313	10,018	5,510	5,286	145,872
Alameda Co. W.D. (Local Supply)	475,523	26,042	31,703	30,126	24,250	14,909	602,553
A.C.F.C. & W.C.D., Zone 7 (Local Supply)	384,785	28,185	33,975	14,101	23,084	43,390	527,520
Pleasanton Township W.D.	674	0	0	0	0	0	674
Santa Clara Valley W.D.	1,321,932	107,085	120,962	87,253	42,839	62,065	1,742,136
Marin W.D.	4,594	0	0	0	0	0	4,594
San Francisco W.D.	4,345	0	332	51,135	21,255	5,219	82,286
Skylonda M.W.D.	10	0	0	0	0	0	10
Oak Flat W.D.	119,171	6,391	3,212	1,472	2,239	2,858	135,343
Mustang W.D.	4,256	0	0	0	0	0	4,256
Granite Construction	120	0	0	0	0	0	120
Lake Del Valle (E.B.R.P.D.)	1,682	152	168	150	147	143	2,442
Orestimba Creek	100	0	0	0	0	0	100
Federal Customers	4,409	473	38	77	154	208	5,359
Solano Co. F.C.W.C.D.	16,402	17,364	19,879	24,527	26,086	29,806	134,064
San Luis Field Division							
Dept. Parks & Rec. (State)	581	64	70	59	72	66	912
Dept. Fish & Game (State)	5,852	429	145	110	391	724	7,651
Federal Customers (Rec.+ Joint-Use)	21,866,695	1,303,249	992,022	504,401	541,568	943,200 10/	26,151,135
Federal Customers (Misc.)	247,586	0	0	0	0	76	247,662
Westlands Water District	0	0	10,900	0	0	0	10,900
San Joaquin Field Division							
Tulare Lake Basin W.S.D. 6/	2,259,287	181,963	90,312	2,180	78,558	123,290	2,735,590
Empire West Side I. D. 7/	72,372	3,000	3,310	221	1,354	2,741	82,998
County Of Kings	45,900	4,000	2,000	0	1,806	4,000	57,706
Hacienda W.D. 2/	75,895	0	0	0	0	0	75,895
Kern County Water Agency	15,523,912	1,146,062	862,448	223,928	446,625	1,081,231	19,284,206
Kern Water Bank 4/	7,501	0	0	0	0	0	7,501
Dudley Ridge Water District	1,139,292	57,049 9/	36,657	14,454	13,945	23,418	1,284,815
Devils Den Water District	318,146	14,645	6,440	716	0	0	339,947
J.G. Boswell	117,430	0	0	0	0	0	117,430
Shell Cal Prod. 3/	85,914	0	0	0	0	0	85,914
Green Valley Water District	11,054	0	0	0	0	0	11,054
Federal Wheeling 8/	864,725	172,656	74,746	23,845	34,154	12,552	1,182,678
Castaic Lake Water Agency	0	0	0	0	0	4,157	4,157
M.W.D. Of S.C.	0	0	0	0	0	50,000	50,000
Wheeler Ridge W.S.D.	92	0	0	0	0	0	92
Southern Field Divison							
A.V.E.K. W.A.	580,533	45,280	47,206	8,607	31,927	43,102	756,655
M.W.D. Of S.C.	8,803,951	1,156,698	1,396,423	606,447	716,250	602,190	13,281,959
Littlerock Creek I. D.	6,506	971	1,747	522	251	734	10,731
Mojave Water Agency	57,615	200	0	2,032	9,334	11,734	80,915
Desert Water Agency	298,800	36,500	38,100	11,430	17,197	38,100	440,127
Coachilla Valley Water District	188,859	21,873	23,100	6,930	10,427	23,100	274,289
Crestline-Lake Arrowhead Water Agency	19,741	2,170	1,950	1,561	264	946	26,632
San Gabriel Valley M.W.D.	88,943	12,839	16,649	5,399	11,971	14,397	150,198
San Bernardino Valley M.W.D. 5/	202,726	20,782	18,831	7,177	5,113	6,552	261,181
Santa Barbara	0	0	0	1,240	0	0	1,240
Dept. Parks & Rec., L.A. Co. Rec. Dept.	32,939	7,490	8,879	4,560	1,995	1,676	57,539
Piru Creek Fish Enhancement	2,915	0	0	0	0	0	2,915
Castaic Lake Water Agency	98,847	21,719	22,139	7,357	14,812	13,787	178,661
Palmdale Water District	11,803	9,009	8,608	3,914	4,035	7,761	45,130
United Water C.D. (Local Supply)	998	0	0	0	0	0	998
Ventura County FCD	0	0	4,836	988	0	0	5,824
Los Angeles Dept. of Water and Power	0	0	0	0	16	0	16
Lilico Pictures	0	10	0	0	0	0	10
Totals	72,456,360	5,239,789	4,769,463	2,225,227	2,704,868	3,999,274	91,394,981

1/ Includes Thermalito Afterbay, Palermo Canal, Upper Feather Lakes deliveries.
2/ Hacienda Water District was annexed by Tulare Lake Basin WSD in 1981.
3/ Repayment of pre-consolidation water.
4/ Advance storage of groundwater, by agreement between KCWA and DWR
5/ Includes 324 acre-feet of Local-Out.
6/ Includes 1,550 acre-feet transferred to Westlands WD (federal).
7/ Includes 300 acre-feet transferred to Tulare Lake BWSD as Entitlement.
8/ Includes 3,000 acre-feet transferred to Westlands WD (federal).
9/ Includes 2,500 acre-feet of transferred entitlement water.
10/ Includes 11,821 AF of KCWA Transfer Entitlement to WWD and 25,421 AF of Cross Valley Canal Transfer Entitlement to WWD

Table 3. Energy Resources
1993

(in megawatt-hours)

Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Hyatt-Thermalito 1/	24,473	48,073	357,365	287,331	286,590	296,330	380,554	363,149	107,232	103,549	124,791	241,446	2,620,883
William R. Gianelli													
State	0	0	5,201	2,622	27,189	36,463	13,825	474	728	0	20,853	0	107,355
Federal	0	0	0	10,870	42,528	44,919	35,743	12,653	0	0	0	0	146,713
Total	0	0	5,201	13,492	69,717	81,382	49,568	13,127	728	0	20,853	0	254,068
CEA Energy 2/	32,050	36,839	40,536	30,750	29,450	37,870	34,100	35,275	29,100	37,250	37,600	31,680	412,500
William E. Warne 3/	18,536	7,995	0	6	21,044	28,899	28,570	24,167	21,512	19,942	1,175	32,356	204,202
Castaic	33,720	41,940	15,456	11,232	34,848	46,800	46,200	37,200	36,000	29,690	1,440	53,760	388,286
Alamo	347	0	0	0	0	0	0	230	901	0	0	0	1,478
Devil Canyon	18,186	9,394	12,047	21,985	38,616	28,753	27,357	37,037	43,645	31,933	31,700	16,757	317,410
Tera Corp.	14	0	41	107	262	394	576	627	414	175	62	22	2,694
MWD Hydro	10,146	10,744	8,517	9,406	16,464	13,217	14,787	18,651	17,570	15,137	13,395	11,905	159,939
Reid Gardner	124,518	101,090	100,204	61,132	14,859	69,705	94,429	100,322	107,077	127,840	149,831	152,163	1,203,170
Pine Flat	0	0	7,374	56,042	107,922	132,984	145,341	92,540	42,707	24,701	0	0	609,611
Purchases 4/	120,106	49,010	51,800	46,892	45,000	46,800	46,885	53,100	51,450	54,550	50,900	58,900	675,393
Other Sources/Exchanges 5/	3,459	19,847	16,055	1,410	1,465	1,223	2,299	30,610	3,763	1,588	19,567	4,795	106,081
SCE Return Additional	175,783	94,916	84,803	89,775	46,649	231,319	125,587	234,291	480,651	386,758	86,513	235,938	2,272,983

1/ At Table Mountain.

2/ Entitlement energy supplied to SCE under long-term contracts.

3/ Includes station-service energy.

4/ Includes Salt River Project; Sacramento Municipal Utility District; Southern California Edison; Bonneville Power Authority; Pacific Gas and Electric; Washington Water and Power Co.; Montana Power Co.; Arizona Public Service Co.; Pacific Power and Light; Western Area Lower Colorado; Los Angeles Department of Water and Power; Puget Sound Power and Light; and Northern California Power Agency.

5/ Includes Southern California Edison; Western Area Mid-Pacific; Los Angeles Dept. of Water and Power; Bonneville Power Authority; City of Vernon; and Pacific Gas and Electric.

State:	9,081,985
Federal:	146,713
Total Project:	9,228,698

Table 4. Total Energy Loads

1993

(in megawatt-hours)

Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Hyatt-Thermalito													
Pumpback and													
Station Service	23,396	39,721	32,382	92	117	102	39	604	94	150	23,240	7	119,944
North Bay 1/	0	0	0	0	0	0	0	720	855	840	921	1,056	4,392
South Bay	3,040	1,235	1,598	4,233	8,761	10,667	12,847	11,744	5,863	3,879	7,531	8,336	79,734
Del Valle	22	19	17	6	5	6	7	6	5	5	6	8	112
Banks													
State	134,979	82,494	33,944	45,535	29,941	35,083	73,658	109,458	109,116	92,619	7,766	111,919	866,512
Federal	0	0	0	0	0	0	0	0	0	21,430	36,833	0	58,263
Bottle Rock 2/	116	93	96	94	81	64	56	53	51	72	95	113	984
Gianelli													
State	114,526	64,748	10,857	32,727	126	244	1,311	11,401	50,946	42,011	-14	67,648	396,531
Federal	67,848	81,982	60,712	48,708	0	0	0	4,739	34,272	62,868	73,053	65,697	499,879
Dos Amigos													
State	5,316	6,007	13,634	12,224	25,606	35,033	40,641	37,737	26,465	23,865	22,957	27,219	276,704
Federal	0	0	4,509	6,887	17,091	22,398	30,513	21,477	2,037	3,759	5,040	7,764	121,475
Pine Flat 2/	211	193	143	0	0	2	0	0	0	10	227	250	1,036
Las Perillas	48	80	361	487	1,066	1,199	1,551	1,069	550	653	178	437	7,679
Badger Hill	70	172	937	1,289	2,918	3,297	4,226	2,904	1,424	1,682	413	1,103	20,435
Buena Vista	11,486	6,056	6,183	7,406	21,758	24,712	26,510	25,749	20,986	19,391	9,589	15,485	195,311
Teerink	13,193	6,556	4,621	6,798	21,552	23,177	23,086	22,957	22,272	21,068	10,085	16,104	191,469
Chrisman	30,078	14,769	10,232	13,841	46,245	50,231	49,679	50,395	49,719	46,402	22,886	36,158	420,635
Edmonston	105,819	52,022	34,510	47,364	159,762	172,638	170,077	173,944	173,280	162,428	80,118	127,319	1,459,281
Oso	8,615	3,916	231	236	9,135	12,637	12,266	10,531	9,426	9,054	785	14,596	91,428
Pearblossom	11,082	6,431	8,923	12,126	21,453	16,775	14,713	20,901	23,755	22,037	20,435	1,589	180,220
Warne 2/	68	104	133	119	50	1	1	0	17	41	142	33	709
Sales	58,330	83,062	479,730	385,429	246,890	527,957	476,312	476,851	398,441	310,310	264,930	365,973	4,074,215
Other Project													
Loads 3/	32,451	36,839	40,545	31,564	31,075	38,149	34,273	44,536	56,661	49,570	37,992	32,327	465,982
Actual Deviation	1,523	791	-448	308	908	775	123	979	1,292	1,831	245	1,079	9,406
Losses	9,269	12,113	14,615	17,670	13,551	16,836	24,714	26,558	19,810	21,726	23,479	18,925	219,266

1/ Includes Barker Slough, Cordelia, and Cordelia Interim pumping plants.

2/ Station Service only.

3/ Includes Southern California Edison; Bonneville Power Authority; City of Vernon; Pacific Gas and Electric; Nevada Power Authority; and Project Emergency Service.

Total State:	9,081,985
Total Federal:	679,617
Total Project:	9,761,602

Table 5. Delta Outflow Index
1993

(in cfs except as noted)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	5,716	34,589	60,399	70,708	26,208	24,544	9,513	11,783	8,140	4,770	5,544	5,656
2	5,153	30,700	53,368	67,046	30,996	29,525	9,156	11,027	7,326	4,995	7,783	5,146
3	16,060	29,776	45,560	68,824	28,493	34,873	7,408	12,270	7,655	3,614	8,032	5,038
4	27,169	26,774	39,486	67,189	25,907	36,648	5,711	13,457	6,674	2,659	7,879	6,561
5	27,028	24,919	35,621	62,999	24,919	38,998	5,807	12,866	6,468	1,685	7,619	5,829
6	20,873	23,969	32,877	60,379	26,424	39,540	7,088	11,871	6,291	1,628	8,038	7,113
7	14,575	22,474	30,398	58,451	26,803	40,484	11,149	11,137	6,421	2,570	7,845	6,260
8	17,942	18,317	28,566	57,160	26,650	43,173	12,188	10,953	6,255	5,390	5,557	7,347
9	22,163	18,598	27,792	54,048	28,046	44,519	11,094	10,925	5,891	6,163	5,352	8,544
10	31,366	25,137	24,852	50,096	25,759	43,715	8,578	10,094	4,553	4,387	5,151	12,070
11	32,714	36,507	22,569	46,582	25,593	41,461	8,771	10,228	4,567	5,510	5,334	13,679
12	26,659	41,522	21,312	42,445	23,422	36,773	9,834	9,817	4,508	6,285	5,676	16,387
13	26,934	44,241	22,454	39,872	26,043	32,611	9,907	9,819	5,665	6,358	6,004	17,258
14	28,060	44,961	22,425	37,402	26,181	29,489	8,925	9,285	4,826	6,546	6,246	17,125
15	38,392	44,714	22,007	35,436	24,446	26,189	9,214	8,662	6,038	7,615	6,377	18,543
16	41,804	40,425	22,048	34,117	24,226	24,428	9,121	9,262	5,068	7,192	5,753	17,930
17	45,013	36,045	22,232	33,170	20,149	23,026	8,957	8,858	4,718	7,220	6,167	18,465
18	53,646	35,390	23,344	32,430	15,216	21,307	8,747	9,246	4,026	7,728	6,404	18,064
19	61,173	35,395	31,263	23,932	16,598	19,482	8,673	9,089	3,520	8,622	6,940	16,003
20	57,761	40,616	47,786	26,659	14,348	18,480	8,829	9,205	3,353	8,509	6,401	14,145
21	54,377	52,163	56,717	29,669	15,957	17,977	8,739	9,425	3,179	5,914	6,192	12,022
22	62,940	62,645	63,938	30,439	14,572	17,845	7,511	8,595	3,493	4,072	2,974	10,654
23	71,551	65,492	79,435	29,227	15,008	17,788	8,712	8,159	4,008	3,181	2,809	10,380
24	74,579	71,360	69,862	28,980	16,713	16,145	8,696	7,453	5,867	2,588	4,397	10,695
25	73,160	74,984	72,918	28,244	18,997	14,284	9,133	7,009	4,581	1,691	5,940	10,897
26	70,801	73,130	76,069	28,522	21,709	12,769	9,170	7,527	4,329	1,233	5,890	10,449
27	64,801	68,814	75,410	29,140	27,238	10,721	8,978	8,096	4,439	965	6,090	10,159
28	60,285	65,076	77,319	28,035	28,761	10,747	9,375	9,127	4,703	1,280	6,477	11,089
29	54,245		79,375	27,406	27,317	10,965	9,921	8,040	4,177	2,114	6,025	11,286
30	43,684		76,555	27,924	27,462	11,632	10,538	8,958	4,295	2,967	6,422	12,508
31	36,038		73,389		26,710		11,177	8,425		3,925		11,464
Total	1,266,662	1,188,733	1,437,346	1,256,531	726,871	790,138	280,620	300,668	155,034	139,376	183,318	358,766
Ave.	40,860	42,455	46,366	41,884	23,447	26,338	9,052	9,699	5,168	4,496	6,111	11,573
Max.	74,579	74,984	79,435	70,708	30,996	44,519	12,188	13,457	8,140	8,622	8,038	18,543
Min.	5,153	18,317	21,312	23,932	14,348	10,721	5,711	7,009	3,179	965	2,809	5,038
Total In AF	2,512,424	2,357,852	2,850,976	2,492,329	1,441,749	1,567,239	556,610	596,375	307,510	276,452	363,611	711,612

Annual Total = 16,034,739 acre-feet

Table 6. Sacramento Basin And Sacramento-San Joaquin Delta Operations
1993

(in thousands of acre-feet except as noted)

Month	Upstream Reservoir Releases to River			Sacramento River In-Basin Use 2/	Delta Inflow			Delta Uses			Delta Exports		
	Keswick 1/	Oroville 1/	Nimbus		Sacramento River at Sacramento 3/	San Joaquin River at Vernalis 4/	Total 5/	Consumptive	Outflow Index Total	Outflow Index Average CFS	Total	DWR	USBR 6/
Jan	185	61	256	2,706	2,959	252	3,211	-56	2,512	41	716	465	251
Feb	221	56	340	2,218	2,698	167	2,865	-37	2,358	42	512	284	228
Mar	1,315	773	442	1,804	3,062	166	3,228	-10	2,851	46	375	120	255
Apr	478	436	207	1,354	2,575	203	2,778	63	2,492	42	338	161	177
May	474	330	332	414	1,546	219	1,765	121	1,442	23	207	105	102
Jun	708	333	345	497	1,840	138	1,978	191	1,567	26	250	121	129
Jul	664	418	331	-94	1,268	94	1,362	268	557	9	534	257	277
Aug	710	423	235	-19	1,370	122	1,492	252	596	10	662	382	280
Sep	561	126	135	119	951	167	1,118	174	308	5	653	381	272
Oct	371	133	163	172	859	188	1,047	118	276	4	671	324	347
Nov	298	143	108	178	725	106	831	55	364	6	414	30	384
Dec	308	356	143	460	1,255	101	1,356	2	712	12	646	385	261
Total	6,293	3,588	3,037	9,809	21,108	1,923	23,031	1,141	16,035	---	5,978	3,015	2,963

1/ Time lagged values (Keswick: 5 days; Oroville: 3 days; Folsom: 1 day).

2/ Positive values are accretions; negative values are depletions.

3/ These values are a measured daily average taken from the Sacramento River at Freeport.

4/ These values are based on daily 6 a.m. readings.

5/ Includes Sacramento County Regional Waste Treatment Plant.

6/ USBR water pumped at Harvey O. Banks Pumping Plant plus Tracy Pumping Plant and Contra Costa Pumping Plant.

Table 7. Upper Feather Area Lakes Monthly Operation

1993

(in acre-feet except as noted

Month	Lake Storage			Outflow							Inflow
				Regulated Release							
	Water Surface Elevation (in feet)	Storage*	Storage Change	Stream-Flow Maint.	Water Supply Contract	Prior Water Rights	Total Regulated Release	Spill	Estimated Evaporation and Seepage	Total Outflow	Computed
Antelope Lake			Capacity 22,566 acre-feet								
Jan	4,992.98	15,059	793	381	0	0	381	0	50	431	1,224
Feb	4,992.71	14,862	-197	111	0	0	111	0	58	169	-28
Mar	5,001.96	22,527	7,665	1,230	0	0	1,230	0	95	1,325	8,990
Apr	5,003.41	23,895	1,368	177	0	0	177	9,182	190	9,549	10,917
May	5,002.96	23,466	-429	0	0	0	0	13,597	306	13,903	13,474
Jun	5,002.36	22,900	-566	0	0	0	0	4,161	472	4,633	4,067
Jul	5,001.13	21,765	-1,135	954	0	0	954	374	791	2,119	984
Aug	4,999.46	20,269	-1,496	1,230	0	0	1,230	0	635	1,865	369
Sep	4,998.11	19,107	-1,162	950	0	0	950	0	456	1,406	244
Oct	4,996.97	18,157	-950	1,230	0	0	1,230	0	250	1,480	530
Nov	4,995.85	17,252	-905	1,190	0	0	1,190	0	129	1,319	414
Dec	4,995.13	16,685	-567	1,230	0	0	1,230	0	87	1,317	750
Total	---	---	2,419	8,683	0	0	8,683	27,314	3,519	39,516	41,935
Frenchman Lake			Capacity 55,477 acre-feet								
Jan	5,543.78	10,085	809	121	0	0	121	0	36	157	966
Feb	5,545.38	10,945	860	111	0	0	111	0	43	154	1,014
Mar	5,563.52	24,707	13,762	123	0	0	123	0	86	209	13,971
Apr	5,573.69	35,621	10,914	119	0	0	119	0	219	338	11,252
May	5,577.06	39,814	4,193	11	2,424	0	2,435	0	404	2,839	7,032
Jun	5,576.87	39,570	-244	45	1,929	0	1,974	0	652	2,626	2,382
Jul	5,574.37	36,443	-3,127	0	2,489	0	2,489	0	853	3,342	215
Aug	5,571.47	33,020	-3,423	0	2,821	0	2,821	0	709	3,530	107
Sep	5,570.17	31,557	-1,463	0	1,014	0	1,014	0	561	1,575	112
Oct	5,569.95	31,313	-244	26	202	0	228	0	332	560	316
Nov	5,569.81	31,159	-154	119	0	0	119	0	176	295	141
Dec	5,570.02	31,391	232	123	0	0	123	0	121	244	476
Total	---	---	22,115	798	10,879	0	11,677	0	4,192	15,869	37,984
Lake Davis			Capacity 84,371 acre-feet								
Jan	5,758.07	31,122	1,968	615	29	0	644	0	155	799	2,767
Feb	5,758.85	32,916	1,794	555	17	0	572	0	160	732	2,526
Mar	5,763.82	45,808	12,892	615	27	0	642	0	302	944	13,836
Apr	5,768.59	60,673	14,865	595	26	0	621	0	630	1,251	16,116
May	5,770.83	68,475	7,802	246	30	369	645	0	1,161	1,806	9,608
Jun	5,770.95	68,908	433	238	56	357	651	0	1,815	2,466	2,899
Jul	5,770.21	66,228	-2,680	246	90	369	705	0	2,344	3,049	369
Aug	5,769.50	63,779	-2,449	246	75	369	690	0	1,990	2,680	231
Sep	5,768.89	61,687	-2,092	238	59	357	654	0	1,714	2,368	276
Oct	5,768.70	61,043	-644	615	16	0	631	0	915	1,546	902
Nov	5,768.51	60,404	-639	595	7	0	602	0	537	1,139	500
Dec	5,768.54	60,505	101	615	12	0	627	0	370	997	1,098
Total	---	---	31,351	5,419	444	1,821	7,684	0	12,093	19,777	51,128

* At end of month.

Table 8. Lake Oroville Monthly Operation
1993

(in acre-feet except as noted) Capacity 3,537,577 acre-feet

Month	Water Surface Elevation (in feet)	Storage	End-Of-Month Storage Change	Outflow						Hyatt Pumpback	Computed Inflow 3/
				Hyatt Generation 1/	Palermo Canal	Spillway Leakage 2/	Evap-oration	Spill	Total Outflow		
Jan	782.63	2,001,921	599,873	46,785	131	0	638	0	47,554	30,469	616,958
Feb	826.86	2,509,679	507,758	83,149	108	0	885	0	84,142	47,069	544,831
Mar	859.36	2,935,879	426,200	567,063	120	298	1,836	253,534	822,851	34,614	1,214,437
Apr	882.85	3,273,870	337,991	449,108	108	1,078	2,969	0	453,263	0	791,254
May	898.63	3,515,972	242,102	434,303	542	1,993	5,002	0	441,840	0	683,942
Jun	896.82	3,487,573	-28,399	447,733	797	2,172	6,873	0	457,575	0	429,176
Jul	872.27	3,118,405	-369,168	585,751	1,190	1,768	8,394	0	597,103	0	227,935
Aug	842.60	2,710,315	-408,090	576,194	1,160	607	7,603	0	585,564	673	176,801
Sep	839.19	2,665,948	-44,367	180,603	1,110	157	6,618	36	188,524	0	144,157
Oct	838.55	2,657,674	-8,274	172,744	697	186	3,520	0	177,147	0	168,873
Nov	836.17	2,627,062	-30,612	207,908	510	119	2,456	0	210,993	25,829	154,552
Dec	820.36	2,429,938	-197,124	403,394	219	91	722	0	404,426	0	207,302
Total	- - -	- - -	1,027,890	4,154,735	6,692	8,470	47,516	253,570	4,470,983	138,654	5,360,219

1/ Includes bypass flows

2/ Only occurs when lake water elevation is greater than or equal to 813.00 and there is no spill.

3/ Does not include pumpback.

Table 9. Thermalito Forebay Monthly Operation
1993

Including Diversion Pool and Power Canal
(end-of-month storage in acre-feet)

Month	End-Of-Month Storage 1/	Storage Change	Inflow			Outflow					Losses (-) and Gains (+)
			Lake Oroville Releases 2/	Kelly Ridge Generation	Thermalito Pumpback	Thermalito Generation	County of Butte	Thermalito Irrigation District	Releases to River 3/	Hyatt Pumpback	
Jan	23,209	-1,746	46,785	15,092	34,381	40,374	78	89	38,390	30,469	11,396
Feb	23,034	-175	83,149	14,166	63,954	87,997	49	83	34,696	47,069	8,450
Mar	23,242	208	820,895	15,670	54,049	571,995	47	98	277,111	34,614	-6,541
Apr	24,692	1,450	450,186	15,161	0	432,221	2	105	40,792	0	9,223
May	24,404	-288	436,296	15,337	0	416,699	34	206	42,818	0	7,836
Jun	23,830	-574	449,905	15,097	0	431,601	8	228	40,502	0	6,763
Jul	22,860	-970	587,519	15,048	0	565,233	0	307	38,334	0	337
Aug	23,633	773	576,801	15,624	0	556,284	2	293	37,840	673	3,440
Sep	23,622	-11	180,796	3,565	0	146,681	0	293	36,480	0	-918
Oct	24,030	408	172,930	13,465	0	148,610	0	166	37,750	0	539
Nov	23,930	-100	208,027	13,877	28,771	189,689	0	123	36,900	25,829	1,766
Dec	23,570	-360	403,485	14,310	0	384,211	36	105	38,340	0	4,537
Total	- - -	-1,385	4,416,774	166,412	181,155	3,971,595	256	2,096	699,953	138,654	46,828

1/ Sum of Thermalito Forebay and Diversion Pool.
2/ Sum of releases from Lake Oroville through Hyatt plant, spill, and spillway leakage.
3/ Sum of Diversion Dam generation plus hatchery.

Table 10. Thermalito Afterbay Monthly Operation
1993

(end-of-month storage in acre-feet

Month	Water Surface Elevation (in feet)	Storage	Storage Change	Inflow	Outflow						Losses (-) and Gains (+)
				Thermalito Generation 1/	Sutter Butte Canal	Western Canal Lateral	Richvale Canal	Western Canal	River Outlet	Thermalito Pumpback	
Jan	128.01	25,861	-15,773	40,374	2,980	0	657	36	28,285	34,381	10,192
Feb	129.90	31,820	5,959	87,997	0	0	0	0	22,215	63,954	4,131
Mar	129.92	31,886	66	571,995	0	0	0	0	498,584	54,049	-19,296
Apr	132.08	39,412	7,526	432,221	2,210	0	246	416	401,407	0	-20,416
May	127.67	24,851	-14,561	416,699	76,580	628	14,660	32,990	293,195	0	-13,207
Jun	131.53	37,425	12,574	431,601	67,400	512	13,200	28,650	297,278	0	-11,987
Jul	129.93	31,919	-5,506	565,233	95,210	883	18,790	53,960	381,127	0	-20,769
Aug	129.78	31,424	-495	556,284	88,190	787	17,660	47,190	385,920	0	-17,032
Sep	124.56	16,494	-14,930	146,681	50,020	133	6,370	15,300	89,843	0	55
Oct	128.38	26,981	10,487	148,610	23,150	0	3,950	15,490	95,857	0	324
Nov	130.59	34,140	7,159	189,689	21,610	254	7,620	16,280	107,100	28,771	-895
Dec	127.82	25,294	-8,846	384,211	20,960	201	11,340	9,070	360,724	0	9,238
Total	- - -	- - -	-16,340	3,971,595	448,310	3,398	94,493	219,382	2,961,535	181,155	-79,662

1/ Includes bypass flows.

Table 11. Lake Del Valle Monthly Operation

1993

(in acre-feet except as noted)

Month	Water* Surface Elevation (in feet)	Storage	Storage Change	Inflow		Outflow					Precipitation (inches)
				Natural	South Bay Aqueduct	South Bay Aqueduct	Recreation 1/	Arroyo Valle	Evaporation Losses	Total	
Jan	702.49	39,555	13,633	21,439	0	3,088	2	4,668	48	7,806	6.63
Feb	703.03	39,936	381	15,651	0	4,653	4	10,556	57	15,270	4.47
Mar	703.64	40,369	433	8,795	0	5,925	7	2,322	108	8,362	2.43
Apr	703.82	40,497	128	2,466	0	1,862	5	283	188	2,338	0.82
May	703.15	40,020	-477	646	0	201	16	646	260	1,123	0.58
Jun	703.13	39,893	-127	283	0	0	17	0	393	410	0.22
Jul	702.32	39,435	-458	6	0	0	26	0	438	464	0.00
Aug	701.72	39,015	-420	54	0	0	24	0	450	474	0.00
Sep	692.58	32,967	-6,048	183	0	4,833	18	1,011	369	6,231	0.00
Oct	681.32	26,469	-6,498	310	0	6,294	12	310	192	6,808	0.80
Nov	678.10	24,827	-1,642	112	0	1,517	5	112	120	1,754	2.17
Dec	678.30	24,926	99	148	0	0	7	0	42	49	2.08
Total	---	---	-996	50,093	0	28,373	143	19,908	2,665	51,089	20.20

*At end of month.

1/ To East Bay Regional Park District.

Table 12. Clifton Court Forebay Monthly Operation
1993

(elevation in feet, storage in acre-feet)

Month	Water Surface Elevation (ft)	Storage (AF)	Storage Change (AF)	Inflow (AF)
Jan	-0.21	17,811	215	465,047
Feb	2.26	23,140	5,329	289,074
Mar	0.11	18,500	-4,640	114,593
Apr	0.61	19,577	1,077	163,865
May	-0.53	17,122	-2,455	109,114
Jun	-0.63	16,907	-215	126,383
Jul	-0.11	18,026	1,119	264,690
Aug	0.17	18,629	603	388,134
Sep	-0.78	16,585	-2,044	383,915
Oct	-1.05	16,004	-581	396,899
Nov	-0.77	16,606	602	154,396
Dec	-0.21	17,811	1,205	386,628
Total	---	---	215	3,242,738

Table 13. San Luis Reservoir Monthly Operation

1993

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Storage 1/	Monthly Storage Change	Inflow	Outflow			Gain (+) Loss (-)	Evaporation	Precipitation (in inches)
				Gianelli P-G Plant Pumping	Gianelli P-G Plant Generation	Pacheco Tunnel	Spill			
Jan	471.24	1,190,213	665,797	673,258	0	2,804	0	-4,657	686	5.31
Feb	510.93	1,634,837	444,624	448,339	0	1,549	0	-2,166	1,454	3.51
Mar	525.09	1,804,747	169,910	197,991	20,065	4,329	0	-3,687	3,346	2.58
Apr	536.11	1,940,946	136,199	194,934	48,435	3,465	0	-6,835	6,405	0.20
May	513.74	1,668,093	-272,853	0	262,211	10,912	0	270	8,983	0.39
Jun	482.68	1,313,473	-354,620	0	343,869	11,963	0	1,212	11,425	0.12
Jul	459.19	1,064,794	-248,679	3,288	236,426	12,754	0	-2,787	12,371	0.00
Aug	456.79	1,040,364	-24,430	55,270	64,311	9,303	0	-6,086	10,511	0.00
Sep	480.92	1,294,245	253,881	284,796	3,669	11,655	0	-15,591	8,065	0.00
Oct	507.28	1,591,983	297,738	317,568	0	7,476	0	-12,354	4,933	0.07
Nov	515.81	1,692,739	100,756	208,702	84,259	13,454	0	-10,233	2,981	0.58
Dec	539.66	1,985,549	292,810	313,069	0	13,524	12	-6,723	1,226	0.93
Total	---	---	1,461,133	2,697,215	1,063,245	103,188	12	-69,637	72,386	13.69

1/ At end of month.

Table 14. O'Neill Forebay Monthly Operation

1993

(in acre-feet except as noted

Month	Reservoir Storage			Inflow				Outflow				Gain (+) Loss (-)
	Water Surface Elevation (in feet)	Storage	Storage Change	Pump In 1/	O'Neill P-G Plant Pumping	Gianelli P-G Plant Generation	California Aqueduct Check 12	O'Neill P-G Plant Generation	Gianelli P-G Plant Pumping	Dos Amigos Pumping	Deliveries	
Jan	220.10	43,411	-6,063	0	246,169	0	455,270	0	673,258	37,089	49	2,895
Feb	219.05	40,711	-2,700	0	206,582	0	281,753	0	448,339	42,987	150	441
Mar	221.47	46,994	6,283	0	202,679	20,065	115,553	0	197,991	136,617	285	2,879
Apr	219.31	41,375	-5,619	0	145,888	48,435	154,068	15,241	194,934	143,196	951	312
May	220.94	45,603	4,228	21	21,431	262,211	87,651	52,335	0	314,118	1,739	1,106
Jun	221.57	47,257	1,654	98	18,230	343,869	104,556	43,634	0	421,882	1,883	2,300
Jul	223.47	52,303	5,046	105	58,866	236,426	235,923	0	3,288	527,749	2,706	7,469
Aug	222.34	49,288	-3,015	74	60,138	64,311	360,711	1,375	55,270	447,953	2,361	18,710
Sep	220.10	43,411	-5,877	0	117,509	3,669	365,027	0	284,796	227,094	1,267	21,074
Oct	220.87	45,420	2,009	0	141,182	0	383,067	0	317,568	217,621	510	13,459
Nov	220.05	43,282	-2,138	0	189,257	84,259	142,857	0	208,702	212,909	297	3,397
Dec	222.54	49,820	6,538	0	220,684	0	367,931	0	313,069	269,429	343	764
Total			346	298	1,628,615	1,063,245	3,054,367	112,585	2,697,215	2,998,644	12,541	74,806

1/ Pump-in located at Mile 79.67R.

Table 15. Monthly Operations Summary, State-Federal San Luis Joint-Use Facilities
1993

(In acre-feet except as noted)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Check 12													
State	455,270	281,753	115,553	154,068	87,651	104,556	235,923	360,711	365,027	310,919	18,836	367,931	2,858,198
Federal	0	0	0	0	0	0	0	0	0	72,148	124,021	0	196,169
Total	455,270	281,753	115,553	154,068	87,651	104,556	235,923	360,711	365,027	383,067	142,857	367,931	3,054,367
O'Neill P-G Plant Pumping													
State	0	0	0	0	0	0	0	0	0	0	0	0	0
Federal	246,169	206,582	202,679	145,888	21,431	18,230	58,866	60,138	117,509	141,182	189,257	220,684	1,628,615
Total	246,169	206,582	202,679	145,888	21,431	18,230	58,866	60,138	117,509	141,182	189,257	220,684	1,628,615
Generation													
Federal	0	0	0	15,241	52,335	43,634	0	1,375	0	0	0	0	112,585
O'Neill Forebay Storage*													
State	23,259	18,858	25,722	23,043	24,969	26,631	27,245	28,161	22,403	25,494	23,024	22,614	- - -
Federal	20,152	21,853	21,272	18,332	20,634	20,626	25,058	21,127	21,008	19,926	20,258	27,206	- - -
Total	43,411	40,711	46,994	41,375	45,603	47,257	52,303	49,288	43,411	45,420	43,282	49,820	- - -
San Luis Reservoir Storage*													
State	798,275	990,060	975,905	1,041,871	939,485	786,803	723,206	786,083	943,656	1,064,110	907,066	1,062,560	- - -
Federal	391,938	644,777	828,842	899,075	728,608	526,670	341,588	254,281	350,589	527,873	785,673	922,989	- - -
Total	1,190,213	1,634,837	1,804,747	1,940,946	1,668,093	1,313,473	1,064,794	1,040,364	1,294,245	1,591,983	1,692,739	1,985,549	- - -
Gianelli P-G Plant Pumping													
State	421,070	198,977	28,931	79,158	0	0	3,288	38,530	169,816	128,831	-398	159,195	1,227,398
Federal	252,188	249,362	169,060	115,776	0	0	0	16,740	114,980	188,737	209,100	153,874	1,469,817
Total	673,258	448,339	197,991	194,934	0	0	3,288	55,270	284,796	317,568	208,702	313,069	2,697,215
Generation													
State	0	0	20,065	9,435	102,524	153,349	65,405	2,312	3,669	0	84,259	0	441,018
Federal	0	0	0	39,000	159,687	190,520	171,021	61,999	0	0	0	0	622,227
Total	0	0	20,065	48,435	262,211	343,869	236,426	64,311	3,669	0	84,259	0	1,063,245
San Felipe Project													
Federal	2,804	1,549	4,329	3,465	10,912	11,963	12,754	9,303	11,655	7,476	13,454	13,524	103,188
Dos Amigos P.P. Pumping													
State	39,906	37,511	102,725	87,182	199,748	248,264	304,119	298,755	185,638	172,582	167,973	200,782	2,045,185
Federal	-2,817	5,476	33,892	56,014	114,370	173,618	223,630	149,198	41,456	45,039	44,936	68,647	953,459
Total	37,089	42,987	136,617	143,196	314,118	421,882	527,749	447,953	227,094	217,621	212,909	269,429	2,998,644

*At end of month.

Table 16. Pyramid Lake Monthly Operation
1993

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Total Storage 1/	Natural Inflow Storage Shares	Storage Change	Inflow			Outflow			Computed Losses (-) Gains (+)
					Natural	Project		Angeles Tunnel	To Piru Creek		
						Warne Power-plant	Pumpback 2/		Natural Inflow Release 3/	Recreation (Metered Water)	
Jan	2,575.81	167,089	1,189	5,868	22,957	30,833	65,005	97,226	22,226	0	6,525
Feb	2,571.49	161,633	20,100	-5,456	42,836	13,110	46,812	104,127	23,925	0	19,838
Mar	2,574.12	164,940	36,872	3,307	28,717	0	64,385	76,643	11,945	1	-1,206
Apr	2,573.32	163,929	43,775	-1,011	14,733	10	74,504	80,569	7,830	1	-1,858
May	2,574.45	165,358	4/ 1,600	1,429	6,219	33,522	63,549	97,483	2,889	0	-1,489
Jun	2,573.31	163,917	2,469	-1,441	3,308	45,926	72,528	118,928	2,439	5	-1,831
Jul	2,570.38	160,250	2,195	-3,667	1,748	45,782	63,956	111,588	2,022	4	-1,539
Aug	2,573.08	163,627	1,846	3,377	1,214	38,728	89,585	124,022	1,563	4	-561
Sep	2,567.32	156,477	1,356	-7,150	1,032	34,495	77,583	119,070	1,522	4	336
Oct	2,572.88	163,375	951	6,898	1,176	32,159	63,225	88,341	1,581	2	262
Nov	2,570.88	160,872	748	-2,503	1,316	1,896	58,832	64,054	1,519	1	1,027
Dec	2,570.42	160,299	886	-573	1,702	53,668	33,173	88,085	1,564	0	533
Total	- - -	- - -	- - -	-922	126,958	330,129	773,137	1,170,136	81,025	22	20,037

1/ At end of month

2/ Pumpback by Los Angeles Department of Water and Power (LADWP) from Elderberry Forebay through Castaic powerplant.

3/ Portions of these amounts are used to satisfy fishery enhancement agreement.

4/ 45,505 AF appropriated as of 5-12-93. 1,600 AF retained by United W.A.

Table 17. Elderberry Forebay Monthly Operation
1993

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Total Storage 1/	Storage Change	Inflow		Outflow			Computed Losses (-) Gains (+)
				Castaic Powerplant Generation	Natural	To Castaic Lake		Pumpback to Pyramid Lake 2/	
						Natural	Project		
Jan	1514.35	21,244	-72	97,226	15,529	15,529	23,768	65,005	-8,525
Feb	1528.32	27,209	5,965	104,127	18,084	18,084	43,120	46,812	-8,230
Mar	1528.09	27,104	-105	76,643	8,405	8,405	9,625	64,385	-2,738
Apr	1514.05	21,125	-5,979	80,569	4,487	4,487	12,360	74,504	316
May	1518.49	22,867	1,742	97,483	1,775	1,775	33,086	63,549	894
Jun	1510.44	19,648	-3,219	118,928	870	870	49,726	72,528	107
Jul	1520.98	23,922	4,274	111,588	309	309	43,750	63,956	392
Aug	1516.28	21,934	-1,988	124,022	117	117	35,452	89,585	-973
Sep	1524.64	25,520	3,586	119,070	52	52	36,762	77,583	-1,139
Oct	1520.62	23,769	-1,751	88,341	71	71	25,470	63,225	-1,397
Nov	1519.40	23,250	-519	64,054	133	133	3,597	58,832	-2,144
Dec	1516.08	21,873	-1,377	88,085	272	272	54,550	33,173	-1,739
Total	- - -	- - -	557	1,170,136	50,104	50,104	371,266	773,137	-25,176

1/ At end of month.

2/ Pumpback by Los Angeles Department of Water and Power (LADWP) through Castaic Powerplant.

Table 18. Castaic Lake Monthly Operation
1993

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Total Storage 1/	Natural Inflow Storage Shares	Storage Change	Inflow			Outflow		Computed Losses (-) Gains (+)
					Natural	From Elderberry Forebay		Deliveries	Released to Castaic Afterbay 2/	
						Natural	Project			
Jan	1,488.27	267,158	25,864	27,737	9,746	15,529	23,768	25,922	184	4,800
Feb	1,528.32	315,689	57,052	48,531	13,216	18,084	43,120	28,300	112	2,523
Mar	1,513.39	320,112	59,426	4,423	7,276	8,405	9,625	11,066	13,307	3,490
Apr	1,505.06	301,928	64,109	-18,184	3,254	4,487	12,360	33,018	3,058	-2,209
May	1,496.97	284,864	2/ 1,566	-17,064	1,604	1,775	33,086	50,486	1,813	-1,230
Jun	1,501.35	294,030	1,689	9,166	810	870	49,726	39,552	1,557	-1,131
Jul	1,501.89	295,172	1,704	1,142	374	309	43,750	42,009	668	-614
Aug	1,493.85	278,438	1,190	-16,734	159	117	35,452	49,867	790	-1,805
Sep	1,486.14	262,916	127	-15,522	102	52	36,762	50,566	1,217	-655
Oct	1,478.07	247,178	269	-15,738	160	71	25,470	42,655	89	1,305
Nov	1,453.98	203,241	395	-43,937	224	133	3,597	46,156	231	-1,504
Dec	1,466.62	225,746	576	22,505	511	272	54,550	31,846	602	-380
Total	- - -	- - -	- - -	-13,675	37,436	50,104	371,266	451,443	23,628	2,590

1/ At end of month.

2/ DWR appropriated 64,109 AF as of 5-1-93.

Table 19. Castaic Lagoon Monthly Operation
1993

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Total Storage	Storage Change	Inflow	Natural Outflow Release From Castaic Afterbay		Deliveries to Recreation	Computed Losses (-) Gains (+)
					Surface	Sub-Surface		
Jan	1135.72	5,607	441	184	0	180	17	454
Feb	1136.22	5,705	98	112	0	140	47	173
Mar	1136.75	5,810	105	13,307	12,953	186	63	0
Apr	1135.50	5,564	-246	3,058	3,031	180	93	0
May	1133.24	5,128	-436	1,813	1,813	336	100	0
Jun	1136.31	5,723	595	1,557	635	240	87	0
Jul	1136.14	5,689	-34	668	341	248	113	0
Aug	1136.32	5,725	36	790	337	279	138	0
Sep	1136.31	5,723	-2	1,217	813	270	136	0
Oct	1135.38	5,540	-183	89	0	168	104	0
Nov	1135.68	5,599	59	231	0	96	76	0
Dec	1136.29	5,719	120	602	341	90	51	0
Total	- - -	- - -	553	23,628	20,264	2,413	1,025	627

Table 20. Silverwood Lake Monthly Operation

1993

(in acre-feet except as noted)

Month	Water Surface Elev. (in feet)	Storage	Natural Inflow Storage Shares 1/	Storage Change	Inflow		Outflow				Computed Losses (-) or Gains(+)	Total Natural Inflow Released 1/
					Natural	Project	San Bernardino Tunnel	Entitlement and Recreation Deliveries	Deliveries To Mojave Water Agency	Releases of Natural Inflow to Mojave River		
Jan	3345.56	66,064	3,073	926	27,643	14,750	15,257	95	0	24,790	-1,325	25,808
Feb	3350.12	70,289	5,261	4,225	25,126	6,668	7,880	61	0	22,145	2,517	22,938
Mar	3352.36	72,417	5,777	2,128	10,354	10,990	10,311	52	0	9,291	438	9,838
Apr	3352.03	72,102	5,842	-315	3,402	15,300	17,730	60	0	3,337	2,110	3,337
May	3352.05	72,121	6,475	19	1,332	27,910	31,185	73	0	699	2,734	699
Jun	3351.91	71,987	5,085	-134	1,174	18,640	22,816	96	2,186	346	5,496	378
Jul	3350.05	70,223	4,888	-1,764	225	19,200	21,602	104	0	15	532	422
Aug	3349.76	69,951	6,025	-272	83	27,740	29,355	131	0	15	1,406	412
Sep	3347.38	67,733	5,700	-2,218	81	31,570	35,104	113	656	15	2,019	406
Oct	3351.19	71,302	5,413	3,569	42	31,810	25,823	99	3,158	14	811	329
Nov	3351.93	72,006	4,460	704	83	27,960	25,491	69	2,306	18	545	1,036
Dec	3337.26	58,730	3,885	-13,276	165	2,000	13,683	72	1,914	13	241	740
Total	- - -	- - -		-6,408	69,710	234,538	256,237	1,025	10,220	60,698	17,524	66,343

1/ Total releases made from Mojave Siphon to Las Flores Ranch Co., in exchange for natural inflow stored in lake, and from Silverwood Lake to Mojave River from outlet for Mojave W.A. The difference between this total column and the natural inflow released to Mojave River equals the Las Flores Ranch exchange.

Table 21. Lake Perris Monthly Operation

1993

(in acre-feet except as noted)

Month	Water Surface Elevation (in feet)	Total Storage	Storage Change	Inflow	Outflow (Deliveries)	Computed Losses (-) Gains (+)
Jan	1,585.67	121,542	6,538	5,332	521	1,727
Feb	1,586.62	123,692	2,150	1,666	393	877
Mar	1,587.26	125,149	1,457	1,775	424	106
Apr	1,586.84	124,192	-957	599	413	-1,143
May	1,586.40	123,193	-999	790	428	-1,361
Jun	1,586.05	122,400	-793	308	418	-683
Jul	1,585.67	121,542	-858	572	415	-1,015
Aug	1,585.25	120,597	-945	516	433	-1,028
Sep	1,585.02	120,080	-517	1,103	410	-1,210
Oct	1,586.44	123,283	3,203	2,606	410	1,007
Nov	1,585.45	121,047	-2,236	626	404	-2,458
Dec	1,585.25	120,597	-450	355	407	-398
Total	---	---	5,593	16,248	5,076	-5,579

Figure 1. Total Deliveries from SWP Facilities

Annual Totals

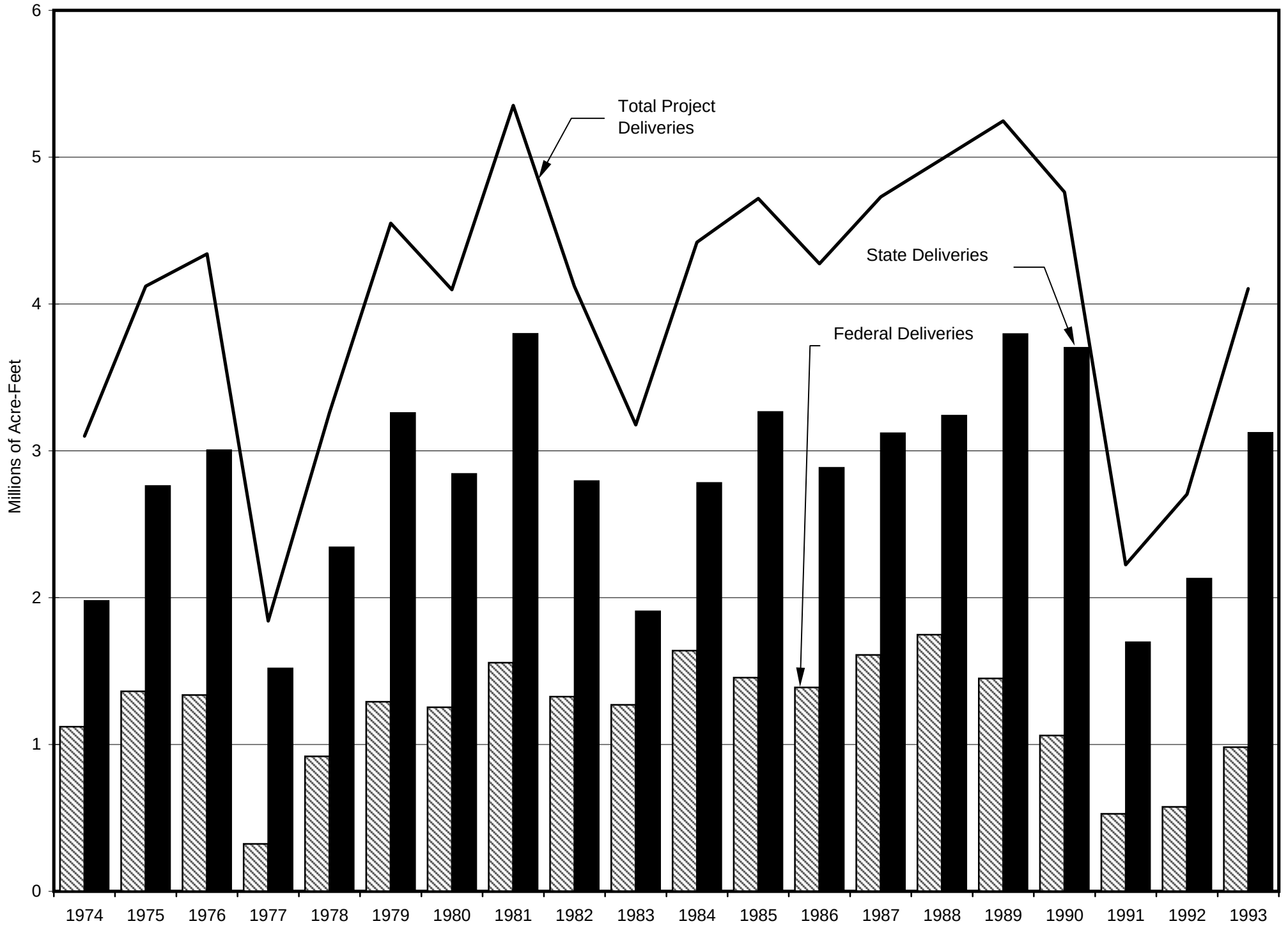
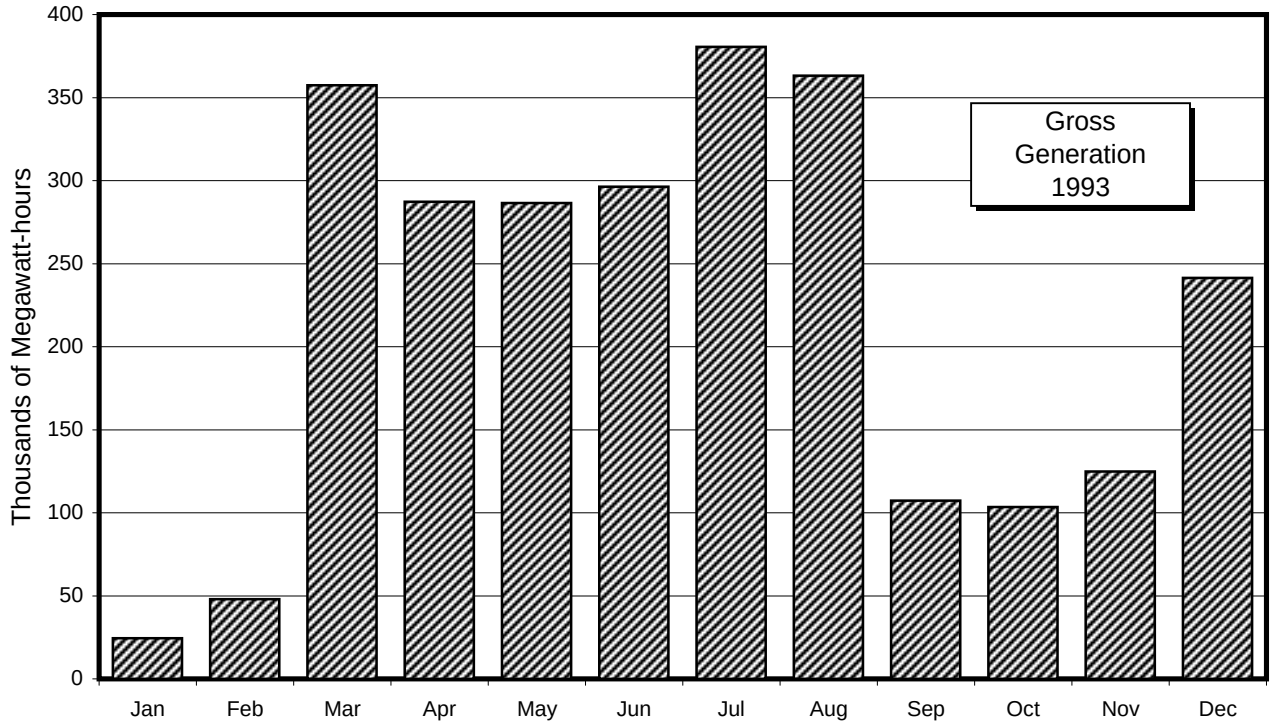


Figure 2. Operation of Edward Hyatt and Thermalito Powerplants



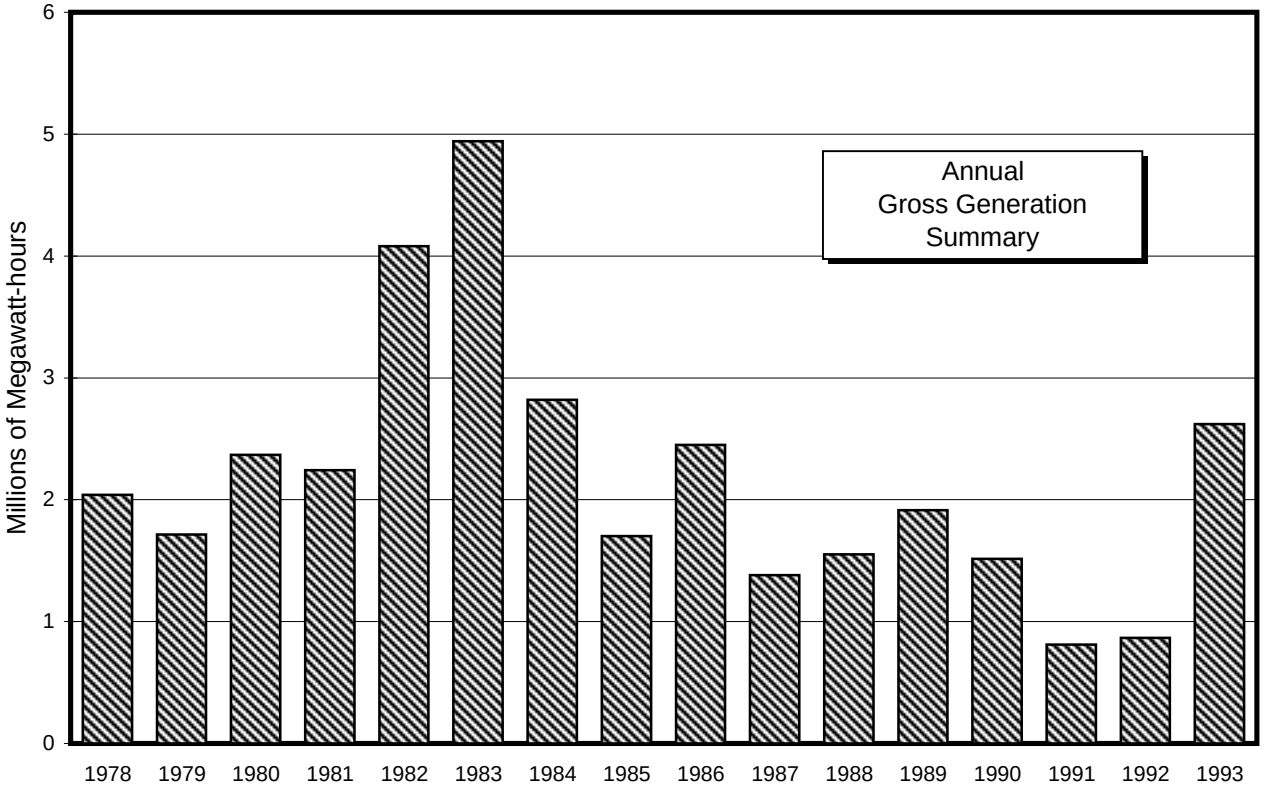
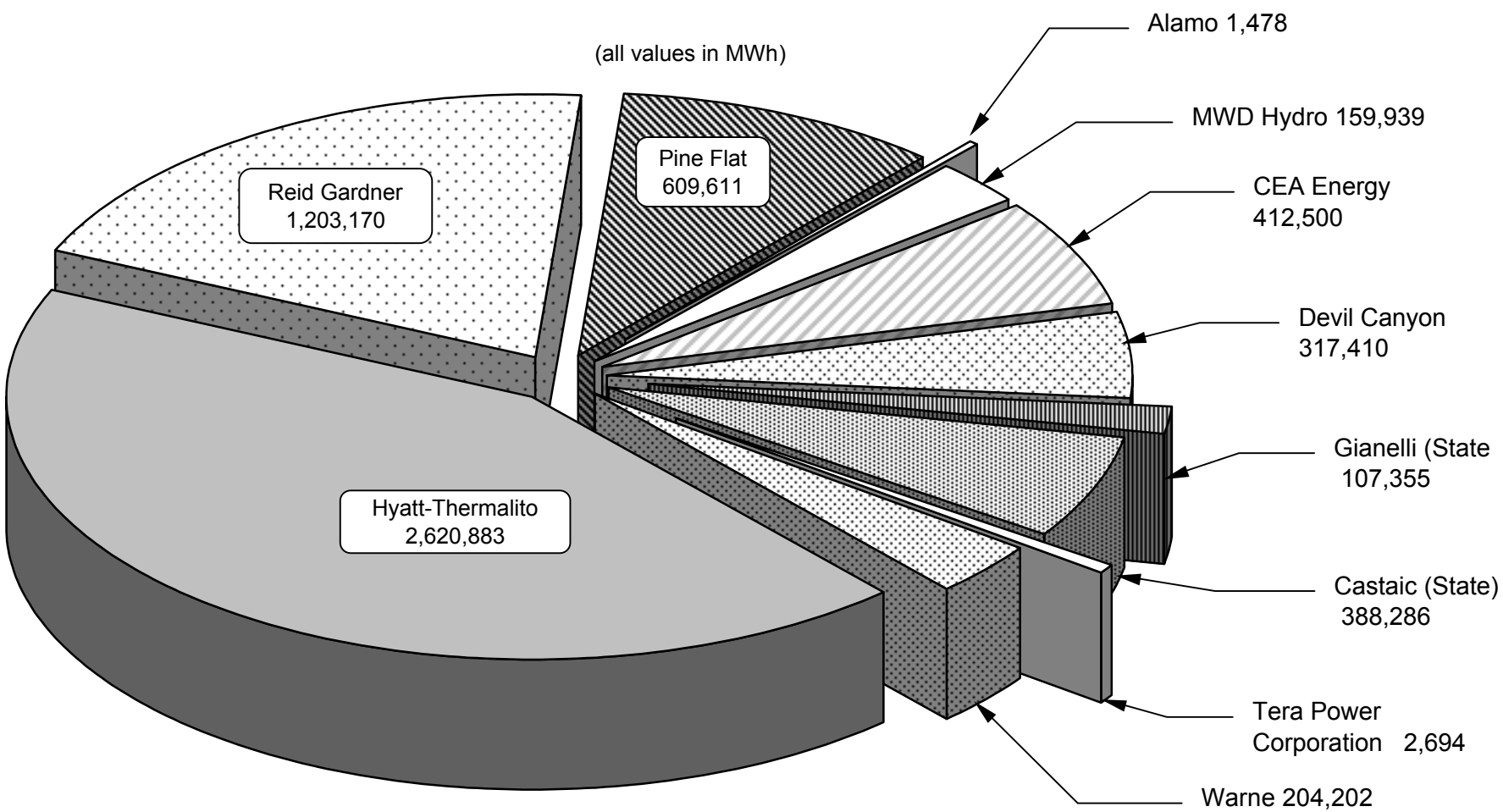


Figure 3. SWP Energy Resources
1993



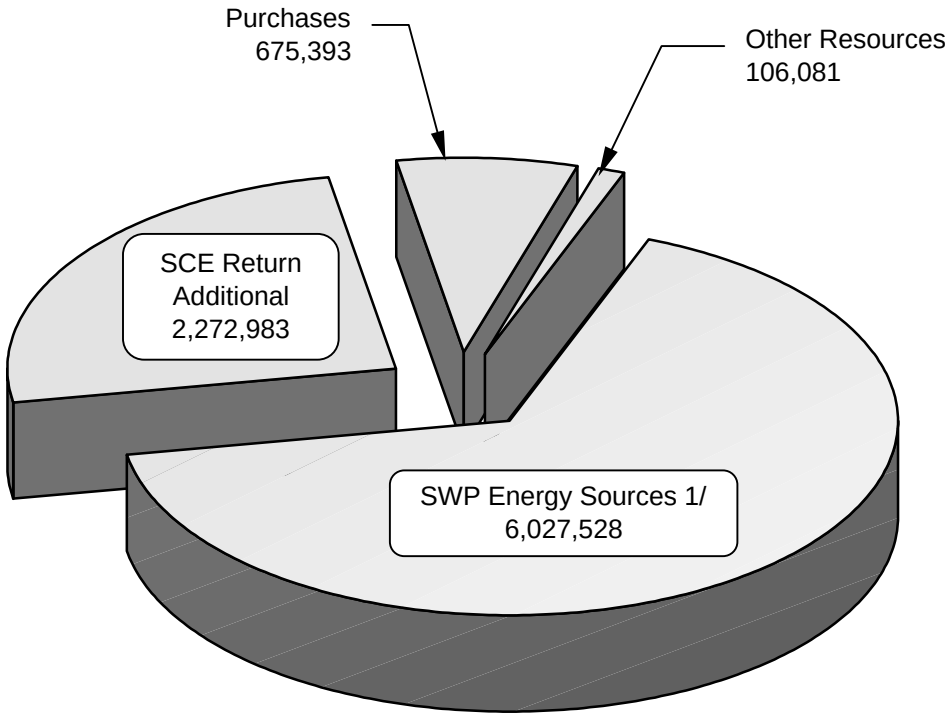
Total: 6,027,528

Note: Purchases, Other Sources, and SCE Return Additional are not shown here. All values are metered readings at plants and are not adjusted for transmission losses.

Figure 4. Total Energy Resources

(all values in MWh)

1993



Total: 9,081,985

1/ See Figure 3 for a breakdown of this source.

Purchases

Pacific Power and Light	622,698
Pacific Gas and Electric	25,967
Salt River Project	10,076
Western Area Lower Colorado	6,040
Northern California Power Association	2,562
Sacramento Municipal Utility District	1,738
Montana Power Company	1,650
Arizona Public Service Company	1,610
L.A. Dept. of Water and Power	1,296
Washington Water and Power Company	1,121
Puget Sound Power and Light	450
Southern California Edison	100
Bonneville Power Authority	85
	675,393

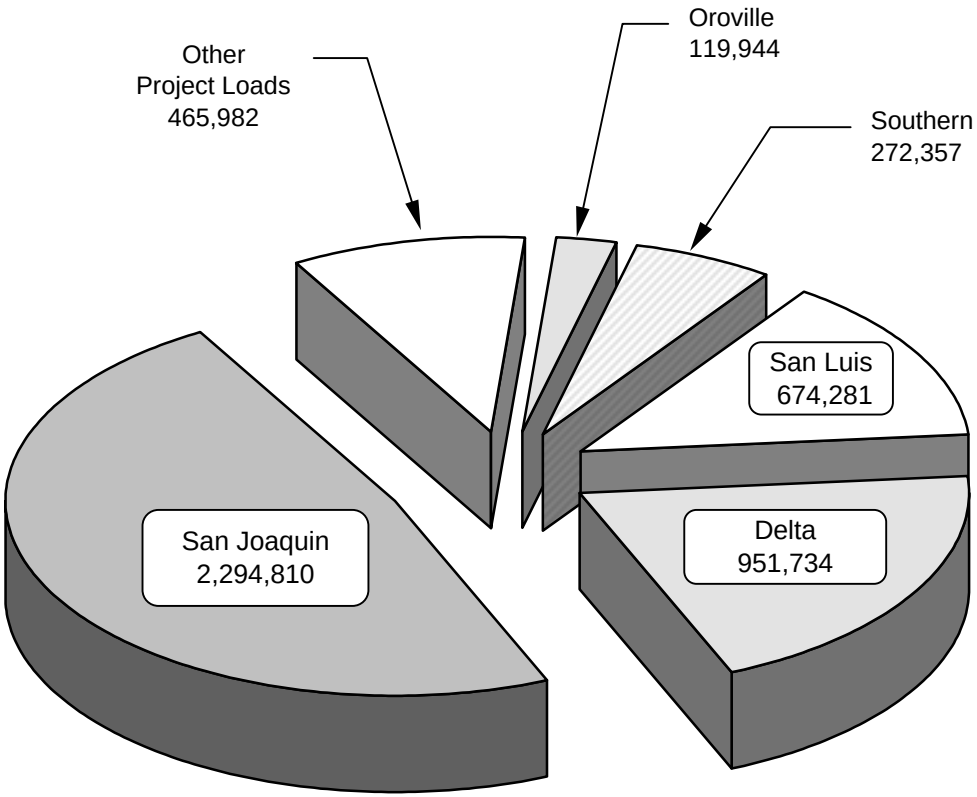
Other Resources

Southern California Edison	58,068
Bonneville Power Authority	27,900
Pacific Gas and Electric	15,751
L.A. Dept. of Water and Power	2,230
Western Area Mid Pacific	1,419
City of Vernon	713
	106,081

SCE Return Additional

Total Received from SCE	4,109,077
SCE Hyatt-Thermalito Entitlement	-944,767
SCE Devil Canyon Entitlement	-317,410
SCE Alamo Entitlement	-1,478
MWD Hydro Entitlement	-159,939
CEA Entitlement	-412,500
	2,272,983

Figure 5. SWP Energy Loads
(By Field Division)
(all values in MWh)
1993



Total: 4,779,098

Oroville Field Division

Hyatt-Thermalito Complex (Pumpback and Station Service)	119,944

Delta Field Division

North Bay	4,392
South Bay	79,734
Del Valle	112
Banks	866,512
Bottle Rock (Station Service)	984

San Luis Field Division

Gianelli	396,531
Dos Amigos	276,704
Pine Flat (Station Service)	1,036

San Joaquin Field Division

Las Perillas	7,679
Badger Hill	20,435
Buena Vista	195,311
Teerink	191,469
Chrisman	420,635
Edmonston	1,459,281

Southern Field Division

Oso	91,428
Pearblossom	180,220
Warne (Station Service)	709

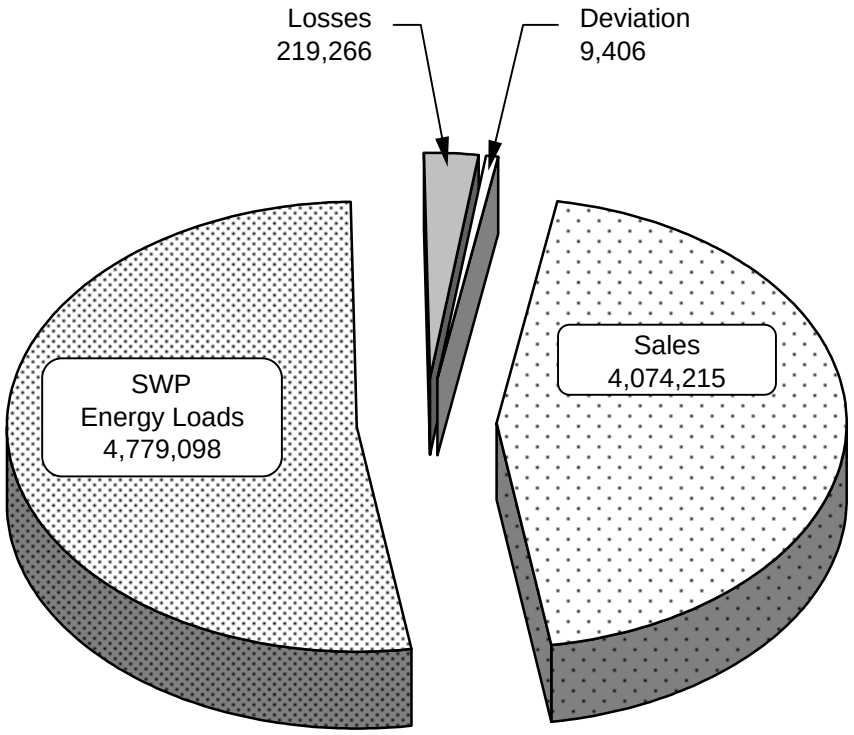
Other Project Loads

Southern California Edison	412,500
Bonneville Power Authority	47,400
Nevada Power Authority	4,799
City of Vernon	713
Pacific Gas and Electric	375
South Bay Station Service	195

Figure 6. Total Energy Loads

(all values in MWh)

1993

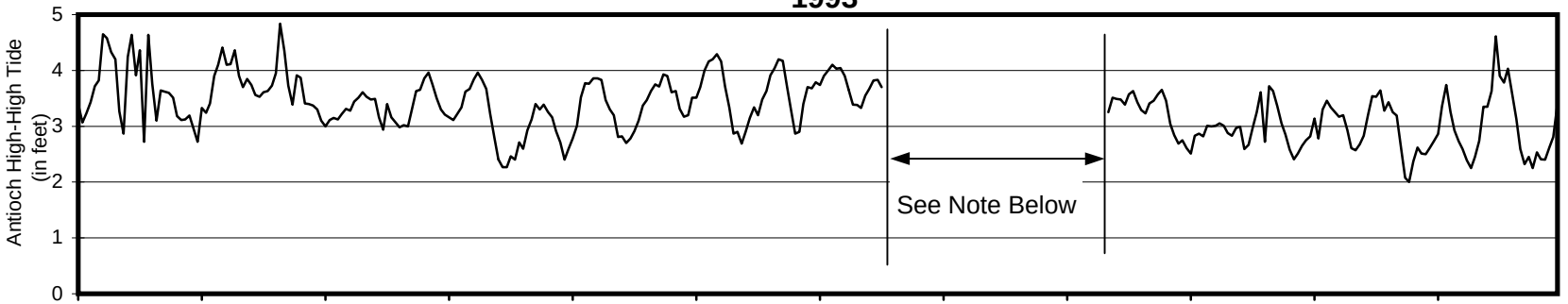


	Sales
Portland General Electric	986,082
Sacramento Municipal Utility District	800,045
Southern California Edison	449,291
Nevada Power	292,221
Modesto Irrigation District	248,074
Bonneville Power Authority	247,988
City and County of San Francisco	213,841
City of Vernon	173,508
Metropolitan Water District	141,360
Pacific Gas and Electric	113,454
Turlock Irrigation District	70,337
Seattle City Light	64,320
Los Angeles Dept. of Water and Power	59,227
Pacific Power and Light	57,439
City of Riverside	41,051
City of Anaheim	33,600
Salt River Project	29,930
City of Glendale	21,639
Northern California Power Agency	18,408
San Diego Gas and Electric	3,880
British Columbia Hydro	3,825
City of Burbank	2,440
Washington Water and Power Company	1,130
City of Pasadena	665
Eugene Water and Electric Board	460
Total	4,074,215

Total: 9,081,985

Note: See Figure 5 for breakdown of SWP Energy Loads.

Figure 7. Delta Tide, Inflow, and Outflow Index
1993



Note: Missing data points are unavailable because equipment was destroyed by vandals and new equipment had to be calibrated.

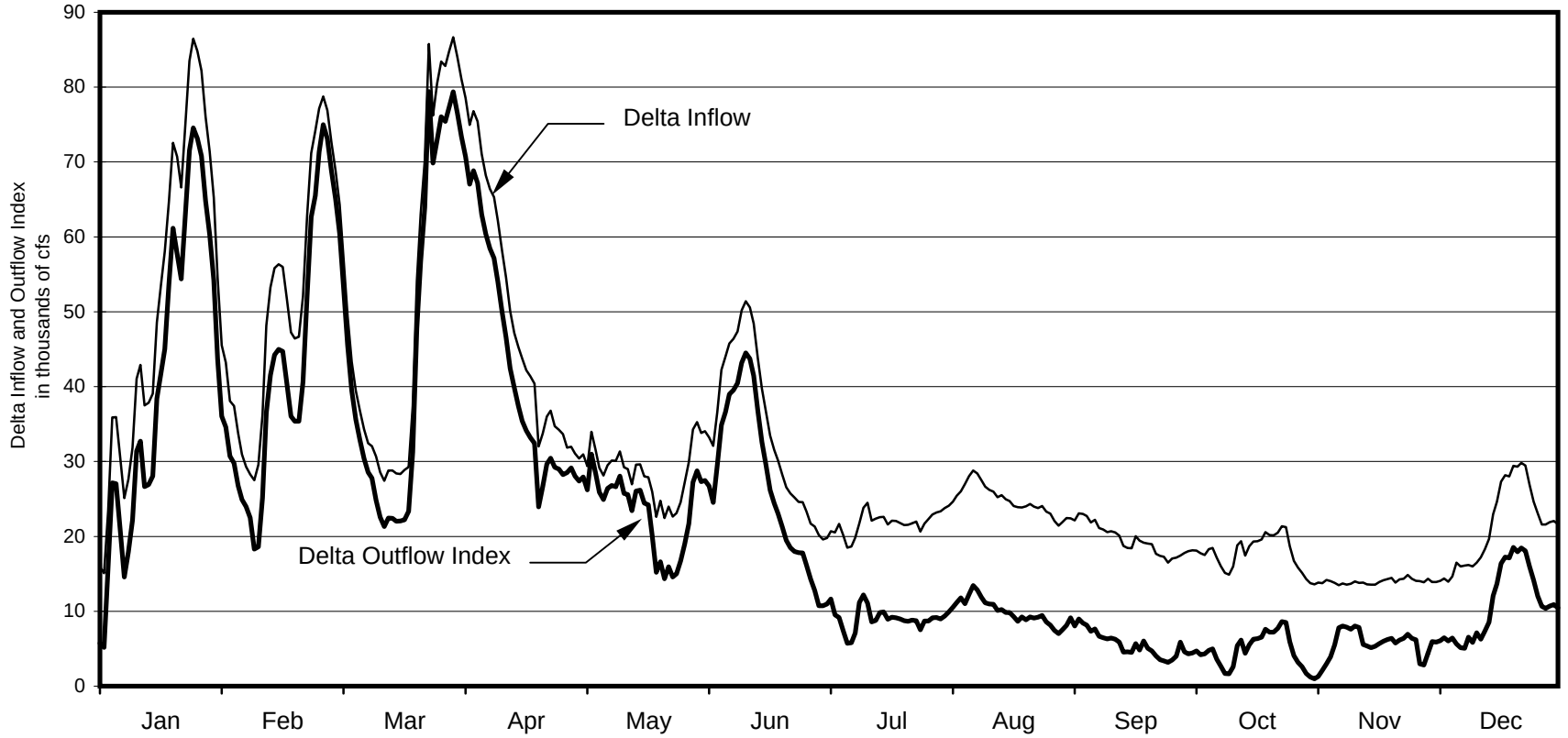
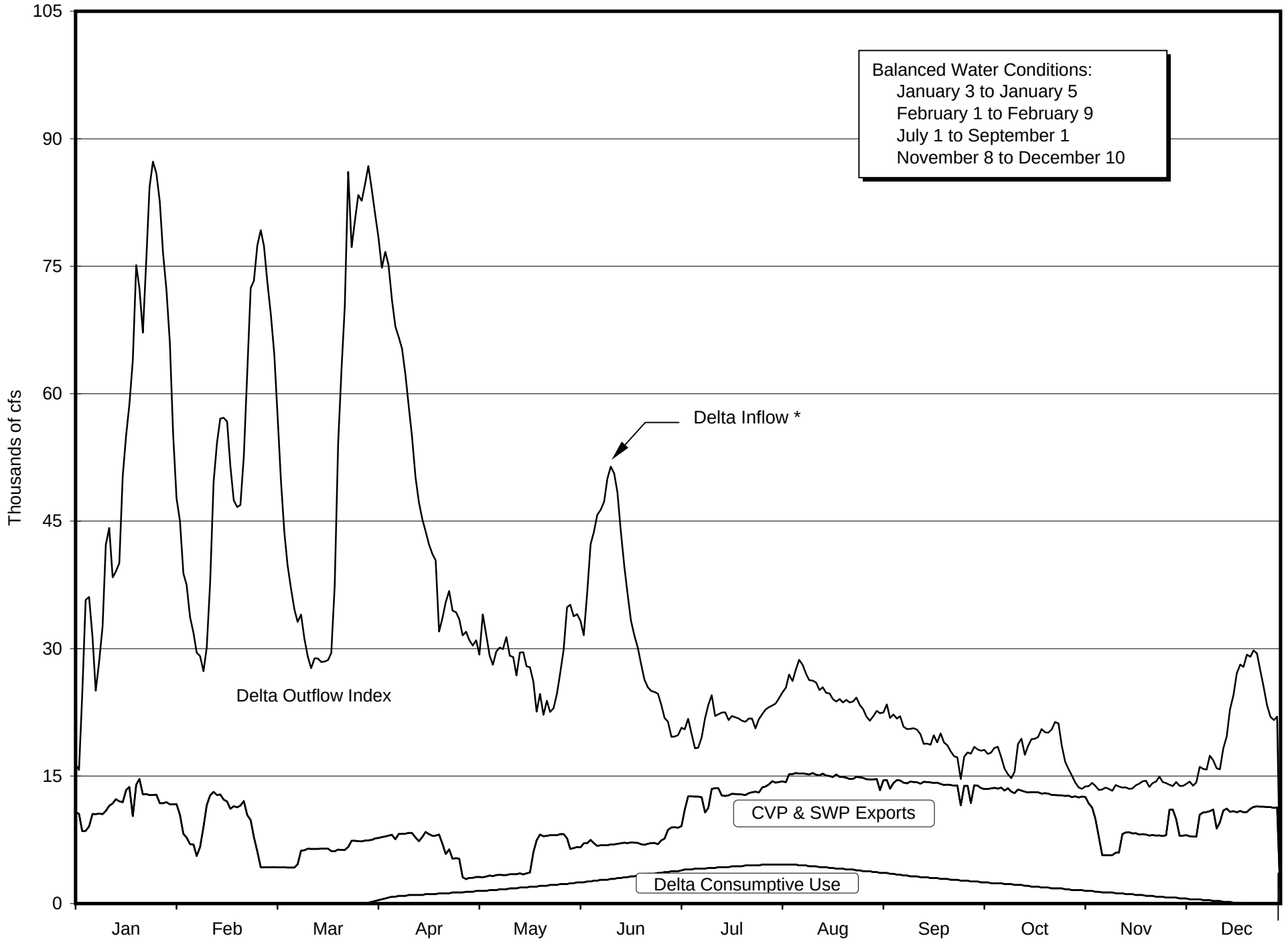


Figure 8. Coordinated Delta Operations
1993



* Delta inflow = Exports + Outflow + Consumptive Use.

Figure 9. Coordinated Delta Operations
Lagged Storage Withdrawals
1993

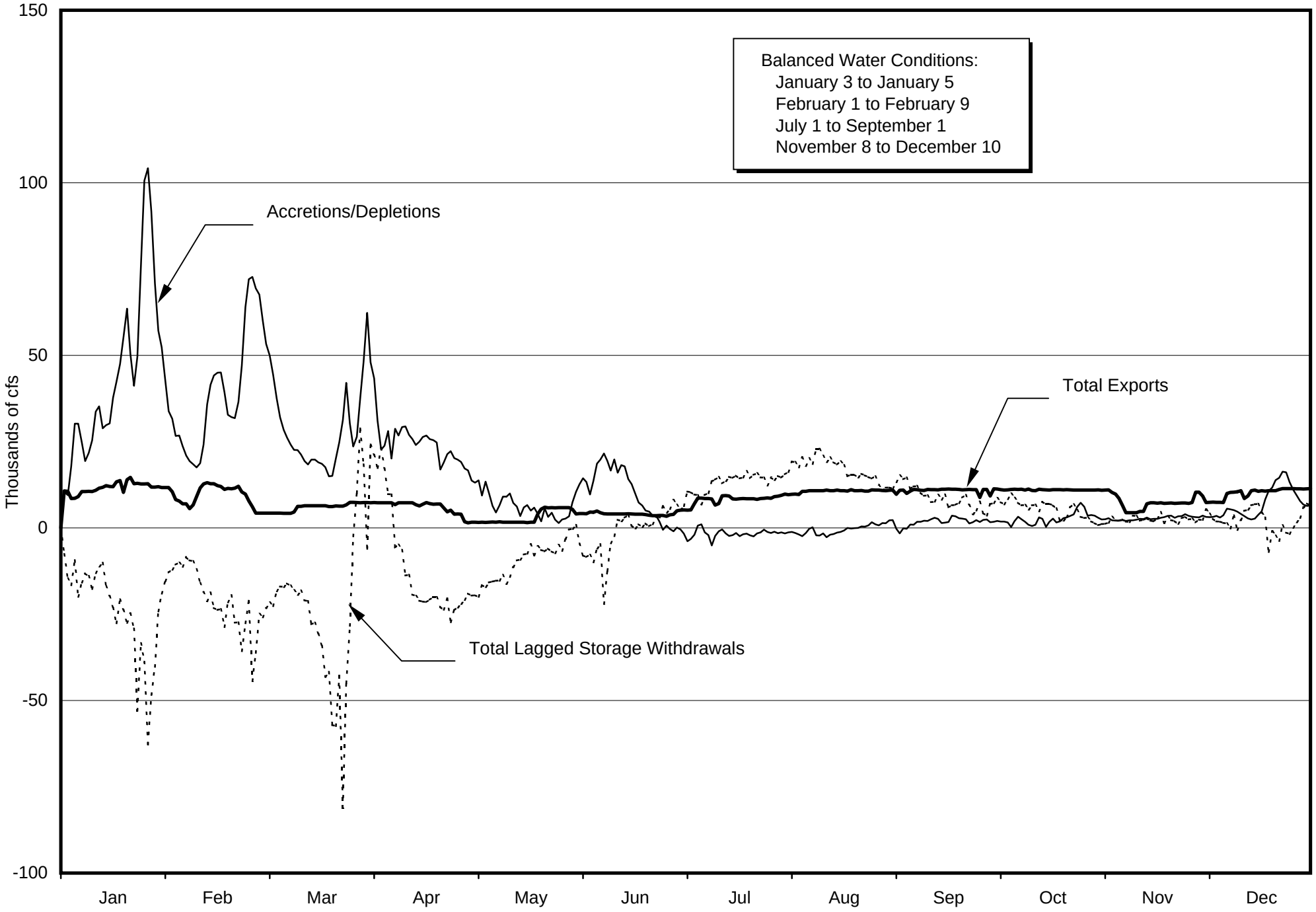


Figure 10. Coordinated Delta Operations
Delta Exports
1993

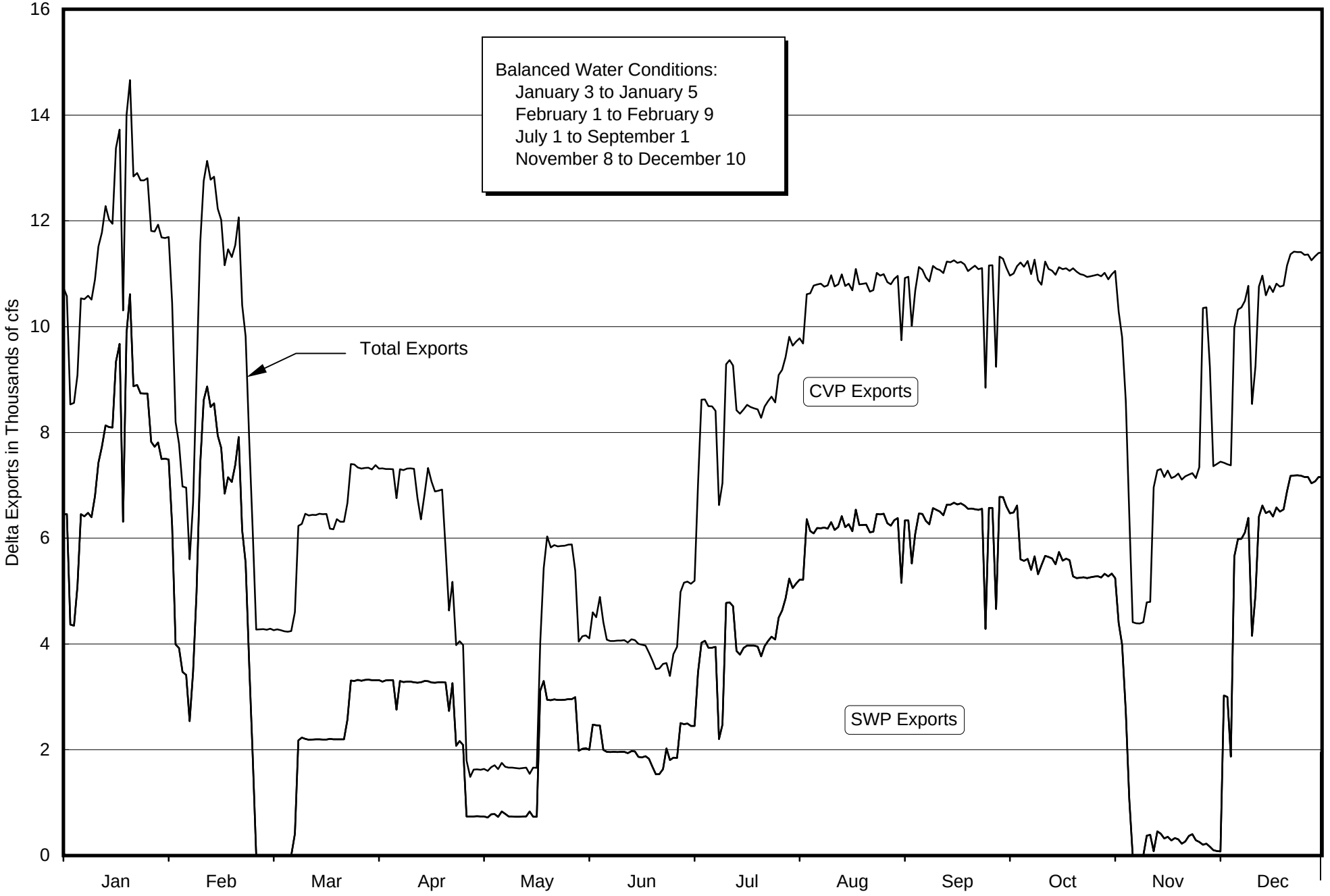


Figure 11. Oroville-Thermalito Complex
1993
Inflow, Releases, and Diversions

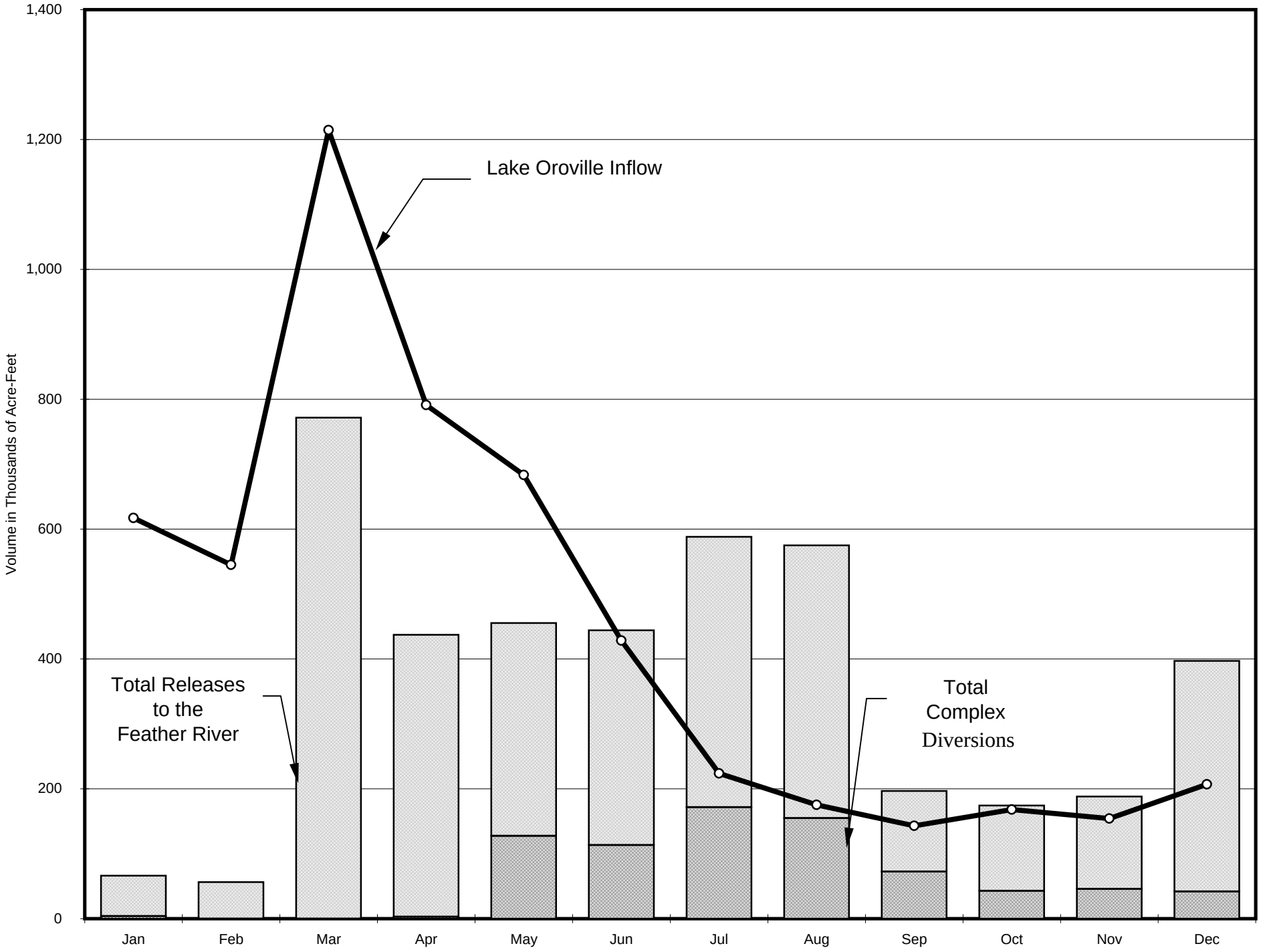
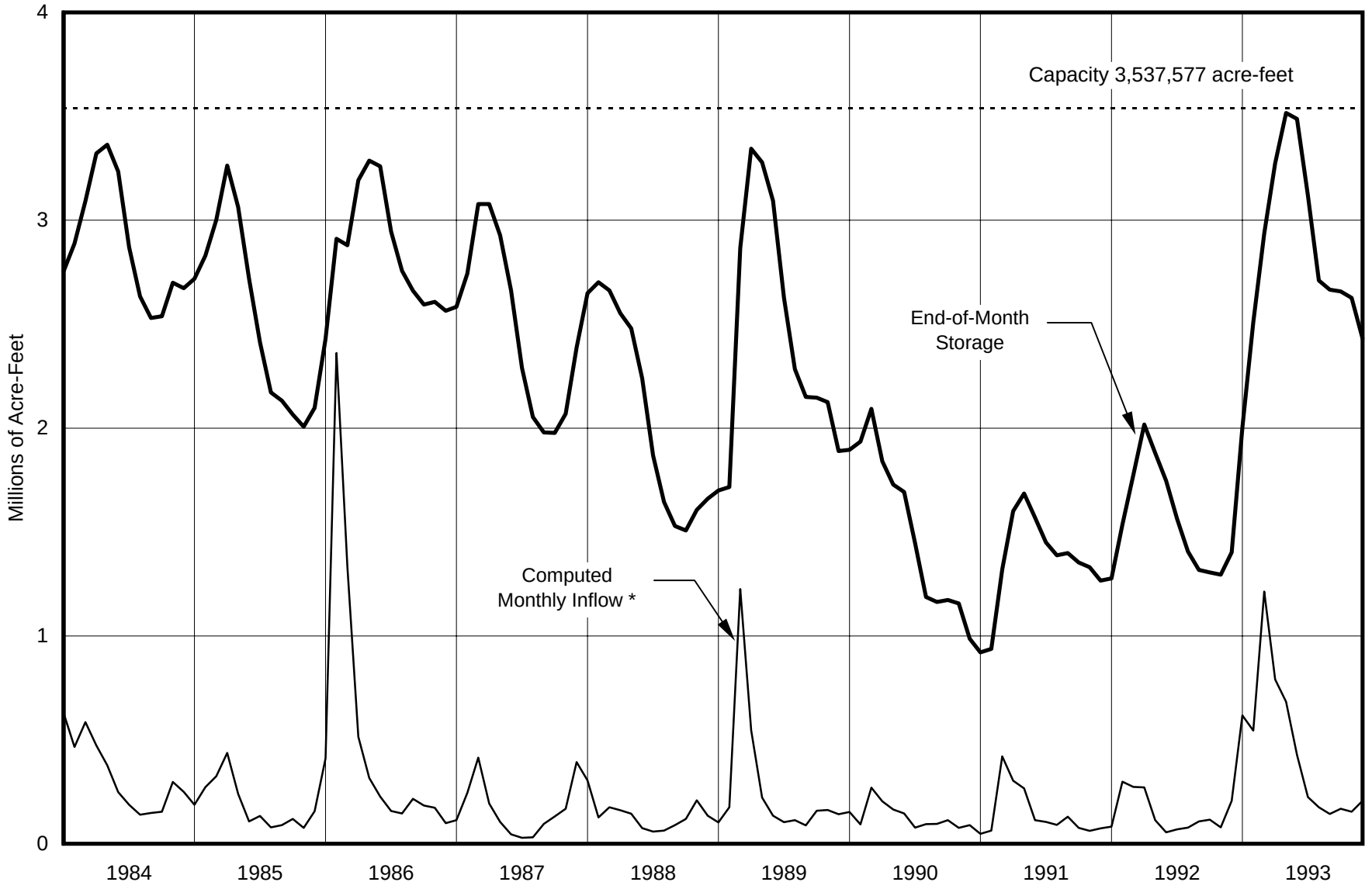


Figure 12. Historical Lake Oroville Operation



* Excludes pumpback.

Figure 13. Operation of Lake Oroville for Flood Control

1992-93

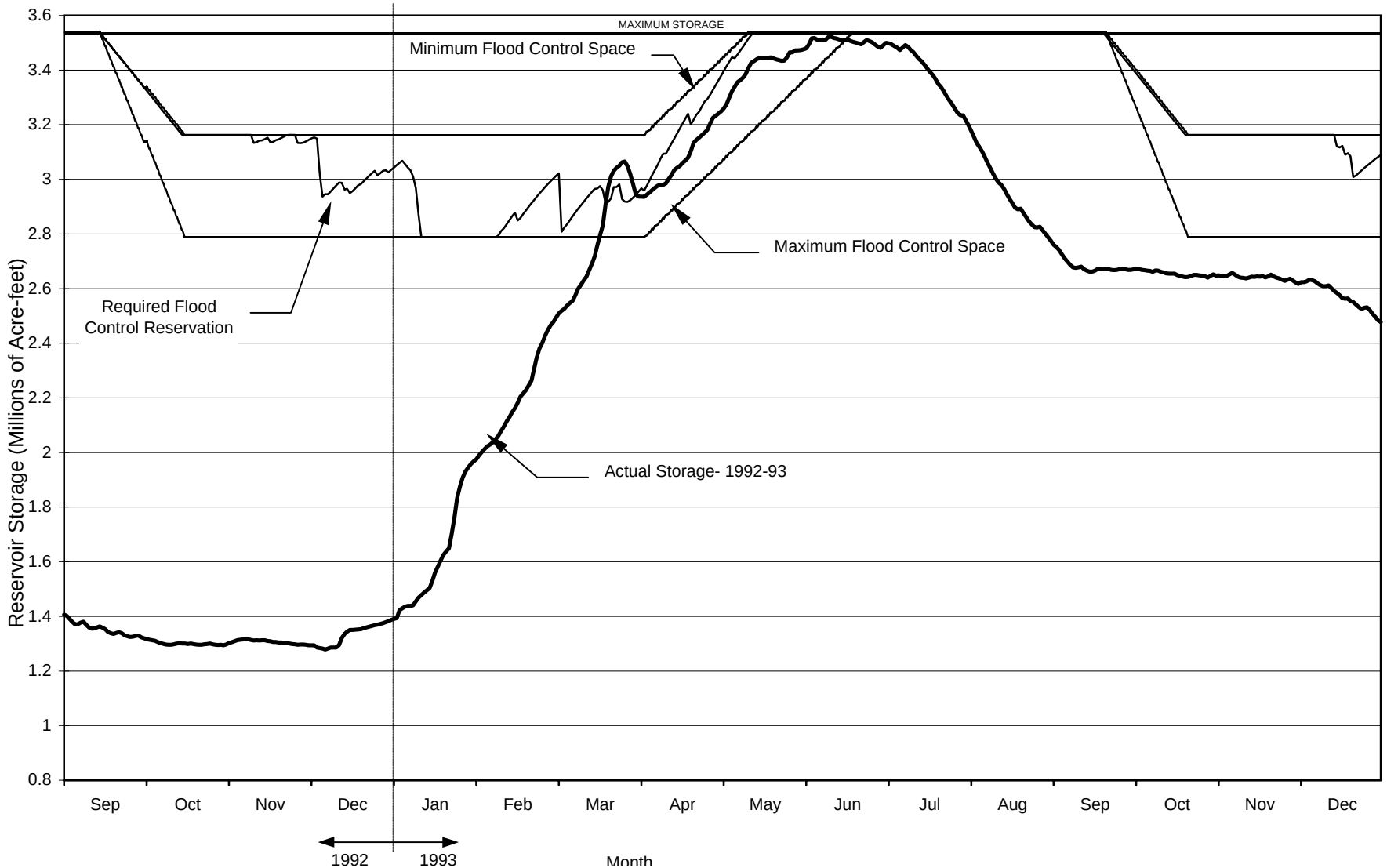
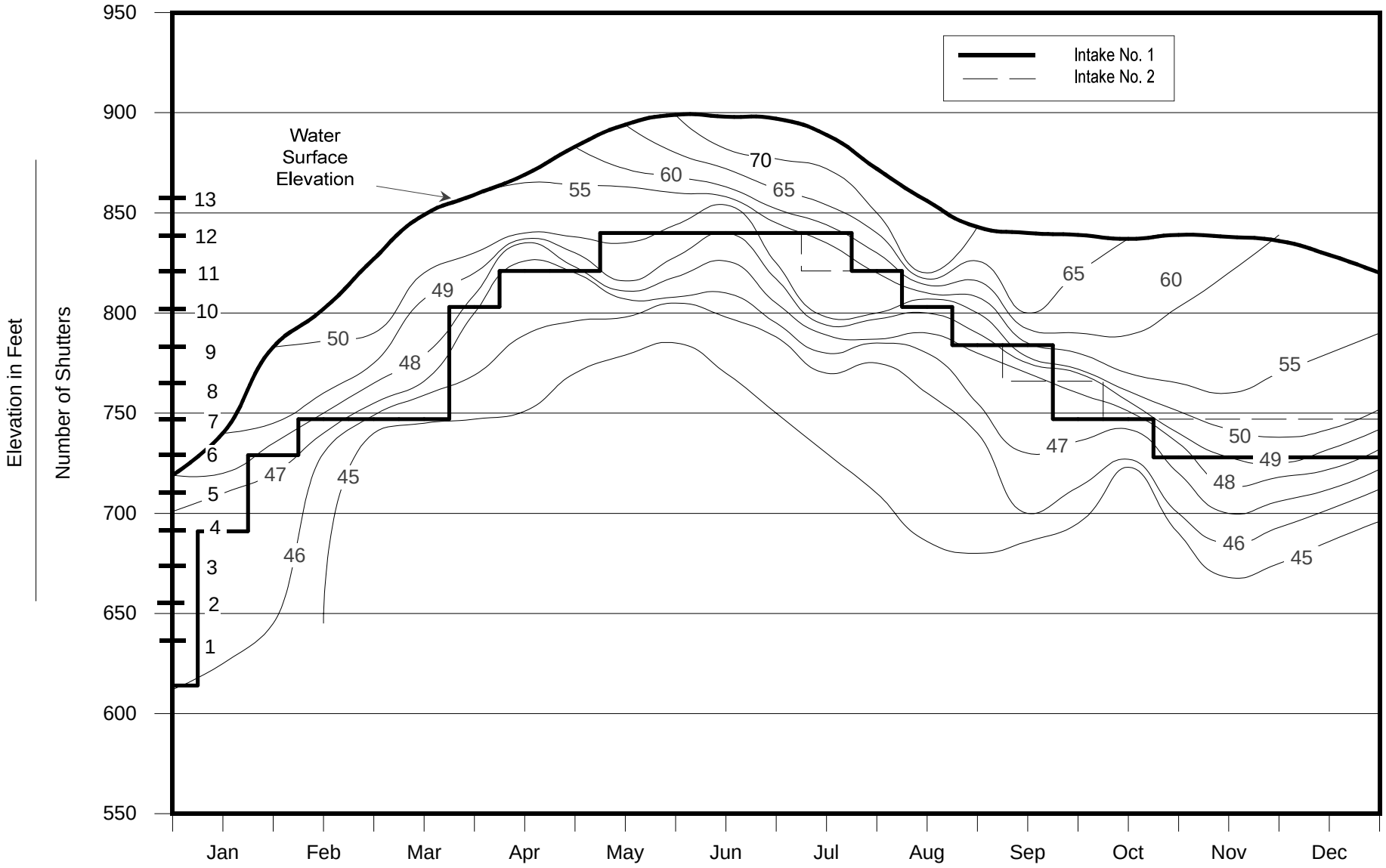
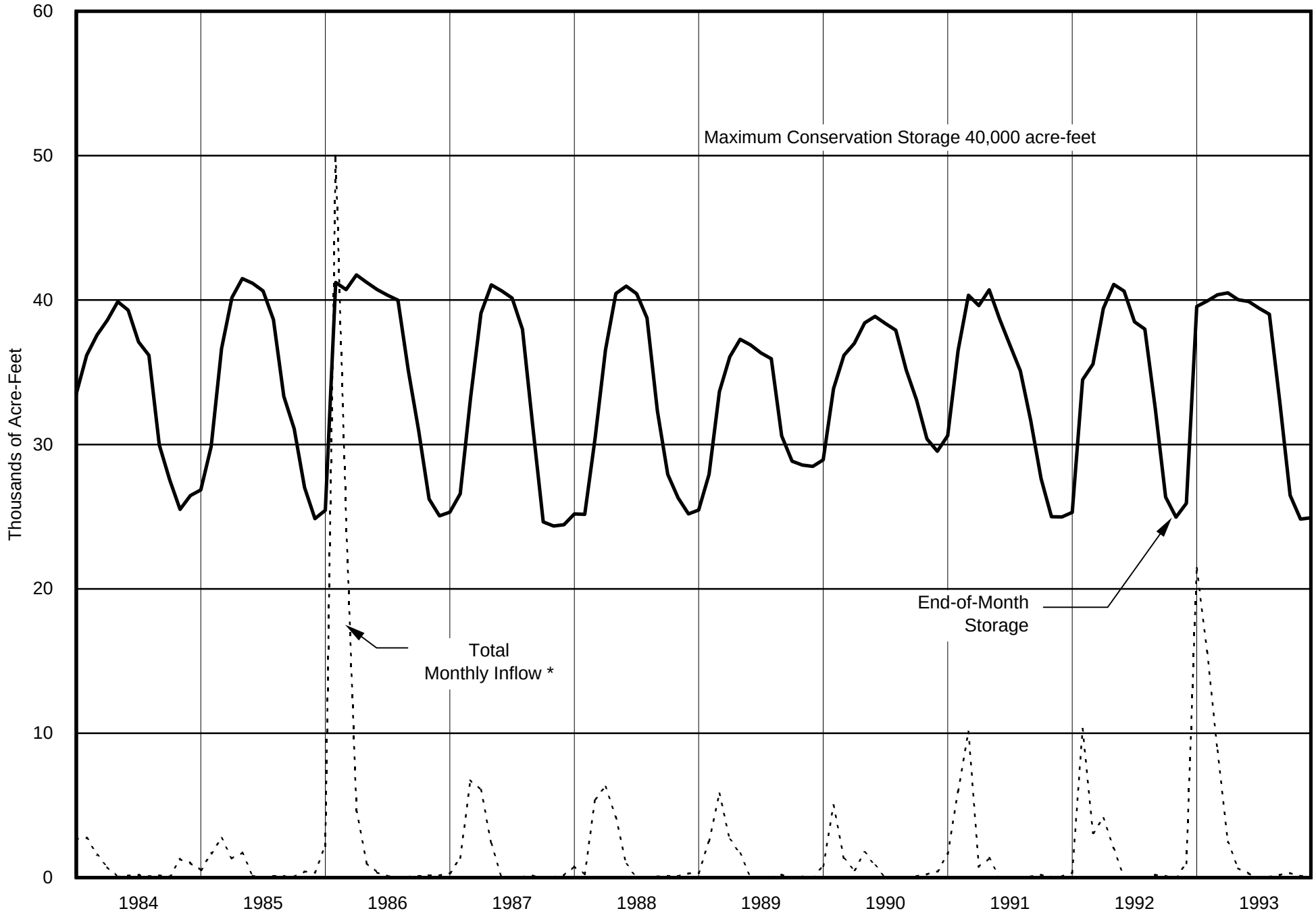


Figure 14. Lake Oroville Temperatures
1993
(isotherms in degrees Farenheit)



Note: Temperature data is taken once per month and interpolated for the rest of the year.

Figure 15. Historical Lake Del Valle Operation



* Natural and pumped inflows.

Figure 16. Historical San Luis Reservoir Operation

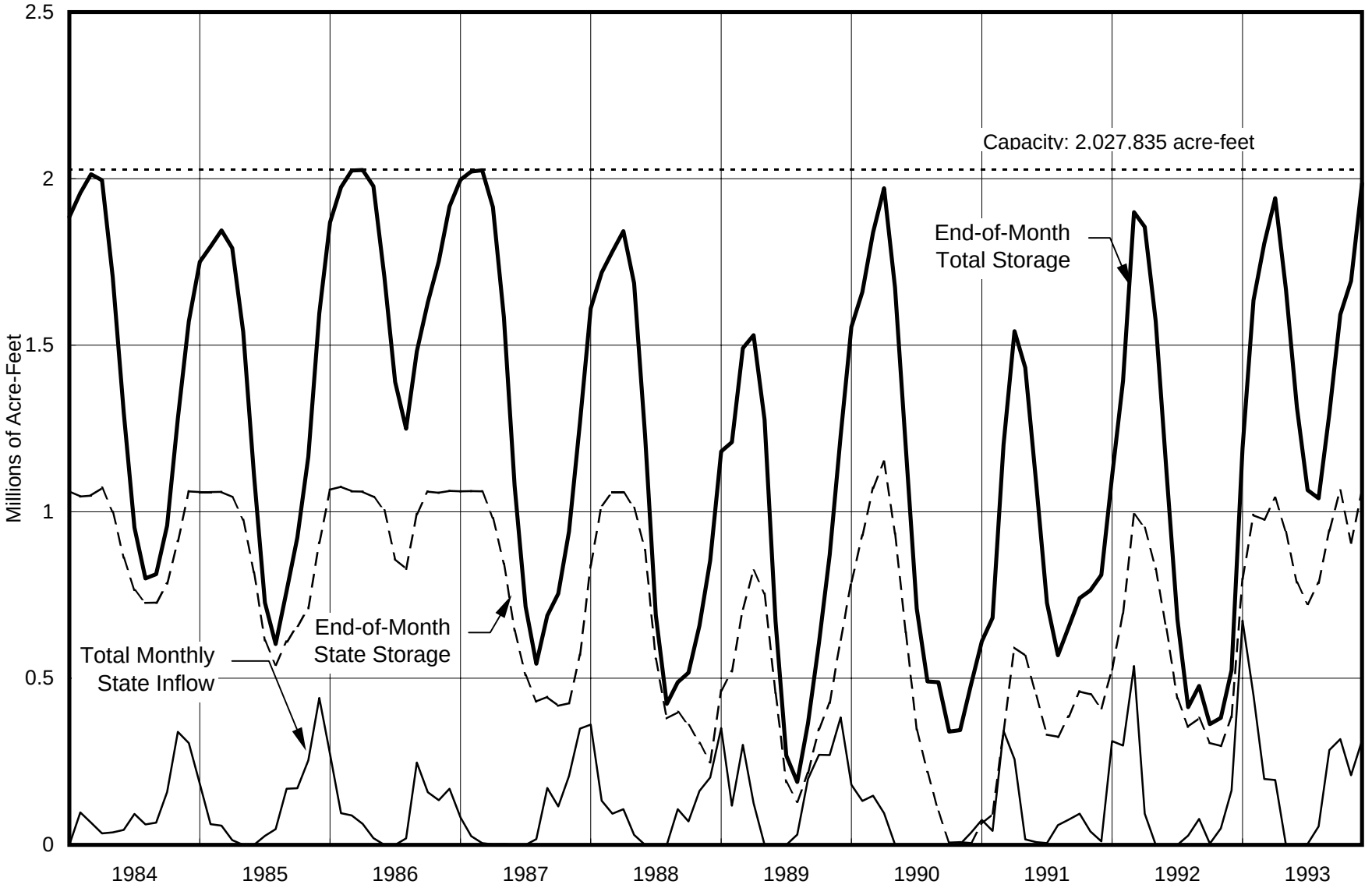
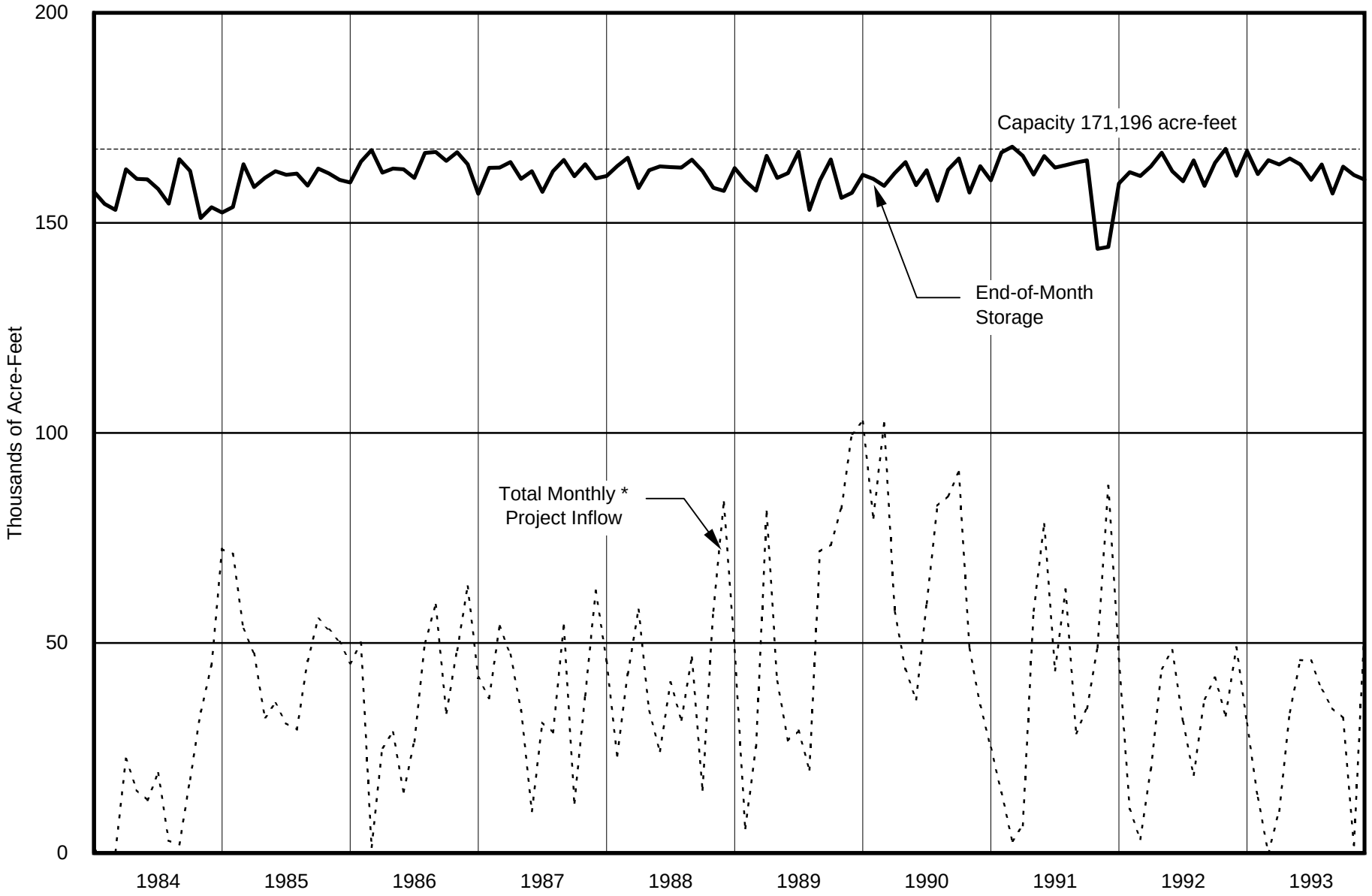


Figure 17. Historical Pyramid Lake Operation



* Excludes pumpback by LADWP through Castaic Powerplant.

Figure 18. Historical Castaic Lake Operation

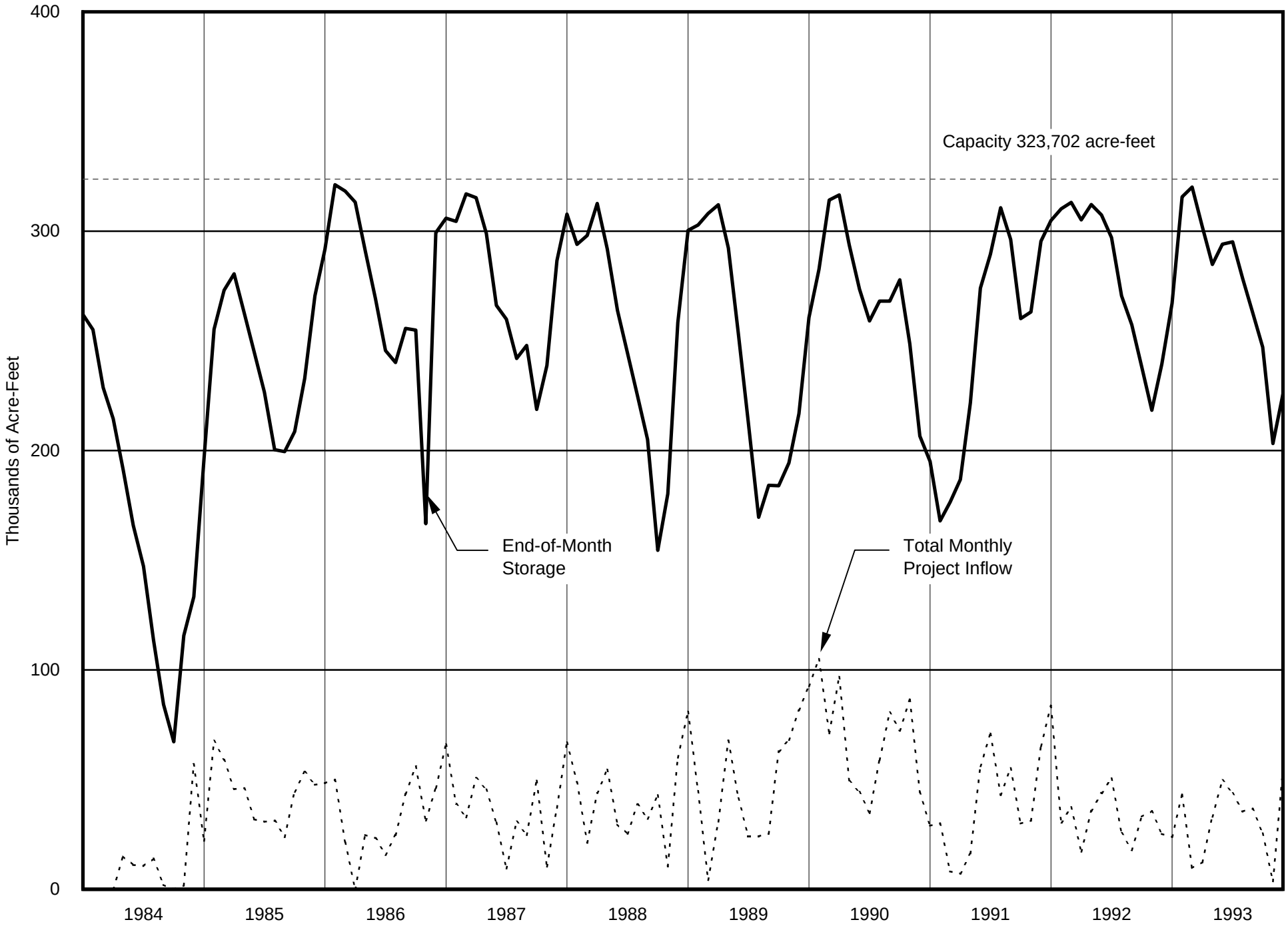


Figure 19. Historical Silverwood Lake Operation

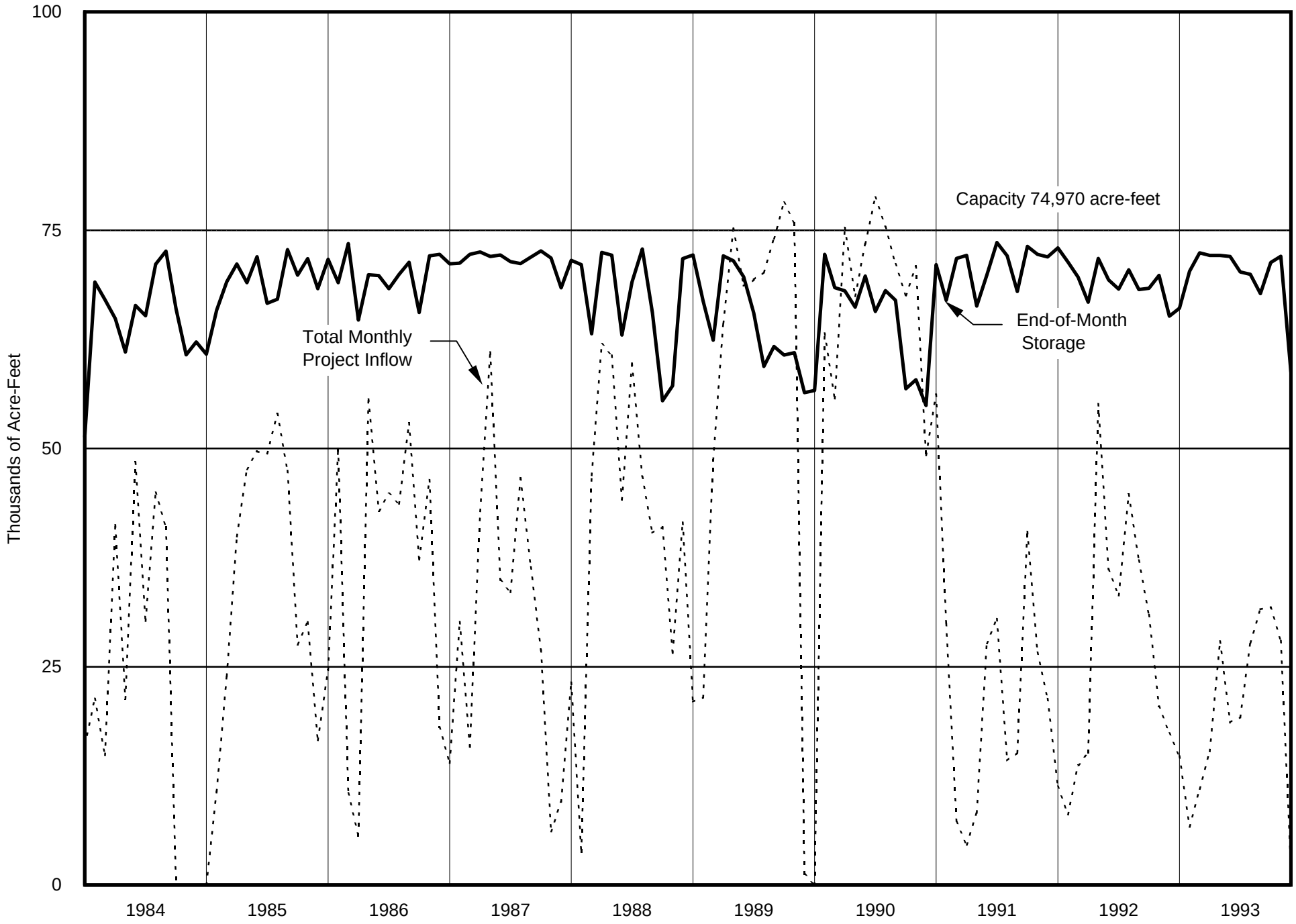
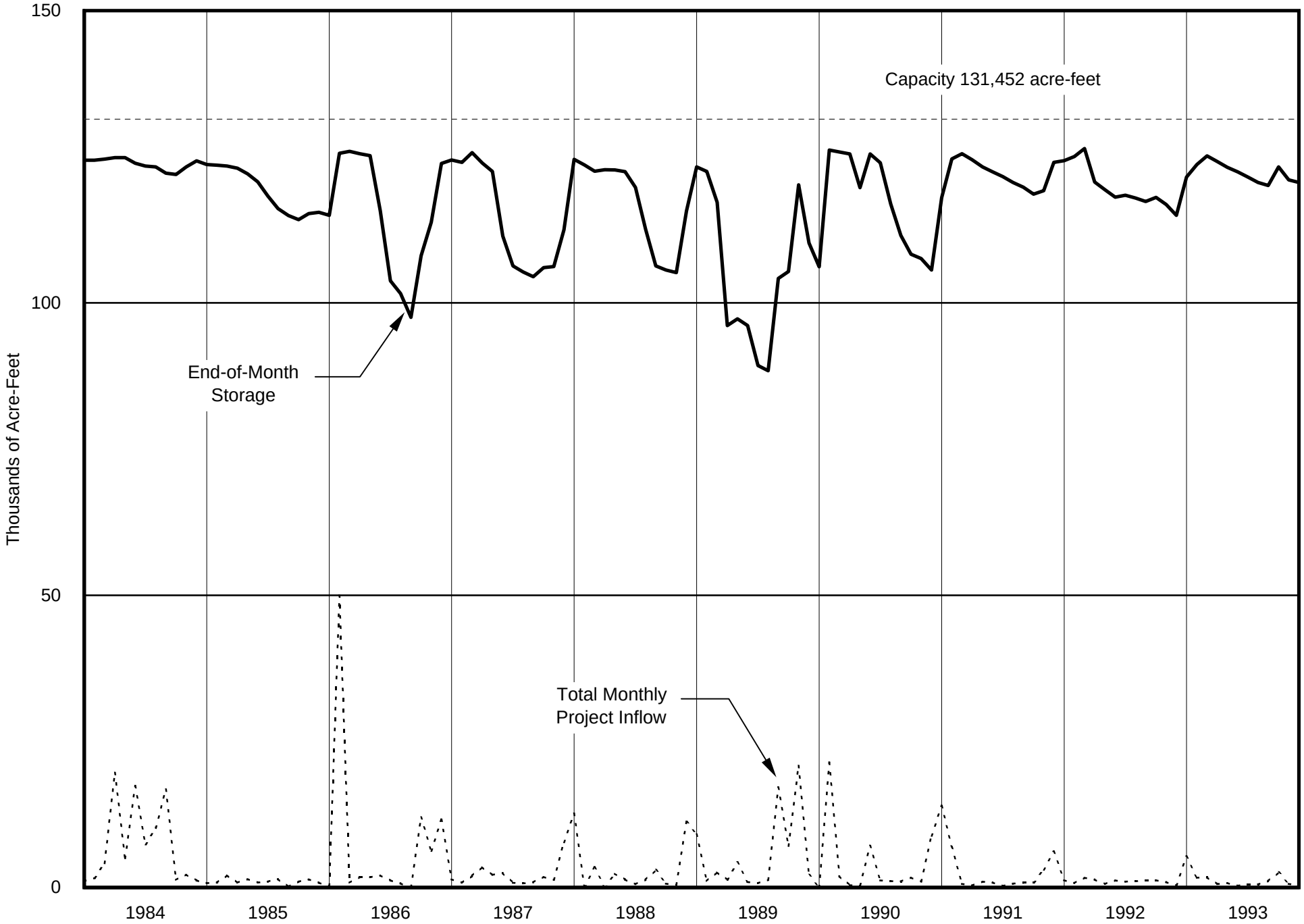
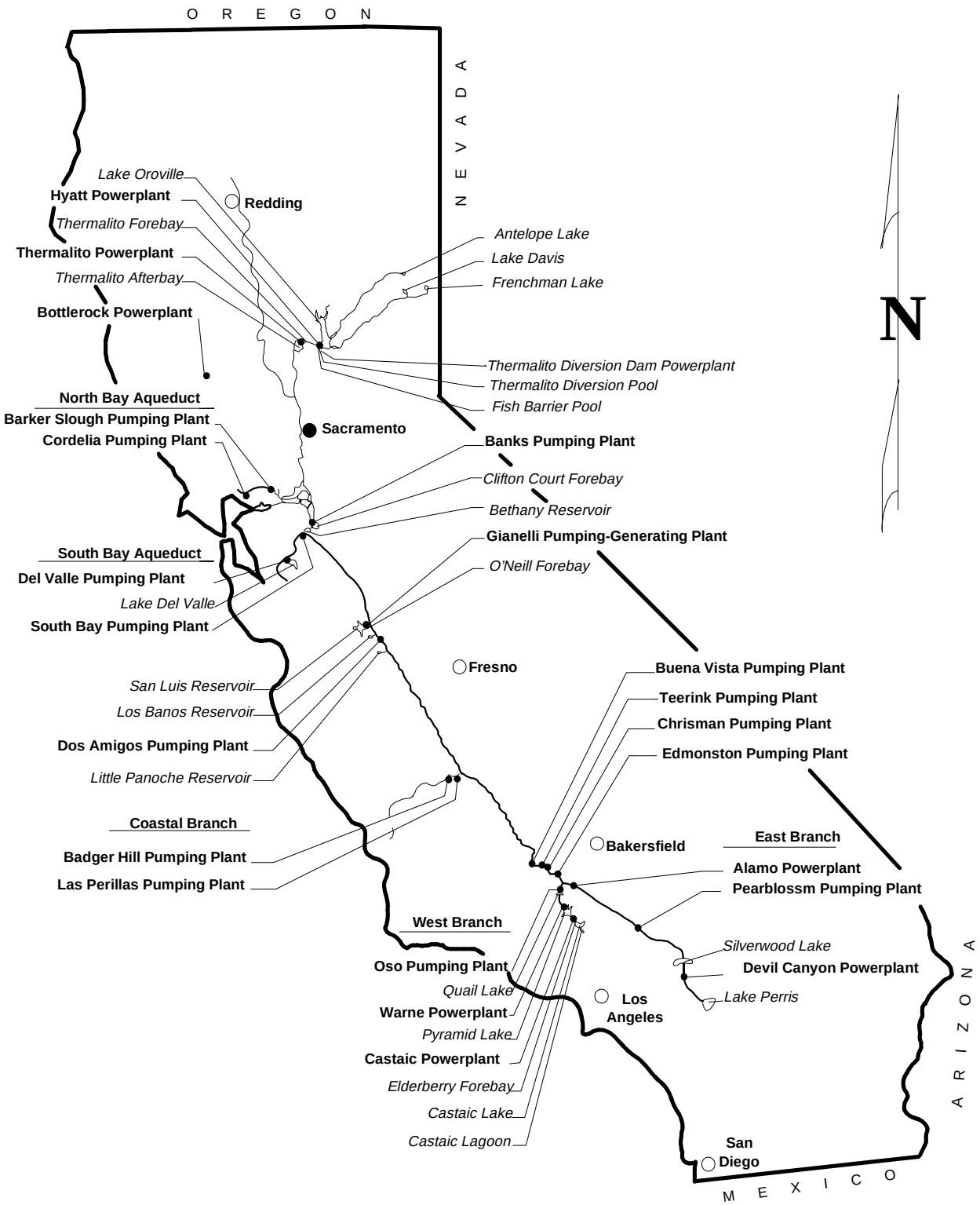


Figure 20. Historical Lake Perris Operation

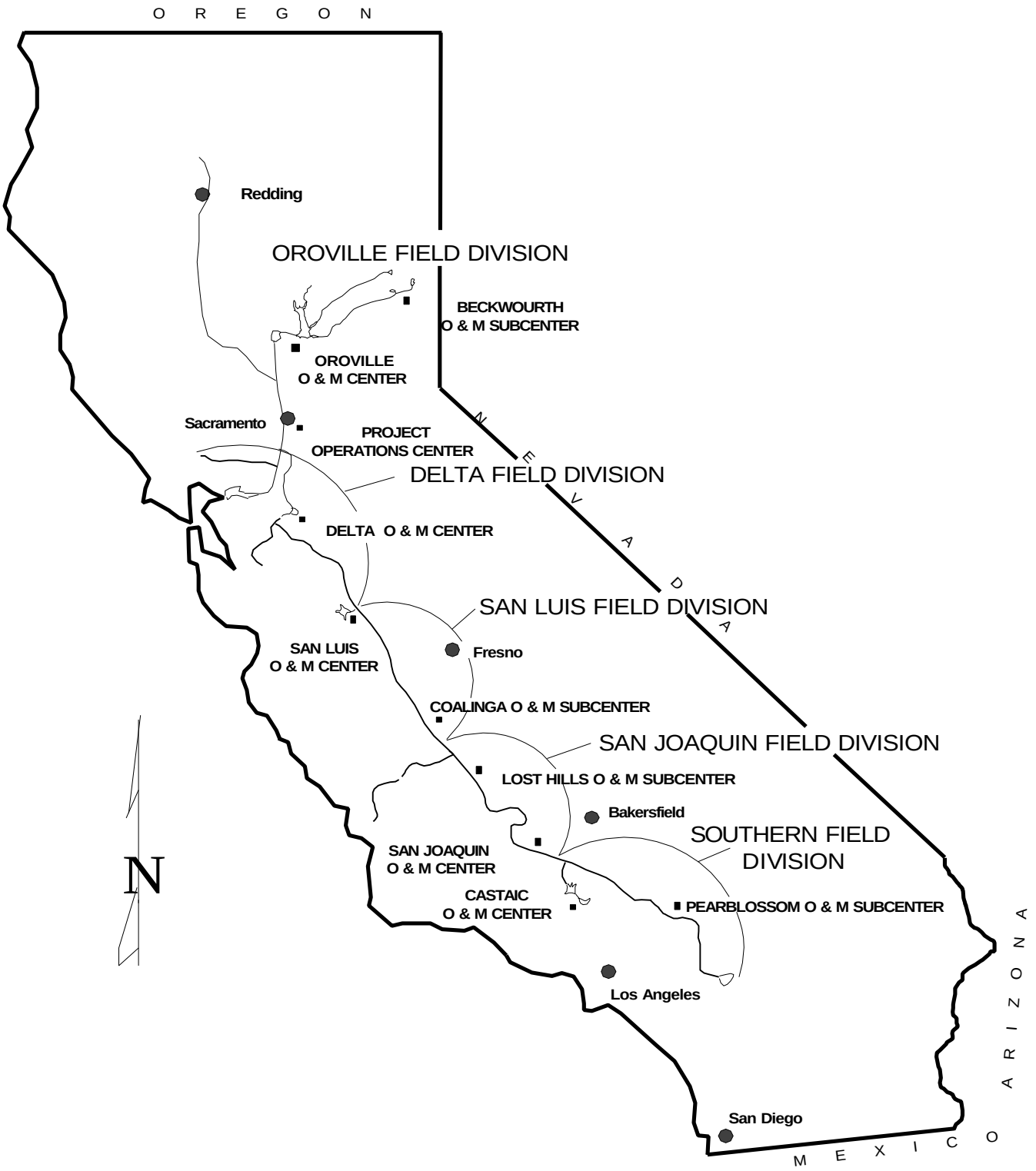


Map 1

Project Facilities

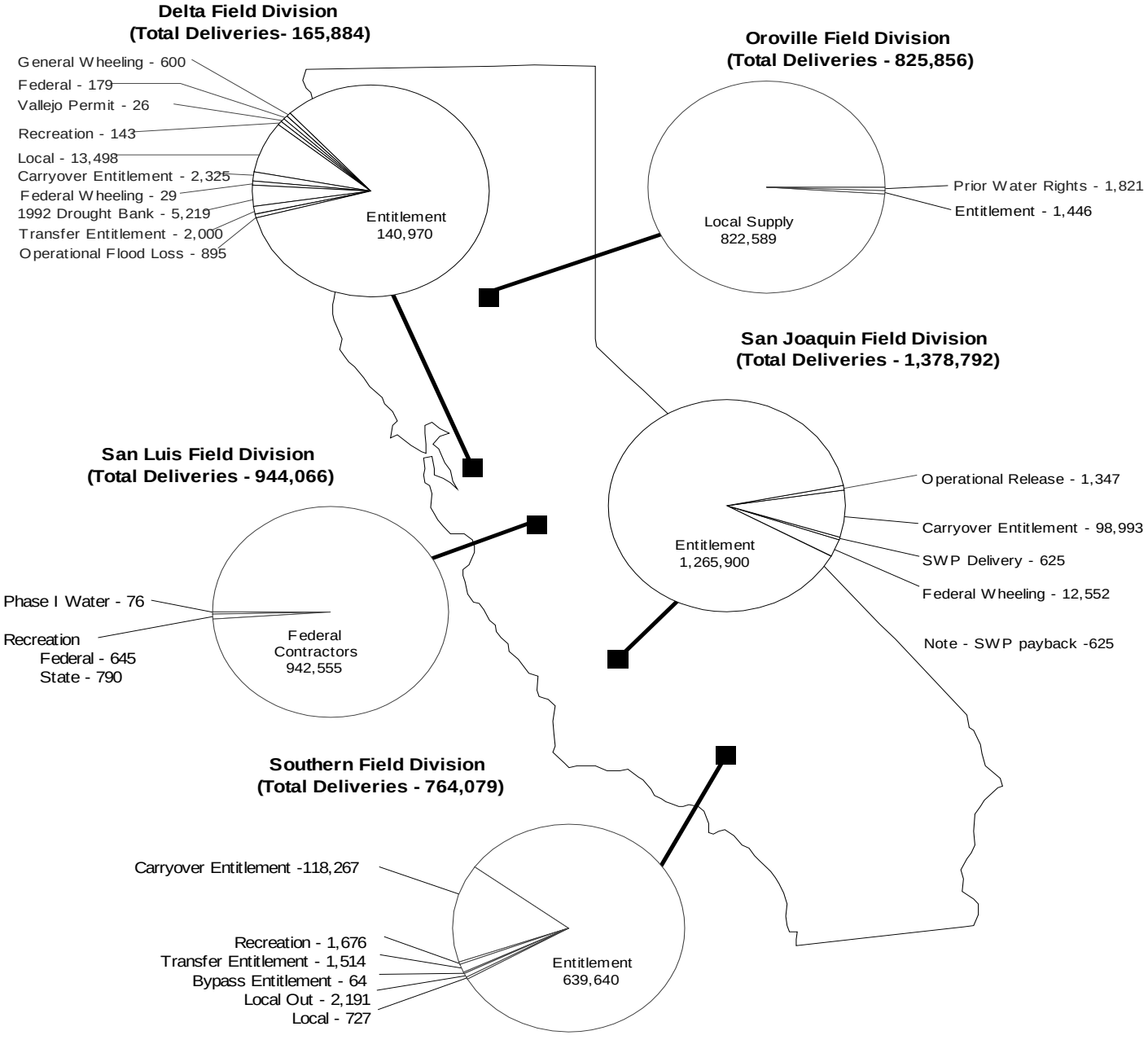


Map 2
Field Division Boundaries



Map 3
1993 Water Deliveries

(in acre-feet)



Total Deliveries
4,078,677

Table 22a. Summary of California Aqueduct Operation

1993

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
DELTA FIELD DIVISION													
	Note: North Bay Aqueduct, South Bay Aqueduct, and Lake Del Valle are not within the Edmond G. Brown California Aqueduct, they are shown here for completeness.												
North Bay Aqueduct													
Pumped at Barker Slough Pumping Plant	1,919	1,501	1,549	2,159	3,247	3,755	3,818	5,156	4,296	3,329	3,224	2,293	36,246
Deliveries (Travis & Fairfield/Vacaville)	967	788	976	1,149	1,693	1,316	1,000	2,285	2,077	1,448	986	624	15,309
Pumped at Cordelia Pumping Plant	917	690	507	1,092	1,896	2,182	2,641	2,542	1,966	1,649	2,076	1,626	19,784
Deliveries (Benicia, Vallejo, A.C. 1&2, & Napa)	917	689	507	1,092	1,896	2,182	2,641	2,542	1,966	1,649	2,076	1,626	19,783
Change in Storage, Napa Terminal Tank	0	1	0	0	0	0	0	0	0	0	0	0	1
Computed Losses (-), Gains (+)	-35	-23	-66	82	342	-257	-177	-329	-253	-232	-162	-43	-1,153
California Aqueduct													
Pumped at Banks Pumping Plant	464,832	283,745	119,532	160,903	105,348	120,503	257,115	381,850	380,984	396,159	153,730	385,423	3,210,124
Pumped at South Bay Pumping Plant	3,330	721	1,744	5,011	10,693	12,899	14,774	13,533	6,921	4,414	8,920	10,262	93,222
Delivered to Contracting Agencies	13	11	19	124	378	752	817	389	309	199	41	14	3,066
Inflow Into Aqueduct (Oak Flat Local-In)	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Storage	1,295	-1,675	-20	552	-240	427	512	-224	350	-39	-825	20	133
Outflow at Check 12	455,270	281,753	115,553	154,068	87,651	104,556	235,923	360,711	365,027	383,067	142,857	367,931	3,054,367
Computed Losses (-), Gains (+)	-4,924	-2,935	-2,236	-1,148	-6,866	-1,869	-5,089	-7,441	-8,377	-8,518	-2,737	-7,196	-59,336
South Bay Aqueduct													
Pumped at South Bay Pumping Plant	3,330	721	1,744	5,011	10,693	12,899	14,774	13,533	6,921	4,414	8,920	10,262	93,222
Lake Del Valle releases into S. Bay Aqueduct	4,682	6,169	4,576	2,145	847	0	0	0	5,844	6,604	1,629	0	32,496
Outflow (Pumped into Lake Del Valle)	0	0	0	0	0	0	0	0	0	0	0	0	0
Delivered to Contracting Agencies	7,995	6,880	6,310	7,146	11,530	12,889	14,764	13,523	12,755	11,008	10,531	10,252	125,583
Computed Losses (-), Gains (+)	-17	-10	-10	-10	-10	-10	-10	-10	-10	-10	-18	-10	-135
Lake Del Valle Operation:													
Natural inflow	21,439	15,651	8,795	2,466	646	283	6	54	183	310	112	148	50,093
Inflow from South Bay Aqueduct	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflows to Arroyo Valle & S.B. Aqueduct	7,756	15,209	8,247	2,145	847	0	0	0	5,844	6,604	1,629	0	48,281
Delivered to EBRP District	2	4	7	5	16	17	26	24	18	12	5	7	143
End-of-Month Storage (State)	39,555	39,936	40,369	40,497	40,020	39,893	39,435	39,015	32,967	26,469	24,827	24,926	- - -
Change in Storage	13,633	381	433	128	-477	-127	-458	-420	-6,048	-6,498	-1,642	99	-996
Evaporation Losses 1/	-48	-57	-108	-188	-260	-393	-438	-450	-369	-192	-120	-42	-2,665
SAN LUIS FIELD DIVISION													
O'Neill Forebay Operation													
End-of-Month Storage	43,411	40,711	46,994	41,375	45,603	47,257	52,303	49,288	43,411	45,420	43,282	49,820	- - -
Inflow, California Aqueduct	455,270	281,753	115,553	154,068	87,651	104,556	235,923	360,711	365,027	383,067	142,857	367,931	3,054,367
Inflow, O'Neill P.- G. Plant	246,169	206,582	202,679	145,888	21,431	18,230	58,866	60,138	117,509	141,182	189,257	220,684	1,628,615
Inflow, Gianelli P.- G. Plant	0	0	20,065	48,435	262,211	343,869	236,426	64,311	3,669	0	84,259	0	1,063,245
Inflow, Pump in	0	0	0	0	21	98	105	74	0	0	0	0	298
Delivered to Dept. of Fish and Game (State)	1	32	0	0	78	7	107	112	37	73	45	44	536
Delivered to Dept. of Fish and Game (Fed.)	0	27	0	0	63	5	88	91	30	59	37	38	438
Delivered to Dept. of Parks & Rec. (State)	0	0	0	0	0	0	0	0	0	0	0	59	59
Delivered to Dept. of Parks & Rec. (Fed.)	0	0	0	0	0	0	0	0	0	0	0	49	49
Delivered to Federal Customers	48	91	285	951	1,598	1,871	2,511	2,158	1,200	378	215	153	11,459
Outflow, O'Neill P.- G. Plant	0	0	0	15,241	52,335	43,634	0	1,375	0	0	0	0	112,585
Outflow, Gianelli P.- G. Plant	673,258	448,339	197,991	194,934	0	0	3,288	55,270	284,796	317,568	208,702	313,069	2,697,215
Outflow, Dos Amigos P.P.	37,089	42,987	136,617	143,196	314,118	421,882	527,749	447,953	227,094	217,621	212,909	269,429	2,998,644
Change in Storage	-6,063	-2,700	6,283	-5,619	4,228	1,654	5,046	-3,015	-5,877	2,009	-2,138	6,538	346
Computed Losses (-), Gains (+)	2,894	441	2,879	312	1,106	2,300	7,469	18,710	21,075	13,459	3,397	764	74,806
San Luis Reservoir Operation													
State End-of-Month Storage	801,700	993,485	979,323	1,045,287	942,912	790,229	726,579	789,450	947,022	1,069,058	911,773	1,067,259	- - -
Total End-of-Month Storage	1,190,213	1,634,837	1,804,747	1,940,946	1,668,093	1,313,473	1,064,794	1,040,364	1,294,245	1,591,983	1,692,739	1,985,549	- - -
Inflow, Gianelli P.- G. Plant	673,258	448,339	197,991	194,934	0	0	3,288	55,270	284,796	317,568	208,702	313,069	2,697,215
Outflow, Gianelli P.- G. Plant	0	0	20,065	48,435	262,211	343,869	236,426	64,311	3,669	0	84,259	0	1,063,245
Deliveries to Parks and Recreation	0	0	0	0	0	0	0	0	0	0	0	12	12
Pacheco Tunnel Diversion	2,804	1,549	4,329	3,465	10,912	11,963	12,754	9,303	11,655	7,476	13,454	13,524	103,188
Change in Storage (Total)	665,797	444,624	169,910	136,199	-272,853	-354,620	-248,679	-24,430	253,881	297,738	100,756	292,810	1,461,133
Computed Losses (-), Gains (+)	-4,657	-2,166	-3,687	-6,835	270	1,212	-2,787	-6,086	-15,591	-12,354	-10,233	-6,723	-69,637

1/ Includes 1,805 AF of State's share of losses and 860 AF of other losses.

Table 22b. Summary of California Aqueduct Operation (cont.)

1993

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SAN LUIS FIELD DIVISION (Cont.)													
California Aqueduct (Pools 14 thru 21)													
Inflow, Dos Amigos P.P.(State)	39,906	37,511	102,725	87,182	199,748	248,264	304,119	298,755	185,638	172,582	167,973	200,782	2,045,185
Inflow, Dos Amigos P.P.(Federal)	-2,817	5,476	33,892	56,014	114,370	173,618	223,630	149,198	41,456	45,039	44,936	68,647	953,459
Total Inflow, Dos Amigos P.P.	37,089	42,987	136,617	143,196	314,118	421,882	527,749	447,953	227,094	217,621	212,909	269,429	2,998,644
Flow into Aqueduct	18,524	8,028	2,043	168	1,615	2,387	2,298	2,550	1,197	847	467	695	40,819
Delivered to Dept. of Fish and Game (State)	0	2	16	6	4	10	30	27	23	37	22	11	188
Delivered to Dept. of Fish and Game (Federal)	0	2	13	5	3	8	24	21	19	30	18	10	153
Delivered to Federal Customers 1/	5,382	8,727	32,131	54,437	117,538	176,158	224,645	144,947	33,833	36,101	36,709	60,564	931,172
Outflow, Check 21 (State)	52,121	42,001	97,380	84,512	200,419	246,966	301,961	290,269	175,389	164,741	162,939	195,738	2,014,436
Outflow, Check 21 (Federal)	0	120	0	0	0	0	0	0	0	3,888	4,143	4,401	12,552
Total outflow, Check 21	52,121	42,121	97,380	84,512	200,419	246,966	301,961	290,269	175,389	168,629	167,082	200,139	2,026,988
Change in Storage (includes evaporation)	-2,431	-373	3,227	-145	-79	483	-145	-814	-407	767	-451	-238	-606
Computed Losses (-), Gains (+)	-541	-536	-5,893	-4,549	2,152	-644	-3,532	-16,053	-19,434	-12,904	-9,996	-9,638	-81,568
SAN JOAQUIN FIELD DIVISION													
California Aqueduct, Check 21 to Buena Vista Pumping Plant													
Inflow, Check 21 (state)	52,121	42,001	97,380	84,512	200,419	246,966	301,961	290,269	175,389	164,741	162,939	195,738	2,014,436
Inflow, Check 21 (Federal)	0	120	0	0	0	0	0	0	0	3,888	4,143	4,401	12,552
Total Inflow, Check 21	52,121	42,121	97,380	84,512	200,419	246,966	301,961	290,269	175,389	168,629	167,082	200,139	2,026,988
West Kern Trade, Pumpback	0	0	0	0	0	0	0	0	0	0	0	0	0
Delivered to Contracting State Agencies	3,830	15,953	63,284	43,701	86,879	122,091	160,026	162,747	76,435	71,666	115,746	122,823	1,045,181
Delivered to Federal Customers	0	120	0	0	0	0	0	0	0	3,888	4,143	4,401	12,552
Kern Water Bank Preconsol. Return	0	0	0	0	0	0	0	0	0	0	0	0	0
Inflow, Hacienda Wells	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow, Buena Vista P.P.	46,199	23,976	24,765	29,963	89,177	101,160	108,936	105,667	85,909	79,825	38,642	62,125	796,344
Coastal Br. Diversion	321	917	4,971	6,748	14,542	16,093	21,220	14,832	7,653	8,858	2,288	5,760	104,203
Change in Storage	-504	-873	914	255	168	-972	715	88	161	48	-79	387	308
Computed Losses (-), Gains (+)	-2,275	-2,028	-3,446	-3,845	-9,653	-8,594	-11,064	-6,935	-5,231	-4,344	-6,342	-4,643	-68,400
California Aqueduct, Buena Vista P.P. to Teerink P.P.													
Inflow, Buena Vista P.P.	46,199	23,976	24,765	29,963	89,177	101,160	108,936	105,667	85,909	79,825	38,642	62,125	796,344
Delivered to Contracting State Agencies	345	1,377	7,929	5,817	12,022	17,820	24,683	23,023	5,727	3,224	2,638	5,080	109,685
W.R.M.W.S.D. Pumpback	625	0	0	0	0	0	0	0	0	0	0	0	625
Outflow, Teerink P.P.	47,178	22,999	16,442	24,257	78,368	85,114	86,783	84,653	81,269	78,245	36,303	58,645	700,256
Change in Storage	-111	-880	160	6	-54	20	864	-128	5	123	-107	106	4
Computed Losses (-), Gains (+)	588	-480	-234	117	1,159	1,794	3,394	1,881	1,092	1,767	192	1,706	12,976
California Aqueduct, Teerink P.P. to Chrisman P.P.													
Inflow, Teerink P.P.	47,178	22,999	16,442	24,257	78,368	85,114	86,783	84,653	81,269	78,245	36,303	58,645	700,256
Delivered to Contracting State Agencies	0	123	590	2,393	4,353	4,577	6,001	3,626	1,995	3,088	414	837	27,997
Outflow, Chrisman P.P.	48,081	23,338	15,770	21,701	74,011	80,463	79,555	81,027	81,026	74,760	36,498	57,485	673,715
Change in Storage	20	-68	-3	11	16	-19	57	-83	28	-12	62	-5	4
Computed Losses (-), Gains (+)	923	394	-85	-152	12	-93	-1,170	-83	1,780	-409	671	-328	1,460
California Aqueduct, Chrisman P.P. to Edmonston P.P.													
Inflow, Chrisman P.P.	48,081	23,338	15,770	21,701	74,011	80,463	79,555	81,027	81,026	74,760	36,498	57,485	673,715
Delivered to Contracting State Agencies	17	91	484	495	1,713	2,061	2,096	1,826	1,423	1,015	171	286	11,678
Outflow, Edmonston P.P.	46,464	22,596	14,696	20,597	70,414	76,707	75,249	77,324	76,865	72,195	35,535	56,727	645,369
Change in Storage	-54	-12	101	-41	-40	-19	-49	27	11	75	19	-21	-3
Computed Losses (-), Gains (+)	-1,654	-663	-489	-650	-1,924	-1,714	-2,259	-1,850	-2,727	-1,475	-773	-493	-16,671
Coastal Branch, California Aqueduct													
Inflow, Las Perillas P.P.	321	917	4,971	6,748	14,542	16,093	21,220	14,832	7,653	8,858	2,288	5,760	104,203
B.M.W.S.D. Pumpback	0	0	0	0	0	0	0	0	0	0	0	0	0
Delivered to Contracting State Agencies	269	840	4,490	6,302	13,772	14,727	19,029	12,722	7,115	8,256	1,968	5,431	94,921
Delivered to Federal Customers	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Storage	35	-13	9	-4	7	-17	12	8	-13	14	8	-24	22
Computed Losses (-), Gains (+)	-17	-90	-472	-450	-763	-1,383	-2,179	-2,102	-551	-588	-312	-353	-9,260

1/ Includes 76 AF of Westland Non-Chargeable Refill Water (Phase I Water)

Table 22c. Summary of California Aqueduct Operation (cont.)

1993

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SOUTHERN FIELD DIVISION													
California Aqueduct, Edmonston P.P. to Junction of West Branch													
Inflow,Edmonston P.P.	46,464	22,596	14,696	20,597	70,414	76,707	75,249	77,324	76,865	72,195	35,535	56,727	645,369
Outflow, West Branch	31,276	13,772	0	44	33,099	45,758	44,865	38,529	34,647	33,188	1,983	53,726	330,887
Outflow, East Branch	15,211	8,839	14,705	20,554	37,317	30,940	30,405	38,784	42,220	38,995	33,536	3,008	314,514
Change in Storage	-8	-3	2	-2	9	-5	-8	11	0	-3	4	-4	-7
Computed Losses (-), Gains (+)	15	12	11	-1	11	-14	13	0	2	-15	-12	3	25
California Aqueduct, Junction of West Branch to Pearblossom P.P.													
Inflow (Aqueduct)	15,211	8,839	14,705	20,554	37,317	30,940	30,405	38,784	42,220	38,995	33,536	3,008	314,514
Delivered to Contracting Agencies	957	1,049	2,132	3,610	6,035	6,123	7,720	8,342	6,991	5,112	3,597	1,437	53,105
Storage Balance Adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow, Pearblossom P.P.	15,782	8,989	12,714	17,455	31,426	24,484	21,483	31,005	35,028	32,239	29,697	1,582	261,884
Change in Storage	-429	-351	156	-544	646	-689	238	-571	389	551	-615	205	-1,014
Computed Losses (-), Gains (+)	1,099	848	297	-33	790	-1,022	-964	-8	188	-1,093	-857	216	-539
California Aqueduct, Pearblossom P.P. to Silverwood Lake													
Inflow, Pearblossom P.P.	15,782	8,989	12,714	17,455	31,426	24,484	21,483	31,005	35,028	32,239	29,697	1,582	261,884
Deliveries (Exchange of Natural Inflow)	0	0	0	0	0	0	0	0	0	0	0	0	0
Exchange of Natural Inflow (Las Flores T.O.)	1,018	793	547	0	0	32	407	397	391	315	1,018	727	5,645
Outflow to Silverwood Lake	14,750	6,668	10,990	15,300	27,910	18,640	19,200	27,740	31,570	31,810	27,960	2,000	234,538
Change in Storage	29	-247	67	-227	356	-164	290	-272	238	-339	885	22	638
Computed Losses (-), Gains (+)	15	-1,775	-1,110	-2,382	-3,160	-5,976	-1,586	-3,140	-2,829	-453	166	1,167	-21,063
Silverwood Lake Operation													
Inflow, Project	14,750	6,668	10,990	15,300	27,910	18,640	19,200	27,740	31,570	31,810	27,960	2,000	234,538
Inflow, Natural	27,643	25,126	10,354	3,402	1,332	1,174	225	83	81	42	83	165	69,710
Delivered to Contracting Agencies	94	60	50	54	68	2,273	94	119	756	3,245	2,369	1,984	11,166
Recreation Deliveries	1	1	2	6	5	9	10	12	13	12	6	2	79
Outflow, Natural Inflow Released	24,790	22,145	9,291	3,337	699	346	15	15	15	14	18	13	60,698
Houston Creek Appropriation	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow, Project Water at San Bernardino Tunnel	15,257	7,880	10,311	17,730	31,185	22,816	21,602	29,355	35,104	25,823	25,491	13,683	256,237
Change in storage	926	4,225	2,128	-315	19	-134	-1,764	-272	-2,218	3,569	704	-13,276	-6,408
Computed Losses (-), Gains (+)	-1,325	2,517	438	2,110	2,734	5,496	532	1,406	2,019	811	545	241	17,524
California Aqueduct, Silverwood Lake to Lake Perris													
Inflow, San Bernardino Tunnel	15,257	7,880	10,311	17,730	31,185	22,816	21,602	29,355	35,104	25,823	25,491	13,683	256,237
Inflow, SBVMWD Pump-in at DC Afterbay	0	0	0	0	567	575	601	448	0	0	0	0	2,191
Delivered to Contracting Agencies	9,927	6,215	8,533	17,131	30,959	23,081	21,627	29,272	34,004	23,215	24,865	13,328	242,157
Outflow to Lake Perris	5,332	1,666	1,775	599	790	308	572	516	1,103	2,606	626	355	16,248
Change in Storage	-3	-2	2	-2	1	0	1	12	-5	0	-1	-1	2
Operational Losses (-), Gains (+)	-1	-1	-1	-2	-2	-2	-3	-3	-2	-2	-1	-1	-21
Lake Perris Operation													
Inflow	5,332	1,666	1,775	599	790	308	572	516	1,103	2,606	626	355	16,248
Delivered to Contracting Agencies	511	389	412	386	385	365	374	378	366	383	375	388	4,712
Recreation Deliveries	10	4	12	27	43	53	41	55	44	27	29	19	364
Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Storage	6,538	2,150	1,457	-957	-999	-793	-858	-945	-517	3,203	-2,236	-450	5,593
Computed Losses (-), Gains (+)	1,727	877	106	-1,143	-1,361	-683	-1,015	-1,028	-1,210	1,007	-2,458	-398	-5,579

Table 22d. Summary of California Aqueduct Operation (cont.)

1993

(in acre-feet)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
SOUTHERN FIELD DIVISION (Cont.)													
West Branch California Aqueduct													
Tehachapi Afterbay to Oso P.P.													
Inflow	31,276	13,772	0	44	33,099	45,758	44,865	38,529	34,647	33,188	1,983	53,726	330,887
Outflow, Oso Pumping Plant	31,348	13,816	0	49	33,105	45,730	44,850	38,496	34,654	33,153	1,934	53,746	330,881
Change in Storage	-26	-9	5	-6	27	-14	-25	32	0	-10	13	-11	-24
Computed Losses (-), Gains (+)	46	35	5	-1	33	-42	-40	-1	7	-45	-36	9	-30
West Branch California Aqueduct													
Oso P.P. to Pyramid Lake													
Inflow, Oso P.P.	31,348	13,816	0	49	33,105	45,730	44,850	38,496	34,654	33,153	1,934	53,746	330,881
Deliveries	0	0	0	0	6	0	0	0	0	0	0	0	6
Outflow Warne Generating Plant	30,833	13,110	0	10	33,522	45,926	45,782	38,728	34,495	32,159	1,896	53,668	330,129
Change in Storage	-709	960	-17	-81	-566	49	-1,137	225	51	994	-36	-179	-446
Operational Losses (-), Gains (+)	-1,224	254	-17	-120	-143	245	-205	457	-108	0	-74	-257	-1,192
Pyramid Lake Operation													
Inflow, Project	30,833	13,110	0	10	33,522	45,926	45,782	38,728	34,495	32,159	1,896	53,668	330,129
Inflow, Natural	22,957	42,836	28,717	14,733	6,219	3,308	1,748	1,214	1,032	1,176	1,316	1,702	126,958
Inflow, Pumpback from Elderberry Forebay	65,005	46,812	64,385	74,504	63,549	72,528	63,956	89,585	77,583	63,225	58,832	33,173	773,137
Deliveries (Fish Enhancement)	0	0	0	0	0	0	0	0	0	0	0	0	0
Deliveries	0	0	0	0	0	0	0	0	0	0	0	0	0
Delivered to Dept. of Parks and Rec. (State)	0	0	1	1	0	5	4	4	4	2	1	0	22
Outflow, Pyramid Diversion	22,226	23,925	11,945	7,830	2,889	2,439	2,022	1,563	1,522	1,581	1,519	1,564	81,025
Outflow, Angeles Tunnel	97,226	104,127	76,643	80,569	97,483	118,928	111,588	124,022	119,070	88,341	64,054	88,085	1,170,136
Change in Storage	5,868	-5,456	3,307	-1,011	1,429	-1,441	-3,667	3,377	-7,150	6,898	-2,503	-573	-922
Computed Losses (-), Gains (+)	6,525	19,838	-1,206	-1,858	-1,489	-1,831	-1,539	-561	336	262	1,027	533	20,037
Elderberry Forebay Operation													
Inflow, Project through Castaic P-G Plant	97,226	104,127	76,643	80,569	97,483	118,928	111,588	124,022	119,070	88,341	64,054	88,085	1,170,136
Inflow, Natural	15,529	18,084	8,405	4,487	1,775	870	309	117	52	71	133	272	50,104
Outflow, Pumpback to Pyramid Lake	65,005	46,812	64,385	74,504	63,549	72,528	63,956	89,585	77,583	63,225	58,832	33,173	773,137
Outflow, Project Water Released to Castaic Lake	39,297	61,204	18,030	16,847	34,861	50,596	44,059	35,569	36,814	25,541	3,730	54,822	421,370
Change in Storage	-72	5,965	-105	-5,979	1,742	-3,219	4,274	-1,988	3,586	-1,751	-519	-1,377	557
Computed Losses (-), Gains (+)	-8,525	-8,230	-2,738	316	894	107	392	-973	-1,139	-1,397	-2,144	-1,739	-25,176
Castaic Lake Operation													
Inflow, Project	39,297	61,204	18,030	16,847	34,861	50,596	44,059	35,569	36,814	25,541	3,730	54,822	421,370
Inflow, Natural	9,746	13,216	7,276	3,254	1,604	810	374	159	102	160	224	511	37,436
Delivered to Contracting Agencies	25,922	28,300	11,066	33,018	50,486	39,552	42,009	49,867	50,566	42,655	46,156	31,846	451,443
Outflow, Castaic Lagoon	184	112	13,307	3,058	1,813	1,557	668	790	1,217	89	231	602	23,628
Change in Storage	27,737	48,531	4,423	-18,184	-17,064	9,166	1,142	-16,734	-15,522	-15,738	-43,937	22,505	-13,675
Computed Losses (-), Gains (+)	4,800	2,523	3,490	-2,209	-1,230	-1,131	-614	-1,805	-655	1,305	-1,504	-380	2,590
Castaic Lagoon Operation													
Inflow (Includes recreation inflow)	184	112	13,307	3,058	1,813	1,557	668	790	1,217	89	231	602	23,628
Inflow, Natural	0	0	0	0	0	0	0	0	0	0	0	0	0
Outflow	180	140	13,139	3,211	2,149	875	589	616	1,083	168	96	431	22,677
Deliveries to Recreation (State)	17	47	63	93	100	87	113	138	136	104	76	51	1,025
Change in Storage	441	98	105	-246	-436	595	-34	36	-2	-183	59	120	553
Computed Losses (-), Gains (+)	454	173	0	0	0	0	0	0	0	0	0	0	627

Glossary

accretion - the water accumulated and retained within a service area.

***acre-foot (AF*)** - a quantity or volume of water covering one acre to a depth of one foot; equal to 43,560 cubic feet or 325,851 gallons.

active storage capacity - the total usable reservoir capacity available for seasonal or cyclic water storage. It is gross reservoir capacity minus inactive storage capacity.

afterbay - a reservoir that regulates fluctuating discharges from a hydroelectric powerplant or a pumping plant.

alluvium - a stratified bed of sand, gravel, silt, and clay deposited by flowing water.

aquifer - a geologic formation that stores and transmits water and yields significant quantities of water to wells and springs.

average annual runoff - the average value of annual runoff amounts for a specified area calculated for a selected period of record that represents average hydrologic conditions.

balanced water conditions - exist when upstream reservoir storage releases, plus other inflows, approximately equal the water supply needed to (1) meet export needs; and (2) satisfy Sacramento Valley and Sacramento-San Joaquin Delta in-basin needs, including Delta water quality requirements.

benthic invertebrates - aquatic animals without backbones that dwell on or in the bottom sediments of fresh or salt water. Examples: clams, crayfish, and a wide variety of worms.

biota - all living organisms of a region, as in a stream or other body of water.

brackish water - water containing dissolved minerals in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses. Considerably less saline than sea water.

carriage water - the amount of water needed above an increased export so as to not increase salinity in the Delta.

conjunctive use - the operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the groundwater basin for later use by intentionally recharging the basin during years of above-average water supply.

Decision 1485 operating criteria - standards for operating water project facilities under Water Rights Decision 1485 regarding the Sacramento-San Joaquin Delta and Suisun Marsh, adopted by the State Water Resources Control Board, August 1978.

Delta consumptive use - the sum of evapotranspiration and changes in soil moisture of Delta lands and evaporation from Delta channels.

Delta outflow index (DOI) -a calculated approximation of this seaward freshwater outflow as it passes Chipps Island near Pittsburg, beyond the confluence of the Sacramento and San Joaquin Rivers.

depletion - the water consumed within a service area and no longer available as a source of supply.

deviation - the amount of return energy given as an adjustment to DWR or to PG&E and SCE due to over or under generation by DWR.

dissolved organic compounds - carbon substances dissolved in water.

drainage basin - the area of land from which water drains into a river; for example, the Sacramento River Basin, in which all land area drains into the Sacramento River. Also called, "catchment area," "watershed," or "river basin."

drought condition - hydrologic conditions during a defined drought period during which rainfall and runoff are much less than average.

ecology - the study of the interrelationships of living organisms to one another and to their surroundings.

ecosystem - recognizable, relatively homogeneous units, including the organisms they contain, their environment, and all the interactions among them.

effluent - waste water or other liquid, partially or completely treated or in its natural state, flowing from a treatment plant.

environment - the sum of all external influences and conditions affecting the life and development of an organism or ecological community; the total social and cultural conditions.

estuary - the lower course of a river entering the sea influenced by tidal action where the tide meets the river current.

evapotranspiration (ET) - the quantity of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces. Quantitatively, it is usually expressed in terms of depth of water per unit area during a specified period of time.

evapotranspiration of applied water (ETAW) - the portion of the total evapotranspiration which is provided by irrigation.

forebay - a reservoir or pond situated at the intake of a pumping plant or power plant to stabilize water levels; also a storage basin for regulating water for percolation into groundwater basins.

fry - a recently hatched fish.

gross reservoir capacity - the total storage capacity available in a reservoir for all purposes, from the streambed to the normal maximum operating level. Includes dead (or inactive) storage, but excludes surcharge (water temporarily stored above the elevation of the top of the spillway).

groundwater - water that occurs beneath the land surface and completely fills all pore spaces of the alluvium, soil or rock formation in which it is situated.

groundwater basin - a groundwater reservoir, defined by an overlying land surface and the underlying aquifers that contain water stored in the reservoir.

groundwater overdraft - the condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years during which water supply conditions approximate average.

groundwater recharge - increases in groundwater storage by natural conditions or by human activity.

groundwater table - the upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

hydraulic barrier - a barrier developed in the estuary by release of fresh water from upstream reservoirs to prevent intrusion of sea water into the body of fresh water.

hydrologic balance - an accounting of all water inflow to, water outflow from, and changes in water storage within a hydrologic unit over a specified period of time.

hydrologic basin - the complete drainage area upstream from a given point on a stream.

hydrologic region - a study area, consisting of one or more planning subareas.

joint-use facilities - specific pumping plants, power plants, canals, and reservoirs in which both State and federal agencies participated in the construction, use, and maintenance.

land subsidence - the lowering of the natural land surface in response to earth movements; lowering of fluid pressure (or lowering of groundwater level); removal of underlying supporting materials by mining or solution of solids, either artificially or from natural causes; compaction caused by wetting (hydrocompaction); oxidation of organic matter in soils; or added load on the land surface.

megawatt (MW) - one million watts.

megawatthour (MWh) - a unit of electric power consumption indicating the total energy developed by a power of one megawatt acting for one hour.

milligrams per liter (mg/L) - the weight in milligrams of any substance dissolved in one liter of liquid; nearly the same as parts per million.

natural flow - the flow past a specified point on a natural stream that is unaffected by stream diversion, storage, import, export, return flow, or change in use caused by modification in land use.

percolation - the downward movement of water throughout the soil or alluvium to a groundwater table.

permeability - the capability of soil or other geologic formations to transmit water.

phytoplankton - minute plants, usually algae, that live suspended in bodies of water and that drift about because they cannot move by themselves or because they are too small or too weak to swim effectively against a current.

pollution (of water) - the alteration of the physical, chemical, or biological properties of water by the introduction of any substance into water that adversely affects any beneficial use of water.

prior water right - a water designation used for water delivered based on its use prior to SWP construction.

pumping-generating plant - a plant at which the turbine-driven generators can also be used as motor-driven pumps.

recharge basin - a surface facility, often a large pond, used to increase the percolation of surface water into a groundwater basin.

riparian vegetation - vegetation growing on the banks of a stream or other body of water.

runoff - the total volume of surface flow from an area during a specified time.

Sacramento River index - the sum of the Sacramento Valley's unimpaired runoff at the following four locations: Sacramento River near Red Bluff; total Feather River inflow to Lake Oroville; Yuba River at Smartville; and total American River inflow to Folsom Lake.

salinity - generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity, or osmotic pressure. See ***total dissolved solids*** .

salinity intrusion - the movement of salt water into a body of fresh water. It can occur in either surface water or groundwater bodies.

salt-water barrier - a physical facility or method of operation designed to prevent the intrusion of salt water into a body of fresh water.

sediment - soil or mineral material transported by water and deposited in streams or other bodies of water.

seepage - the gradual movement of a fluid into, through, or from a porous medium.

service area - the geographical land area served by a distribution system of a water agency.

snow water content - a calculated or measured amount of water contained in packed snow based on its depth and density.

spawning - the depositing and fertilizing of eggs (roe) by fish and other aquatic life.

streamflow - the rate of water flow past a specified point in a channel.

surplus water - developed water supplies in excess of contract entitlement or apportioned water.

total dissolved solids (TDS) - a quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter. See ***salinity***.

transpiration - an essential physiological process in which plant tissues give off water vapor to the atmosphere.

unimpaired runoff - represents the natural water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds.

waste water - the water, liquid waste, or drainage from a community, industry, or institution.

water conservation - reduction in applied water due to more efficient water use.

water quality - used to describe the chemical, physical, and biological characteristics of water, usually in regard to its suitability for a particular purpose or use.

water right - a legally protected right to take possession of water occurring in a natural waterway and to divert that water for beneficial use.

water table - see ***groundwater table***.

water year - a continuous 12-month period for which hydrologic records are compiled and summarized. In California, it begins on October 1 and ends September 30 of the following year.

watershed - see ***drainage basin***.