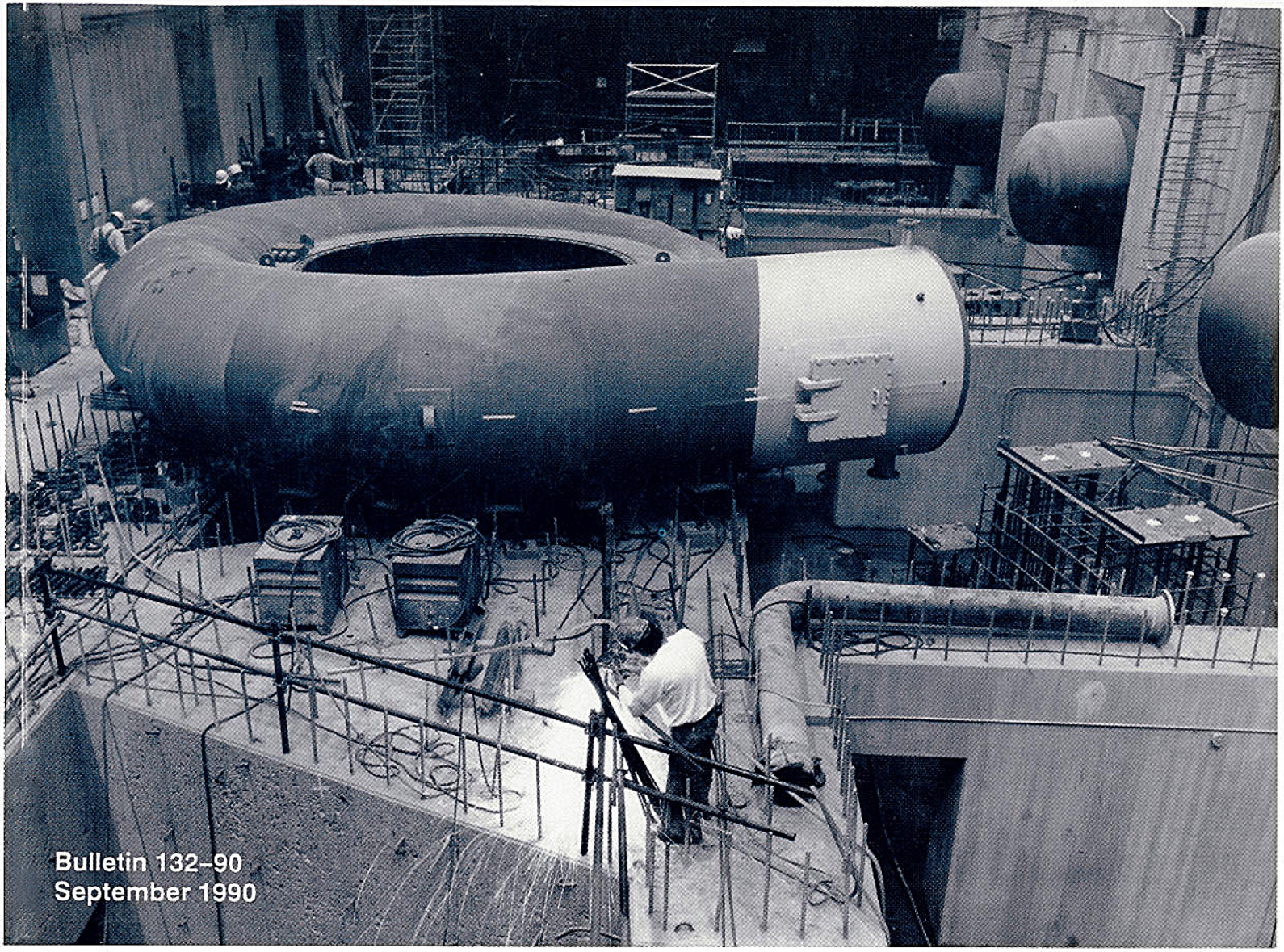

Bulletin 132–90
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State of California
The Resources Agency

Department of
Water Resources

Management of the California State Water Project

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Chapter I
Overview of the California State Water Project

Bulletin 132-90 is the 28th edition of *Management of the California State Water Project.* This report has provided a history of State Water Project water contract administration activities, water and power operations, financing, and management plans. Appendix B, which is bound within each bulletin, documents Project costs and other information to support the annual Statements of Charges to long-term water supply contractors.

As in past bulletins, each chapter of Bulletin 132-90 updates a different aspect of SWP activities. Chapter I opens the report with a review of the development of the State Water Project, discusses in detail a particular aspect of SWP management and highlights SWP accomplishments. Chapter II covers SWP operations--water and power operations, water service, recreation and visitor facilities, and fish and wildlife activities. Administrative activities affecting the management of the SWP, including water contracts, water rights, the Davis-Grunsky Act Program, legislation, and litigation, are addressed in Chapter III. Chapter IV highlights SWP design, construction, right of way, and safety activities. Present and future SWP water supply and power management plans are described in Chapters V and VI, respectively, while Chapter VII details the costs and financing of the SWP.

State Water Project Development

In 1947, the State Legislature funded the water resources investigation that led to the development of the State Water Project. This investigation resulted in the publication of *The California Water Plan*, which presented preliminary plans to meet the State's ultimate water needs, including those works required for transferring surplus water from the north to the water-deficient south.

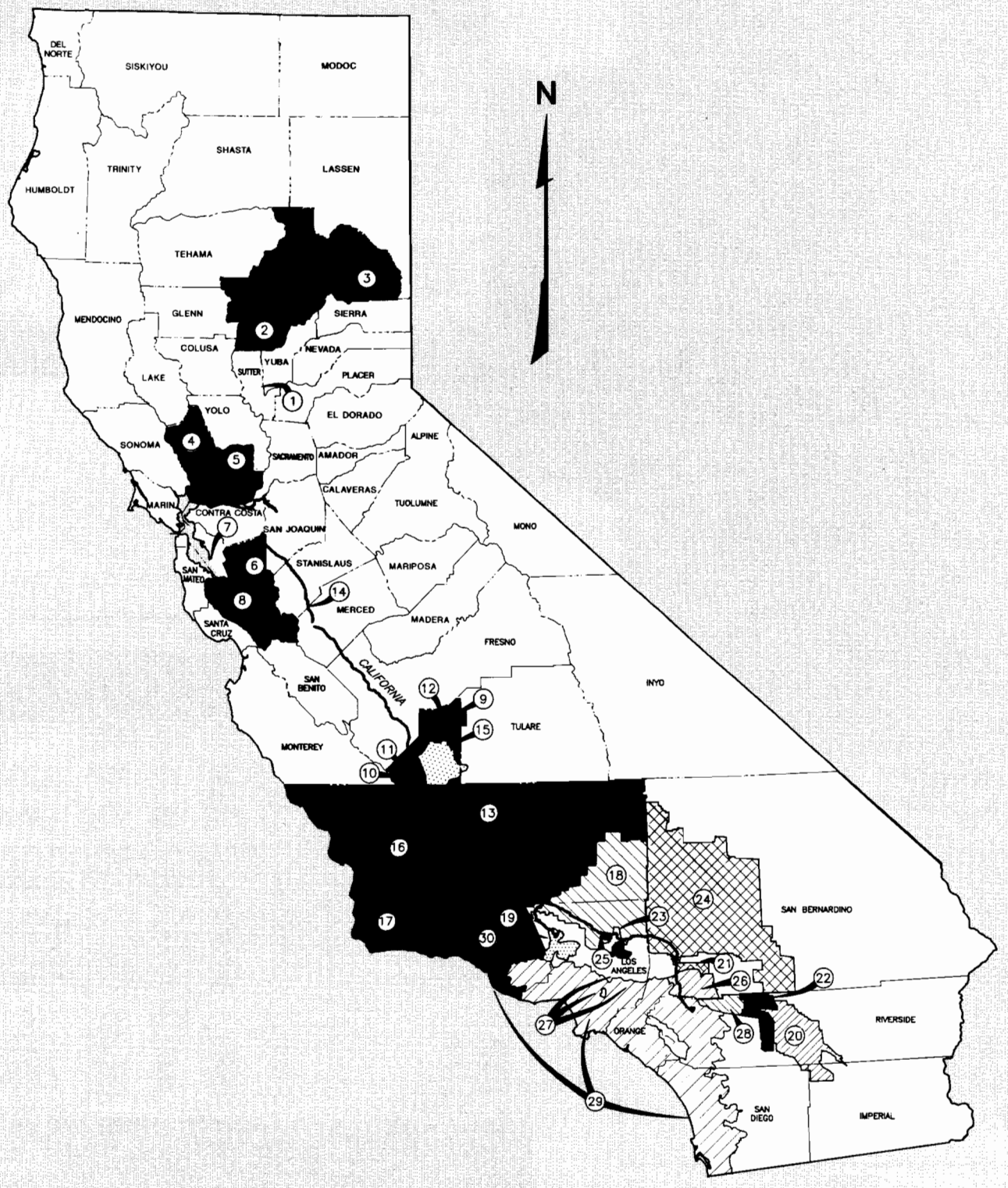
Financing for the construction of SWP facilities was authorized in 1959, when the State Legislature enacted the California Water Resources Development Act (known as the Burns-Porter Act). Initial works included Oroville Dam and Lake Oroville, San Luis Dam (now called B. F. Sisk San Luis Dam) and San Luis Reservoir, the South Bay Aqueduct, the North Bay Aqueduct, and the California Aqueduct. The first SWP water deliveries were made in 1962, just two years after construction began. Figure 1 shows existing and proposed SWP facilities, with Project statistics.

DWR and The Metropolitan Water District of Southern California signed the first water supply contract in 1960, and today 30 agencies have long-term water supply contracts with DWR. The service areas of these long-term water supply contractors vary widely in size, location, climate, and population (Figure 2). The contractors' uses for SWP water also differ. In the San Joaquin Valley, SWP water is used primarily for agriculture; in the Feather River area, in the San Francisco South Bay and North Bay areas, and in Southern California, SWP water is used primarily for urban and industrial needs.

SWP long-term contractors' requests for water in 1990 totaled about 3.2 million acre-feet. Existing contracts call for SWP water deliveries to eventually total 4.2 million acre-feet per year. To meet this contractual obligation, DWR continues to plan and construct new facilities for the SWP. The most recently completed project is the North Bay Aqueduct, Phase II, which began delivering water to Napa and Solano counties in May 1988.

Facilities now under construction include the East Branch Enlargement and the installation of four pumps at Harvey O. Banks Delta Pumping Plant. The East Branch Enlargement, which will accommodate an additional 1,500 to 1,683 cfs in the various reaches, will supplement services to Antelope Valley-East Kern Water Agency, Coachella Valley Water District, Desert Water Agency, Mojave Water Agency, Palmdale Water District, San Bernardino Valley Municipal Water District, and The Metropolitan Water District of Southern California. Installing the additional pumps at Banks Pumping Plant will increase the total capacity of the plant to 10,300 cfs (from the current 6,400 cfs) and will increase the reliability of SWP water supply deliveries.

Figure 2. Long-Term Water



Supply Contracting Agencies

Location No.	Contracting Agency	First Year of Service	Total Cumulative Deliveries through 12/31/89(a *acre-feet*	Maximum Annual Entitlement *acre-feet*	Total Payments through 12/31/89 *dollars*	Gross Area as of 7/1/89 *acres*	Assessed Valuation 1988-89(b *dollars*	Estimated Population on 7/1/89
	UPPER FEATHER AREA							
1.	City of Yuba City	1968	1,292	9,600	222,000	4,480	714,942,000	25,000
2.	County of Butte	1968	6,014	27,500	425,000	1,069,000	6,239,500,000 (c	172,600
3.	Plumas County Flood Control and Water Conservation District	1968	7,184	2,700	578,000	1,644,000 (d	1,554,303,000 (d	18,000
	Subtotal		14,490	39,800	1,225,000	2,717,480	8,508,745,000	215,600
	NORTH BAY AREA							
4.	Napa County Flood Control and Water Conservation District	1968	111,705	25,000	13,527,000	508,000	5,797,081,000	108,600
5.	Solano County Flood Control and Water Conservation District	1988	30,040	42,000	15,412,000	537,600	12,309,472,000	340,000
	Subtotal		141,745	67,000	28,939,000	1,045,600	18,106,553,000	448,600
	SOUTH BAY AREA							
6.	Alameda County Flood Control and Water Conservation District, Zone 7	1962	354,808	46,000	27,585,000	272,000	7,009,487,000 (c	161,600
7.	Alameda County Water District	1962	450,698	42,000	31,725,000	63,000	12,104,371,000 (c	255,000
8.	Santa Clara Valley Water District	1965	2,129,017	100,000	112,074,000	833,000	79,624,000,000	1,448,000
	Subtotal		2,934,523	188,000	171,384,000	1,168,000	98,737,858,000	1,864,600
	SAN JOAQUIN VALLEY AREA							
9.	County of Kings	1968	49,900	4,000	1,408,000	893,300 (e	2,569,000,000 (e	99,300 (e
10.	Devil's Den Water District	1968	332,791	12,700	10,444,000	8,700	(f	50
11.	Dudley Ridge Water District	1968	1,185,841	57,700	25,016,000	29,970	(f	50
12.	Empire West Side Irrigation District	1968	75,784	3,000	1,471,000	7,400	(f	50
13.	Kern County Water Agency	1968	16,660,170	1,153,400	530,142,000	5,161,000 (g	32,622,680,000 (g	537,500 (g
14.	Oak Flat Water District	1968	125,562	5,700	1,987,000	4,000	(f	50
15.	Tulare Lake Basin Water Storage District	1968	2,521,839	118,500	46,177,000	189,200	(f	50
	Subtotal		20,951,887	1,355,000	616,645,000	6,293,570	35,191,680,000	637,050
	CENTRAL COASTAL AREA							
16.	San Luis Obispo County Flood Control and Water Conservation District	N/A	0	25,000	7,502,000	2,131,300	14,109,987,000	212,074
17.	Santa Barbara County Flood Control and Water Conservation District	1990	0	45,486	14,029,000	1,775,296	18,122,495,000	348,400
	Subtotal		0	70,486	21,531,000	3,906,596	32,232,482,000	560,474
	SOUTHERN CALIFORNIA AREA							
18.	Antelope Valley-East Kern Water Agency	1972	625,723	138,400	114,050,000	1,524,949	7,597,600,000	200,000
19.	Castaic Lake Water Agency	1979	120,566	41,500	43,323,000	125,000	6,738,030,000	150,200
20.	Coachella Valley Water District	1973	210,732	23,100	40,957,000	637,600	11,132,616,000	200,000
21.	Crestline-Lake Arrowhead Water Agency	1972	21,839	5,800	7,713,000	55,100	1,030,166,000	14,000
22.	Desert Water Agency	1973	335,300	38,100	63,265,000	208,800	4,233,795,000	100,000
23.	Littlerock Creek Irrigation District	1972	7,477	2,300	1,996,000	43,300	85,052,000	2,900
24.	Mojave Water Agency	1972	57,815	50,800	45,350,000	3,160,400	8,444,241,000	268,000
25.	Palmdale Water District	1985	20,812	17,300	13,940,000	73,900	1,956,651,000	90,000
26.	San Bernardino Valley Municipal Water District	1972	216,060	102,600	136,479,000	210,200	10,380,911,000	468,000
27.	San Gabriel Valley Municipal Water District	1974	101,782	28,800	38,714,000	17,335	5,770,749,000	190,000
28.	San Gorgonio Pass Water Agency	N/A	0	17,300	19,271,000	140,600	1,238,913,000	44,600
29.	The Metropolitan Water District of Southern California	1972	9,946,164	2,011,500	2,464,552,000	3,289,593 (h	671,699,559,000 (h	14,500,000 (h
30.	Ventura County Flood Control District	N/A	0	20,000	14,665,000	1,199,900 (i	33,418,587,000 (i	653,600 (i
	Subtotal		11,664,270	2,497,500	3,004,275,000	10,686,677	763,726,870,000	16,881,300
	TOTAL STATE WATER PROJECT		35,706,915	4,217,786	3,843,999,000	25,817,923 (j	956,504,188,000 (j	20,607,624 (j
	NET TOTAL, STATE WATER PROJECT SERVICE AREA					24,772,300 (k	801,075,458,000 (k	19,732,900 (k
	TOTAL, STATE OF CALIFORNIA					100,314,000	1,275,516,000,000	28,314,500
	PERCENT, NET SWP VS. TOTAL CALIFORNIA					24.7	62.8	69.7

a) All water delivered to long-term SWP contractors, including current and deferred entitlement, surplus, unscheduled, emergency relief, exchange, and non-SWP water delivered through SWP facilities.
b) Statutes of 1978 , Chapter 1207, added Section 135 to the Revenue and Taxation Code, requiring assessment at 100 percent of full value for the 1981-82 fiscal year and fiscal years thereafter.
c) Estimated Assesed Valuation.
d) Total for all Plumas County Flood Control and Water Conservation District, including Last Chance Creek Water District.
e) Total for all Kings County, including the following contracting agencies: County of Kings, Dudly Ridge Water District, Empire West Side Irrigation District, nearly all Tulare Lake Basin Water Storage District, and about 40 percent of Devil's Den Water District.
f) Assessed valuation not available on an agency area breakdown.
g) Total for all Kern County, including the following contracting agencies: Kern County Water Agency, about 60 percent of Devil's Den Water District, and about 50 percent of Antelope Valley-East Kern Water Agency.
h) Total for MWDSC including Calleguas Municipal Water District, which is common to MWDSC and Ventura County Flood Control District.
i) Total for all Ventura County, including the following contracting agencies: Ventura County Flood Control District and portion of Antelope Valley-East Kern Water Agency, Castaic Lake Water Agency, and MWDSC
j) Includes duplicate values. Some areas that are within two or more agencies are included in each agency's total.
k) Excludes duplicate values where agencies have overlapping boundaries.

Facilities in the planning stage include the Kern Water Bank, which will store about one million acre-feet of water in the Kern Fan Element ground water basin, allowing the water to be pumped out when needed. As more elements are developed, increased storage and pumping capabilities will provide an additional dependable supply of water to SWP contractors. Also under study are Los Banos Grandes Reservoir, which would increase SWP storage capacity south of the Sacramento-San Joaquin Delta, and the Coastal Branch, Phase II, which would transport up to 70,486 acre-feet of water annually to Santa Barbara and San Luis Obispo counties.

Protecting the SWP

On October 17, 1989, a strong earthquake struck Northern California along the San Andreas fault between Santa Cruz and San Jose. According to the U.S. Geological Survey, the Loma Prieta earthquake, as the temblor was called, registered magnitude 7.1 on the Richter scale. Damage to the affected area was extensive. A gubernatorial state of emergency was proclaimed for the counties of Alameda, Contra Costa, San Benito, Santa Clara, Monterey, San Mateo, Marin, San Francisco, and Santa Cruz, and for the City of Isleton (in Sacramento County) as well.

Despite the destruction of structures from Watsonville to San Francisco, SWP facilities were unharmed by the Loma Prieta earthquake. The success of SWP facilities in withstanding this quake--as well as the magnitude 6.6 San Fernando earthquake of 1971 and the magnitude 5.7 Oroville earthquake of 1975--without significant interruptions in service, reflects favorably upon the planning, design, construction, and maintenance of the SWP. It demonstrates the effectiveness of the planning that characterized the SWP's development: anticipating future needs and working to meet them; foreseeing potential problems and working to prevent them; and preparing contingency plans for situations that cannot be foreseen, or problems that can be foreseen but not totally prevented. This attention to planning for the protection of SWP facilities and water supply deliveries quite possibly contributed to the SWP's ability to make uninterrupted water deliveries during and after the most powerful earthquake that has struck California since the magnitude 8.3 quake which devastated San Francisco in 1906.

SWP planners recognized that earthquakes would be inevitable in California. With SWP facilities necessarily crossing or being located near major faults--including the San Andreas, Hayward, and Calaveras--as well as several minor fault systems, SWP facilities would be subjected to tectonic stresses such as earthquakes. Moreover, planners understood the necessity of maintaining water deliveries despite the occurrence of earthquakes. To ensure that deliveries could be made reliably, SWP facilities had to resist earthquake forces to the extent practicable.

When the SWP was being planned, earthquake-resistant engineering was a relatively new discipline, especially as applied to the large hydraulic structures required by the SWP. Designers understood that traditional design methods would be inadequate for designing the SWP's earth structures and foundations, but no design criteria existed for facilities of this type. Ensuring the integrity and reliability of the SWP meant that DWR had to develop appropriate criteria for design, construction, operation, and maintenance of the SWP while the project was being planned.

The development of these criteria required specialized technical expertise in many fields, including: mechanics of faulting; the relation of seismicity to geologic structures; tectonics; engineering seismology; structural dynamics; seismic design; soil mechanics; foundation and embankment stability; structural analysis; design of hydraulic structures; and design of earth and rockfill dams. To obtain the necessary expertise, in December 1961 DWR appointed the Consulting Board for Earthquake Analysis, a team of experts in the above-mentioned fields, who could advise DWR on seismic problems and matters of general and specific application. The SWP was designed and constructed--and continues to be evaluated--under the guidance of such experts.

Thus DWR's earthquake engineering program began--the first comprehensive program for systematically collecting and analyzing seismic, geodetic, and other data specifically to locate and design large hydraulic structures. Under this program, DWR began to gather data, both from historical records and field investigations, which

were critical for the development of earthquake-resistant facilities. Acquiring information on earthquake and ground movements near the SWP, and assessing the related hazards posed to SWP structures, was essential for minimizing or, whenever possible, eliminating the effects of such hazards.

To determine the types of earthquake damage that could affect the SWP, DWR obtained and indexed all available published and unpublished reports on earthquake damage to hydraulic structures in California. To illustrate the relative hazards in SWP areas, an intensity map was compiled from U.S. Coast and Geodetic Survey intensity descriptions to show the number of times during a 50-year period that all areas of California have been subjected to shaking of Intensity VI or greater on the Modified Mercalli Scale (the level at which structural damage generally first appears). These data were then used for comparing alternative aqueduct alignments and facility locations.

Field evaluation of earthquake damage provided information useful for designing and constructing earthquake-resistant facilities. Before the SWP was designed and constructed, most earthquake investigations emphasized damage to buildings in major population centers. However, DWR's primary interest was in damage sustained by hydraulic structures during major earthquakes. To identify problems that could be avoided in the design and construction of SWP facilities, key DWR personnel were (and still are) immediately notified of major earthquakes occurring in California. Teams were assigned to investigate and evaluate earthquake-related damage of significance to the safety of SWP facilities.

The Consulting Board for Earthquake Analysis also began its research and, in November 1962, submitted a report to DWR that provided basic guidelines for the earthquake-resistant design of the SWP. The report included: (1) an estimate of the ground movement in the vicinity of the San Andreas fault that could be expected in the event of a great earthquake on that fault; (2) specification of the central ground shaking, maximum acceleration, and spectrum characteristics that may be expected in the event of a great earthquake on the San Andreas fault; (3) a statement on the behavior of fluids in reservoirs during earthquakes; and (4) a statement on the occurrence of landslides during earthquakes (describing four pertinent types of soil failures and indicating where basic information was lacking). The Consulting Board also prepared a family of average earthquake acceleration curves, which have general applicability, to determine design earthquakes (theoretical seismograms that are the product of theoretical equations) for SWP facility sites.

In addition, the Consulting Board recommended that DWR sponsor or conduct further research and collect basic data related to earthquake-resistant design. DWR responded by developing programs for collecting and analyzing data that might warn of increased probability of earthquake hazard or damage. Under these programs, DWR monitored the following items both before and after SWP construction: earthquakes, gradual fault movement and its relation to earthquakes, tectonic tilting, subsidence, and earthslides. The programs also determine expected earthquake ground motion for the SWP facility sites.

DWR installed sensitive seismographs near and around each major SWP dam or group of dams to determine the epicenters of small earthquakes that may not be felt by humans and may not cause any visible damage to facilities, but which may indicate the existence of active faults or stress-induced adjustments on faults that could lead to dam failure. Strong-motion seismographs were installed at construction sites and in SWP facilities to record the reverberating ground motion that follows the larger earthquakes and measure structural response to that motion. Data from the strong-motion seismographs indicate whether a structure may have been stressed beyond its designed limits by an earthquake and, if so, warn engineers that thorough inspection and testing, and perhaps repair or even redesign, are necessary to ensure continued safety.

Besides collecting data on the sudden ground movements of earthquakes, DWR needed information on gradual ground movement, which could also affect the reliability and integrity of SWP facilities. For instance, ground tilting of a few degrees could cause an increase in the need for pump repairs, because tilting affects bearing wear on SWP pumps. To prevent this problem, DWR determined amounts of tilting at pumping plant sites before completing project designs. Other types of gradual ground movement, such as sub-

sidence caused by agricultural and industrial activities, and gradual sliding of hillsides above water facilities, are also of concern to the SWP. To detect potential problems, gradual movements are carefully measured and monitored in cooperation with other agencies.

DWR pursued further research in earthquake engineering by contracting with the University of California for the development of engineering criteria and design procedures for soils structures and for model testing of embankment dams. The applied research was used to determine factors involved in soil failure, allowing the behavior of soils structures to be calculated. Other university research investigated conditions in which sands can partially or completely liquefy and clays undergo large deformations under loads simulating earthquakes. Additional studies included development of new design procedures for embankment dams and examination of the interaction between dams and water in reservoirs during earthquakes. Knowledge gained from these investigations was then incorporated into the design of the SWP.

Planning for the safety, reliability, and protection of SWP facilities involved extensive data collection and analysis; research in fields where little information had previously been available; and consultation with experts who advise DWR about design, construction, operation, and maintenance procedures. Concern with the SWP's integrity is similarly reflected in the inspection and maintenance programs DWR has developed. Besides inspecting dams at least annually, DWR also retains consultants to evaluate SWP facilities periodically and make recommendations about any repairs or modifications that might be required. In addition, DWR monitors the long-term operational performance of SWP dams by collecting and analyzing performance data and preparing reports to be reviewed by the consultants, as well as by DWR's Divisions of Operations and Maintenance, Design and Construction, and Safety of Dams. (See Chapter IV, "Safety of SWP Facilities.")

Although the results of detailed planning and inspection are often taken for granted in the day-to-day operation of the SWP, benefits become obvious in extraordinary situations, such as the Loma Prieta, San Fernando, and Oroville earthquakes, when despite damage to non-SWP structures and water facilities, SWP structures were unaffected. For example, the only reported incidents at SWP facilities that were related to the Loma Prieta earthquake were minor ones: a cooling fan tripped off at Bottle Rock Powerplant, and power generation was altered at the Oroville facilities in reaction to high system frequency. Detailed inspections revealed that no repairs to SWP facilities were required as a result of the Loma Prieta earthquake.

SWP facilities fared equally well during the 1971 San Fernando earthquake, which was the first significant earthquake to occur near the SWP. Despite the fact that the epicenter of the main shock was only 24 miles from Pyramid Reservoir, 13 miles from Castaic Reservoir, and 11 miles from the East Branch of the California Aqueduct, SWP structures both completed and under construction were undamaged.

The magnitude 5.7 Oroville earthquake of 1975 also demonstrated the ability of SWP facilities to withstand moderate quakes. The epicenter of the main shock was only about 7.5 miles southwest of Oroville Dam. During the main shock and the numerous foreshocks and aftershocks, Oroville facilities continued to operate, with service from Hyatt and Thermalito powerplants interrupted for just 45 minutes. Instrumentation and detailed inspections revealed only minor damage; all facilities were structurally sound.

The structures at the Oroville complex were carefully scrutinized, because they were very close to the quake's epicenter, have a high hazard potential, and were relatively new structures at the time of the quake. Immediately after the earthquake, DWR convened the Consulting Board to review the Oroville facilities and the earthquake. One month later, under the guidance of the Special Consulting Board for the Oroville Earthquake, additional studies began, including a reanalysis of Oroville structures for earthquake safety. These studies were especially concerned with the safety of the facilities if a stronger quake were to occur. A program for dynamic structural analysis of critical structures was implemented in cooperation with the University of California, and a seismic risk analysis program was undertaken. The results of these investigations were published in DWR Bulletins 203-78 and 203-88, which reported that Oroville facilities

were essentially sound and able to withstand seismic loading.

SWP facilities have so far performed well in earthquakes. Yet good planning also requires SWP managers to consider that an extremely strong earthquake could potentially damage the project and interrupt water deliveries. For instance, the Earthquake Response Plan developed by the California Office of Emergency Services in 1983 assumes that an earthquake of magnitude 8.3 occurring on the southern portion of the San Andreas fault would sever all major aqueducts importing water to Southern California, including the California Aqueduct (although water storage facilities would not be significantly damaged). To handle such contingencies, DWR has developed its own Earthquake Emergency Plan. Under this plan, schedules of actions to be taken by repair and operations crews are outlined for various types of possible damage to the SWP, allowing repairs to be made as quickly as possible, while water supplies continue to be available from storage facilities.

In addition to preparing its own plan, DWR has assisted The Metropolitan Water District of Southern California in developing an emergency response handbook and distributing it to all local water supply managers in Los Angeles County. This manual provides a check list covering the tasks and decisions required to bring a water distribution system back into service and gives information to help agencies develop and maintain their own emergency response plans before a disaster occurs. This preparation includes taking steps to prevent or reduce damage to the system and training all employees to handle emergencies.

A detailed emergency response plan is essential to ensure that employee responsibilities in an emergency are clearly defined. Crews must know exactly what to do and be able to begin work immediately after the disaster, without relying upon instructions from headquarters, since communication might be impossible. Crews must also know how to obtain the necessary equipment, workers, and materials for emergency repairs and be able to establish tentative priorities for needed work. Ninety-two DWR employees learned first-hand the value of sound emergency response plans as they assisted in the inspection of facilities and the evaluation of damage after the Loma Prieta earthquake. For them, as for all Californians, the destruction caused by the quake served as a reminder of the importance of planning, designing, and constructing facilities that can withstand earthquakes to the extent practicable. By following guidelines for earthquake-resistant design, SWP developers, as well as those who operate and maintain the SWP, have worked to ensure the continued reliable operation of facilities and delivery of water supply to SWP contractors.

SWP Accomplishments

Table 1 summarizes SWP water deliveries, recreational use, and power generation from 1962 through 1989. The following items are highlights of SWP activities reported in Bulletin 132-90.

- In 1989, during the third consecutive year of drought in California, the SWP met contractors' full requests for delivery of water. Deliveries totaled 4,158,699 acre-feet of water, including 2,853,747 acre-feet of entitlement water to long-term water supply contractors and 1,304,952 acre-feet of other water (Chapter I, Table 1).

- From July through September 1989, the SWP transferred 200,000 acre-feet of water from Yuba County Water Agency's New Bullards Bar Reservoir for two SWP contractors: Santa Clara Valley Water District and Tulare Lake Basin Water Storage District. DWR purchased the water on behalf of the two contractors. The SWP also wheeled 3,958 acre-feet of YCWA water purchased by the City of Napa (Chapters II and III).

- Under an agreement dated August 31, 1989, DWR conveyed 7,200 acre-feet of CVP water for the U.S. Fish and Wildlife Service. The water was conveyed to Buena Vista Water Storage District for use by the Kern National Wildlife Refuge (Chapter II).

- Under an October 1989 exchange agreement, Kern County Water Agency delivered 45,000 acre-feet of its 1989 entitlement water to Westlands Water District, a USBR contractor. In return, Westlands must deliver an equal amount of its CVP water to Kern by December 31, 1999 (Chapter II).

Table 1. SWP Accomplishments through 1989

Year	Water Delivered *acre-feet*							Recreation Supported(b *recreation days*	Energy Generated(c *million kWh*
	Entitlement Water			Other Deliveries					
				Surplus and Unscheduled					
	Municipal and Industrial	Agri-cultural	Total	Municipal and Industrial	Agri-cultural	Other Water(a	Total Deliveries		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
1962						18,289	18,289	30,000	
1963						22,456	22,456	105,000	
1964						32,507	32,507	331,600	
1965						44,105	44,105	449,800	
1966						67,928	67,928	482,700	
1967	5,747	5,791	11,538	0	0	53,605	65,143	455,200	
1968	46,472	125,237	171,709	10,000	111,534	14,777	308,020	931,300	628
1969	34,434	158,586	193,020	0	72,397	18,829	284,246	1,554,800	2,614
1970	47,996	185,997	233,993	0	133,024	38,080	405,097	1,804,800	2,679
1971	85,286	272,054	357,340	2,400	293,619	44,127	697,486	2,085,900	3,302
1972	181,066	430,735	611,801	22,205	401,759	73,127	1,108,892	1,971,200	1,922
1973	293,824	400,564	694,388	3,161	293,255	43,666	1,034,470	2,502,000	3,298
1974	418,521	455,556	874,077	4,753	412,923	48,342	1,340,095	4,073,600	4,672
1975	641,621	582,369	1,223,990	21,043	601,859	67,170	1,914,062	4,189,300	3,159
1976	818,588	554,414	1,373,002	32,488	547,622	116,962	2,070,074	4,239,600	2,131
1977	280,919	293,236	574,155	0	0	390,176	964,331	3,951,900	958
1978	742,385	710,314	1,452,699	3,566	13,348	122,916	1,592,529	5,773,700	2,882
1979	690,659	969,237	1,659,896	66,081	582,308	189,396	2,497,681	5,298,700	2,485
1980	730,545	799,204	1,529,749	19,722	384,835	48,590	1,982,896	5,701,900	2,988
1981	1,057,273	852,289	1,909,562	12,000	896,428	283,849	3,101,839	6,017,800	3,358
1982	928,721	821,303	1,750,024	0	215,873	159,528	2,125,425	6,187,700	5,097
1983	483,499	701,370	1,184,869	0	13,019	189,302	1,387,190	5,838,200	5,843
1984	725,925	862,694	1,588,619	3,663	259,254	388,064	2,239,600	6,273,100	4,667
1985	992,536	1,002,915	1,995,453	9,638	298,034	408,875 (e	2,712,000	6,639,800	5,237
1986	998,611	997,025	1,995,636	2,595	34,025	197,471	2,229,727	6,966,039	4,683
1987	1,096,368	1,033,718	2,130,086	6,949	107,958	385,264	2,630,257	7,228,815	3,951
1988	1,316,820	1,068,302	2,385,122	0	0	521,370	2,906,492	6,854,300	4,871
1989	1,602,454	1,251,293	2,853,747 (d	0	0	1,304,952 (f	4,158,699	6,738,300	5,566
Total	14,220,272	14,534,203	28,754,475	220,264	5,673,074	5,293,723	39,941,536	104,677,054	76,991

a) Includes preconsolidation repayment water, emergency relief water, regulated delivery of local supply, non-SWP water delivered to Napa County FC&WCD through SWP facilities, conveyance of CVP water (including Decision 1485 and recreation and fish & wildlife water), recreation water, and exchange water.

b) A recreation day is the visit of one person to a recreation area for any part of one day.

c) Includes SWP share of generation from Hyatt-Thermalito, Gianelli, Devil Canyon, Warne, Alamo, Castaic, Reid Gardner Unit No. 4 and Bottle Rock powerplants.

d) Includes 149,880 acre-feet of 1988 carryover entitlement delivered in 1989, and 89 acre-feet of 1990 advance entitlement delivered in 1989.

e) Revised and corrected from Bulletin 132-86 to reflect 4,033 acre-feet of recreation water.

f) 1989 is the first year local water from Oroville-Wyandotte Irrigation District, Western Canal Water District, and Joint Water District are included. Also includes DWR-purchased Yuba County Water Agency water.

- During 1989, several long-term contractors made some of their annual SWP entitlement water available for transfer to areas where irrigation water was urgently needed for crops. Under various agreements, Dudley Ridge Water District transferred entitlement water to Tulare Lake Basin Water Storage District and San Luis Water District, and Tulare transferred entitlement water to Oak Flat Water District (Chapter II).

- During October and November 1989, DWR conveyed 30,000 acre-feet of water through Banks Pumping Plant for the Department of Fish and Game. The water was delivered from O'Neill Forebay to the Grassland Water District by USBR and was later released to aid the outmigration of juvenile chinook salmon (Chapter II).

- During a scheduled outage from November 1989 to February 1990, progress was made on the enlargement of the East Branch of the California Aqueduct. Pearblossom Pumping Plant was modified for the third and fourth discharge lines, and the San Bernardino Tunnel was modified to accommodate the enlargement of Devil Canyon Powerplant (Chapters II and IV).

- In 1989, the SWP generated a total of 5,566 million kWh of energy (3,769 million kWh from hydroelectric powerplants) and used 7,597 million kWh to deliver water to contractors. The SWP also purchased 1,285 million kWh (including power from MWDSC hydroelectric plants, Pine Flat Powerplant, and TERA Power Corporation) and sold 1,099 million kWh of energy (Chapter II, Tables 6, 7, and 8).

- Under an April 1989 agreement between DWR and the City and County of San Francisco, DWR is designing and constructing a 70-cfs-capacity turnout, enabling San Francisco to divert water from the SWP's South Bay Aqueduct to San Francisco's San Antonio Reservoir. Construction is scheduled to be completed on November 30, 1990 (Chapter III).

- On May 1, 1990, the 1990 Demonstration Semitropic Local Element Agreement was executed. The agreement will serve as a prototype for establishing local elements of the Kern Water Bank (Chapter III).

- In early 1990, DWR published a draft feasibility study of three potential solutions to cross-drainage problems at Arroyo Pasajero. Enlargement of the impoundment basin on the west side of the California Aqueduct is a component of all three solutions (Chapter III).

- As of July 20, 1989, DWR's operation studies workgroup for the Bay-Delta Hearings had completed over 70 operation studies analyzing the impacts of various alternatives proposed in the State Water Resources Control Board's November 1988 draft water quality control plan. These studies will provide valuable information for the development of the final water quality control plan, scheduled for release in late 1990 (Chapter III).

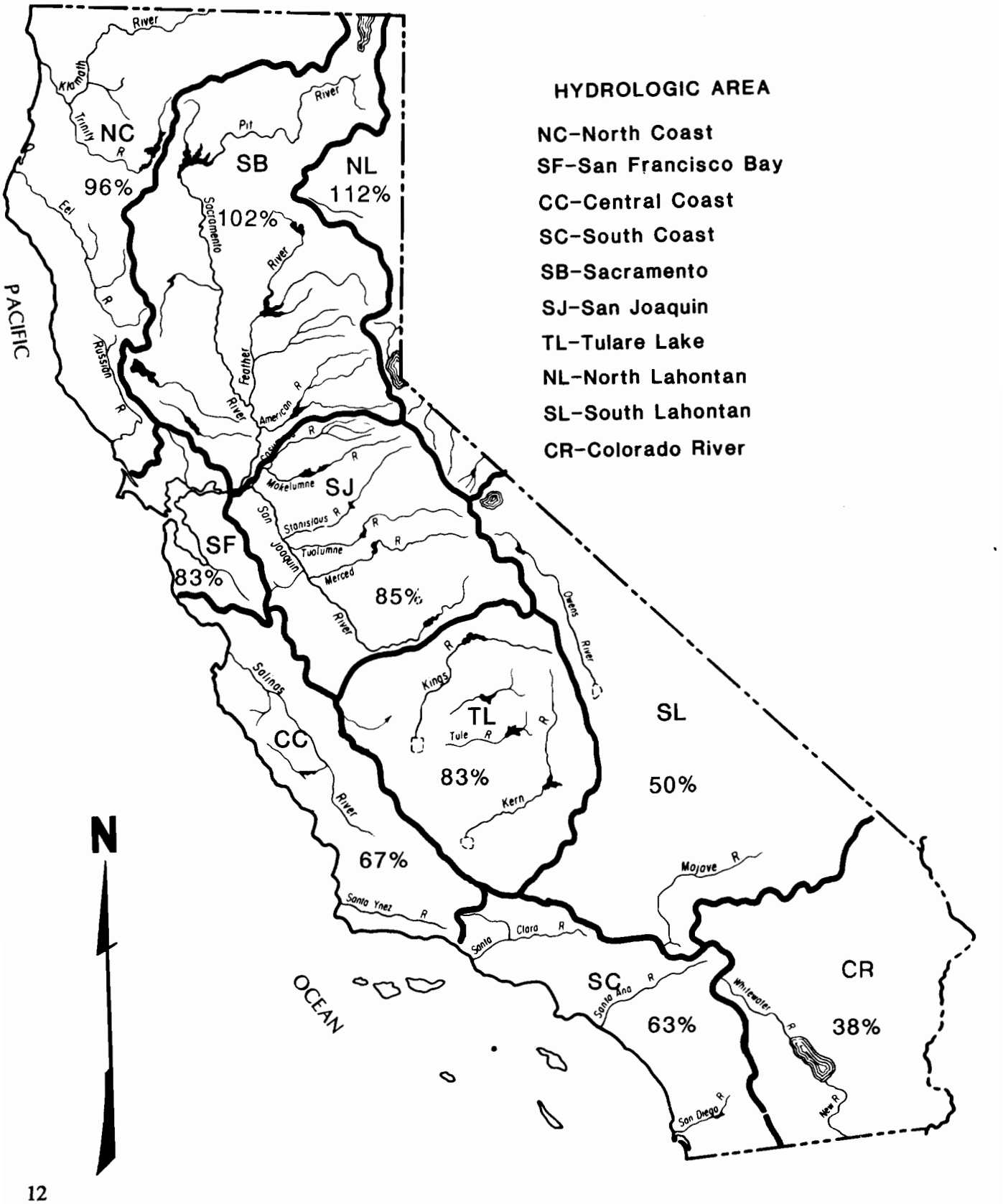
- In May and June 1990, emergency seepage repairs were successfully completed at Mile 56 of the California Aqueduct. The repairs were scheduled to coincide with Decision 1485-mandated restrictions on Delta pumping during May and June (Chapter IV).

- In June 1990, DWR released the draft Environmental Impact Report for Phase II of the Coastal Branch of the California Aqueduct. The proposed Phase II facilities will transport up to 70,486 acre-feet of entitlement water annually to Santa Barbara and San Luis Obispo counties (Chapter V).

- On April 30, 1990, DWR's application to amend FERC License No. 2426 for the construction of the Mojave Siphon Powerplant was approved. The powerplant, a 32.4 MW facility on the East Branch of the California Aqueduct, is scheduled to be operational in 1994 (Chapter VI).

- On March 6, 1990, DWR sold $100 million of Water System Revenue Bonds, Series G. The proceeds of the Series G sale were used for the reimbursement of other SWP funds used for construction expenditures prior to the sale of the bonds and for funding the debt service reserves for Series G bonds.

Figure 3. Statewide Precipitation, 1988-1989 Water Year
(Precipitation in Percent of Average)



DWR continued monthly monitoring of asbestos in SWP water south of the Delta. Results indicate that asbestos remained essentially at background levels during 1989.

Water Service

The following sections summarize 1989 water conveyance and deliveries via SWP facilities.

Total Water Conveyed

A total of 4,158,699 acre-feet of water was conveyed through SWP facilities in 1989, including 2,853,747 acre-feet of entitlement water delivered to SWP contractors. Table 3 summarizes total water conveyance and disposition for the 28 years of SWP operation. The following paragraphs discuss Table 3 in detail.

Annual Entitlements. The SWP water supply contracts, executed in the early 1960s, established the maximum annual entitlement water amounts each long-term water contractor may request. These initial entitlement schedules, shown in Table A of the contracts, reflect projections of each contractor's future water needs at the time the contracts were signed. Some schedules have subsequently been revised through contract amendments. Table B-4 in Appendix B ("Data and Computations Used in Determining Water Charges for 1991," included in this bulletin) presents up-to-date information on annual entitlements for each contractor, as set forth in Table A of each SWP water supply contract.

Columns (1) through (7) of Table 3 summarize annual contractual entitlements for the various SWP service areas from 1962 through 1989.

Entitlement Water. Actual entitlement deliveries by year are shown in column (8) of Table 3. Annually, in September, each contractor furnishes an updated estimate of future requirements for SWP water. In the fall of 1988, 26 contractors requested a total of 2,999,451 acre-feet of entitlement water and 116,672 acre-feet of deferred entitlement water (8,600 acre-feet of wet-weather water and 108,072 acre-feet of 1988 carryover water) for 1989 delivery. In December 1988, based upon the 1989 Risk Analysis criteria and the prevailing water supply forecast, DWR approved 2,514,115 acre-feet of 1989 entitlement water deliveries, reflecting a 40 percent reduction (485,336 acre-feet) for all 1989 agricultural entitlement requests. However, above-average precipitation and heavy runoff in the Feather River Basin during March 1989 improved SWP water delivery capability. Subsequently, DWR reinstated full agricultural delivery requests and gave the agricultural contractors the option of revising their requests (see Bulletin 132-89, page 83). Also, the 121,057 acre-feet of 1988 carryover entitlement water initially approved by DWR was increased to 155,127 acre-feet. No wet-weather water was approved.

Entitlement water delivered in 1989 to 26 contractors totaled 2,853,747 acre-feet. This amount includes 47,800 acre-feet of 1989 transfer entitlement water (entitlement water temporarily transferred from one contractor to another), 149,880 acre-feet of 1988 carryover entitlement water (entitlement water carried over from 1988 and delivered in 1989), and 89 acre-feet of 1990 advance entitlement water (1990 entitlement water delivered in 1989), as listed under columns (2) and (3) of Table 4. Eighteen contractors took less entitlement water than they initially requested, and five contractors took all their initially requested Table A entitlement.

In 1989, Napa County Flood Control & Water Conservation District received 23 acre-feet more water than it originally requested, and Palmdale Water District received 819 acre-feet more than originally requested.

Surplus and Unscheduled Water. Surplus water (column 9) is water in excess of that required to meet all entitlement demands, reservoir storage goals, water quality requirements, and other SWP requirements (such as recreation water), which can be delivered to contractors when SWP capability is available. Surplus water may be released from storage and scheduled in advance for use by contractors. First priority for surplus water is given to SWP contractors for agricultural use or for ground water replenishment. Second priority is given to SWP contractors for other uses, and lowest priority is given to non-SWP contractors. For 1989, no surplus water was available.

Unscheduled water (column 9) is also water in excess of SWP entitlement demands, but unlike

Table 3. Historical Summary of Entitlements,

acre-feet

Calendar Year	Annual Entitlements Under Long-Term Water Supply Contracts (a							
	Feather River Area	North Bay Area	South Bay Area	San Joaquin Valley Area	Central Coastal Area	Southern California Area	Total	Entitlement Water
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1962	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0
1967	0	0	11,538	0	0	0	11,538	11,538
1968	550	0	109,900	81,050	0	0	191,500	171,709
1969	620	0	98,700	168,075	0	0	267,395	193,020
1970	700	0	114,200	207,700	0	0	322,600	233,993
1971	890	0	116,200	258,500	0	0	375,590	357,340
1972	970	0	118,300	420,766	0	201,723	741,759	611,801
1973	1,100	0	120,400	392,352	0	472,400	986,252	694,388
1974	1,230	0	122,400	470,350	0	588,220	1,182,200	874,077
1975	1,610	0	124,500	556,509	0	704,250	1,386,869	1,223,990
1976	1,990	0	126,500	555,117	0	824,780	1,508,387	1,373,002
1977	2,420	0	128,600	594,100	0	942,201	1,667,321	574,155
1978	1,850	0	130,700	647,262	0	1,038,222	1,818,034	1,452,699
1979	2,130	0	132,700	715,385	0	1,177,873	2,028,088	1,659,896
1980	1,810	500	134,800	770,800	1,946	1,304,914	2,214,770	1,529,749
1981	1,940	650	137,000	830,700	2,813	1,419,365	2,392,468	1,909,562
1982	1,970	800	139,200	889,200	5,626	1,537,749	2,574,545	1,750,024
1983	2,000	950	141,400	880,648	8,439	1,668,557	2,701,994	1,184,869
1984	3,630	1,100	143,600	991,911	12,698	1,731,398	2,884,337	1,588,619
1985	3,760	1,250	145,800	1,031,749	21,138	1,852,149	3,055,846	1,995,453
1986	4,190	1,400	148,100	1,139,200	28,210	1,971,190	3,292,290	1,995,636 (e
1987	4,620	1,550	150,300	1,201,200	35,204	2,091,241	3,484,115	2,130,086 (g
1988	5,060	15,571	152,500	1,258,800	43,722	2,212,782	3,688,435	2,385,122 (h
1989	5,500	24,615	156,700	1,303,100	56,342	2,411,933	3,958,190	2,853,747 (i
Total	**50,540**	**48,386**	**2,904,038**	**15,364,474**	**216,138**	**24,150,947**	**42,734,523**	**28,754,475**

a) From Table B-4.

b) Values include deliveries of SWP water to short-term contractors (Mustang Water District, 1970-1972; Tracy Golf and Country Club, 1974, 1979, and 1980; Green Valley Water District, 1974, 1975, 1978, 1979, 1980, and 1985; Granite Construction Company, 1980).

c) Includes preconsolidation repayment water, 1977 emergency relief water, regulated delivery of local supply, non-SWP water delivered to Napa County FC&WCD through SWP facilities, 1987 Advance Storage Program water, CVP water conveyed (including D-1485 and recreation and wildlife water), 1978 and 1982 exchange water. See column (14) for SWP recreation water.

d) Includes net effect of (1) operational losses from SWP transportation facilities, (2) changes in reservoir storage south of the Delta, (3) storable local inflows to SWP reservoirs, (4) side inflow to the San Luis Canal, and (5) inflow into the California Aqueduct from the Kern River Intertie.

Deliveries, and Water Conveyed

acre-feet

Water Conveyed							
Deliveries							
Surplus and Unscheduled Water (b	Other Water (c	Subtotal	Initial Fill Water	Operational Losses and Storage Changes (d	Recreation Water	Total	Calendar Year
[9]	[10]	[11]	[12]	[13]	[14]	[15]	
0	18,289	18,289	9	272	0	18,570	1962
0	22,456	22,456	71	185	0	22,712	1963
0	32,507	32,507	171	152	0	32,830	1964
0	44,105	44,105	93	729	0	44,927	1965
0	67,928	67,928	0	1,746	0	69,674	1966
0	53,605	65,143	8,328	4,212	0	77,683	1967
121,534	14,777	308,020	498,926	117,906	0	924,852	1968
72,397	18,829	284,246	510,614	72,196	0	867,056	1969
133,024	38,080	405,097	23,947	2,435	0	431,479	1970
296,019	44,119	697,478	7,853	5,812	8	711,151	1971
423,964	66,638	1,102,403	100,274	53,062	6,489	1,262,228	1972
296,416	42,511	1,033,315	204,638	53,798	1,155	1,292,906	1973
417,676	46,224	1,337,977	237,554	10,657	2,118	1,588,306	1974
622,902	63,793	1,910,685	103,352	- 94,606	3,377	1,922,808	1975
580,110	115,217	2,068,329	61,122	- 681,025	1,745	1,450,171	1976
0	389,065	963,220	0	- 131,151	1,111	833,180	1977
16,914	121,225	1,590,838	64,443	717,370	1,691	2,374,342	1978
648,389	187,630	2,495,915	12,302	- 83,430	1,766	2,426,553	1979
404,557	46,459	1,980,765	0	- 26,606	2,131	1,956,290	1980
908,428	279,161	3,097,151	0	- 802,263	4,688	2,299,576	1981
215,873	154,882	2,120,779	0	480,752	4,646	2,606,177	1982
13,019	181,453	1,379,341	0	- 90,997	7,849	1,296,193	1983
262,917	381,024	2,232,560	0	- 140,182	7,040	2,099,418	1984
307,672	404,842	2,707,967	0	92,885	4,033 (j	2,804,855	1985
36,620 (f	193,606	2,225,862	0	284,380	3,865	2,514,107	1986
114,907	377,592	2,622,585	0	- 390,413	7,672	2,239,844	1987
0	516,481	2,901,603	0	- 92,850	4,889	2,813,642	1988
0	1,296,817	4,150,564	0	447,917	8,135	4,606,616	1989
5,893,338	**5,219,315**	**39,867,128**	**1,833,697**	**-187,057**	**74,408**	**41,588,146**	**Total**

e) Includes 37,170 acre-feet of entitlement water carried over from 1985.

f) Includes 12,270 acre-feet of surplus water carried over from 1985.

g) Includes 639 acre-feet of 1988 entitlement water delivered during 1987, and 16,171 acre-feet of entitlement water recaptured from ground water storage.

h) Includes 67,581 acre-feet of 1987 entitlement water delivered in 1988, and 8,749 acre-feet recaptured from ground water storage.

i) Includes 149,880 acre-feet of 1988 entitlement delivered in 1989, and 89 acre-feet of 1990 entitlement delivered during 1989.

j) Revised and corrected from Bulletin 132-86 to reflect 4,033 acre-feet of recreation water.

surplus water, unscheduled water is not scheduled in advance. Unscheduled water is water that is sometimes available in the Delta, rather than water released from SWP storage. Its availability can be as brief as one day or as long as two weeks. The unscheduled water program was initiated in January 1980 as "extra surplus water." First priority for unscheduled water is given to ground water replenishment or to agricultural use in lieu of ground water pumping. Second priority is given to pre-irrigation. For 1989, no unscheduled water was available.

Other Water. Column (10) of Table 3 summarizes deliveries of several other types of water, as defined in the accompanying footnote. These deliveries are shown in more detail (for 1989) in Table 5 and are described in this chapter under the heading "Total 1989 Water Deliveries."

Initial Fill Water. The quantities shown in column (12) of Table 3 are the amounts used for initially filling aqueducts and reservoirs south of the Delta to maximum operational capacities. Initial filling began in 1962 with the filling of the South Bay Aqueduct and was completed in 1979, when Lake Perris reached its maximum operational capacity.

Operational Losses and Storage Changes. Column (13) of Table 3 shows the annual quantities of water conveyed to replenish losses through evaporation and seepage from SWP aqueducts and reservoirs south of the Delta, with corrections for changes in reservoir storage and for inflow from local drainage areas (including inflows from the Kern River Intertie and the First Los Angeles Aqueduct). Years with negative values are those in which storage withdrawals from reservoirs south of the Delta exceed storage additions.

Recreation Water. Column (14) of Table 3 summarizes historical deliveries of recreation water. Recreation water is used both at SWP recreation facilities and for fish and wildlife mitigation and enhancement. In 1989, a total of 8,135 acre-feet was conveyed under this category, as follows:

- 1,966 acre-feet was delivered for public recreation facilities at Lake Del Valle, San Luis Reservoir, O'Neill Forebay, Silverwood Lake, Pyramid Lake, Castaic Lake, and Lake Perris.
- 2,870 acre-feet was released for maintenance of a trout fishery in Piru Creek, in accordance with a condition of the Federal Energy Regulatory Commission license for power development at Pyramid Lake.
- 2,870 acre-feet was conveyed for replacement of water losses at Castaic Lagoon, an impoundment downstream from Castaic Lake devoted entirely to recreation.
- 429 acre-feet was delivered for the Pilibos Wildlife Area (40 miles south of Los Banos) and for wildlife mitigation on about 770 acres of land near O'Neill Forebay.

Water Deliveries and Credits to Long-Term Contractors

Table 4 summarizes 1989 water deliveries to each SWP long-term contractor that received water during the year. Columns (1) through (3) display actual entitlement water deliveries for the various SWP long-term contractors and service areas. Column (4) lists deliveries of non-SWP water to North Bay, South Bay, and San Joaquin Valley service areas. Table 4 also shows future entitlement delivery and reduction credits, as explained in the following sections.

Future Entitlement Credits--Delivery Credits. There are several circumstances under which SWP contractors can acquire credits for future water deliveries. These circumstances are described in the following paragraphs.

- *Make-Up Water.* When the SWP is unable to deliver the requested entitlement water in any year, long-term contractors are afforded relief under Articles 12(d) and 14(b) of the water supply contract. Contractors may elect to receive the undelivered entitlement water at other times during the year, or in succeeding years, to the extent that the water and delivery capability are available. Credits for undelivered entitlement under this category are shown in column (6) of Table 4. No make-up water was delivered in 1989.
- *Wet-Weather Water.* Under Article 7 (for the South Bay contractors) or Article 45 (for the San Joaquin Valley contractors) of their water supply contracts, SWP contractors can acquire

credits for future deliveries when above-normal local water supplies reduce the need for SWP water. Delivery of surplus water or unscheduled water in a subsequent year reduces the balance of credit as provided under the provisions of the surplus and unscheduled water amendments. At the time of delivery, the sum of current annual entitlement plus wet-weather water cannot exceed a contractor's maximum annual entitlement. In 1990, Oak Flat Water District and Tulare Lake Basin Water Storage District reached their maximum annual entitlement and are no longer eligible to receive deliveries of wet-weather water under the present program. The amounts shown in column (7) of Table 4 are credits acquired in prior years. No additional credits were acquired under Article 7 or Article 45 during 1989.

- *1988 Carryover Water.* During the fall of 1988, insufficient rainfall prompted fears that California would suffer a third year of drought. Precipitation remained below normal in the state during winter months, prompting DWR to impose deficiencies on the 1989 agricultural entitlement requests.

  Water Service Contractors Council Memorandum No. 1920, dated November 28, 1988, informed the contractors of DWR's willingness to consider requests to carry over 1988 entitlement water to January, February, and March 1989 for two purposes: (1) for agricultural contractors to use for pre-irrigation, and (2) for all contractors to replace water that could not be delivered during the fall of 1988 because of outages within the contractors' distribution systems.

  The memorandum also informed contractors that, if they requested delivery of carryover water in March 1989, they must also take delivery of six percent of their annual entitlement during the month. DWR waived the six percent requirement on March 20, 1989, through Water Service Contractors Council Memo No. 1935, based on the consideration that if 1989 were to be the third consecutive critically dry year, Lake Oroville and San Luis Reservoir had an extremely low probability of filling. The total 1988 carryover entitlement water delivered in 1989 was 149,880 acre-feet (column 2).

- *1989 Carryover Water.* Through Water Service Contractors Council Memorandum No. 1958, dated November 20, 1989, DWR informed the contractors of its willingness to consider requests to carry over 1989 entitlement water to January and February 1990 (1) for agricultural contractors to use for pre-irrigation, and (2) for all contractors to use for replacing water that could not be delivered during the fall of 1989 because of outages within the contractors' distribution systems. The memorandum also informed contractors that the requests for carryover water must not affect the delivery of entitlement water to other SWP contractors. The carryover program was later extended through March 1990.

  During the spring of 1989, insufficient precipitation indicated that California would suffer a third consecutive year of drought. Although heavy rains in the northern third of the state during March 1989 allowed the delivery of full 1989 entitlement requests, the March 1989 rainfall was not enough to allow significant reservoir carryover storage into 1990. Precipitation remained below normal in the rest of the state during 1989, prompting DWR to impose deficiencies on the 1990 agricultural entitlement requests.

  To ensure that delivery of carryover water would not affect allocations of 1990 entitlement water, DWR considered the amount of 1989 water remaining to be delivered at any time in its evaluation of deliveries under the 1990 Risk Analysis. Any 1989 entitlement water not delivered by March 31, 1990, would be foregone by the individual contractor and would become part of the total SWP supply. The carryover contractor agreed to pay for any identified cost in either 1989 or 1990 that, if not paid by the carryover contractor, would otherwise result in increased charges to other contractors.

  The total 1989 entitlement water carried over for delivery in 1990 was 128,546 acre-feet, as shown in column (8) of Table 4.

Table 4. Summary of 1989 Deliveries

acre-feet

Long-Term Water Supply Contractor	Water Deliveries in 1989				
	Entitlement Water Deliveries				
	1989 Entitlement	1988 & 1990 Entitlement Delivered During 1989	Total Entitlement	Other Water Deliveries (a	Total Deliveries
	[1]	[2]	[3]	[4]	[5]
UPPER FEATHER RIVER AREA					
City of Yuba City	403		403		403
County of Butte	300		300		300
Plumas County FC&WCD	486		486		486
NORTH BAY AREA					
Solano County WA	17,256		17,256	108 (c	17,364
Napa County FC&WCD	6,195		6,195	3,958 (d	10,153
SOUTH BAY AREA					
Alameda County FC&WCD, Zone 7	26,227		26,227	1,958 (e	28,185
Alameda County WD	25,317	725	26,042		26,042
Santa Clara Valley WD	90,000		90,000	17,085 (f	107,085
SAN JOAQUIN VALLEY AREA					
County of Kings	4,000		4,000		4,000
Devil's Den WD	12,600	2,045	14,645		14,645
Dudley Ridge WD	47,227 (g	9,822 (h	57,049		57,049
Empire West Side ID	3,000		3,000		3,000
Kern County WA	1,027,387 (i	118,675	1,146,062		1,146,062
Oak Flat WD	5,528	563	6,091		6,091
Tulare Lake Basin WSD	109,900 (j	18,050	127,950	54,313 (f	182,263
SOUTHERN CALIFORNIA AREA					
Antelope Valley-East Kern WA	45,191	89 (k	45,280		45,280
Castaic Lake WA	21,719		21,719		21,719
Coachella Valley WD	21,873		21,873		21,873
Crestline-Lake Arrowhead WA	2,170		2,170		2,170
Desert WA	36,500		36,500		36,500
Littlerock Creek ID	971		971		971
Mojave WA	200		200		200
Palmdale WD	9,009		9,009		9,009
San Bernardino Valley MWD	20,782		20,782		20,782
San Gabriel Valley WD	12,839		12,839		12,839
The Metropolitan Water District of Southern California	1,156,698		1,156,698		1,156,698
TOTAL	**2,703,778**	**149,969**	**2,853,747**	**77,422**	**2,931,169**

a) Delivery of water rights water through SWP facilities, not shown in previous issues of Bulletin 132.
b) Credits for all contractors are under Article 12(d) of their water supply contract unless otherwise stated.
c) Vallejo permit water right water delivered through SWP facilities.
d) YCWA water purchased by Napa County FC&WCD and wheeled through SWP facilities.
e) Local water right water delivered through SWP facilities.
f) YCWA Water purchased by DWR for SWP contractors.

and Credits to Long-Term Contractors

acre-feet

Future Entitlement Credits as of January 1, 1990				Future Entitlement Reduction Credit Per Articles 7 or 45	Long-Term Water Supply Contractor
Make-Up Water (b Per Articles 12(d) or 14(b)	Wet-Weather Water Per Articles 7 or 45	1989 Carryover for Potential Delivery in 1990	Total Delivery Credit		
[6]	[7]	[8]	[9]	[10]	
					UPPER FEATHER RIVER AREA
					City of Yuba City
					County of Butte
					Plumas County FC&WCD
					NORTH BAY AREA
					Solano County WA
					Napa County FC&WCD
					SOUTH BAY AREA
2,438	111,580		114,018		Alameda County FC&WCD, Zone 7
2,220	172,088	2,088	176,396		Alameda County WD
					Santa Clara Valley WD
					SAN JOAQUIN VALLEY AREA
					County of Kings
		100	100		Devil's Den WD
		8,373	8,373		Dudley Ridge WD
					Empire West Side ID
		84,913	84,913		Kern County WA
		72	72	2,466	Oak Flat WD
			0		Tulare Lake Basin WSD
					SOUTHERN CALIFORNIA AREA
14,841 (l			14,841		Antelope Valley-East Kern WA
500			500		Castaic Lake WA
					Coachella Valley WD
151			151		Crestline-Lake Arrowhead WA
					Desert WA
438			438		Littlerock Creek ID
20			20		Mojave WA
					Palmdale WD
4,269			4,269		San Bernardino Valley MWD
1,000			1,000		San Gabriel Valley WD
					The Metropolitan Water District
102,239		33,000	135,239		of Southern California
128,116	**283,668**	**128,546**	**540,330**	**2,466**	TOTAL

g) Includes 900 acre-feet transferred to Westlands WD and 1,600 acre-feet transferred to San Luis WD.

h) Includes 7,431 acre-feet of carryover entitlement water and 2,391 acre-feet of transfer carryover entitlement to TLBWSD.

i) Includes 45,000 acre-feet of transfer entitlement water to Westlands WD.

j) Includes 300 acre-feet transferred to Oak Flat WD.

k) Advance 1990 entitlement water.

l) Antelope Valley-East Kern Water Agency future entitlement delivery credits total 4,787 acre-feet under water supply contract Article 14(b), and 10,054 acre-feet under Article 12(d).

Future Entitlement Credits--Reduction Credits. There are circumstances under which SWP contractors acquire reductions in future entitlement deliveries. For 1989, these reduction credits are described in the following paragraph.

- *Wet-Weather Water.* Article 7 (for the South Bay contractors) and Article 45 (for the San Joaquin Valley contractors) of the water supply contracts provide that a contractor can increase entitlement water deliveries in years of below-average local water supply and decrease entitlement deliveries by an equal amount in later years. Reduction credits for wet-weather water are shown in column (10) of Table 4.

Total 1989 Water Deliveries

During 1989, the SWP provided water service to 48 agencies. These included 26 long-term water contractors and 22 other agencies. Only five SWP contractors took their full contract entitlement. Monthly deliveries to each of the 48 agencies, shown in Table 5, are summarized as follows:

- 2,853,747 acre-feet entitlement water (including 2,703,778 acre-feet of 1989 entitlement water, 149,880 acre-feet of 1988 carryover entitlement water, and 89 acre-feet of 1990 advance entitlement water) was delivered to 26 long-term contractors.

- 8,135 and 408 acre-feet of SWP and CVP water, respectively, was conveyed for recreation and fish and wildlife enhancement.

- 108 acre-feet of non-SWP water was conveyed to the City of Vallejo's delivery structure under Vallejo's water right claim.

- 823,302 acre-feet of regulated local supply was conveyed to one long-term contractor and five agencies in the Feather River area.

- 3,958 acre-feet of non-SWP Yuba County Water Agency water was wheeled to Napa County Flood Control and Water Conservation District, and 30,000 acre-feet of YCWA water was wheeled for the Department of Fish and Game.

- 71,398 acre-feet Yuba County Water Agency water (out of a total of 200,000 acre-feet purchased by DWR on behalf of two SWP contractors) was delivered in 1989, including 17,085 acre-feet delivered to Santa Clara Valley Water Agency and 54,313 acre-feet delivered to Tulare Lake Basin Water Storage District.

- 10 acre-feet of water was delivered to a temporary turnout for Lilico Pictures.

- 26,593 acre-feet of CVP water was transported to six annual USBR contractors in the San Joaquin Valley.

- 140,250 acre-feet of CVP water was transported to eight USBR Cross Valley Canal contractors, including 7,000 acre-feet reassigned to Westlands Water District and 1,600 reassigned to San Luis Water District.

- 193,590 acre-feet of CVP water was conveyed to O'Neill Forebay to replace CVP pumping curtailed during May and June in accordance with SWRCB Decision 1485.

- 7,200 acre-feet of CVP water was conveyed for the U.S. Fish and Wildlife Service.

Table 5 shows 1989 monthly deliveries of each type of water, along with summaries of Table A entitlements and cumulative entitlements not delivered. The types of water service not described in preceding sections are covered in the following paragraphs.

Regulated Delivery of Local Supply. SWP facilities are also used to transport non-SWP water for long-term SWP contractors and other agencies under various agreements for local water rights. Some of this water simply passes through SWP transportation facilities, and some is stored in SWP reservoirs for later release. In 1989, a total of 823,302 acre-feet in this category was delivered to one long-term contractor (Alameda County FC&WCD, Zone 7) and five non-SWP agencies in the Feather River area (lines 3, 5, 6, 7, 8, and 11).

Preconsolidation Repayment Water. Because of limited SWP water supply, no preconsolidation repayment water was delivered in 1989.

Transfer of Entitlement Water. During 1989, several long-term contractors made a portion of their annual entitlement water available for transfer. These transfer requests were urgently needed to irrigate permanent crops in water-deficient areas.

- Under an agreement signed January 4, 1989, Dudley Ridge Water District transferred 2,391 acre-feet of its 1988 carryover entitlement water to Tulare Lake Basin Water Storage District for use by a landowner who farms in both districts (line 17).

- Under an agreement dated August 1, 1989, Dudley Ridge Water District transferred 800 acre-feet of its 1989 entitlement water to the San Luis Water District for use by one of its farmers who has orchards in Dudley Ridge, San Luis, and Westlands Water Districts. Under a second agreement, dated October 25, 1989, Dudley Ridge Water District transferred an additional 800 acre-feet of its 1989 entitlement water to San Luis Water District for use by the same farmer served under the August 1 agreement, and 900 acre-feet of water to Westlands Water District, also for the same farmer (line 17).

- Under an agreement dated September 13, 1989, Tulare Lake Basin Water Storage District transferred 300 acre-feet of its 1989 entitlement water to Oak Flat Water District (line 21).

- By a letter dated October 13, 1989, DWR denied Devil's Den Water District's request to transfer 70 acre-feet of its 1989 entitlement water to Westlands Water District. DWR determined that the transfer did not demonstrate an urgent consumptive need. This water was for a farmer who had overdrawn his allocation from Westlands and wanted the transfer water to help repay his water account.

Exchange of Entitlement Water. Under an agreement dated October 13, 1989, DWR agreed to allow Kern County Water Agency to exchange up to 55,000 acre-feet of its 1989 entitlement water with Westlands Water District to help Westlands during a water-short year. Westlands would have ten years to deliver a like amount of its CVP water to Kern (until December 31, 1999). The total amount of Kern's 1989 entitlement water delivered to Westlands under the exchange agreement was 45,000 acre-feet. Westlands has not yet transferred any CVP water to Kern (line 19).

Purchase and Wheeling of Non-SWP Water. During 1989, DWR purchased 200,000 acre-feet of water from the Yuba County Water Agency's New Bullards Bar Reservoir on behalf of two SWP contractors. As part of the sales agreement with DWR, each contractor was required to provide a proportionate share of water for Delta carriage requirements (the additional Delta outflow required to maintain water quality standards when export rates from the southern Delta increase) and paid a charge for the water, the melded system energy rate for the power (the total cost of SWP power sources--including off-aqueduct facilities--less total power revenues, divided by the energy requirement to pump all SWP water), the variable replacement from the Sacramento-San Joaquin Delta to their respective turnouts, and the estimated charge for the proportionate share of the costs determined by DWR to offset direct fish losses associated with SWP pumping at Banks Pumping Plant.

- Under an agreement in the summer of 1989, Tulare Lake Basin Water Storage District purchased 110,000 acre-feet of water from DWR's Yuba County Water Agency purchase, at $11 per acre-foot. The Delta carriage requirement was 22,445 acre-feet.

  Of the remaining 87,555 acre-feet of water, 300 acre-feet was purchased by Oak Flat Water District, and 2,843 acre-feet was purchased by Empire West Side Irrigation District (lines 18, 20, and 21). As discussed earlier under the section "Transfer of Entitlement Water," Oak Flat's purchase was accommodated by the exchange of 300 acre-feet of Tulare's 1989 entitlement water for the YCWA water. The total YCWA water delivered during 1989 was 54,313 acre-feet--53,501 acre-feet to Tulare and 812 acre-feet to Empire. Tulare and Empire received the remaining water--31,211 acre-feet and 2,031 acre-feet, respectively--during January through June 1990.

Table 5. Monthly Water

acre-feet

Line No.	Contracting Agency and Type of Service	Month						
		JAN	FEB	MAR	APR	MAY	JUN	JUL
	FEATHER RIVER AREA							
1.	City of Yuba City:							
	Entitlement Water	0	0	0	0	0	0	217
2.	County of Butte:							
	Entitlement Water	14	6	177	89	0	0	0
3.	Last Chance Creek Water District:							
	Regulated Delivery of Local Supply	0	0	0	5	2,505	2,454	3,080
4.	Plumas County Flood Control and Water Conservation District:							
	Entitlement Water	18	20	3	23	44	74	120
5.	Thermalito Irrigation District:							
	Regulated Delivery of Local Supply	96	95	89	137	274	284	327
6.	Oroville-Wyandotte Irrigation District							
	Regulated Delivery of Local Supply	202	182	202	284	1,019	1,190	1,180
7.	Western Canal Water District							
	Regulated Delivery of Local Supply	0	0	0	2,546	47,263	47,576	56,518
8.	Joint Water Districts Board							
	Regulated Delivery of Local Supply	2,059	0	0	17,426	109,220	105,256	116,520
	SWP	32	26	180	112	44	74	337
	NON-SWP	2,357	277	291	20,398	160,281	156,760	177,625
	AREA TOTAL	2,389	303	471	20,510	160,325	156,834	177,962
	NORTH BAY AREA							
9.	Napa County Flood Control and Water Conservation District:							
	Entitlement Water	772	693	582	619	594	620	677
	YCWA Water via SWP Facilities	0	0	0	160	644	799	840
	Agency Total	772	693	582	779	1,238	1,419	1,517
10.	Solano County Water Agency:							
	Entitlement Water	882	697	815	801	1,546	1,769	2,782
	Vallejo Permit Water	107	1	0	0	0	0	0
	Agency Total	989	698	815	801	1,546	1,769	2,782
	SWP	1,654	1,390	1,397	1,420	2,140	2,389	3,459
	NON-SWP	107	1	0	160	644	799	840
	AREA TOTAL	1,761	1,391	1,397	1,580	2,784	3,188	4,299
	SOUTH BAY AREA							
11.	Alameda County Flood Control and Water Conservation District, Zone 7:							
	Entitlement Water	1,366	1,087	427	1,948	3,060	3,351	3,452
	Regulated Delivery of Local Supply	318	339	984	143	0	0	0
	Agency Total	1,684	1,426	1,411	2,091	3,060	3,351	3,452
12.	Alameda County Water District:							
	Entitlement Water	2,273	1,666	1,099	1,969	1,763	3,206	2,974
	Carryover Entitlement Water	370	355	0	0	0	0	0
	Agency Total	2,643	2,021	1,099	1,969	1,763	3,206	2,974
13.	Santa Clara Valley Water District:							
	Entitlement Water	4,365	5,905	6,000	6,500	7,500	8,500	9,000
	DWR YCWA Water	0	0	3,676	4,116	3,519	1,835	1,953
	Agency Total	4,365	5,905	9,676	10,616	11,019	10,335	10,953
14.	Recreation/Fish and Wildlife Water	3	5	7	8	15	20	21
	SWP	8,377	9,018	7,533	10,425	12,338	15,077	15,447
	NON-SWP	318	339	4,660	4,259	3,519	1,835	1,953
	AREA TOTAL	8,695	9,357	12,193	14,684	15,857	16,912	17,400
	SAN JOAQUIN VALLEY AREA							
	SWP Water							
15.	County of Kings:							
	Entitlement Water	400	400	97	0	403	440	440
16.	Devil's Den Water District:							
	Entitlement Water	0	22	2,104	1,013	815	1,754	2,557
	Carryover Entitlement Water	616	1,429	0	0	0	0	0
	Agency Total	616	1,451	2,104	1,013	815	1,754	2,557
17.	Dudley Ridge Water District:							
	Entitlement Water	0	0	1,011	4,304	6,233	8,688	10,453
	Transferred Entitlement Water (900 AF to Westlands WD, 1,600 AF to San Luis Water District)	0	0	0	0	0	0	0
	Transferred Carryover Entitlement Water (To Tulare Lake Basin Water Storage District)	2,391	0	0	0	0	0	0
	Carryover Entitlement Water	1,602	4,293	1,536	0	0	0	0
	Agency Total (Excludes Transferred Entitlement Water & Transferred Carryover Entitlement Water)	1,602	4,293	2,547	4,304	6,233	8,688	10,453
18.	Empire West Side Irrigation District:							
	Entitlement Water	235	119	0	0	0	1,203	859
	DWR YCWA Water Transferred From TLBSD	0	0	0	0	0	0	0
	Agency Total	235	119	0	0	0	1,203	859

Deliveries in 1989

acre-feet

Month					1989 Total	1989 Contract	1989 Entitlement Not	Net Cumulative Entitlement Not Delivered Through (a		Line
AUG	SEP	OCT	NOV	DEC	Deliveries	Entitlement	Delivered	1988	1989	No.
186	0	0	0	0	403	3,300	2,897	9,911	12,808	1.
0	0	14	0	0	300	1,200	900	15,186	16,086	2.
2,364	805	221	53	0	11,487					3.
84	58	17	14	11	486	1,000	514	6,642	7,156	4.
292	209	132	124	93	2,152					5.
1,766	1,040	468	330	297	8,160					6.
45,451	11,828	5,855	10,900	6,313	234,250					7.
109,410	51,004	21,550	17,220	15,630	565,295					8.
270	58	31	14	11	1,189	5,500	4,311	31,739	36,050	
159,283	64,886	28,226	28,627	22,333	821,344	0	0	0	0	
159,553	64,944	28,257	28,641	22,344	822,533	5,500	4,311	31,739	36,050	
636	534	176	105	187	6,195	6,195	0	353	353	9.
833	682	0	0	0	3,958					
1,469	1,216	176	105	187	10,153					
2,504	1,733	1,246	1,327	1,154	17,256	18,420	1,164	2,350	3,514	10.
0	0	0	0	0	108					
2,504	1,733	1,246	1,327	1,154	17,364					
3,140	2,267	1,422	1,432	1,341	23,451	24,615	1,164	2,703	3,867	
833	682	0	0	0	4,066	0	0	0	0	
3,973	2,949	1,422	1,432	1,341	27,517	24,615	1,164	2,703	3,867	
3,244	3,053	2,006	1,594	1,639	26,227	31,000	4,773	160,616	165,389	11.
0	129	0	45	0	1,958					
3,244	3,182	2,006	1,639	1,639	28,185					
3,324	2,044	1,295	932	2,772	25,317	35,700	10,383	261,810	271,468 (b	12.
0	0	0	0	0	725					
3,324	2,044	1,295	932	2,772	26,042					
9,500	9,400	9,089	6,860	7,381	90,000	90,000	0	40,821	40,821	13.
994	867	125	0	0	17,085					
10,494	10,267	9,214	6,860	7,381	107,085					
25	19	13	8	8	152					14.
16,093	14,516	12,403	9,394	11,800	142,421	156,700	15,156	463,247	477,678	
994	996	125	45	0	19,043	0	0	0	0	
17,087	15,512	12,528	9,439	11,800	161,464	156,700	15,156	463,247	477,678	
440	440	440	440	60	4,000	4,000	0	0	0	15.
2,955	571	432	240	137	12,600	12,700	100	2,173	228	16.
0	0	0	0	0	2,045					
2,955	571	432	240	137	14,645					
7,695	2,905	2,023	178	1,237	44,727	55,600	8,373 (c	10,618	9,169 (b	17.
600	200	0	0	1,700	2,500					
0	0	0	0	0	2,391					
0	0	0	0	0	7,431					
7,695	2,905	2,023	178	1,237	52,158					
358	226	0	0	0	3,000	3,000	0	12,023	12,023	18.
358	41	246	167	0	812					
716	267	246	167	0	3,812					

a) This column includes entitlement not delivered, deferred or otherwise, whether or not the water contractor has received any remuneration.
b) Reflects carryover entitlement water delivered in 1989.
c) Reflects transfer entitlement water delivered in 1989.

Table 5. Monthly Water

acre-feet

Line No.	Contracting Agency and Type of Service	Month						
		JAN	FEB	MAR	APR	MAY	JUN	JUL
	SAN JOAQUIN VALLEY AREA (con't.)							
19.	Kern County Water Agency:							
	Entitlement Water	3,877	21,670	31,456	73,466	102,722	207,940	237,738
	Carryover Entitlement Water	14,882	58,039	45,754	0	0	0	0
	Transferred Entitlement Water (To Westlands Water District)	0	0	0	0	0	0	0
	Agency Total (Excludes Transferred Ent. Water to Westlands WD)	18,759	79,709	77,210	73,466	102,722	207,940	237,738
20.	Oak Flat Water District:							
	Entitlement Water	0	0	132	749	651	1,004	1,394
	Carryover Entitlement Water	4	379	180	0	0	0	0
	Transfer Ent. Water from TLBWSD	0	0	0	0	0	0	0
	Agency Total	4	379	312	749	651	1,004	1,394
21.	Tulare Lake Basin Water Storage District:							
	Entitlement Water	0	345	1,890	2,846	538	32,412	26,531
	Transferred Entitlement Water (To Oak Flat Water District)	0	0	0	0	0	0	0
	Carryover Entitlement Water	10,887	7,163	0	0	0	0	0
	Transfer Water (Transferred Carryover Entitlement Water from Dudley Ridge Water District)	2,391	0	0	0	0	0	0
	DWR YCWA Water	0	0	0	0	0	0	0
	DWR YCWA Water (812 AF transferred to Empire West Side ID)	0	0	0	0	0	0	0
	Agency Total (Excludes Transfer Ent. Water to Oak Flat WD)	13,278	7,508	1,890	2,846	538	32,412	26,531
22.	San Luis WD							
	Ent. Water Transferred from Dudley Ridge WD	0	0	0	0	0	0	0
23.	Westlands Water District							
	Ent. Water Transferred from Dudley Ridge WD	0	0	0	0	0	0	0
	Ent. Water Transferred from Kern County WA	0	0	0	0	0	0	0
	Agency Total	0	0	0	0	0	0	0
24.	Parks & Recreation:							
	Recreation/Fish and Wildlife Water	0	1	1	6	11	13	1
25.	Fish & Game:							
	YCWA Water via SWP Facilities	0	0	0	0	0	0	0
	Recreation/Fish and Wildlife Water	14	25	6	45	16	17	19
	Agency Total	14	25	6	45	16	17	19
	SWP	34,908	93,885	84,167	82,429	111,389	253,471	279,992
	NON-SWP	0	0	0	0	0	0	0
	AREA SUBTOTAL (SWP Water)	34,908	93,885	84,167	82,429	111,389	253,471	279,992
	SAN JOAQUIN VALLEY AREA							
	Conveying CVP Water							
26.	Annual Contract:							
	Green Valley Water District	0	58	0	0	0	0	222
	Kings County Water District	1,936	1,755	0	0	0	0	0
	Lakeside Irrigation Water District	1,936	1,754	0	0	0	0	0
	Musco Olive Products, Inc.	0	0	0	0	0	5	0
	Tracy Golf and Country Club	7	12	11	61	82	92	95
	Cawelo Water District	106	100	0	0	0	496	629
	SUBTOTAL	3,985	3,679	11	61	82	593	946
27.	Cross Valley Canal Contracts:							
	Fresno County	0	0	131	394	413	520	450
	Lower Tule River Irrigation District	0	0	1,361	4,086	1,715	2,884	4,652
	Pixley Irrigation District	0	0	1,361	4,086	2,127	3,404	6,025
	Rag Gulch Water District	305	0	1,691	4,391	0	0	0
	Tulare County	0	0	232	697	731	919	797
	Kern-Tulare Water District	536	3,109	2,571	4,755	6,570	6,826	0
	1,600 AF transferred to San Luis WD	0	0	0	0	0	0	0
	7,000 AF transferred to Westlands WD	0	0	0	0	0	0	0
	Agency Total (Excludes 1,600 AF transferred to San Luis WD and 7,000 AF transferred to Westlands WD)	536	3,109	2,571	4,755	6,570	6,826	0
	Hills Valley Irrigation District	0	1,742	0	0	461	579	502
	Tri-Valley Water District	0	616	0	0	157	198	171
	SUBTOTAL	841	5,467	7,347	18,409	12,174	15,330	12,597
28.	USBR:							
	Federal Wheeling (U.S. Fish & Wildlife)	0	0	0	0	0	0	0
	Decision 1485	0	0	0	0	0	0	103,754
	SUBTOTAL	0	0	0	0	0	0	103,754
29.	San Luis WD							
	Transferred from Kern-Tulare WD	0	0	0	0	0	0	0
30.	Westlands Water District							
	Transferred from Kern-Tulare WD	0	0	0	0	0	0	0

Deliveries in 1989

acre-feet

Month					1989 Total	1989 Contract	1989 Entitlement Not	Net Cumulative Entitlement Not Delivered Through (a		Line
AUG	SEP	OCT	NOV	DEC	Deliveries	Entitlement	Delivered	1988	1989	No.
										19.
165,397	53,831	37,185	22,457	24,648	982,387	1,112,300	84,913 (c	445,931	412,169	
0	0	0	0	0	118,675					
0	2,837	11,872	18,267	12,024	45,000					
165,397	53,831	37,185	22,457	24,648	1,101,062					
										20.
804	340	262	0	192	5,528	5,600	72	1,203	712	
0	0	0	0	0	563					
0	0	0	251	49	300					
804	340	262	251	241	6,391					
										21.
19,782	12,782	7,394	5,080	0	109,600	109,900	0	98,712	80,662 (b	
0	0	0	251	49	300					
0	0	0	0	0	18,050					
0	0	0	0	0	2,391					
10,525	5,495	0	22,387	15,094	53,501					
358	41	246	167	0	812					
30,307	18,277	7,394	27,467	15,094	183,542					
										22.
600	200	0	0	800	1,600					23.
0	0	0	0	900	900					
0	2,837	11,872	18,267	12,024	45,000					
0	2,837	11,872	18,267	12,924	45,900					
										24.
1	8	20	2	0	64					25.
0	0	10,000	20,000	0	30,000					
122	99	55	1	10	429					
122	99	10,055	20,001	10	30,429					
198,154	74,239	59,683	46,916	40,057	1,359,290	1,303,100	93,458	570,660	514,963	
10,883	5,536	10,246	42,554	15,094	84,313	0	0	0	0	
209,037	79,775	69,929	89,470	55,151	1,443,603	1,303,100	93,458	570,660	514,963	
										26.
470	67	0	7	33	857					
0	0	5,000	0	0	8,691					
0	7,000	3,000	0	0	13,690					
0	1	1	0	0	7					
58	16	19	12	1	466					
623	554	283	91	0	2,882					
1,151	7,638	8,303	110	34	26,593					
										27.
323	258	241	231	39	3,000					
5,028	3,730	3,486	3,335	825	31,102					
12,567	4,159	3,888	3,719	1,766	43,102					
3,505	1,143	1,069	1,021	175	13,300					
573	456	426	407	70	5,308					
2,849	2,499	1,685	0	0	31,400					
0	0	1,502	98	0	1,600					
0	0	6,000	1,000	0	7,000					
2,849	2,499	1,685	0	0	31,400					
0	0	0	0	12	3,296					
0	0	0	0	0	1,142					
24,845	12,245	10,795	8,713	2,887	131,650					
										28.
0	0	3,391	2,868	941	7,200					
89,836	0	0	0	0	193,590					
89,836	0	3,391	2,868	941	200,790					
										29.
0	0	1,502	98	0	1,600					30.
0	0	6,000	1,000	0	7,000					

a) This column includes entitlement not delivered, deferred or otherwise, whether or not the water contractor has received any remuneration.
b) Reflects carryover entitlement water delivered in 1989.
c) Reflects transfer entitlement water delivered in 1989.

Table 5. Monthly Water

acre-feet

Line No.	Contracting Agency and Type of Service	Month						
		JAN	FEB	MAR	APR	MAY	JUN	JUL
	SAN JOAQUIN VALLEY AREA (con't.)							
31.	Recreation/Fish and Wildlife Water	11	21	7	43	21	26	16
	SUBTOTAL	11	21	7	43	21	26	16
	SWP	0	0	0	0	0	0	0
	NON-SWP	4,837	9,167	7,365	18,513	12,277	15,949	117,313
	AREA SUBTOTAL (CVP Water)	4,837	9,167	7,365	18,513	12,277	15,949	117,313
	SAN JOAQUIN VALLEY AREA SUMMARY							
	SWP	34,908	93,885	84,167	82,429	111,389	253,471	279,992
	NON-SWP	4,837	9,167	7,365	18,513	12,277	15,949	117,313
	AREA TOTAL	39,745	103,052	91,532	100,942	123,666	269,420	397,305
	CENTRAL COASTAL AREA							
32.	San Luis Obispo County Flood Control and Water Conservation District: Entitlement Water	0	0	0	0	0	0	0
33.	Santa Barbara County Flood Control and Water Conservation District: Entitlement Water	0	0	0	0	0	0	0
	AREA TOTAL	0	0	0	0	0	0	0
	SOUTHERN CALIFORNIA AREA							
34.	Antelope Valley-East Kern Water Agency: Entitlement Water	1,139	1,002	2,815	4,550	4,956	5,983	7,130
	1990 Advance Entitlement	0	0	0	0	0	0	0
	Agency Total	1,139	1,002	2,815	4,550	4,956	5,983	7,130
35.	Castaic Lake Water Agency: Entitlement Water	1,158	963	1,339	1,848	2,218	2,124	2,216
36.	Coachella Valley Water District: Entitlement Water	1,822	1,822	1,822	1,822	1,822	1,822	1,822
37.	Crestline-Lake Arrowhead Water Agency: Entitlement Water	184	166	115	152	178	197	254
38.	Desert Water Agency: Entitlement Water	3,041	3,041	3,041	3,041	3,041	3,041	3,041
39.	Littlerock Creek Irrigation District: Entitlement Water	0	0	0	0	0	0	247
40.	Mojave Water Agency: Entitlement Water	0	0	0	0	0	0	0
41.	Palmdale Water District: Entitlement Water	231	87	17	117	1,055	2,243	1,818
42.	San Bernardino Valley Municipal Water District: Entitlement Water	401	429	358	389	1,892	2,438	2,535
43.	San Gabriel Valley Municipal Water District: Entitlement Water	0	668	0	1,807	548	182	1,454
44.	The Metropolitan Water District of Southern California: Entitlement Water	7,248	20,906	72,832	131,325	123,779	122,070	130,573
45.	San Gorgonio Pass Water Agency Entitlement Water	0	0	0	0	0	0	0
46.	Ventura County Flood Control District: Entitlement Water	0	0	0	0	0	0	0
47.	Recreation/Fish and Wildlife Water	104	86	175	226	465	824	1,363
48.	Lilico Pictures/SWP sales	0	0	0	0	0	0	0
	AREA TOTAL (ALL SWP)	15,328	29,170	82,514	145,277	139,954	140,924	152,453
	ALL AGENCIES							
49.	Total 1989 Entitlement Water	29,426	61,714	128,132	239,378	265,358	411,061	450,284
50.	Total 1988 Carryover Entitlement Water	30,752	71,658	47,470	0	0	0	0
51.	Total 1990 Advance Entitlement Water	0	0	0	0	0	0	0
	SUBTOTAL (Entitlement Water Delivered)	60,178	133,372	175,602	239,378	265,358	411,061	450,284
52.	Recreation/Fish and Wildlife Water	121	117	189	285	507	874	1,404
	SUBTOTAL (SWP WATER)	60,299	133,489	175,791	239,663	265,865	411,935	451,688
53.	Vallejo Permit Water	107	1	0	0	0	0	0
54.	Regulated Delivery of Local Supply	2,675	616	1,275	20,541	160,281	156,760	177,625
55.	YCWA Water via SWP Facilities	0	0	0	160	644	799	840
56.	DWR YCWA Water	0	0	3,676	4,116	3,519	1,835	1,953
57.	Lilico Pictures	0	0	0	0	0	0	0
58.	Conveying CVP Water--Annual Contract	3,985	3,679	11	61	82	593	946
59.	Conveying CVP Water--Cross Valley Canal	841	5,467	7,347	18,409	12,174	15,330	12,597
60.	Conveying CVP Water-- Decision 1485	0	0	0	0	0	0	103,754
61.	Conveying CVP Water-- U.S. Fish and Wildlife	0	0	0	0	0	0	0
62.	Conveying CVP Water--Recreation/Fish and Wildlife Water	11	21	7	43	21	26	16
	San Luis WD	0	0	0	0	0	0	0
	Westlands Water District	0	0	0	0	0	0	0
64.	SUBTOTAL (OTHER WATER)	7,619	9,784	12,316	43,330	176,721	175,343	297,731
64.	**TOTAL WATER**	**67,918**	**143,273**	**188,107**	**282,993**	**442,586**	**587,278**	**749,419**

Deliveries in 1989

acre-feet

Month					1989 Total	1989 Contract	1989 Entitlement Not	Net Cumulative Entitlement Not Delivered Through (a		Line
AUG	SEP	OCT	NOV	DEC	Deliveries	Entitlement	Delivered	1988	1989	No.
102	89	60	4	8	408					31.
102	89	7,562	1,102	8	9,008					
0	0	0	0	0	0					
115,934	19,972	30,051	12,793	3,870	368,041					
115,934	19,972	30,051	12,793	3,870	368,041					
198,154	74,239	59,683	46,916	40,057	1,359,290	1,303,100	93,458	570,660	514,963	
126,817	25,508	40,297	55,347	18,964	452,354	0	0	0	0	
324,971	99,747	99,980	102,263	59,021	1,811,644	1,303,100	93,458	570,660	514,963	
										32.
0	0	0	0	0	0	20,000	20,000	57,000	77,000	33.
0	0	0	0	0	0	36,342	36,342	102,796	139,138	
0	0	0	0	0	0	56,342	56,342	159,796	216,138	
6,226	4,537	3,306	2,210	1,337	45,191	125,700	80,509	285,809	366,229 (d	34.
52	37	0	0	0	89					
6,278	4,574	3,306	2,210	1,337	45,280					
2,239	2,218	1,947	1,671	1,778	21,719	37,400	15,681	208,489	224,170	35.
2,554	2,188	2,188	2,189	0	21,873	21,873	0	5,200	5,200	36.
251	229	152	141	151	2,170	5,510	3,340	29,577	32,917	37.
4,259	3,650	3,650	3,654	0	36,500	36,500	0	8,000	8,000	38.
218	215	184	106	1	971	2,190	1,219	13,632	14,851	39.
69	131	0	0	0	200	48,500	48,300	402,068	450,368	40.
1,531	992	536	352	30	9,009	16,660	7,651	159,457	167,108	41.
3,653	3,618	3,437	1,553	79	20,782	97,000	76,218	882,399	958,617	42.
2,110	1,709	2,144	2,119	98	12,839	27,400	14,561	200,179	214,740	43.
127,055	91,939	127,576	116,818	84,577	1,156,698	1,961,000	804,302	8,787,528	9,591,830	44.
0	0	0	0	0	0	16,200	16,200	97,800	114,000	45.
0	0	0	0	0	0	16,000	16,000	52,000	68,000	46.
1,412	1,087	894	492	362	7,490					47.
2	3	4	1	0	10					48.
151,631	112,553	146,018	131,306	88,413	1,335,541	2,411,933	1,083,981	11,132,138	12,216,030	
367,674	202,380	218,571	188,558	141,242	2,703,778					49.
0	0	0	0	0	149,880					50.
52	37	0	0	0	89					51.
367,726	202,417	218,571	188,558	141,242	2,853,747					
1,560	1,213	982	503	380	8,135					52.
369,286	203,630	219,553	189,061	141,622	2,861,882					
0	0	0	0	0	108					53.
159,283	65,015	28,226	28,672	22,333	823,302					54.
833	682	10,000	20,000	0	33,958					55.
11,877	6,406	371	22,554	15,094	71,398					56.
2	3	4	1	0	10					57.
1,151	7,638	8,303	110	34	26,593					58.
24,845	12,245	10,795	8,713	2,887	131,650					59.
89,836	0	0	0	0	193,590					60.
0	0	3,391	2,868	941	7,200					61.
										62.
102	89	60	4	8	408					
0	0	1,502	98	0	1,600					
0	0	6,000	1,000	0	7,000					
287,929	92,078	68,652	84,020	41,297	1,296,817					64.
657,215	**295,708**	**288,205**	**273,081**	**182,919**	**4,158,699**	**3,958,190**	**1,254,412**	**12,360,283**	**13,464,726**	64.

a) This column includes entitlement not delivered, deferred or otherwise, whether or not the water contractor has received any remuneration.
d) Reflects 1990 Advance Entitlement Water delivered in 1989.

- Also under an agreement in early 1989, Santa Clara Valley Water District purchased 90,000 acre-feet of water from DWR's YCWA purchase, at $45 per acre-foot. Santa Clara's share of the Delta carriage water requirement for this purchase was 18,634 acre-feet.

  Because of the limited conveyance capacity on the South Bay Aqueduct, Santa Clara has until March 31, 1991, to take full delivery of the water. During 1989, 17,085 acre-feet was delivered to Santa Clara, leaving 54,281 acre-feet yet to be conveyed (line 13).

Conveyance of CVP Water. During 1989, DWR had several arrangements for conveying CVP water through SWP facilities. In each arrangement, USBR provided the electrical energy required for moving the water through Banks Pumping Plant and, if needed, through Dos Amigos and Las Perillas pumping plants.

Under contracts executed in 1975 and 1976, DWR conveys CVP water through SWP facilities to the turnout for Kern County Water Agency's Cross Valley Canal, west of Bakersfield. The Cross Valley Canal contracts, which extend to 1995, provide that conveyance of CVP water shall not interfere with, adversely affect the quality of, or add to the delivery cost of SWP water to SWP contractors.

- Hills Valley Irrigation District and Tri-Valley Water District executed amendments to their three-party Cross Valley Canal contracts in 1987. These amendments provided for the use of SWP facilities from the Delta to Reach 12E, where the turnout for the Cross Valley Canal is located, and for the use of USBR storage in San Luis Reservoir when DWR cannot pump CVP water at Banks Pumping Plant. The original contracts required the use of SWP facilities from the Delta to O'Neill Forebay and from Reach 8C to Reach 12E. The original contracts also provided wheeling through USBR's share of the joint-use facilities but did not provide for the use of any San Luis Reservoir storage. During 1989, 4,438 acre-feet of water was wheeled to these two contractors, of which 2,068 acre-feet was accounted for as deliveries from USBR's share of San Luis Reservoir (line 27).

  Under separate agreements, 38,033 acre-feet of water was delivered during May, June, and July 1989 from DWR's share of storage in San Luis Reservoir to the remaining participants in the three-party Cross Valley Canal contracts. The contractors were charged for the use of San Luis Reservoir and for the cost of electrical energy to replace an equal amount of water furnished by USBR into DWR's share of storage.

  Water conveyed during 1989 under allocations to the participants of the three-party Cross Valley Canal contracts included 1,600 acre-feet to Reaches 3 and 4 for Kern-Tulare Water District (transferred to San Luis Water District); 7,000 acre-feet to Reaches 4, 5, 6, and 7 for Kern-Tulare Water District (transferred to Westlands Water District); 7,000 acre-feet to Reaches 8C and 8D for a Pixley Irrigation District exchange; and 124,650 acre-feet to the Cross Valley Canal in Reach 12E, for a total conveyance of 140,250 acre-feet. Water conveyed for the three-party Cross Valley Canal contractors to reaches other than Reach 12E (Cross Valley Canal) is conveyed under separate wheeling agreements, and the contractors are charged for use of DWR facilities from the Delta to the point of delivery.

- Under the annual conveyance agreement with USBR, DWR agreed to wheel up to 49,840 acre-feet of CVP water to nine USBR contractors. The term of the agreement is from March 1 to the end of February of the following year. This conforms to the USBR contractors' irrigation season, covering the current irrigation and the next pre-irrigation periods. During the 1989 calendar year, 26,593 acre-feet was conveyed (line 58). Of this amount, 18,929 acre-feet was delivered in 1989 under the 1989 agreement. The remaining 7,664 acre-feet delivered in 1989 was delivered in January and February, under the 1988 agreement. The total amount of water delivered under the 1989 agreement (delivered in 1989 and in January and February 1990) was 20,923 acre-feet--18,929 acre-feet delivered in 1989 and 1,994 acre-feet delivered in 1990.

  During May, June, and July 1989, 496 acre-feet of water was delivered from DWR's

share of storage in San Luis Reservoir. USBR replaced this water by October 1989. Also, the SWP wheeled USBR water to Tulare Lake Basin Water Storage District for Kings County Water District (8,691 acre-feet) and Lakeside Irrigation Water District (13,690 acre-feet).

- Under another agreement, signed August 31, 1989, DWR conveyed 7,200 acre-feet of CVP water for the U.S. Fish and Wildlife Service. The water was conveyed to the Buena Vista Water Storage District turnout (Reach 10A) for delivery to the Kern National Wildlife Refuge (line 28).

- Under the Coordinated Operation Agreement, DWR pumped 193,590 acre-feet of CVP water at Banks Pumping Plant during July and August 1989. DWR conveyed the water from the Delta to O'Neill Forebay to replace USBR capacity foregone during May and June 1989 due to pumping limitations in compliance with Decision 1485 (line 28).

Conveyance of Non-SWP YCWA Water. During 1989, two SWP contractors independently purchased water from Yuba County Water Agency. DWR had agreements with both contractors to convey the independently purchased water through SWP facilities.

- The first contract, between the City of Napa, Napa County Flood Control and Water Conservation District, and DWR, was executed April 5, 1989. DWR conveyed 3,958 acre-feet through the North Bay Aqueduct facilities from Barker Slough to the City of Napa's turnout (line 9). This water was purchased by the City of Napa from the Yuba County Water Agency.

- The second agreement, between the Department of Fish and Game and DWR, was signed October 17, 1989. DFG purchased 39,000 acre-feet of water for waterfowl enhancement from the East Bay Municipal Utility District, which had previously purchased, but did not take, 78,000 acre-feet of water from the Yuba County Water Agency. DWR conveyed 30,000 acre-feet through the California Aqueduct from Banks Pumping Plant to O'Neill Forebay during October and November 1989 (line 25). Nine thousand acre-feet was carriage water to meet Delta water quality requirements. The water was delivered from O'Neill Forebay to the Grassland Water District by USBR. This water was later released through Mud and Salt sloughs to benefit the outmigration of juvenile chinook salmon. Conveyance was furnished by DWR and reimbursed at actual cost.

SWP Sales. Under an agreement dated August 11, 1989, Lilico Pictures, Inc., purchased 10 acre-feet of SWP water to be used in the production of a movie. The water was delivered through a temporary turnout in Reach 22B.

Power Operations

DWR has operated as a bulk power agency since April 1983. As such, DWR uses a combination of owned, contracted, and purchased power resources to meet SWP needs via contracted transmission capacity. DWR also sells and exchanges temporary resource excesses to other bulk power agencies and utilities.

Energy Use

Table 6 summarizes monthly SWP energy use at SWP plants during 1989. Transmission losses from the major transmission network to the SWP plants are included as part of the monthly SWP energy use at the SWP plants. Total energy use and losses for the year were 7.58 billion kWh, approximately 25 percent more than the corresponding amount for 1988. Increased water deliveries to The Metropolitan Water District of Southern California (28 percent increase), a large pumpback water operation at the Hyatt-Thermalito facilities, and a greater pumping requirement at Gianelli Pumping-Generating Plant were the major reasons for higher SWP energy use in 1989 than in 1988. Energy losses on the major transmission line networks in California for the SWP Pumping plants and powerplants was 0.16 billion kWh in 1989.

Under various water conveyance contracts and exchange agreements, some CVP water is pumped through SWP facilities at Banks, Dos Amigos, Gianelli, and Las Perillas pumping plants. USBR furnishes the energy for this use of SWP pumping facilities. Table 6A summarizes the total