THE

1991 DROUGHT WATER BANK

Introduction

After four drought years and three winter months of meager precipitation, California's water prospects looked bleak at the start of 1991. In February, the Department of Water Resources announced that the State Water Project would deliver only 10 percent of the requests for water to urban areas and that no water would be delivered to agriculture. For those with water rights settlement agreements in the Feather River Service Area, deliveries of about 50 percent of normal were projected. Forecasted SWP deliveries during 1991, excluding provisions in water rights settlements, were about 225,000 acre-feet. The U.S. Bureau of Reclamation announced similar, but less severe, cutbacks for its Central Valley Project: urban and agricultural CVP water users would receive 25 percent of their contract amounts, and those with water rights settlements would receive 75 percent of contract amounts.

Storage in major reservoirs had dropped to 54 percent of average, the lowest since 1977, a record dry year. Other supply systems were even more water short. Kings, Madera, Santa Barbara, San Benito, and San Luis Obispo counties had declared drought emergencies, and the Governor had proclaimed a state of emergency in Santa Barbara County. The shortages translated into stringent water rationing and severe cutbacks in agricultural production (including threats to survival of permanent crops such as trees and vines). Fish and wildlife resources were in critical shape as well. Not since the 1928-34 drought had there been such a prolonged dry period.

Water was so scarce that most suppliers doubted the SWP and CVP would be able to provide minimum carryover storage as a hedge against yet another dry year. With no end to the drought in sight, on February 1, 1991, the Governor signed Executive Order No. W-3-91, which established the Drought Action Team. The team was to coordinate State efforts in mitigating the effects of the drought, encourage local governments to prepare and implement drought emergency plans, and provide the Governor with periodic reports and recommendations. By February 15, the team reported to the Governor with a number of recommendations, one of which was the creation of an emergency drought water bank to develop a supply for four critical needs:

- municipal and industrial uses
- agricultural uses
- protection of fish and wildlife
- carryover storage for 1992

The responsibility for operating the Water Bank was assigned to the Department of Water Resources. At the onset, a Water Purchase Committee was formed to negotiate the terms and conditions of a model contract for buying water for the Bank. Committee members representing public agencies that might buy water from the Bank also aided in beginning negotiations and assisted in implementing water purchase contracts. In February, most of the participants expected demand to exceed the supply developed by the Water Bank. Unusually abundant March rains eased conditions slightly but did little to alleviate the effects of the drought. Following the March rains, requests for water to fulfill critical needs diminished somewhat. The slight reduction in demand, coupled with an aggressive Water Bank purchasing program, moved California from a condition of insufficient supply to one in which all critical needs were met.

Development of the Water Bank

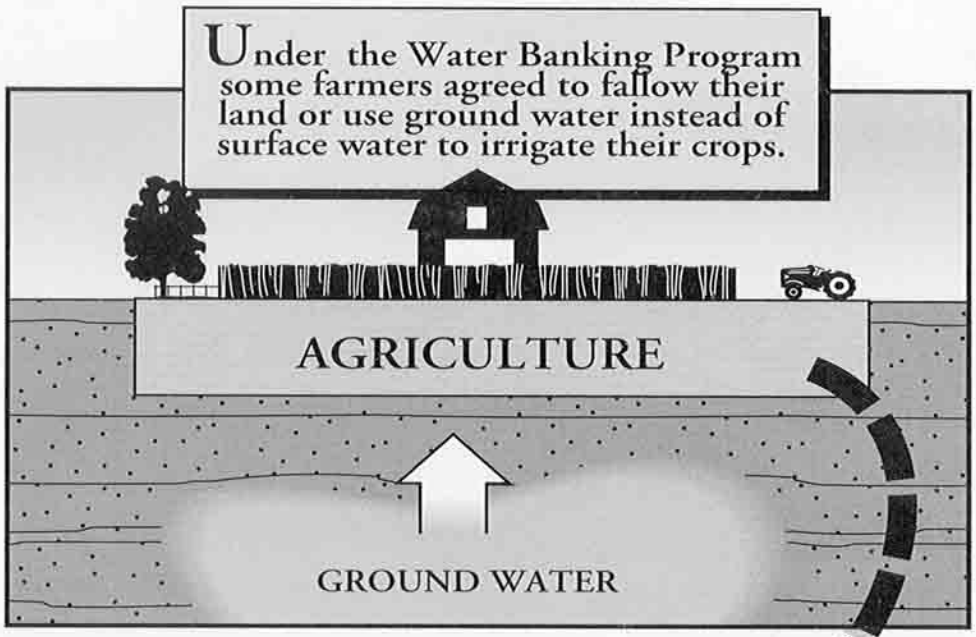
The Department of Water Resources was responsible for organizing and implementing the Water Bank. Its primary role was to purchase water from willing sellers and sell it to entities with critical needs. Staff members were redirected from other DWR programs and formed into teams to negotiate purchase contracts for different regions of the State or for specific types of contracts; some were assigned to work out the logistics and timing of water transfers required to establish the Bank. The Water Purchase Committee and government agencies at all levels worked with DWR to negotiate contracts, provide centralized control of water transfers, and coordinate distribution.

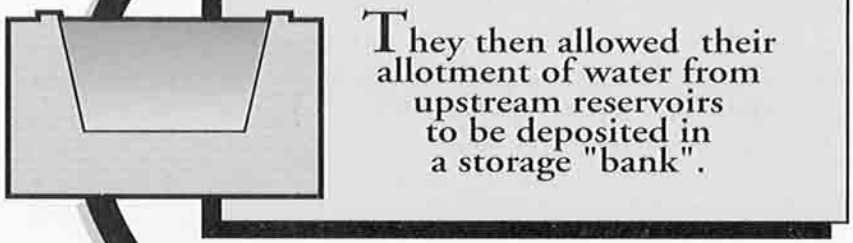
Water Purchase Contracts

Sellers made water available to the Bank by: fallowing farmland (not planting or irrigating a crop) and transferring conserved irrigation water to the Bank, using ground water instead of surface water , or transferring water stored in local reservoirs to the Bank. Within a month and a half, over 300 contracts were under way. No precedent existed for such an endeavor; consequently, procedures and guidelines were developed as the program progressed. Uniform contracts and a standardized system of quantifying the water sold to the Bank were developed. Most of the contracts were processed by early June; however, much work remained to coordinate, monitor, and document the program.

Table 1. Drought Water Bank Purchase Summary

Region	Category	Acre-feet	Percent of Total
Delta	Fallowing	333,723	40.7
	Ground water	2,529	0.3
	Stored water	2,576	0.3
Sacramento River	Fallowing	36,652	4.5
	Ground water	46,787	5.7
Yolo	Fallowing	34,463	4.2
	Ground water	27,308	3.3
Yuba/Feather/Elsewhere	Fallowing	15,226	1.9
	Ground water	182,341	22.2
	Stored water	139,200	17.0
		820,805	
Statewide Totals	Fallowing	420,064	51.2
	Ground water	258,965	31.5
	Stored water	141,776	17.3
		820,805	**100**
Total Number of Contracts	351		


Under the Water Banking Program some farmers agreed to fallow their land or use ground water instead of surface water to irrigate their crops.
AGRICULTURE
GROUND WATER


They then allowed their allotment of water from upstream reservoirs to be deposited in a storage "bank".

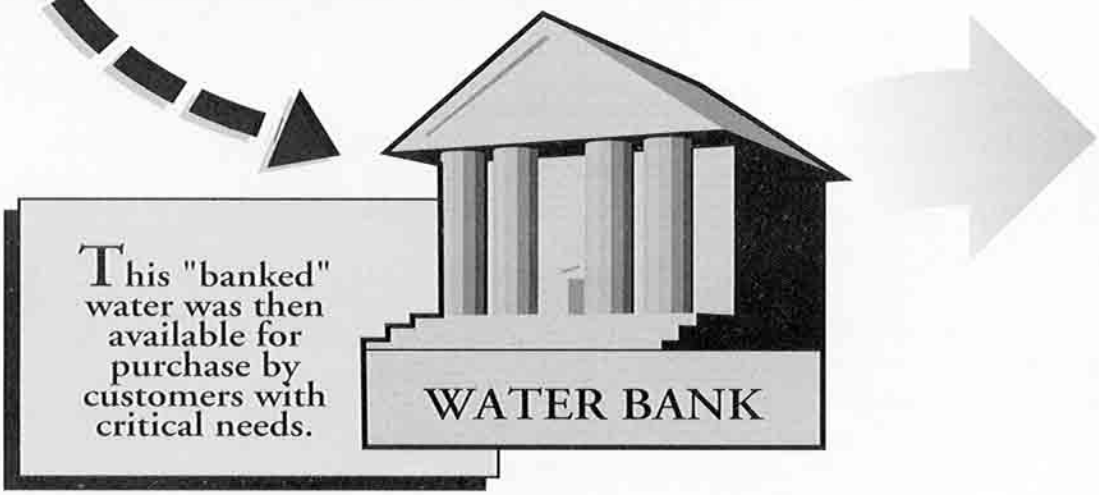

This "banked" water was then available for purchase by customers with critical needs.
WATER BANK

Table 2. Drought Water Bank Crop Summary by County
(acres fallowed)

Crops	Butte County	Colusa County	Contra Costa County	Sacramento County	San Joaquin County	Shasta County	Salano County	Stanislaus County	Sutter County	Tehama County	Yolo County	Total
Alfalfa*			678.0	996.5	3,795.2	521.9	913.8				3,313.6	10,219.0
Asparagus					1,277.4							1,277.4
Barley*				175.6	412.6		79.2				53.9	721.3
Corn			6,500.0	9,014.3	24,958.3		5,471.7	136.0	1,589.4		11,606.6	59,276.3
Dichondra*											27.4	27.4
Dry Beans	458.5			243.9	959.1		387.5				1,187.1	3,236.1
Grapes*				198.0							56.2	254.2
Melons									167.0			167.0
Milo			40.0		188.9							228.9
Misc. Truck			18.0	58.9	462.7							539.6
Pasture*			1,482.0	1,783.9	591.7	3,258.1	3,208.5			390.0	5,473.3	16,187.5
Rice	1,158.0	2,231.0		798.0		577.6			2,557.8		857.8	8,180.2
Safflower*				1,034.8	24.6		325.7				3,013.2	4,398.3
Seed Grass*							74.4				488.1	526.5
Sudan*				131.6								131.6
Sugar Beets		92.2		1,323.7	3,699.0		1,206.5		923.8		2,705.4	9,950.6
Sunflowers			518.0	862.1	383.7		572.4		166.1		267.1	2,769.4
Tomatoes				125.6	1,216.4		451.6				2,553.4	4,347.0
Turnips						35.4						35.4
Wheat*	1,455.7		1,344.2	11,927.1	14,288.5	50.5	5,859.9		55.0		8,602.9	43,583.8
Subtotal	3,072.2	2,323.2	10,580.2	28,674.0	52,258.1	4,443.5	18,551.2	136.0	5,459.1	390.0	40,206.0	166,093.5

Several contracts were negotiated in which the method of conserving water was left to the discretion of the water district. These contracts may represent some additional fallowing; however, the amounts cannot be quantified.
** Crops noted were planted but not irrigated, rather than fallowed.*

The first wave of purchases concentrated on paying farmers to fallow their land and credit the conserved water to the Bank. As the program progressed, contracts involving the substitution of ground water for surface water, direct ground water pumping, and reservoir storage withdrawals were negotiated. The quantities of water purchased are shown in Table 1(page 2). Locations of water purchases and allocations are shown in Figure 1(page 6).

Although the standardized system was used to the maximum extent possible, many contracts presented unique circumstances, and standard contracts were modified as needed. For example, because of shallow ground water levels in much of the Delta, fallowing contracts included requirements for controlling excessive vegetation to reduce water losses to the Water Bank. Ground water contracts included provisions for well activation and metering costs; in some cases, provisions to cover monitoring costs were included. Contracts with sellers who were shifting from surface supplies to ground water also required that the surface water be transferred only when the Delta was in balanced conditions to assure full benefit from the purchased water. (The Delta is "in balanced conditions" when the releases from upstream sources match the Sacramento Valley and Delta instream requirements, Delta water quality requirements, and Delta exports.)

Purchase Price: During early deliberations, the Water Purchase Committee spent considerable time on the difficult issue of establishing a fair and workable price for water. Typical prices of water in California reflect cost of development and give little or no consideration to the water's value to the user. It was clear that this time, the value to the potential user had to be considered. Early discussions covered prices ranging from $50 per acre-foot to $300 per acre-foot. DWR had purchased water in previous but less severe drought years for prices ranging from $11 per acre-foot to $45 per acre-foot, with the price increasing as the drought persisted. At the start of the Water Bank program, purchases focused on water from fallowed farmland, a primary factor in arriving at a price. The intent was to offer a price that would yield a net income to the farmer similar to what the farmer would have earned from farming plus an additional amount to encourage the farmer to enter into a contract with a new and untried Water Bank.

After taking a detailed look at farm budgets, talking to potential sellers and buyers, and getting advice from agricultural economists and others knowledgeable about crop water use, the price was set at $125 an acre-foot. Once negotiations began, it was difficult to change the established price. Relying on individual negotiations to set a different price would have caused unaffordable delays. Thus, the Bank paid $125 an acre-foot for water from all sellers. Late in the year, the SWP negotiated contracts for the purchase of 10,000 acre-feet at $50 per acre-foot and 10,000 acre-feet at $30 per acre-foot. The price reduction reflected the more favorable water supply and demand conditions. Among the factors contributing to the improved conditions were the ample March rains, a mild summer, and the remarkable success of the Water Bank and urban water conservation measures.

Fallowing: About 50 percent of Water Bank supplies came from fallowing farmland. The crop acreages and locations included in the program are shown in Table 2. The relative percentage of crop acreage included in the program varied significantly according to the type of crop being fallowed. For example, very little rice acreage was included in the program, but a large percentage of the Delta corn acreage was fallowed.

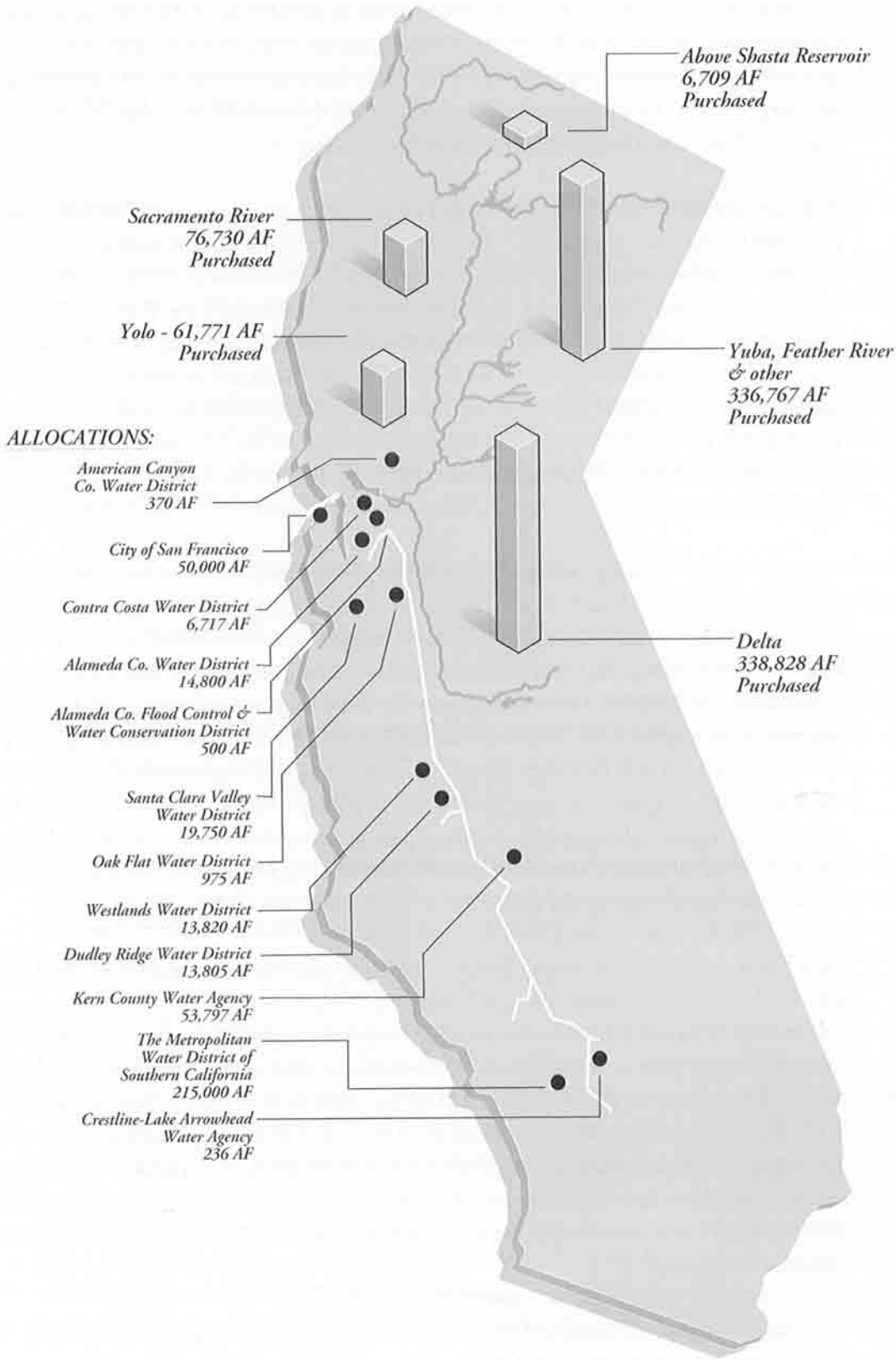


Figure 1. Drought Water Bank Purchases & Allocations

Table 3. Drought Water Bank Fallowing Payment Schedule for Representative Crops[1]

Irrigated Crop	Crop Water Use, Acre-feet per Acre[2]	$/Acre	Comments
Alfalfa	3.5	450	rounded amount
Dry Beans	2.1	263	
Field Corn	2.5	325	rounded amount
Pasture	3.5	450	rounded amount
Rice	3.5	450	rounded amount
Sugar Beets	3.0	375	
Tomatoes	2.5	325	rounded amount
Wheat, Barley[3]	2.0	250	prior to 3/1/91
	1.5	190	3/1/91 to 3/13/91
	1.0	125	after 3/13/91

[1] *Slightly lower values were used for crops grown in lower elevations of the Sacramento-San Joaquin Delta, due to the influence of seepage from surrounding channels. Most of the crops in the program are shown.*
[2] *The crop water use numbers in acre-feet per acre used in this table are the estimated crop water needs that were expected to be met by applied irrigation water. These amounts assumed minimum rainfall in 1991, similar to rainfall in 1977.*
[3] *Water savings for these crops depended to a large extent on rainfall. The initial value of 2.0 acre-feet per acre was progressively reduced over time due to the record high rainfall throughout March 1991. The initial value, like all values in the table, was based on an assumption of minimum future rainfall. Other crops were not reduced since they relied primarily on summer irrigation.*

Program participation requirements also varied by crop. Grain, pasture, and alfalfa were allowed if irrigation was withheld for the entire season. Land intended for corn, tomatoes, and other annual crops was left fallow. Asparagus was allowed if the crop was plowed under. Each fallowing method resulted in different projected impacts, and the March rains changed some expectations. As a case in point, many grain farmers in the Delta lowlands received nearly full crops, even though irrigation was withheld for the remainder of the season.

The amounts of water conserved by fallowing crops were calculated using information from a survey of crop water use conducted after the 1976-77 drought. The total acre-feet saved by fallowing a crop was estimated to be the net amount of applied water consumed by the crop. The price paid to fallow a specific type of crop was equal to the amount of water saved per acre multiplied by $125 per acre-foot. For example, the water conserved by fallowing an acre of sugar beets was estimated at 3.0 acre-feet; multiplying 3.0 by $125 resulted in payments of $375 per fallowed acre. Some of the resulting prices were rounded off to simplify negotiations.

Information from a study of the 1991 Drought Water Bank will be used to develop criteria for future efforts. Table 3 shows the estimated water savings by crop and the prices paid per fallowed acre.

Ground Water: Contracts involving the use of ground water in lieu of surface water accounted for roughly 33 percent of the water transferred to the Bank. Sellers agreed to pump ground water to irrigate crops and allow surface water they normally used to be transferred to the Water Bank. A few contracts addressed pumping of ground water for direct transfer to the Bank; these accounted for less than 10,000 acre-feet.

Ground water contracts involved a different set of problems than those associated with fallowing. The Bank had to determine whether the water was "new" non-surface water, often a complex task. Water was considered "new" if it had been made available to the State's supply system only because of actions undertaken as part of the Water Bank program. To ensure that the Bank received new water, well logs for each well were reviewed.

In many areas, the ground water basin is the major regional source of agricultural and urban supply. However, basin characteristics and conditions are often poorly understood. Concerns were expressed that ground water might be pumped for use outside of the basin. To address these concerns, the contracts with land owners who shifted to ground water and transferred surface water to the Bank required that the seller meter the ground water pumped. The local water district then released an equal amount of surface water to the Bank instead of the land owner. In this way, the pumped ground water was used on lands overlying its source.

The contracts for pumping ground water required slightly different provisions; many contained a range of water amounts due to variables affecting capacities of irrigation wells. Actual quantities pumped were measured directly and paid for, up to the maximum quantities stipulated in the contract.

Reservoir Storage Withdrawal: Withdrawals from reservoirs accounted for 17 percent of the total water delivered to the Water Bank. Transfers of water from a reservoir that is operated according to a State permit or license require a petition to the State Water Resources Control Board for a change in point of diversion, place, and purpose of use. Two Water Bank transfers, releases from storage facilities of the Yuba County Water Agency and the Oroville-Wyandotte Irrigation District, required petitions to the Board.

Allocations from the Water Bank

In its February 15 report to the Governor, the Drought Action Team stated:

> *"Water in the pool shall be allocated by the State for the purposes of firming up urban supplies to minimum levels, meeting critical agricultural uses, preservation of fish and wildlife, and carryover storage for 1992."*

When the water purchase contract was developed, participants anticipated that the critical needs outlined by the Drought Action Team would exceed available Bank supplies. Therefore, priorities were provided for in the buyer's contract to assure that the most urgent needs were met first. Allocations were made according to the following priorities:

- Water to meet identified emergency needs, such as health and safety.
- Water for areas with critical needs, defined as: urban water users with less than a 75 percent supply, agricultural users who needed water to assure survival of permanent or high-value crops, and fish and wildlife resources.
- Other critical needs, such as water to meet critical needs for the first few months of 1992, until next year's water supplies are known and are available.
- Water for entities previously receiving allocations for critical needs and who need additional supplies to reduce substantial economic impacts resulting from reduced water supplies.
- Carryover water for the SWP. SWP purchase of any remaining, unallocated Water Bank supplies provided the financial backstop for the program, with the remaining water saved in reservoir storage for later use should the drought continue.

On December 4, allocations from the Bank totaled 389,770 acre-feet. Locations and amounts of the deliveries are shown in Figure 1.

The Selling Price

The price for water from the Bank was set at $175 an acre-foot for water delivered as far as the SWP Delta Pumping Plant. This price covered: the purchase price ($125 an acre-foot); outflow requirements to move the water through the Delta, which reduced the net amount of water available for delivery; and the costs of monitoring and contract administration. Additional costs were charged for conveying the water to the places of use.

Most Bank water was delivered through SWP facilities. The costs of conveying the water through SWP facilities were accounted for in separate conveyance contracts. The SWP contractors who received water from the Bank paid primarily for the energy required to pump the water to the contractor's area. Non-SWP contractors were charged an additional use of facilities fee, which was a proportional share of the capital and annual costs associated with SWP facilities used to make the transfer.

Deliveries

The amount of water available for delivery during a given period depended on the source of the water. The mosaic of sources required substantial coordination to match storage and delivery operations with the availability of Water Bank supplies. To minimize alterations in SWP and CVP operations and maximize direct delivery of Water Bank supplies as they became available, water from the various sources was pooled and retained in the SWP-CVP system until the most opportune time for delivery. Ground water contracts provided that water be delivered only when the Delta was in balanced conditions. Water not delivered directly was stored upstream in reservoirs for later delivery south of the Delta.

Most of the water supply for the Bank was developed during the irrigation season; however, demand for the water did not run on the same schedule. For example, water not used for irrigat-

ing a corn crop during the normal irrigation season was retained in upstream reservoirs. Requests for deliveries extended from April 1991 through March of 1992. Re-regulation of reservoirs to store and release water at different times allowed a matching of supplies and demands.

Changes in SWP and CVP reservoir operations also provided an opportunity to reduce impacts to fisheries that could be caused by Bank operations. Water Bank supplies were moved through the Sacramento-San Joaquin Delta during September and October to keep impacts on salmon and striped bass at a minimum, an action made possible only because the Bank had used water from reservoirs south of the Delta to meet some of the demands.

Operation

SWP contractors experienced severe reductions in allocations for 1991 (reductions of 100 percent for agricultural users and, ultimately, 70 percent for municipal and industrial users). Implementing the Water Bank significantly improved deliveries of water to those SWP contractors who participated in the Water Bank, as well as increasing carryover storage in SWP facilities to aid in meeting 1992 demands.

The heavy March rains made it unnecessary to relax Delta water quality standards, which had been considered in February. However, the reduced instream flow and five years of drought had already placed the Delta in a vulnerable condition. Outlined below is the strategy that was followed to minimize fishery impacts in the Delta:

- Deferred May and June export pumping till later in the year to minimize impacts on striped bass eggs and larvae and on other organisms with similar needs.
- Made advance delivery of Water Bank water from San Luis Reservoir until water could later be transferred across the Delta.
- Transferred Water Bank water across the Delta later in the year to minimize impacts on striped bass, chinook salmon, and Delta smelt.
- Decided to plant additional yearling striped bass from hatcheries in May 1992 in consideration of cumulative and indirect impacts of Water Bank transfers.
- Retained maximum storage levels in Shasta Reservoir for the benefit of win ter-run salmon and conveyed Water Bank water across the Delta at times that would avoid potential impacts on migrating winter-run salmon.

DWR decided early in 1991 that it would minimize exports during May and June because of possible impacts to Delta fisheries. As originally proposed, Water Bank transfers would have increased diversion at the SWP's Delta pumping facility in July, August, September, and October. Analysis showed that pumping in July and August might capture substantial numbers of American Shad, Delta smelt, and striped bass at the export pumps. Therefore, pumping was rescheduled from July and August to September and October as far as was feasible under energy constraints.

The analysis of fishery impacts was based on a worst-case assumption that total Water Bank amounts minus carriage water requirements would be exported from the Delta. Many agencies that purchased water from the Bank had requested advance deliveries, and the analysis assumed that these requests would be met by transferring water through the Delta. However, the Bank released water to meet these requests from San Luis Reservoir instead. The water from San Luis was replaced in September and October when it could be moved through the Delta with minimum effects on fisheries. In addition, a portion of the water was held in reservoirs north of the Delta as carryover storage, reducing exports during 1991.

Water Bank Administration

In an endeavor as fast-paced and comprehensive as creating an emergency water bank, procedural aspects could turn into a tangled web of flow charts, formulas, agreements, permits, and documentation. Fortunately, past cooperative arrangements, such as the 1986 Coordinated Operation Agreement, provided structure for allocating water, accounting, timing and tracking deliveries, and other administrative procedures.

Coordination

Implementing the Water Bank program required careful coordination with several agencies, including the U.S. Bureau of Reclamation, the State Water Resources Control Board, the Department of Fish and Game, and local governments.

USBR: As operators of the CVP and SWP, the Bureau of Reclamation and DWR are jointly charged with maintaining water quality standards within the Sacramento-San Joaquin Delta. Water operations of both projects are coordinated by provisions of the 1986 Coordinated Operation Agreement. Under the COA, each project contributes a specific share of reservoir releases to meet in-basin uses, including the water necessary to maintain Delta water quality standards. For the conditions that prevailed through most of 1991, the federal share was 75 percent and the State share, 25 percent. In general, water made available by the Bank was considered new water under the COA and was accounted for separately from CVP and SWP supplies.

Coordination of the accounting function under the COA required intensive efforts by the Bureau and DWR. In late March, a joint Technical Review Team was formed to review details of proposed Water Bank contracts for sources of water outside the Delta. Nearly all of the contracts with sellers located north of the Delta received concurrence on quantities of water involved prior to approval.

The review did not extend to Delta contracts or to Sacramento River contracts with farmers who do not have a settlement contract with the Bureau. The final Water Bank balance was based on a detailed analysis by the Bureau and DWR, which established a method of accounting for water made available by the fallowing contracts. The method used accounted for the heavy March rainfall and fine-tuned assumptions about agricultural water use. The difference between the quantity of water purchased by the Water Bank and that accounted for by the COA was about 60,000 acre-feet, of which roughly 30,000 acre-feet was attributed to the March rainfall. The March rainfall was subtracted from water savings attributed to fallowing Delta grain crops, which

were initially assumed to require irrigation during the winter due to extremely dry conditions in December 1990 and January and February 1991.

SWRCB: The State Water Resources Control Board is responsible for administration of appropriative water rights within the State. Petitions for changes in point of diversion, purpose, or place of use of a post-1914 appropriative right must be approved by the Board before water can be transferred. In addition, the Board is responsible for Delta water quality standards contained in Decision 1485, which affects both the CVP and DWR. DWR reported to the Board on the proposed operation of the SWP and the Water Bank. Two Water Bank transfers, releases from storage in facilities of Yuba County Water Agency (New Bullards Bar Reservoir) and Oroville-Wyandotte Irrigation District, received Board approvals for changes in place of use.

DFG: One of the Governor's purposes in establishing the Water Bank was the protection of fish and wildlife and their habitat. Five years of drought had placed considerable stress on much of the Central Valley's wildlife. The winter-run chinook salmon, which had been placed on the federal endangered species list, was a particular concern. Additional concerns were Central Valley wildlife refuges and Delta fisheries. DWR cooperated with the Department of Fish and Game to minimize the impacts to fish and wildlife from the drought and SWP operations. This cooperative effort resulted in significant modifications to SWP operation, including Water Bank transfers. For example, one priority for the Bank was to keep water in Shasta Reservoir for temperature control for the 1991 fall- and winter-run salmon, as well as a contingency supply for 1992.

DFG worked on several proposals to provide additional water to Central Valley refuges in the fall. The Yuba County Water Agency transfer from New Bullards Bar included 28,000 acre-feet of water, at a reduced cost, to DFG for fish and wildlife uses at Graylodge, Los Banos, Volta, and Mendota wildlife management areas.

Local Government: Concern over impacts to local economies and water resources were expressed in many areas affected by Drought Water Bank operations. Considerable effort was and is being made to evaluate those concerns.

Impacts on ground water resources generated concern in both Yolo and Butte counties. Yolo County relies heavily on ground water. The Yolo Bypass area also has a documented problem of subsidence, which caused concern about flood protection. To help alleviate these concerns, a monitoring program was established to study water levels and quality, aquifer characteristics, and subsidence. The program, specified in a Memorandum of Understanding between the Conaway Conservancy Group and Yolo County, was jointly funded by the Water Bank and the water sellers. The contract also provided for reimbursement to the sellers for a 2 percent payment to Yolo County on contracts involving any transfer of ground water. Funds generated by this fee will be used to update the county's water plan. The data compiled as part of the monitoring program will also be valuable in gaining a better understanding of the area's long-term ground water resources.

Butte County also expressed concern over the impacts to the ground water resources within the county. DWR agreed to help fund the county's water plan development through similar 2 percent payments for contracts involving ground water within the county.

The economic impacts of the Water Bank were and are of particular concern to Delta counties. Local economies in this region depend heavily on agriculture and related businesses, and onlookers were aware that many Delta farmers were participating in the Water Bank program.

Extensive efforts are being taken to evaluate the economic impacts of the Water Bank on the local area and to evaluate operational changes that may mitigate impacts of future water transfers. Information about Water Bank program impacts will be published in a report that should be available by fall 1992.

Program Monitoring

Programs were developed for monitoring fallowing and ground water pumping to ensure compliance with contract provisions. A summary of the monitoring activities follows.

Fallowing: The program for monitoring fallowing in the Delta included two flyovers of the Delta and at least two detailed field evaluations or evaluation of aerial photographs for each contract. The first flight was conducted during the week of June 10, 1991, and the second the week of August 19, 1991. The photographs were evaluated to assess the effectiveness of the fallowing program as well as contract compliance.

Generally, compliance was good. Potential problems were dealt with case-by-case to verify facts. Where irrigation water was applied to the land in violation of the contract with the Water Bank, the liquidated damages can result in a demand for an amount equal to double the quantity received by the grower.

The monitoring program for contracts involving fallowing of land north of the Delta included at least one flyover of all the major areas defined in contracts covering the region. Field verification was similar to the Delta verification program. Compliance has been good.

Ground Water Monitoring: The ground water monitoring program for the Yuba County area included monthly monitoring of about 70 to 80 wells that DWR normally monitors on a semi-annual basis. In addition, five data loggers were installed to record well levels on an hourly basis in areas where ground water level variation was of particular concern. Specific capacity data was collected on as many wells as possible as part of the monitoring program.

Water level monitoring equipment was installed in wells in Linda, Olivehurst, Wheatland, near Beale Air Force Base, and near a subdivision which was experiencing a drop in domestic well levels. Data is being collected from the monitoring wells for one year to evaluate aquifer response to the pumping as well as recovery.

Approximately 100 wells that are part of DWR's usual semi-annual monitoring program in Butte, Colusa, and southern Glenn counties were monitored monthly from June through the fall. Several contracts covering ground water pumping in the area did not specify the source of reductions in surface water diversions, and the methods of calculating water savings were left to the discretion of the districts selling water. Each contract area was visited, however, in an effort to assess the source of water savings.

Assembly Bill No. 9

CHAPTER 1

An act relating to water, and declaring the urgency thereof, to take effect immediately.

[Approved by Governor April 17, 1991. Filed with Secretary of State April 19, 1991.]

LEGISLATIVE COUNSEL'S DIGEST

AB 9, Cortese. Water transfers.

(1) Existing law authorizes any water supplier that has an existing right which
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Assembly Bill No. 10

CHAPTER 2

An act relating to water, and declaring the urgency thereof, to take effect immediately.

[Approved by Governor April 17, 1991. Filed with Secretary of State April 19, 1991.]

LEGISLATIVE COUNSEL'S DIGEST

AB 10, Costa. Water transfers.

(1) Existing law authorizes various short-term and long-term transfers of water.

This bill would provide that no temporary water transfer made pursuant to any provision of law for drought relief in calendar years 1991 and 1992 shall affect any water rights.

(2) The bill would remain in effect only until January 1, 1993.

(3) The bill would declare that it is to take effect immediately as an urgency statute.

The people of the State of California do enact as follows:

SECTION 1. (a) No temporary transfer of water made pursuant to any provision of law for drought relief in calendar years 1991 and 1992 shall affect any water rights.

(b) This section shall remain in effect only until January 1, 1993, and as of that date is repealed, unless a later enacted statute, which is enacted before January 1, 1993, deletes or extends that date.

SEC. 2. This act is an urgency statute necessary for the immediate preservation of the public peace, health, or safety within the meaning of Article IV of the Constitution and shall go into immediate effect. The facts constituting the necessity are:

In order to facilitate the transfer of water to respond to water shortages which this state is currently experiencing, thereby protecting the public health and safety, it is necessary that this act take effect immediately.

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The Drought Water Bank probably would not have gotten off the ground as quickly as it did had it not been for two key pieces of legislation:

Chapter 1, Statutes of 1991, gave water suppliers explicit authority to enter into contracts, either with the Water Bank or with other water suppliers, for transfer of water outside the service area of the water supplier.

Chapter 2, Statutes of 1991, declared that no temporary transfer of water under any provision of law for drought relief in 1991 or 1992 will affect any water rights.

The ground water monitoring program in the Yolo Bypass area encompassed all the region's ground water contracts and included a component for monitoring land subsidence. Additional elements of the monitoring program included equipment for monitoring ground water levels, collection of water quality data, and aquifer testing.

Third Party Impacts

Concerns about the side effects of transferring water from other uses to the Drought Water Bank were expressed in many areas of the State. Some of the more pressing issues had to do with effects on local agricultural-based economies, ground water basins, and the environment.

About 420,000 acre-feet of water was transferred to the Water Bank by withholding irrigation from agricultural land; this represents roughly 166,000 acres of farmland, of which almost two-thirds was fallowed. The remainder of the acreage was in grain, pasture, or alfalfa; although irrigation was withheld from these crops, they were dry farmed.

A preliminary survey of potential third party impacts from Water Bank operations was conducted in May 1991. The survey focused primarily on the impacts of sales by Delta farmers to the Water Bank, because of the high percentage of participants in the Delta. The agribusiness firms thought to be affected most by water sales are small- and medium-sized agricultural haulers that transport, and sometimes store, Delta farm output. In the Delta, the potential impacts appeared to be greatest around Clarksburg. In terms of significance within a crop category, the heaviest impacts were expected in industries related to the sugar beet crop, and substantial overall economic impacts were expected in corn crop industries.

Delta corn growers signed contracts covering nearly 50,000 acres, approximately 66 percent of the Delta's corn, and 38 percent of the corn in the four-county area (San Joaquin, Sacramento, Yolo, and Solano counties). These acres are in addition to acres idled by government commodity programs.

Agribusiness firms expected to feel the second heaviest negative impacts from water sales were those serving farmers in Solano, Yolo, Sacramento, and San Joaquin counties by providing custom grain harvesting or by buying, selling, or storing locally-grown grains. The study did not evaluate positive third party impacts of water deliveries to areas buying water from the Bank . A more detailed study is being conducted to gather data on the impacts of the program.

DWR has contracted with the RAND Corporation to conduct a study of the economic impacts of the 1991 Drought Water Bank. The study is to evaluate the Bank's effects on agricultural operations and analyze impacts in both the areas transferring water and those receiving water. Its findings should provide valuable insight into cause-and-effect relationships associated with water transfers in California. Preliminary seller survey results are expected in early 1992; final results are expected in fall 1992.

DWR economists are interviewing urban water agencies that purchased water from the Bank to determine the effect of additional supplies on 1991 water management decisions. Based on this

information, economic benefits to residential, commercial, and industrial sectors will be estimated using data from previous studies relating economic impacts to urban water shortages.

Significant third party effects are not limited to fallowing contracts. The impacts of ground water extractions can also be significant. These impacts include lowered ground water levels, increased pumping costs or costs for deepening wells, and potential subsidence. As previously discussed, several extensive ground water monitoring programs were conducted under the Water Bank program. The data on aquifer characteristics compiled by these studies will be valuable to local water managers and other agencies charged with managing natural resources.

Environmental Concerns

The effects of the drought on the Central Valley's fish and wildlife and their habitat were of particular concern. Modifications to SWP operations, including Water Bank transfers, were made to minimize impacts on Delta and Sacramento River fisheries.

Contract requirements for controlling excessive vegetation on Delta lands may have resulted in some unanticipated impacts to wildlife resources. Sellers were required to control excessive vegetation on fallowed property to limit evapotranspiration from weed growth to reduce water losses from subsurface seepage. One option the farmers had was to disk the property, which had to be timed carefully to minimize impacts on birds that nest on the ground. Closer coordination will be encouraged in any future contracts to avoid such impacts.

Although Water Bank operations were designed to have minimum impacts on fisheries and wildlife, not all impacts could be eliminated. To mitigate the indirect and cumulative impacts of water transfers on striped bass, DWR purchased an additional 300,000 yearling striped bass from brood year 1991 for release in the Delta, under an agreement with DFG.

Purchase of water upstream of the Butte Sink resulted in concerns over the adequacy of supplies for wildlife refuges and waterfowl habitat within the Butte Sink. To address these concerns, the various interests met to negotiate a solution. A five-party agreement was executed which provided sufficient water for waterfowl habitat, a commitment to work on long-term solutions to problems in the region, and development of a comprehensive water management plan by the waterfowl association members. Western Canal Water District, Butte Sink Waterfowl Association, DWR, DFG, and the U.S. Fish and Wildlife Service are all parties to the agreement.

The fallowing of large areas in the Delta also raised concerns regarding waterfowl habitat. Several Delta fallowing contracts were modified to allow early flooding to provide habitat. Many of the flooded areas attracted significant amounts of waterfowl.

Water Bank operations provided some benefits to fish and wildlife that would not have been incurred in a "no-Bank" situation. Capture of juvenile fish in unscreened pumps and diversions in the Delta and Sacramento River were reduced since water diversions to farmland were reduced under the fallowing contracts. Fallowing lands also provided the opportunity to retain more water in reservoirs until later in the season, helping to cool fall river temperatures to the benefit of salmon. The reduction of irrigated acreage also reduced salts and chemical loading in return flows during a prolonged period of low river flows.

Water Bank Effectiveness

The landslide of activity and sea of paperwork that established the 1991 Drought Water Bank raised hopes as well as water levels. Thanks to stringent water conservation practices, plentiful March rains, and a mild summer, conditions that could have been disastrous in some areas were made bearable. The large-scale water transfer program was implemented in less than 100 days with the help of the entire water community, and important links with local water interests and local government were established for future programs. The operational flexibility of both the SWP and CVP proved advantageous in conveying water through the Delta to minimize impacts to fisheries. That flexibility, the March rains, and the Water Bank enabled suppliers to meet all critical needs for water.

Work on the 1991 Drought Water Bank continues. Followup monitoring of ground water levels is proceeding, land use surveys are being completed, and evaluations of the 1991 program are being conducted to develop recommendations to aid in future water banking operations.

A two-day workshop for Water Bank staff was held in July 1991 to evaluate the Bank's effectiveness and identify areas for improvement. The primary goal was to develop a foundation for any future water banking operations. Some of the areas of improvement that came clear during the evaluation include how to better:

- reduce negative third party impacts
- streamline the regulatory process and break down institutional barriers to water transfers
- price water so that critical needs are consistently met
- spread the burden of risk and finance such large-scale, multifaceted programs

To supplement the staff critique, DWR contracted with three consultants to interview a representative sample of buyers, sellers, environmental organizations, and third party interests and provide an independent evaluation of the program.

The 1991 Drought Water Bank is an example of what can be created with resourcefulness and cooperation. Over 800,000 acre-feet of water was developed in a short time because all of the participants were committed to the program's success. The lessons learned will help in future water banking endeavors. California has steadily progressed in the areas of water conservation and reuse, conjunctive use techniques, and timing deliveries to increase efficiency. These methods, along with traditional projects and water banking, can help California meet its increasing water demands. With refinements, water banking may someday become an integral part of the State's water distribution system.