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# THE EXPANDING CALIFORNIA WATER SYSTEM

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In July 1980, the California legislature authorized expansion of the State Water Project. This monumental $20 billion undertaking would greatly enlarge the present California water storage and transportation system, already the largest in the world. The central and most controversial feature of the proposal is the Peripheral Canal, which would transfer water around the Delta formed by the confluence of the Sacramento and San Joaquin rivers at the head of San Francisco Bay. Also included in the package is the largest storage reservoir in the State, together with various other dams, canals, and structures to mitigate environmental impacts.

The State Water Project expansion is not only the biggest public works project in California's history, it is also one of the most bitterly contested political issues. Accordingly, the people of the State should be apprised of the following: (1) some background on water development in California; (2) the legislative history of the proposal; (3) political alignments; (4) principal features of the expansion package; (5) the central issue dividing opinion, i.e., whether water quality in the San Francisco Bay and Sacramento-San Joaquin Delta can be safeguarded when the Peripheral Canal is in place; (6) the larger questions of whether additional water transfers are actually needed or economically rational; and (7) alternatives to the construction of new water supply facilities—alternatives which follow from our conclusion that further water system expansion at this time is economically and environmentally unsound.

## FOUR STAGES OF WATER DEVELOPMENT

As the population in the cities and the area of irrigated land exploded in California during the last decades of the nineteenth century, it quickly became apparent that individual initiative and private enterprise would not be sufficient to provide an adequate supply of water. City governments and the State legislature were therefore called upon for aid. In 1887, the legislature enacted the Wright Act, authorizing the formation of local irrigation districts with the power to secure water rights and to finance storage and conveyance structures by means of the property tax. At the turn of the century, Imperial Valley growers became the first agriculturalists to attempt a major interbasin transfer, from the Colorado River. Carried out by a private ditch company, this experiment came to a disastrous end in the floods of 1906-07; a public irrigation district was formed soon thereafter to try again. In the years before the First World War, the cities of San Francisco and Los Angeles reached out hundreds of miles for water from the streams of the Sierra Nevada via the Hetch Hetchy and Owens Valley aqueducts.

By the 1920s, however, strictly local efforts were deemed inadequate for future supplies and new plans were set in motion. Thus began the second stage of public water development. In 1924, the cities of the East Bay formed the East Bay Municipal Utility District (EBMUD) and began importing Mokelumne River water in the early 1930s. San Jose and Santa Clara County organized a Water Conservation District to build a unique local system for ground-water recharge in the 1930s. Los Angeles, which surpassed San Francisco as the largest metropolis of the State during the twenties, had the grandest design of all: importing water from the Colorado River. For this purpose a Metropolitan Water District (MWD), embracing all of urban Southern California (inciuding San Diego) was formed in 1927. Imperial Valley Irrigation District also had plans for the Colorado

River water, so they allied themselves with the Southern Californians to promote Federal aid for the largest water storage project yet conceived. The Boulder Canyon Project Act was passed in 1928 and Hoover Dam completed in the early 1930s. This regulated the river's flow sufficiently to allow diversion and storage dams to be built downstream for MWD's Colorado Aqueduct, completed in 1940, and Imperial's All-American Canal, completed in 1942.

Meanwhile another ambitious program of water development was being conceived in the heart of California's agricultural land—the Great Valley. Central Valley growers looked for their solution to the regulation, storage, and transfer of the rivers of the Sacramento-San Joaquin system, especially the Sacramento. In 1921, the State legislature asked the State Engineer to draw up a comprehensive plan for water development. Such a plan was published in 1930 as the first State Water Plan and became the basis for the Central Valley Project (CVP). The CVP was approved by the legislature and the voters in 1933, but because of the Great Depression, the State was unable to undertake such a massive venture. Project backers were then able to interest the Federal government in the CVP as a New Deal public works project under the Bureau of Reclamation (now Water and Power Resources Service, WPRS). The principal features of the CVP—Shasta Dam, the Delta-Mendota Canal, Friant Dam, and the Friant-Kern Canal—were completed shortly after the Second World War.

The post-war era brought planning for the third phase of public water development. In particular, Central Valley growers were restive with the acreage limitations and residency requirements incorporated in the Federal Reclamation Law. They were also in the process of expanding the area of irrigated agricultural land farther south and west in the San Joaquin and Tulare basins. Various strategies were pursued, such as a congressional amendment to the Reclamation Act, State buy-back of the CVP, and working with the Corps of Engineers in place of the Bureau of Reclamation. The first two failed. The Corps successfully built dams on several rivers but had to relinquish operation to the Bureau. Enforcement of the Reclamation Law, however, was rendered moot by agency practice.

The growers also looked to the State for a new round of construction. They were joined by the Metropolitan Water District of Southern California seeking future water supplies for urban growth south of the Tehachapis. The legislature authorized a set of studies in 1947 which came to fruition with the 1957 publication of the California Water Plan (California Department of Water Resources 1957). A portion of the plan, designated as the State Water Project (SWP), was adopted by the legislature in 1959 under the Burns-Porter Act. The necessary bond issues were approved narrowly by the voters in 1960, following an intense political battle. Construction of the key features—the Oroville Dam on the Feather River and the California Aqueduct—got underway as soon as water contracts were signed. Water deliveries began in the late 1960s, and construction was essentially complete by the early 1970s.

The main target areas of the State Project are Kern County, at the south end of the Central Valley, and the urbanized south coast. (It also delivers CVP water to the Westlands Water District, Fresno County, under the joint Federal-State San Luis unit agreement). The State Water Project thus joins Central Valley irrigation and metropolitan Los Angeles in a single system.

Expansion of the State Water Project would simply mark the fourth and latest stage of state-aided water supply expansion—an event we have come to expect with each new generation. The claim of project supporters that the new authorizations are merely to complete an unfinished SWP, since a cross-Delta facility was mentioned in the California Water Plan but never constructed, is not convincing for the following reasons: (1) twenty years have passed since the SWP was authorized; (2) the cost is many times the original SWP bond issue; (3) authorization of the Peripheral Canal in the Burns-Porter Act is questionable; (4) the addition of features other than the Canal is supposed to double SWP water yield. We will therefore refer to the new legislative package as SWP-Phase II (cf. California Department of Water Resources 1976a).

## LEGISLATIVE HISTORY OF PHASE II

Agitation for the Peripheral Canal began soon after the State Water Project was launched. In 1966, the Department of Water Resources, which administers the project and oversees the California Water Plan, officially designated the canal as the Delta-transfer facility mentioned in the Water Plan. It has been embroiled in controversy ever since. An environmental impact report issued in 1974 by the Reagan administration drew such a strong reaction that the incoming Governor, Jerry Brown, ordered a new study of "Delta Alternatives." After several draft reports, the Peripheral Canal emerged once more as the official favorite (California Department of Water Resources 1976a; Robinson 1977a). It had become clear in the meantime, however, that the canal could not by itself meet the future water demands likely to be made on the State system nor answer the protests of those concerned about Delta water quality. Therefore, large new storage, conveyance, and mitigation plans were added to the final package offered by the Brown administration to the legislature as a "compromise" solution (California Department of Water Resources 1976a, 1977b).

After two years of bitter wrangling, the first project bill, SB 346, died in August 1978 for want of senate concurrence with assembly amendments despite strong backing by the Governor. A crucial barrier was the two-thirds vote required for passage of an appropriations bill. Although the massive bond issues necessary to build such a project were not brought before the legislature (or the voters), as in 1959-60, the $50 million spending proposal for water conservation in SB 346 made a two-thirds majority necessary. This requirement was dropped from the new authorization bill, SB 200, introduced and passed in 1979. That bill was signed into law in 1980. Nonetheless, the political battle has not let up.

Opponents immediately circulated a petition to refer the law to popular vote. The referendum qualified in early October 1980 with more than 800,000 signatures--the first such measure to qualify in California since 1952. It attracted more signatures than any other voter petition in the State's history. The date of the election is not yet known. Normally, it would be taken up at the next state-wide general election in June 1982, but many politicians are uncomfortable about running with this issue on the ballot, so there is pressure on Governor Brown to call a special election sometime before that date. Complicating matters further is the passage of Proposition 8, an amendment to the State constitution approved in November 1980. Proposition 8 specifies that water quality in the Delta be maintained and confirms the status of California's North Coast rivers in the State's Wild and Scenic Rivers System. Such status could be removed, however, by a two-thirds vote of the State legislature. Ironically, Proposition 8 was placed on the ballot by Southern California legislators eager to demonstrate their commitment to protect the Northern California environment in order to quell protests from that region. A majority "no" vote on the referendum would repeal both SB 200 and Proposition 8.

## POLITICAL ALIGNMENTS

Support of Phase II of the State Water Project (SWP) comes principally from areas of Southern California that will receive the water. The urban forces are led by the Metropolitan Water District of Southern California (MWD), and Southern San Joaquin Valley (Tulare Basin) growers are represented chiefly by the Kern County Water Agency (KCWA). MWD and KCWA act as wholesale agencies, buying water from the State Department of Water Resources (DWR) and selling it to member irrigation districts, water supply districts, and city water departments. MWD services all of metropolitan Southern California, although the city of Los Angeles draws most of its water from the Owens Valley. Together MWD and KCWA purchase about 75% of project deliveries. Most southern growers who are not direct beneficiaries also support Phase II expansion either because of general approval for agricultural water development or to ease competitive pressure on water supplies.

Four basic arguments are made in favor of building Phase II. First, both MWD and valley irrigators point to contractual obligations incurred by the State that cannot be met with existing storage and delivery capabilities. Second, the MWD fears the loss of over half its minimum entitlement to Colorado River water by 1985, as Arizona begins to exercise its rights to a larger share. Third, many valley growers are faced with a falling water table that makes drilling and pumping increasingly expensive and causes ground subsidence in some places. Fourth, all users claim a future need based on projections of past and present use.

Arrayed against the water industry is a coalition, based principally in Northern California, opposed to further water development. The most determined opponents are the farmers of the rich agricultural Delta region, who draw water directly from Delta channels to irrigate their crops. Salt water from the Bay can penetrate the Delta in the summer when runoff from the Sacramento and San Joaquin rivers is low, damaging water quality. Upstream storage reservoirs allow releases of fresh water that keep the salt water at bay. Delta farmers fear that further diversion to the south will jeopardize their water supply.

Further opposition comes from Bay Area municipalities concerned about the detrimental effects on the Bay of reduced fresh-water outflow from the Delta. They worry about the loss of Bay "flushing" and possible neutralization of the gains in water quality achieved through large investments in pollution control made during the last decade.

Regional economic interests in the northwest portion of the State also oppose Phase II of the SWP. They question the long-range plans of the water industry to divert the waters of the last significant undammed rivers in California—the Eel, Klamath, Trinity, Van Duzen, and Smith—because these are the main local natural resources (after timber) and a probable basis for future regional development. Their fears appear to be well grounded, despite the protection afforded by the California Wild and Scenic Rivers Act of 1972. Plans for extensive North Coast impoundment and transfer have long been on the books of various water resources agencies (Harding 1960; Humlum 1969; California Department of Water Resources 1957). By law, the status of the Eel River must be reconsidered in 1983. Many water industry officials are frank about their intent to repeal the protection law and dam the Eel. And the planned additions to the State Water Project make the next step of tapping the North Coast much easier, geographically and economically.

Environmentalists and sportsmen share the fears of the others regarding Bay water quality, the fate of the Delta, and the future of the North Coast rivers, although they generally do not share the pro-development bias of regional interests. Particular concern involves the loss of fish and wildlife that depend on the Bay-Delta estuarine system, as a result of declining water quality. The 89,000-acre Suisun Marsh constitutes 10% of California's wetlands and is a major stop along the Pacific Flyway. Large numbers of migratory salmon and striped bass also pass through the Bay system each year, the latter spawning in the Delta.

Environmentalists have often been split over tactics, however. For example, in 1978 the Sierra Club supported the Brown administration's strategy of incorporating legal protections for Delta water quality *within* the Phase II legislation. The Club's leadership argued that unless the compromise bill were accepted, a worse one with no environmental safeguards whatsoever might be enacted in years to come. Other environmental groups, such as Friends of the Earth (joined by Delta farmers), put little faith in government promises about water quality protection *after* the Peripheral Canal is completed, removing the principal obstacle to greater water withdrawal. Opposition within the ranks of the Sierra Club subsequently forced the leaders to retreat to a neutral position.

After SB 200 was introduced in 1979 to replace SB 346, most of the neutral environmental groups actively opposed it, because it significantly weakened the safeguards contained in the earlier bill. But when Proposition 8 was enacted, the split again emerged, some parts of the environmental community opposing the referendum because it would void Proposition 8's constitutional protections.

A split has also plagued the forces normally favoring water development. Many valley water

districts, the California Farm Bureau Federation, and several Republican senators representing Southern California refused to support SB 346 in 1978 because they felt that Delta environmental protection measures were too strong and could prevent delivery of water. The same groups supported SB 200, since it removed many of the protective measures contained in SB 346. After Proposition 8 was enacted by the voters, however, they began supporting an anti-Phase II "no" vote on the referendum. They hope to void Proposition 8 and SB 200 so that a water development bill with no environmental protection can be introduced into the legislature.

As if all this were not complicated enough, the Metropolitan Water District separated from its pro-canal allies to endorse Proposition 8. This move was apparently a tactic to undermine the referendum effort and to ward off more stringent protection for the North Coast rivers. For when Governor Brown requested that the U.S. Department of the Interior designate these as *Federal* Wild and Scenic Rivers, the MWD sued to block action by the outgoing Carter administration. (Secretary Andrus acted favorably on Brown's request before leaving office, but the matter is not yet fully resolved.)

Nor is the commonly alleged schism between north and south, seen in purely geographic terms, a reality. In Southern California there are not only differences of opinion over tactics, but a real clash of economic interests over who pays and who benefits. The strong current of fiscal conservatism that swept Proposition 13's tax limitations into law runs counter to the big-spending penchant of the water industry, and some environmental opposition exists as well. Nor is the north solidly against the Peripheral Canal and Phase II, despite a higher overall level of voter awareness and intensity of regional feeling.

Thus, the Governor's effort to unify the State politically behind plans to expand the State Water Project (by providing legal safeguards for the Delta and North Coast rivers) has not been successful. Fundamental conflicts over both economic and environmental interests are not so easily reconciled.

## PRINCIPAL FEATURES OF PHASE II

### The Peripheral Canal

Water planners face a basic geographic discrepancy in water supply and demand. The area of greatest rainfall and the largest rivers is in the northern third of California. The Sacramento River has an average flow of 23 million acre-feet (maf) per year and the San Joaquin 6.3 maf. Together, they carry roughly 40% of the total runoff in the State. Less than 15% of the outflow of California's rivers occurs south of San Francisco. The main storage dams of the State Water Project and Central Valley Project are located on the Sacramento system—CVP's Shasta, and Folsom, and SWP's Oroville. To the south lie the arid regions, much of the State's arable land, and the majority of its people. In the middle of the State, however, lies a major obstacle to water transport: 1,100 miles of meandering channels and 738,000 acres of islands, comprising the largest inland delta in the conterminous United States. Some 5 to 6 maf of water per year are pumped from the south edge of the Delta into two man-made rivers—the California Aqueduct (SWP) and the Delta-Mendota Canal (CVP)—for delivery to 76 contracting agencies. The purpose of the Peripheral Canal, then, is to span the Sacramento-San Joaquin Delta with an efficient large-scale conduit to move more water from the northern part of the State to the south.

When the giant project pumps are operating at capacity, however, water does not move so much across the Delta as around it, traveling down the main channel of the Sacramento River and then being pulled back around the westernmost island. This "reverse flow" drags salt water back with it from the tidal zone where the Delta's fresh water mixes with the San Francisco Bay's salt water. In summer, lower river flow and maximum water demands coincide to make the problem worse.

Saline intrusion into the Delta has four major impacts: (1) Water users to the south do not want salty water, so the agencies are limited in the amount of water they can pump. (2) Delta farmers are directly affected by saline conditions. Very low water during dry years such as 1976-77

has already seriously jeopardized agriculture in the western and southern Delta. (3) Homes and industries in northern Contra Costa County are serviced with water drawn from the Delta via the Contra Costa Canal. In the spring of 1977, during the drought, water quality was seriously lowered; intake water at Rock Slough failed to meet health standards on all but four days. The State had to build emergency rock barriers across several channels to keep back the salt water. (4) The Delta and adjoining Suisun Marsh are at various times home, breeding ground, and migratory way station for many waterfowl and fish, including king salmon and striped bass. High salt levels affect these species in ways which are not well understood but which are very likely detrimental. In addition, the "reverse flow" confuses migrating fish and the project pumps ingest millions of fry and eggs. Together, these effects have had a serious impact on fish populations.

The water agencies hope that the Peripheral Canal will solve all these difficulties as well as fulfilling its primary purpose of moving the water south. The canal would be an unlined ditch, 43 miles long, 400 feet wide, and 30 feet deep, with a capacity of 16.3 maf per year—enough to carry over 70% of the average flow of the Sacramento. It would skirt the east side of the Delta, pumping water directly from the Sacramento near Hood and deliver it to Clifton Court Forebay. Along the way it would have 12 gates from which water could be released into the channels of the Delta to create a westward flow. The Department of Water Resources claims that the canal will augment delivery capability by 1 maf per year.

### Remainder of the Phase II Package

By itself, however, the Peripheral Canal cannot solve the problems of the Delta, nor even meet the goals of the water industry for supply expansion to meet an estimated Delta export demand of 7.5 maf by the year 2000. As a result, a complementary system of storage and conveyance facilities has been proposed by DWR (California Department of Water Resources 1976a, 1977b). This system would increase the delivery and storage capability of the CVP and SWP by about 3 maf and make it easier to meet commitments during water-short years. It includes the following facilities: (1) Storage facilities north of the Delta: the Cottonwood Creek project (two reservoirs), and the Glenn Reservoir and diversion complex (or, alternatively, the Colusa Reservoir complex). All these are off-stream storage areas located on the west side of the Sacramento Valley. Glenn would be the State's largest reservoir at 8.7 maf (as compared to Shasta's 4.5-maf capacity). (2) Facilities in the Delta: the Peripheral Canal, relocation of the Contra Costa Canal intake to Clifton Court, southern and western Delta water quality improvement structures, and Suisun Marsh protective structures. (3) Components south of the Delta: Los Vaqueros unit (two reservoirs west of Clifton Court); if needed, Los Banos Grandes Reservoir, near San Luis Reservoir; unspecified additional service to the Bay Area; and ground-water storage works and waste-water reclamation projects.

Phase II also contains certain innovations heralded by its proponents as differentiating it from previous water projects. Delta water quality and wildlife protection are mandated. Use of the Canal by the Federal CVP will be allowed only if Congress orders the Water and Power Resources Service (WPRS) to operate in accordance with California Delta water quality standards. (The original bill, SB 346, required Federal participation in financing the canal but this was dropped from SB 200 at the request of pro-development forces.) Water conservation and waste-water reclamation are declared to be goals of State water policy. Funds targeted for agricultural conservation loans and reclamation facilities in SB 346 were dropped from SB 200, however. Finally, the package includes as goals ground-water restoration and storage (the Brown administration would like to see reform of water rights laws to achieve conjunctive use).

In all, the cost of the package is just short of $20 billion, not $7 billion, as claimed by DWR. Their figure includes only those facilities they expect to build prior to 2000. SB 200 in fact obligates the State to build not just dams and canals, but power and pumping facilities, additional capacity for the California Aqueduct, and some minor appurtenant facilities. The total cost of these facilities is $19.6 billion, over $1 billion of which goes to the Peripheral Canal.

## PROTECTING THE BAY-DELTA ENVIRONMENT

Debate over Phase II of the State water project centers on whether certain water management measures and legal safeguards offset the effects of increased withdrawals from the Bay-Delta system. Many backers of the project, including administration officials, see it as an environmentally sound alternative to the present degradation of the Delta. Project opponents claim that these measures are insufficient to protect the Bay and Delta, arguing that (1) the environmental impacts of Phase II are poorly understood, and (2) the formal protections would be unable to withstand future political pressure to relax or eliminate them.

### Unresolved Environmental Problems

Several problems remain unresolved even if the Peripheral Canal is constructed, despite the claims of its supporters. They involve Delta circulation, performance of fish screens, water quality protection in the Bay and Delta, and increased agricultural runoff.

First, if the Federal government does not participate in use of the canal, the two water projects will be operating at cross-purposes, with uncertain consequences for Delta circulation and CVP operations. If WPRS continues to draw from Delta channels, the reverse-flow problem may not be corrected. Department of Water Resources studies of the canal's effects on the Delta have never taken this contingency into account, so confident are they that the Federal government will participate. Yet even the pro-canal California Department of Fish and Game admits the operation of the CVP through the Delta would have unknown effects on water quality and fish and wildlife.

Second, the Peripheral Canal will shift the point of intake 40 miles north to the Sacramento River, but will not eliminate one basic problem, namely, that millions of fish eggs and fry are now sucked into the Delta pumps every year, despite attempts to devise a system of screens. According to fishermen's reports, more bass are now to be found in San Luis Reservoir than in the Delta. In recognition of this problem, DWR proposes that a secure screen be installed at the head of the canal. Furthermore, the DWR proposes that the Canal be constructed in three segments that could not be connected until effective screens were developed and demonstrated. The State Department of Fish and Game, which supports Phase II, claims that development of an effective fish screen is close at hand, but the U.S. Fish and Wildlife Service disagrees (Sweeney 1979). Project opponents ask why it is assumed that such screens can be invented if specialists have thus far found it an impossible task. In addition, they point out that it is unlikely that the absence of a suitable fish screen would be expected to hold up a $1 billion project when it is nearly complete.

A third difficulty arises concerning the requirements of the Delta for fresh-water flows from the Sacramento. Satisfactory scientific knowledge is lacking as to the long-term impacts on wildlife and soils of greater saline penetration. Researchers are gradually discovering the serious implications for the Delta environment of progressively larger water diversions. In the last 12 years, estimates of the amount of river inflow required to maintain minimum summer water quality in the Delta have risen significantly from 1800 to 4000 cubic feet per second (cfs). Further research could raise these estimates—the 4000-cfs figure is currently being challenged by Delta farmers and municipalities unhappy with the latest water quality standards (MacDiarmid 1976). Knowledge about these effects is not sufficient, and estimates are subject to significant change. In light of water commitments now being planned, there is serious risk to the Delta. We believe it unlikely that after these commitments have been made, new scientific knowledge of outflow requirements would be reason enough to curtail the use of the expensive new facilities.

Fourth, the water circulation patterns and flow requirements of San Francisco Bay Area are also poorly understood. It is not known how much Sacramento River flows can be diminished, and at what times of the year, without lowering Bay water quality. A key question is the relative roles played by fresh-water influx and tidal action in moving water and pollutants out to sea. This

question is particularly difficult to answer for the portion of the Bay south of the San Francisco-Oakland Bay Bridge, an area with little natural runoff and longer residence times for water. The South Bay receives significant amounts of fresh water only when there are relatively large-volume, rapid outflows from the Sacramento River. Otherwise, a threshold apparently exists under which almost all river water bypasses the South Bay and goes directly out the Golden Gate (Imberger et al. 1977; McCulloch et al. 1970). While the relation between water circulation and pollution levels in the Bay is complex and little researched, two studies have indicated that removal of phosphorus and heavy metals from the South Bay is hastened by large Delta outflows (McCulloch et al. 1970; Luoma and Cain 1979). Bay water has been seriously polluted by urban wastes and has only improved as the result of large expenditures on municipal sewage-treatment systems. But the margin of safety for dissolved oxygen levels in summertime remains narrow in some places; a breakdown of San Jose's sewage treatment plant in 1980 rendered the area south of the Dumbarton Bridge virtually lifeless for weeks. At the same time, the North Bay receives the heaviest load of industrial and municipal wastes, so even here the reduction of river flows could be harmful.

Lastly, the Bay and Delta are further jeopardized by Phase II because as more water goes south to irrigate farmland, more runoff is generated, ladened with salts and chemical pollutants. A growing dilemma for San Joaquin Valley farmers is what to do with their wastes. The proposed solution is called the San Joaquin Valley Agricultural Drain, already partially completed. The San Joaquin Valley Interagency Drainage Program (1979) has recommended that the drain be continued to the Delta, where its load of pollutants would be discharged. This recommendation has given rise to several criticisms: (1) that it will not be possible to meet salt standards safely while discharging 300 cfs of drain water into Suisun Bay, when total Delta outflows are sometimes less than 10 times that amount; (2) that discharges of pesticides will pose a health hazard and a threat to wildlife, and no specific mitigation or control measures have been suggested; (3) that waste-water nutrients from fertilizer will stimulate the growth of undesirable algae that compete for oxygen with fish and other organisms.

Thus, despite the great effort to market Phase II as an environmentally sound alternative to the present situation, serious questions about its ultimate impact upon the unique Bay-Delta environment remain.

## Legal Safeguards

The crux of the Brown administration's plans for Phase II is a set of legal safeguards designed to govern operation of the expanded State Water Project and to force WPRS to tailor management of the Central Valley Project (CVP) to meet the State standards for water quality and fish protection in the Delta. By physically by-passing the Delta, the Peripheral Canal would preserve the quality of water going south, regardless of possible deterioration of Bay-Delta water quality. Therefore the Bay-Delta estuary is especially vulnerable and needs firm guarantees as part of any development scheme. Project supporters believe in the efficacy and permanence of legal regulations, whereas opponents hold that—in the words of former California Senator Peter Behr—"A thirsty beast cannot be contained in a paper cage."

The State Water Resources Control Board (SWRCB) presently sets standards for the Delta under authority granted by the Porter-Cologne Act of 1969 and Federal Water Pollution Control Act Amendments of 1972. After years of intense conflict, reasonable standards emerged in the form of Decision 1379 in 1971 (MacDiarmid 1976). The State Water Project attempts to meet SWRCB standards, but WPRS does not. A former Regional Director set CVP policy in 1957 when he informed the State: "I consider that the obligations of the Central Valley Project are satisfied when a satisfactory quality of water is provided at the intakes to the Contra Costa and Tracy pumping plants" (MacDiarmid 1976).

The controversy recently came to a head in a decision by the United States Supreme Court

(1978). The court, however, begged the question by ruling that the State could impose conditions of operation on the CVP when they were not inconsistent with "clear Congressional directive" for operation of the project. Former Secretary of the Interior Cecil Andrus (1978) announced that WPRS would voluntarily comply with the State Delta standards in years of sufficient water supply, but the issue is what will happen during *dry* years, so the Federal government gave away nothing. The Secretary also reserved the right to challenge the consistency of State standards. In any event, his decision could be reversed by a subsequent administration.

The SWRCB is also empowered to plan for pollution control in the basin. The objectives are contained in a Water Quality Control Plan for the Sacramento-San Joaquin Basin. In August 1978 SWRCB put this plan in effect by Decision 1485, which replaces Decision 1379 and continues the historic trend of upward revision of minimum standards for the protection of the Delta. At the same time, the board now believes that with careful control of fresh-water releases from upstream dams a higher level of protection can be achieved while another million acre-feet of water are exported. This finding appears to be an attempt to please all concerned, but its feasibility has been questioned by environmentalists, Delta farmers, and the Environmental Protection Agency. The EPA approved the plan only after attaching many conditions (Friends of the Earth 1978).

Under section 313 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and Executive Order No. 12088 (issued in 1978), all Federal facilities must comply with State basin plans. Nonetheless, WPRS claims that because the CVP has prior water commitments authorized by Congress, it is exempt. Because of this intransigence, legislation for Phase II insists that Congress require the CVP to be operated in accordance with State regulations before Federal water can be transported through the Peripheral Canal.

Will this requirement assure compliance? Several unfortunate scenarios can be foreseen, such as: Congress does not agree, and the two water projects work at cross-purposes, as noted above; Congress does not agree, but State legislation is amended to eliminate this provision; Congress agrees, but fails to provide airtight requirements, so that a court challenge overturns the agreement; Congress agrees and all political pressures are focused on the SWRCB standard-setting process, which is due to be reopened in 1986.

What is the security of the State standards? We already have evidence of how poorly they hold up under pressure. Twice during the drought year of 1977, Decision 1379 was amended to lower Delta water-quality standards on an "emergency" basis in the face of inadequate upstream storage (owing to normal drawdown in 1976 which was not replenished when the drought continued into 1977, the driest year on record). But if standards can be set aside precisely when they come into play—during periods of lowest flow—then their protective powers are an illusion.

If we are to believe proponents of Phase II, laws governing operation of the CVP and establishing minimum quality standards for Delta water are expected to work in the future even though they have not worked in the past. Unfortunately, powerful political forces, armed with the actual control of dams and canals, can often find ways around seemingly airtight agreements.

Phase II also calls for a Four-Agency Fish and Wildlife Administration agreement. This compact between WPRS, DWR, the California Department of Fish and Game, and the U.S. Fish and Wildlife Service would specify that fish and wildlife populations be maintained at "average historical levels" in the Delta. Three problems attend such an effort. To begin with, it is impossible to determine objectively the meaning of "average historical levels" in an ecosystem that has been drastically altered by man (including the introduction of the striped bass from the East Coast of the United States). Next, existing predictive models relating fish populations to Delta outflows are generally recognized as unreliable. For example, striped bass survival rates in 1979-80 were only 18% of what we would expect from the State Department of Fish and Game's striped bass index. Finally, there is the inevitable malleability of such an agreement under political pressure.

## WATER NEEDS AND SUPPLY ALTERNATIVES

Although debate over expanding the State Water Project has centered on considerations of environmental and regional interests, these are not necessarily the crux of the matter. More important is the claim of need for additional surface-water supplies—a need which has never been demonstrated. This section takes up the three major arguments to justify supply expansion under Phase II of the State Water Project: contractual obligations, loss of Colorado River water, and ground-water overdraught. In it we question the rationality of present practices of project promotion, ground-water management, water pricing and project repayment, and inefficient water use. By showing that water use need not expand inexorably, we point the way to alternatives to building Phase II.

### Contractual Obligations and Project Water Yield

The Department of Water Resources claims that it requires Phase II in order to meet the contractual obligations incurred as part of the SWP, namely, 4.23 maf compared with the 2.5 maf now being delivered. This discrepancy says less about the need for water, however, than about the overly optimistic predictions of past water planners. When DWR signed contracts in the early 1960s, they simply promised more than could feasibly be delivered by the system as conceived under the original SWP authorization—a system which was supposed to cost only $2 billion. If these contracts cannot now be met because adequate storage and delivery facilities do not exist, it is unlikely that they are legally binding. In fact, all such water contracts have clauses that limit delivery and construction obligations to cases where they are "physically and financially feasible." Further, SWP contracts are made in accordance with the "Governor's Contracting Principles" which are guidelines only, not statutory requirements. In any event, the contracts have never been tested in court, and the State has made no effort to challenge them. We consider it self-fulfilling prophecy for the State to promise more than it can deliver and then to use those promises to justify further supply expansion. (The same criticism applies to the Federal WPRS, which has just signed contracts for more water to the Westlands area and is eager to convert another 0.9 maf to firm contracts, even though it cannot meet existing commitments in dry years.)

Agency zeal continually overrides wise planning, so that commitments are made and expectations of water supply created that cannot be met. This system is epitomized in the contracting and pricing that distinguishes between firm and surplus (or interim) water. Firm water is that which is generated in all but the driest years (based on the twentieth-century minimum runoff during the drought years of 1928-34); surplus water is that which is left over. The price of the latter is considerably lower. Climatic variability is thus apparently accounted for in water planning. The most serious fallacy of this arrangement, however, is that surplus water comes to be relied on by growers as if it were firm. This expectation leads them to bring new land into cultivation and to commit themselves to various capital improvements; as such expansion is usually debt-financed, and payments are due regularly regardless of climatic fluctuations, a dry year can mean financial disaster. The surplus water problem is made worse by the policy of planning and financing water projects on the basis of firm water yields. By targeting minimums, the agencies create the illusion of *more* surplus water than exists on the average. The promise of firm water also leads to trouble. It presupposes that the driest years since rainfall records have been kept are a good indication of the probable minimum precipitation. In fact, however, tree ring data for the last 700 years show the twentieth century to be wet compared with earlier periods of low rainfall. In other words, droughts such as 1976-77 are by no means the worst foreseeable events, yet even that rather short interval of dry years was nearly a disaster for California agriculture. For example, CVP deliveries were cut by up to 75% of contract entitlements. Salvation for many agriculture areas came only by exorbitant pumping of ground water (Department of Water Resources 1977a).

More specifically, the yield of the Peripheral Canal is being exaggerated by DWR, in two

ways. First, the 1.0 maf per year now being promised is an *average* figure, not a firm or minimum yield. Second, water releases to protect water quality in the Delta in dry years would, if carried out as promised by DWR, lower the minimum firm yield. A more realistic figure for the Peripheral Canal (excluding other features of Phase II) would thus be below 0.5 maf per year of additional water available.

As long as these practices continue, there can never be a water supply system big enough to meet demand, and there will always be a built-in lever for expansion in the form of unmeetable contractual obligations and unfulfilled expectations.

### Water Supply for Metropolitan Southern California

The Metropolitan Water District of Southern California (MWD) currently draws much of its water from the Colorado River Aqueduct. MWD fears it will lose about 500,000 acre-feet per year from this source because Arizona won a Supreme Court decision in 1963 entitling it to a larger share of the water. The WPRS is now constructing the Central Arizona Project (CAP) to make use of that water. Does this mean, as the district argues, that additional Northern California water must be imported?

For the present, MWD is quite secure. It has firm water rights to about 1.0 maf per year from the SWP and the capacity to draw about 1.2 maf per year from the Colorado, whereas current withdrawals from both sources average 1.3 maf per year. In other words, MWD has a considerable excess supply. The anticipated reduction in Colorado River supplies would still leave a margin of safety for a number of years, all else being equal. MWD thus bases its argument for augmented State delivery capacity on a projection of water use and supply to the year 2000. There are several reasons why building Phase II at this time is probably a mistake.

Even if MWD's estimates are correct, the supply shortfall in 2000 without Phase II would be small. MWD foresees a demand of 2.1 maf per year. On the supply side it will have a firm commitment of 1.0 maf from the SWP (without the Peripheral Canal and Phase II); between 0.4 and 0.55 maf from the Colorado, even after CAP diversions; and 0.3 maf from waste-water reclamation. These sources will provide a firm supply of 1.7 to 1.85 maf per year. With 15% conservation—a figure the Department of Water Resources (1976a) itself thinks reasonable—MWD will be able to eliminate the difference between supply and demand. This conservation effort would only be required in dry spells, because "surplus" water is available in most years.

Moreover, the preceding scenario is a "worst possible case." Both the predictions of demand growth and of the loss of Colorado River water are questionable.

MWD has consistently overestimated water demands in the past. It built the original Colorado Aqueduct at least ten years too soon (Hirschleifer et al. 1960). It has never yet taken its full entitlement from the SWP for which it contracted in the early 1960s. Instead, an average of over 300,000 acre-feet of its allotment has been sold as surplus to San Joaquin Valley growers in all but the drought years 1976-1977. Given this record of exaggerating demand and the inherent uncertainty of predicting future growth, it would be wise to question the validity of MWD's estimates. For example, a recent study calculates that if housing price constraints are taken into consideration, metropolitan Southern California will only grow 24% by the year 2000 (Kimball and Shulman 1980), not 60% as MWD predicts.

Nor is it certain that Colorado River water will not be available in the future. The river has been running higher than its historical average of 14 maf for some time now. While one cannot assume that this will continue indefinitely, the risk of drought in both the Central Valley and Colorado River basins at the same time is considerably lower than for either one alone—as was discovered in 1976-77, when the Colorado ran very full. Moreover, the storage capacity of the large Colorado reservoirs appears to be more than half again their actual volume, thanks to the surprisingly absorbent character of the sandstone formations on which they are built.

The exercise of States' rights to their legal share of Colorado water does not mean emptying the river of its entire flow. The Colorado Compact of 1922 apportioned 7.5 maf of the river's flow to the upper Colorado basin states (Wyoming, Colorado, Utah, and New Mexico) and 7.5 maf to the lower basin states (Arizona, California, and Nevada). The Boulder Canyon Project Act of 1928 further divided the lower basin's share as follows: California 4.4 maf, Arizona 2.8 maf, and Nevada 0.3 maf. When the Central Arizona Project is completed in the 1980s, Arizona will have the physical capability to divert its portion. Nevada is expected to do so also by the end of the century. Since California has up to now been taking more than its share, it would appear that it must give up part of this water.

Such a conclusion is unwarranted at this time, however. Under the Colorado Compact, each basin is entitled to 7.5 maf of applied or beneficial use, not final consumptive withdrawals. In fact, upper basin states return a considerable amount of their used water to the river, where it is available for reuse. Currently, they deplete the river's flow by 2.8 maf per year, a figure expected to rise to 4.2 maf by 1990 and 5.8 maf sometime in the early 21st century (Kahrl 1979:43). Although there are questions of salt content, Indian claims, and Mexican water treaties to be considered, nonetheless the picture for California over the next 20 to 40 years is not as bleak as MWD claims. According to one assessment: "Based upon current prospects of future storage increases and runoff, California's water planners are therefore confident that the basin water requirements can be met for many years beyond the turn of the century" (Kahrl 1979:45).

Even if California must live within a 4.4-maf limit to its Colorado River diversions, this does not mean that MWD must turn exclusively to the State Water Project for relief. The SWP is a more expensive source of water than the Colorado for the simple reason that the former has a pump lift over the Tehachapi range of over 3000 feet compared with only 1300 feet for the Colorado Aqueduct. The power cost today is over $60 per acre-foot for state-supplied water. Therefore, it would make better sense economically for metropolitan Southern California to be able to divert water currently allocated to irrigators in the Imperial, Palo Verde, and Coachella valleys (Hirschleifer et al. 1960; Bain et al 1966). Since the irrigators pay the Federal government the astonishingly low amount of $3.50 per acre-foot, MWD could compensate the growers handsomely and still come out ahead. Reassignment of only 10-15% of the 4.4-maf entitlement of these Southern California irrigators would make up the projected loss of water to Arizona. Yet MWD has closed its eyes to this alternative. In a colossal act of largesse, MWD agreed in the 1930s to the assignment of virtually all of California's Colorado River "firm" share to agricultural users. Now, through its past errors, MWD finds itself caught between Arizona, on the one hand, and the Imperial-Palo Verde-Coachella irrigators, on the other. But that 50-year-old agreement is not written in stone. It could be revised in light of current realities, instead of building massive new additions to the State Water Project.

A last consideration that weighs against expanding water imports from the north is the energy it requires. The SWP is the largest single user of electrical power in California, principally because of the tremendous pump-lift over the mountains. It consumes some six billion kWh, or an amount equal to that used by the entire city of Los Angeles in 1965. The planned increase in water shipments to the southern coastal basin will very nearly double present project energy consumption, to 11-12 billion kWh. More importantly, Phase II, unlike the original SWP, will add almost no new generating facilities. DWR will therefore have to buy power from the private sector, and this added demand will require the construction of several new power plants. Where will these be located? As the recent conflicts over power-plant licensing in California attest, finding sites will not be easy. Nuclear plants are opposed by the Brown administration and coal plants almost invariably violate air quality standards.

### Ground-Water Overdraft in the San Joaquin Valley

Presently 40% of applied water in California comes from the ground. Supporters of Phase II argue that ground-water overdrafts threaten the future of irrigated agriculture in portions of the San

Joaquin Valley unless the project is undertaken. The problem is undoubtedly serious (California Department of Water Resources 1976a). The question is whether further water imports will solve it. History suggests they will not.

When the Central Valley Project was proposed in the 1930s, a major rationale was that it would replace the use of ground water in the San Joaquin Valley. Nonetheless, after the CVP was constructed, the ground-water problem remained because excessive pumping now extended to the west and south, as irrigated agriculture expanded into these areas. The State Water Project was then promoted to help alleviate *this* overdraft. It was not intended for the promotion of further irrigated agriculture. In developing the SWP, however, DWR contracted more than 1 maf to the Kern County Water Agency (KCWA). Unfortunately, ground water proved cheaper for Kern County growers than project water, despite falling water tables, so KCWA had to seek out buyers in previously unirrigated areas. As a result, much of the agricultural supply of the SWP went to expand irrigated agriculture (MacDiarmid 1976). Portions of the Phase II project are again being touted as "rescue" operations for declining water tables (California Department of Water Resources 1976:14). Nonetheless, DWR admits that ground-water levels will still fall an average of 140 feet *with* the project (Robie 1977).

We conclude that such divergences between intent and result are inevitable as long as ground-water pumping remains unregulated. Nor will the demand for ground-water rescue operations end as long as the future implications of competitive pumping are ignored in favor of short-run gain. Despite extensive evidence of the need for, and possibility of, successful ground-water management (Birdlebough and Wilkins 1971), the agricultural lobby remains officially opposed to even the moderate program proposed by the recent Governor's Commission to Review California Water-Rights Law (Governor's Commission 1978). One of the principal water industry lobbyists argued before a recent hearing of the Senate Agricultural and Water Resources Committee that: "there is no ground-water overdraft . . . , simply a shortage of imported surface water." This is the official position of the San Joaquin Agricultural Committee--an organization of valley water districts (San Francisco Chronicle 1979). In short, the water users have not been interested in conserving and managing California's water resources rationally because so far it has been more profitable for them to secure imported water. This reasoning is based on the government's willingness to subsidize agricultural water supplies.

### Pricing and Repayment: Subsidies to Agriculture

Must all new demands for water be met? Water demands are not water requirements dictated by nature (Hanke and Boland 1971). Not all demands are economically rational. Because water is costly to supply, it is no more to be dispensed carelessly than any other economic commodity (National Water Commission 1973). Yet agricultural water is heavily subsidized in California, making it appear very cheap to growers.

Because agriculture is essentially a business, farm operators seize upon the opportunity cheap water provides to cut costs of production and raise profits. The low price of water thus artificially inflates demand and offers little incentive to make wise use of existing water supplies (Willey 1979). Among other things, water subsidy promotes the irrigation of low-value crops. For example, forage crops such as alfalfa account for 63% of all agricultural water used in the State. But water demand is flexible and responds to price changes. Economic studies have repeatedly shown that the acreage of low-value, water-intensive crops is reduced when water prices rise (Berle 1976; Turner 1977). Furthermore, the argument that agriculture is a social priority deserving of subsidy to keep food output up and prices down does not hold for large areas serviced by the water projects. The bulk of the water delivered to the Westlands (Fresno County) and Tulare Basin (Kern County)--the most recently developed areas of irrigated agriculture--goes to irrigate cotton and forage.

The Federal reclamation program is the worst offender in granting subsidies. Average prices to irrigators are $2 to $11 per acre-foot for Federal water, compared with $18.50 to $30 for State water. Federal prices to cities are roughly double those to agriculture, ranging from $7 to $21 per acre-foot (but $61 for the San Felipe project serving Santa Clara County). The pricing and repayment policies of the WPRS are so generous that irrigators pay less than 5% of the total costs of the water they use (LeVeen 1978). They pay so little, in fact, that recently the CVP could not even cover its operating costs; a Federal audit showed it to be more than $8 billion in arrears (U.S. Department of the Interior 1978).

In contrast, the State's water program is at least currently solvent, although this does not necessarily mean that it is a model of fiscal responsibility. DWR also provides subsidies to agriculture, especially through the practice of selling "surplus" water at reduced rates. Surplus water comes in two forms: (1) that remaining after the total firm yield has been allocated to various contractors and any portion of a contractor's "firm" yield that is not used. Most years, except the driest, MWD relinquishes a surplus of several hundred thousand acre-feet. This water is sold to San Joaquin Valley growers, primarily in Kern County, where many of the State's largest agricultural landholdings are to be found. The people of the Los Angeles area actually subsidize the growers because MWD must continue to pay the large capital costs of the surplus water it does not consume, while the irrigators purchase the same water with capital costs removed. Similarly, MWD pays just over half of the fixed costs of the SWP through its payments for "firm" water, but never takes any of the "hydrologic surplus" that exists in normal or wet years. It thus underwrites several hundred thousand more acre-feet per year that go to agricultural users.

Another source of subsidy in the State system is from the property taxes of local water districts. These taxes are levied on all land and improvements in a water district regardless of whether the owner actually purchases water. Urban land has a disproportionately high value, but accounts for relatively little water use, so "captive" cities pay more than their share of the costs, e.g., Bakersfield in Kern County. A similar situation obtains in Los Angeles. In 1978, Los Angeles used only 2% of MWD's water but paid 21% of the total taxes; hence the city subsidized the suburban purchasers of MWD water.

Other subsidies include hydro-power revenues—$25,000,000 per year transferred from tidelands oil leases—and capital provided at below-market rate to the project. In short, despite apparent fiscal soundness, Bain, Caves, and Margolis (1966) judged the benefit-cost ratio of the SWP to be less than 1:1.

Phase II is liable to require much greater subsidies because of its enormous costs. DWR is caught in a bind because water priced high enough to recover costs (even with current intra-project subsidies) may not be saleable to growers. If the project costs $20 billion, has a life of 50 years, and yields 2.5 maf per year, the cost of the water it yields will be $160 per acre-foot, *exclusive* of pumping and maintenance costs. Such water is no bargain. Or, if project deliveries are reduced by having to maintain the quality of Delta water, and/or if there are several years of low rainfalls, DWR will not be able to meet its repayment schedules. Not surprisingly, a recent benefit-cost analysis of Phase II by Rand Corporation economists arrived at the figure of 0.95, using a modest 6% interest rate (Hashimoto 1977).

### Water-Use Efficiency: The Potential for Conservation and Diversion to Higher-Valued Users

There is a "source" of water other than just augmentation of the supply—conservation through reduced and rational use. But given current policies and practices—such as excess contractual obligations, ground-water mismanagement, and government willingness to supply low-cost water to meet all demands—users have little incentive to conserve. Substantial water savings without significant dislocations could be possible by: (1) cutting unnecessary losses in storage

and transfer, (2) investing in improved equipment, and (3) paying closer attention to technical efficiency of use. In addition, it is possible to cut back on water for low-value end-uses in favor of higher-valued uses.

The potential for conserving urban residential water was demonstrated in the great drought of 1976-77, when unprecedented cutbacks of 50-75% were achieved with water rationing, and 10-25% on a voluntary basis in less hard-hit communities (Bruvold 1978). While one need not advocate such extreme reductions, 25-33% no longer seems unrealistic, and can be secured by a few basic technical modifications without significant changes in habits. Indeed the efficiences in urban water use realized during the drought have put demand well below previous estimates of growth, forcing local water agencies to raise prices to meet their fixed costs. A Lawrence Berkeley Laboratory study has concluded that 1.8 maf per year could be obtained from urban conservation, while DWR itself sees 1.2-2.4 maf of potential urban water savings state-wide (Benenson 1977; California Department of Water Resources 1976b).

The potential importance of saving agricultural water is much greater, since 25.2 maf per year or 86% of California's water withdrawals go to irrigation. Savings can be considerably increased by cutting delivery and application losses (through seepage and evaporation), applying water more efficiently, and reducing excessive consumption by the crops themselves (plants can actually consume more water than needed for optimum growth). For example, many canals are unlined and uncovered; the Coachella Canal alone loses some 300,000 acre-feet of the 1.2 maf sent down it each year. (Ironically, the Peripheral Canal would also be unlined.) Approximately 82% of California's irrigation is by gravity methods, chiefly open-ditch—methods which use much more water than other techniques. Solid-set and sprinkler systems are present on only 19% of the acreage, and drip irrigation on less than 1% (California Department of Water Resources 1976b:38). Although these methods are not applicable to all situations and require periodic flushing of the soil, no one—including DWR—believes that their potential has been fully tapped. Similarly, possibilities have scarcely been touched with respect to scientific management of irrigation, especially careful scheduling related to soil moisture and crop-growth patterns. Within the last five years, the WPRS has begun an advisory irrigation management service that has shown results (Ritschard and Tsao 1978:57-59).

DWR's estimate of potential water saving in agriculture state-wide is 1.2 maf (California Department of Water Resources 1976b:3). While this is still considerably greater than the entire yield of the Peripheral Canal, it amounts to only a 4% reduction in current use. DWR is therefore being very conservative. One should recall that economists who once asserted that a 10% reduction in urban water use was possible through metering and marginal cost pricing were considered dreamers. In the aftermath of the 1976-77 drought, they appear, if anything, unduly cautious. If agriculture state-wide were to cut back water use by 10%, it would yield 2.5 maf or roughly the equivalent of the entire Phase II project.

Of course, water conservation measures are not without costs, but they may cost society less than massive water supply projects (Howe and Easter 1971). The problem is that under current arrangements—particularly government subsidies for water supply but not for water conservation—the rational solution for the whole State, whose population is now 85% urban, is not rational for the farmers (Wiliey 1979). The comparative values of water used (and ability to pay for water) between agricultural and urban customers is striking. Agriculture (including forestry and fishing) uses 86% of the State's water to generate 3% of its income, while basic manufacturing uses 2% of the water to generate 22% of the State's income (California Department of Water Resources 1980:12). Even within the agricultural sector, water is being misallocated to low-value uses. A comparison of output values per unit of water for selected crops and industrial uses is shown in Table 1. In the worst cases, hay and rice, output value per acre-foot of water applied is not much, if at all, higher than the real cost of the water, let alone *total* input cost. These activities would not be possible if subsidized water were not available.

TABLE 1. OUTPUT VALUE AND WATER USE
IN SELECTED CROPS AND INDUSTRIES, 1977
(for the twelve most water-consuming crops and industries)

| Crop/Industry | Value of Output[a] | Water Use[b] | Dollar of Output Per Acre-Foot[c] |
|---|---|---|---|
| 1. Hay and Pasture | 794 | 11,350 | $ 69.95 |
| 2. Cotton | 833 | 4,677 | 178.10 |
| 3. Rice | 161 | 3,521 | 45.72 |
| 4. Noncitrus Fruits | 1,344 | 3,451 | 389.45 |
| 5. Vegetables | 1,388 | 1,972 | 703.85 |
| 6. Corn | 181 | 1,691 | 107.03 |
| 7. Wheat | 229 | 1,350 | 169.62 |
| 8. Sugar Beets | 192 | 1,110 | 172.97 |
| 9. Barley | 157 | 1,049 | 149.66 |
| 10. Almonds | 182 | 941 | 193.41 |
| 11. Citrus | 430 | 820 | 524.39 |
| 12. Walnuts | 109 | 646 | 168.73 |
| 1. Petroleum/Wells | 2,932 | 185.7 | 15,788.90 |
| 2. Paper & Paperboard | 2,848 | 170.8 | 16,674.47 |
| 3. Petroleum Refining | 11,026 | 141.9 | 77,702.60 |
| 4. Canned & Frozen Foods | 6,951 | 113.2 | 61,404.59 |
| 5. Logging & Sawmills | 2,046 | 63.37 | 32,286.57 |
| 6. Natural Gas | 333 | 60.76 | 5,480.58 |
| 7. Sugar | 959 | 41.93 | 22,871.45 |
| 8. Industrial Chemicals | 1,892 | 37.72 | 50,159.06 |
| 9. Electric Utilities | 3,803 | 35.86 | 106,051.31 |
| 10. Stone, Clay & Quarry | 411 | 26.94 | 15,256.12 |
| 11. Chemical & Mineral Mining | 145 | 19.21 | 7,548.15 |
| 12. Cement & Concrete Products | 1,135 | 23.26 | 48,796.22 |

[a] In millions of dollars. [b] In thousands of acre-feet. [c] To nearest cent.

Source: California Department of Water Resources 1980: Table 17.

What the preceding figures suggest is that there ought to be a way of cutting back water use in marginal activities and transferring that water to more economically rewarding sectors. If that were done, it would be possible to live within our means for many years to come without building Phase II. Savings could be achieved either by conservation in the transfer and application of water, as through the installation of closed irrigation systems where feasible, or by reducing the acreage devoted to certain crops, such as forage. As for the means of transferring the water, that already exists in the form of the state-wide system of canals and reservoirs. The problem is organizational and political—inducements for the desired reductions and transfers must be provided, and the institutional means for their implementation must be established. Ending water subsidies to agriculture and raising prices to a level commensurate with real costs would be one way of improving efficiency. It is a strictly negative inducement, however. A more attractive alternative for the growers—and hence more politically feasible—would be not to penalize them financially. One way to do this would be to allow the sale of water on a short-term basis *without* the loss of future water rights. These transferable rights would need to include water now under contract. And the water agencies, from the local irrigation districts to the Department of Water Resources, would have to be willing to facilitate the transactions. By the simulation of a market in water, farmers

could look forward to a monetary gain while industry and urban users could secure augmented supplies at a lower cost than by building water projects with large internal subsidies. On the other hand, if it is our chosen policy to promote and subsidize irrigation directly, even that purpose could be more rationally achieved. The State might just as easily provide growers with cheap sprinklers and other water-saving equipment as with cheap water. The State would not only save money thereby, but avoid the environmental costs that now attend the construction of larger and larger water supply projects, such as Phase II.

## SUGGESTIONS FOR REFORM

Proponents of Phase II have promised conservation, water quality agreements for the Delta, and now a series of expensive water conservation policy studies originally proposed by the environmentalists. Nevertheless, the preceding discussion should make it clear that giving conservation a high priority is not part of the California water industry's prevailing philosophy. Instead, expansion of supply to meet all demands has been the rule. We believe basic reforms are needed in the State's water laws, policies and practices before further authorizations for expansion of supply are made. Otherwise, it will be impossible ever to slake the exaggerated thirst of agricultural and urban water users.

Reforms should include: (1) a firm acre-foot limit on Delta exports; (2) congressional reauthorization of the Central Valley Project to make it conform to State water quality objectives in the Bay and Delta; (3) further research on the circulation and ecology of the Bay-Delta system before building the Peripheral Canal; (4) Wild and Scenic River protection for the North Coast rivers by the Federal government; (5) reform of State and Federal repayment practices so that actual water users contribute their fair share of project costs; (6) following the suggestion of the General Accounting Office by authorizing no further projects in areas with ground-water overdrafts unless management programs are in force; (7) well-financed research and funding programs for diffusion of water-conserving techniques; (8) changes in agency contracting practices to eliminate overcommitment of supplies; (9) making all water-use rights contingent on the demonstration of good management practices, and (2) allowing present users of water, including grower-contractors, to transfer their water via market-type transactions without forfeiting water rights.

The real answer to the need for environmental protection, economic efficiency, and safeguards for water supply lies in wise use of the water resources already at hand. But forceful and effective conservation policies will not be adopted and implemented as long as the alternative of government subsidies and rescue operations is available. If Phase II of the State Water Project is approved without the reforms we have suggested, the water industry will continue to operate as it has in the past. Demand will once again outrun supply, and even larger projects will be proposed to meet the inevitable "need" for more water. Phase II will not solve California's water problems; it will simply recreate them on a larger scale.

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