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The Sacramento-San Joaquin Delta: The Evolution and Implementation of Water Policy: An Historical Perspective

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Abstract

This report is a history of the attempts to control the encroachment of salinity from San Francisco Bay into the Delta of the Sacramento and San Joaquin rivers from 1920 to the present. Two basic solutions to the problem present themselves: the physical separation of salt water from fresh water by means of a barrier at some point downstream from the Delta, or the release of sufficient water from upstream storage reservoirs to drive back tidal salinity.

THE SACRAMENTO-SAN JOAQUIN DELTA
THE EVOLUTION AND IMPLEMENTATION OF WATER POLICY
AN HISTORICAL PERSPECTIVE

by

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ABSTRACT

This report is a history of the attempts to control the encroachment of salinity from San Francisco Bay into the Delta of the Sacramento and San Joaquin rivers from 1920 to the present. Two basic solutions to the problem presented themselves: the physical separation of salt water from fresh water by means of a barrier at some point downstream from the Delta, or the release of sufficient water from upstream storage reservoirs to drive back tidal salinity.

Salt water barriers received long scrutiny in the 1920's and again from about 1946 to 1963 when the focus was on the Reber Plan, but the proposed dams were found to be unacceptable from both an economic and environmental standpoint. The State Water Plan of 1931 contained plans for a so-called hydraulic barrier. When the state was unable to finance the scheme, the federal government adopted it as the Central Valley Project. But the Bureau of Reclamation did not, despite the vehement claims of some Delta advocates, inherit the obligation to control salinity beyond the minimum needs of project operation. Delta water users could contract for salinity control services but in spite of intensive negotiations in recent years, no such agreement has been signed for the agricultural Delta.

Throughout the period, the most vocal element in water policy was from Contra Costa County. Development-minded businessmen on the western edge of the Delta expressed a consistent concern over the supply of good quality water for municipal and industrial uses. Their organizational and political ability brought the hopes and fears of Delta water users forcibly to the attention of decision-makers, often with decisive results.

The increasingly heavy demands made on the Delta by the Central Valley Project, and the later California State Water Project, posed additional management problems because of the consequences of export pumping to the San Joaquin Valley and southern California and the difficulty of protecting from salinity the quality of Sacramento River water bound for these pumps. Planners considered various means of restructuring the physical Delta, finally agreeing on the Peripheral Canal in 1965. The Peripheral Canal proposal and intentions to reroute San Joaquin Valley agricultural drainage directly to the western Delta coincided in time with a growing interest in water quality and the environment that raised questions concerning the wisdom of further modification of the Delta water system. Environmentalists joined with local foes of further development to stymie the Canal and force a thorough re-evaluation of the available alternatives. At the same time, water quality regulations proposed by the state initiated a significant contest with the federal government over water management that has yet to be settled. The drought that began in 1976 was a crisis in itself and lent additional impact to the other Delta problems. For all these reasons, the Delta provides important insights into the history of water resource management in the twentieth century.

PREFACE

Water pollution is generally assumed to mean fish kills, foul-smelling lakes, or discolored streams, but in California's Sacramento-San Joaquin Delta, pollution comes primarily from salt. Balanced between salt tides and fresh water flowing from the interior rivers, the Delta is threatened by advancing tidal salinity whenever river flow is significantly reduced. Since the problem of saline intrusion became important over half a century ago, a variety of remedies has been proposed, prompted not only by the need to protect the Delta itself but also by the need to maintain the Delta as a source of suitable water for exports to the San Joaquin Valley and southern California. This report tells the story of those suggested solutions from 1920, when salinity became a problem, to the present.

Despite the critical importance of water resource management as an issue on contemporary public policy, historians have been lamentably reluctant to deal with the topic. We believe there is a real need for historical analysis of water resource development not only for the insights it gives on decisions made over the span of time but also because there exists a need for an ongoing assessment of the past as it applies to problems of current concern. With increasing technical sophistication and complexity of water management, the need for perspective and synthesis is even more acute. Because no final, satisfactory solution to the problem of salinity control has been agreed upon, Delta water policy remains an outstanding example of the national problems of resource management still to be solved during the last quarter of the twentieth century.

Study of the Sacramento-San Joaquin Delta is in the truest sense contemporary history. Frequently, laymen as well as historians regard history as a discipline dealing with events sufficiently removed from the present to allow a comfortable perspective that reveals the truly significant, as opposed to the temporarily notable, happenings. Following that logic, this report might have concluded with events perhaps ten years ago, but we subscribe to the theory that history ideally should connect the past to the present. For the Delta, the present, 1977, may be a turning point as the drought gripping California complicates settlement of the important issue of environmental quality and federal-state relationships over water control and quality. Because the dramatic events of the drought are comprehensible only in light of historic conditions, we have attempted to bring the story of salinity control as close to the date of publication as possible.

If the historian is by training and temperament equipped to draw together the threads of policy that lead from various technical disciplines, as well as from government agencies and the law, he is also handicapped to an extent by the lack of scientific or legal training. We therefore apologize beforehand to those professionals in water-related fields for the generalized explanations of complicated matters of engineering or law that appear in this report, and to the historians who may find even that detail bothersome.

In our research we have drawn on a variety of sources. The Archives of the California Water Resources Center in Berkeley provided a valuable collection of both basic and specialized materials as well as the papers of Carl W. Schedler. At the U. S. Bureau of Reclamation in Sacramento, Gerald King, Donald Swain, Don Hebert, Ed Price, Ernst Burkhardt, Jim Cook, Dale Creasy, Bill Manderscheid, Galen Fuller and John Budd were especially helpful. The Central Files of the California Department of Water Resources supplied information on the Interagency Delta Committee. At the Central District of the Department, Walt Fisher and Ben Vanberg were particularly helpful. We are especially indebted to the late Eugene Huggins of the U. S. Army Corps of Engineers, San Francisco District, for permission to examine the extensive papers of John Reber and to the staff of the San Francisco Bay-Delta Hydraulic Model in Sausalito, where the papers are located, for making that work pleasant as well as productive. At the Sacramento District office of the Corps, Art Champ provided important information on the ongoing work on modified barrier projects. John Luther provided a number of useful insights into negotiations between Delta interests and water project operators. Gleason Renoud of the North Delta Water Agency and John Wilson and Robert Ferguson of the South Delta Water Agency helped bring the story of negotiations up-to-date. Robert Ayers and Jewell Meyer of the University of California's Cooperative Extension Service were also helpful in defining the technical problems of Delta water management. In explaining the history of agricultural drainage in the San Joaquin Valley, Louis Beck of the San Joaquin Valley Interagency Drainage Program was of considerable assistance. Dean Thompson of the State Water Resources Control Board staff helped secure recent information on the operation of the Board. Comments by a number of individuals on the preliminary draft of a portion of this report circulated in the summer of 1976 helped shape the final version; A. N. Murray and Frederick Bold, Jr. made particularly noteworthy contributions. In addition, there are many more people in a variety of agencies who have helped in a multitude of ways with the research that went into this report, and whose assistance is sincerely appreciated. Here at Davis we benefitted from the editorial assistance of Rosa Crowell at the Water Resources Center and we are especially indebted to Zella Dudley for her hard work, patience, and good humor in typing and preparing this manuscript. While we gratefully acknowledge the assistance of all who helped us, all errors of fact or interpretation are entirely the responsibility of the authors.

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I. Origins of the Salt Water Menace

RIVERS AND TIDES -- The great rivers of California's Central Valley Basin, the Sacramento and the San Joaquin, after draining more than one-third of the state, flow into a complex network of interconnecting channels known as the Delta, before entering the shallow waters of Suisun Bay on their way to the sea through the Carquinez Straits and San Pablo Bay, the northernmost arm of the great bay of San Francisco. Stretching from Mount Shasta to Kern County and from the crest of the Sierra to the Golden Gate, the waters of the Central Valley Basin and the partially overlapping San Francisco Bay tidal basin form one massive hydraulic system, part saline and part fresh, the boundary between the two varying in response to changes in the system as a whole. Since the advent of man in the Delta region and along the shores of Suisun Bay, the limits and control of salt water penetration have been issues of major importance.

Originally a marsh-filled basin where over one-half of the land was at or below mean sea level, the Delta was about three-fifths "awash with an ordinary tide."[1] Local relief was slight, with low natural levees bordering the major streams. Tules, a fresh water perennial marsh plant, provided the dominant Delta vegetation.

> *The monotony of the green or brown canebrake-like vegetation was broken by channel and pond surfaces and by strips of alluvial land where woody shrubs and trees and herbaceous annuals grew. This natural levee cover consisted of coarse bunch grasses, willows, blackberry and wild rose thickets, and galleries of oak, sycamore, alder, walnut, and cottonwood.*[2]

Although the Delta was a tidal swamp, its waters remained predominantly fresh. One of the factors determining the limits of ocean salinity was,and is, streamflow, the volume of water travelling down the Sacramento and San Joaquin Rivers into the Delta and Suisun Bay. As fresh water flows increase, salt water is flushed out, while low flows allow salinity to move up the rivers. Because precipitation and runoff are concentrated in a wet season extending from December through May, streamflow is subject to normal seasonal variations, reaching a low point late in the summer. As the rivers turn sluggish during the hot, dry months of summer, ocean salinity finds decreased resistance to its upriver advance, resulting in a seasonal pattern of saline encroachment that corresponds closely to changes in the streamflow.

While the effects of streamflow are subject to marked seasonal, and even annual, variations, tidal action results in " . . . tidal flows of varying magnitudes, . . . the pulsating action of which exerts a positive and continuing tendency to push upstream and mix the more saline water with the fresher waters upstream in the tidal basin."[3] Though tidal action is obviously affected and opposed by streamflow, it is also governed by the volume of the tidal basin. The Delta and Suisun Bay are part of a tidal basin that reaches from the Golden Gate to the highest point on the rivers where the rise and fall of the tide can be detected. On the Sacramento River a tidal influence has been observed as far north as Verona, near the mouth of the Feather River. Tidal flow is stronger in, and the upriver movement of ocean salinity is encouraged by, a large tidal basin, and restricted by a small one.

It is not altogether certain how far upstream ocean salinity extended under natural conditions because by the time systematic observations were attempted those conditions had ceased to exist. In his 1928 report, engineer Thomas H. Means described the Carquinez Straits as the approximate dividing line between saline and fresh waters, using as evidence the predominance of plants suited to salt water in the marshes around San Pablo Bay, while fresh water species prevailed on the margins of Suisun Bay.[4] There is, however, some evidence that salt water invaded Suisun Bay and parts of the Delta. When the first explorers to visit the area, Father Juan Crespi and Pedro Fages, reached the banks of the Carquinez Straits on March 29, 1774, they found fresh water, but the next summer when Juan Manuel de Ayala sailed the San Carlos into Suisun Bay fresh water was not encountered until he had reached the middle or upper portion of that body of water. Like Ayala, Commander Ringgold's expedition of 1841 arrived during the summer, but found conditions to be even worse. Four miles above the mouth of the San Joaquin River, near the site of Antioch, the party "encamped, without water, that of the river being still brackish."[5] Many early residents of the Antioch district took the

precaution of filling cisterns with fresh water during the spring for use later in the year when water in the river became too salty. Whatever the frequency of its occurrence, salinity was no stranger to Suisun Bay or the lower end of the Delta.

The first accurate records of salinity were compiled by the California and Hawaiian Sugar Company, which had established a sugar refinery at Crockett, near the western end of the Carquinez Straits, in 1905. Water used in sugar refining must have a very low salinity, and, in order to obtain a suitable supply, the company sent barges upriver to draw water above the influence of tidal salinity. As the barge moved upriver, frequent tests were made to determine the degree of salinity, until the point was reached where the barge could be safely filled with fresh water. Complete records of these daily journeys extending as far back as 1908 revealed much about the movement of salinity through the bay-river system:

> *It is evident . . . that from 1908 to 1920, there have been periods of from three to nine months during each year when all of Suisun Bay up to the lower end of the delta was impregnated by saline water in varying degrees and that for shorter periods each year, the invasion of salinity has reached points well above the confluence of the Sacramento and San Joaquin rivers. Even in wet seasons such as 1909, 1911, and 1914 to 1916, inclusive, saline invasion as far as the lower end of the delta has occurred during periods within the above limits.*
>
> *On the other hand, the record shows that in most years from 1908 to 1929, Suisun Bay has been completely full of fresh water for certain periods, varying from nothing to six months and averaging about two and one-fourth months per year during the 22 year period . . . The record also shows that there have been brief periods during several years in which the company was able to obtain fresh water directly in front of their plant at Crockett.*[6]

By the time C and H arrived on the scene, natural conditions of saline penetration had fallen victim to a number of circumstances, and were still being altered. Streamflow, always low during the summer, had been further depleted by the diversion of water for irrigation. Water was first applied to the thirsty land along the Merced River in 1852, and by 1870 so much water was being taken from the San Joaquin River and its tributaries that streamflow was noticeably reduced. Because it had less rainfall than the Sacramento Valley, agricultural development in the San Joaquin Valley depended heavily on irrigation, with the result that virtually the entire summer flow of the San Joaquin River was appropriated, and had it not been for the return of some water applied but not used by crops, the river might have been entirely dry.

Irrigation developed more slowly in the Sacramento Valley but with the coming of the rice industry in 1912 diversions increased dramatically. Under the stimulus of wartime demand, the price paid for a one hundred pound sack of rice jumped from $2.02 in 1912 to $5.93 in 1919, with rice plantings covering 149,000 acres in the latter year.[7] Since rice fields must be completely inundated, rice culture was primarily responsible for increasing the gross irrigation diversion from the Sacramento River from 1,154,000 acre-feet in 1915 to 2,300,000 acre-feet in 1919.[8] Not all that water was actually lost, for based on measurements made between 1924 and 1929, 35 to 40 percent of the gross irrigation diversion was returned to the river, leading to the conclusion that " . . . as an approximation, the actual total reduction in natural streamflow of the Sacramento-San Joaquin River system into the Delta due to irrigation, may be considered to be about two-thirds of the gross annual diversions."[9] Even so, such significant reductions in the already low summer streamflow could not help but affect the penetration of ocean salinity. Therefore, it is not surprising that when Delta and Suisun Bay water users spoke of their growing problem of salinity, the rice producers of the upper Sacramento Valley came in for a major share of the criticism for their role in upsetting the natural balance that kept salinity as far downstream as possible.

Not only did the volume of streamflow change, but its character was altered as well. The entire system was "uncorked" and the meandering streams that once flooded the overflow basins along the Sacramento River and large sections of the Delta were channeled by reclamation and flood control projects designed to move flood waters as quickly as possible to the sea. It was sometimes asserted that the elimination of the "natural reservoirs" that held, and then released, quantities of water after the floods from upstream had subsided, allowed salinity to begin its upstream advance against reduced streamflows earlier in the season. However, in all probability the overall effect of these changes was relatively insignificant.


OREGON
CRESCENT CITY
EUREKA
MT. SHASTA
REDDING
RED BLUFF
CHICO
WILLOWS
MARYSVILLE
LAKE TAHOE
NEVADA
SANTA ROSA
SACRAMENTO
STOCKTON
MODESTO
MERCED
SAN FRANCISCO
MONTEREY
MENDOTA
FRESNO
VISALIA
TULARE LAKE AREA
MT. WHITNEY
BAKERSFIELD
SANTA BARBARA
PACIFIC OCEAN
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION — REGION II
CENTRAL VALLEY BASIN
CALIFORNIA
SCALE IN MILES
0 10 20 40 60 80
1944

USBR photo

Beginning in the 1850s, reclamation turned the Sacramento-San Joaquin Delta from a tule swamp into a rich agricultural area, irrigated from the channels that wind between the islands.

DWR photo

None of the other changes in natural conditions had as much effect on salinity as the reduction in streamflow. The volume of the tidal basin, a factor that influenced the force of tidal flows, was probably reduced somewhat by reclamation in the Delta. Though it is uncertain exactly how much of the low-lying region was flooded even at high tide, it may be reasonable to assume that a substantial part of it was inundated, particularly during the season of high water. Reclamation began in the 1850's principally in the southern, or San Joaquin, portion of the Delta with the construction of artificial levees on top of the old natural ones. The clamshell dredge, introduced in 1879, allowed the construction of levees that gave reasonable insurance against flooding of the reclaimed islands and made possible more extensive reclamation. By 1920 virtually the entire Delta had been reclaimed. The levees that transformed a vast tule swamp into one of California's richest agricultural areas eliminated some portion of the original tidal basin. The dredging that created the levees deepened the shallow natural channels of the Delta but could not compensate for the loss of thousands of acres to reclamation. The degree of reduction in tidal flow that resulted is uncertain, but "if the original tidal flow had been materially greater than the present tidal flow, it would have resulted in a much greater magnitude of saline invasion than is known to have occurred."[10]

One final factor affected by reclamation was vegetation. The replacement of the natural aquatic plant life such as tules and cattails with agricultural crops that consumed only one-third to one-fourth as much water actually allowed more water to flow into Suisun Bay to combat salinity. In summarizing the result of all the changes in the Delta tidal basin it can be assumed that the decrease in tidal flow and water consumption in the Delta strengthened to some extent the river system's ability to withstand the constant pressure of tidal salinity.

By 1920, then, natural conditions had long since disappeared. Changes in tidal volume, and hence in tidal flow, had been on the whole beneficial but proved inadequate to compensate for the massive reductions in streamflow resulting from irrigation diversions. The balance was becoming more precarious, and more dependent on an adequate level of rainfall to maintain both irrigation and the natural barrier against salinity. When the one natural condition that remained unchanged, the weather, brought less than the normal supply of moisture, the tides began a new invasion of the rivers.

THE CRISIS AND PROPOSALS FOR A BARRIER -- The increased diversion of water from the Sacramento River was noted by the State Water Commission as early as 1917, when they began to make preliminary tests of river salinity. At that time they warned:

> *In the event of additional appropriations of water and the consequent increased lowering of the stream in the summer season, the question arises as to whether the influence of the tides will encroach further inland and render water unfit for irrigation that can now be used. This matter serves to indicate one of the many new and important phases of the great water question as it is developing in California through the great use of that commodity and a rapidly increasing demand for more.*[11]

The next year some increase in salinity was observed but it was not until 1920 that the crisis anticipated by the Commission occurred. In that year predictions of record rice acreages in the Sacramento Valley coincided with a serious drought. Bulletins issued by the State Water Commission in February, 1920, warned irrigators of the impending shortage of water and cautioned them to investigate their legal rights to a sufficient supply before planting their crops. With the runoff of the Sacramento River, as measured at Red Bluff, only 34 percent of normal at the beginning of March, the State Railroad Commission called a meeting of the relevant state and federal agencies as well as interested individuals from the Sacramento Valley. At that meeting in the spring of 1920, representatives of about 70 percent of the irrigated acreage in the Sacramento Valley recognized the necessity for concerted action and agreed to place the administration of diversions in the hands of the conference in order to apportion water fairly and conserve it wherever possible.[12]

It was well that action had been taken, for the situation during the summer of 1920 was severe. By August the flow of the Sacramento River at Sacramento had dropped to under 500 cubic feet per second (second-feet), well below the volume of flow from that stream that was later estimated as the minimum level at which salinity could be barred from the Delta. The

saline content of the Sacramento River stood between 7,000 and 8,000 parts of chloride per million parts of water* for over a month at Collinsville, at the junction of the San Joaquin and Sacramento rivers. Further up the Sacramento River, Rio Vista recorded a peak of over 2,000 ppm of chloride.[13] Since the generally accepted limit of safety for irrigation purposes is a concentration of 1,000 ppm of chloride, 1920 proved a frightening year for Delta water users.

With the emergency water conference acting as overseer, water was used efficiently and rice acreage was reduced by 50,000 acres, so that, in the words of the State Water Commission:

> *The degree of the crisis which was met is well expressed by the ratio of the total diverting capacity of all the projects to the flow in the river. At its low point, the flow in the river was just about one-third of the total capacity of all the pumping plants and diversions between Sacramento and Red Bluff. Had projects diverted to the full capacity of their systems and to the full extent of their claims to water rights, the river would have been dry early in the summer with no water for the lower projects.*[14]

However effective the conference might have been it was only a temporary emergency expedient rather than a solution to the problem of over-appropriation of the Sacramento River. Delta interests, seeking to protect their rights to sufficient fresh water to restrain the upriver movement of salinity and insure that crops could be safely irrigated, made plans for a massive legal action. On July 2, 1920, the town of Antioch, representing and financed by Delta interests, brought suit against upstream irrigators in the Sacramento Valley requesting that they be enjoined from diverting so much water that tidal salinity would be allowed to move upstream and jeopardize Antioch's municipal water supply, which was taken directly from the San Joaquin River. By the end of 1920 the defendants in the case included "ten irrigation districts, twenty-one irrigation and land companies and reclamation districts, thirty-nine specifically named individuals and 248 John Does. All of these defendants are users of water for irrigation from Sacramento River or its tributaries . . ."[15]

Although a lengthy trial resulted in a temporary injunction in early 1921, it was ultimately overturned by the California Supreme Court in a decision handed down in March, 1922. In that decision, the Court responded to Antioch's assertions of riparian and appropriative rights to a fresh water supply.

> *The fact that the city of Antioch is situated upon the San Joaquin River is wholly immaterial in the consideration of its rights in this case. The rights in a stream or body of water which attach to land because it abuts thereon are not of a political nature, but are private rights. They are vested exclusively and only in the owner of the abutting land and they extend only to the use of the water upon the abutting land and none other . . .*
>
> *An affidavit was filed at the hearing in the court below stating that the city owns a small tract of land bordering on the river, upon which its pumping plant is situated, and that it makes some use of the water of the river on that land for the flushing of its filters there in use as a part of its works. But the complaint does not allege any of these facts and does not claim protection for that right. Hence, if that is a riparian use, it is not here in issue.*[16]
>
> *Our conclusion is that an appropriator of fresh water from one of these streams at a point near its outlet to the sea does not, by such appropriation acquire the right to insist that subsequent appropriators above shall leave enough water flowing in the stream to hold the salt water of the incoming tides below his point of diversion. Further than this we need not go.*[17]

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* Parts per million parts of water, abbreviated "ppm" hereafter, is the common measurement of concentration in solution. Early reports often expressed concentrations as "parts per 100,000 parts of water." Adjustments to ppm have been made accordingly.

Antioch had claimed that 3,500 second-feet had to flow past Sacramento in order to maintain acceptable quality, while in 1920 the flow of the river at Sacramento had dropped as low as 420 second-feet. The Court viewed as unnecessarily wasteful the demand that an additional 3,080 second-feet be allowed to pass unused into the ocean so that the city could pump less than one second-foot for domestic purposes.[18] The "Antioch Case," though unsuccessful, was a landmark in the history of the fight against salinity. However, the suit dealt only with water rights at the edge of the Delta. The legal basis of the suit might have been firmer had it been on behalf of irrigators making substantial diversions within the Delta. The reasons for taking a stand at Antioch rather than further upstream are obscure, though if Antioch had succeeded the entire Delta would have been protected, while in the event of a defeat, Delta irrigators could insist that the ruling did not apply to water users further upstream.[19] Litigation that might have settled the issue, the so-called "Holland Land Company Case" of 1928 with 143 plaintiffs and 443 defendants did not come to trial and was voluntarily dismissed when Shasta Dam went into operation in 1944.[20]

Litigation was not the only logical solution: an engineering alternative was also conceivable. The erection of dams on the headwaters and tributaries of the great rivers could store flood waters for release during the dry season to provide water for irrigation and salinity control. A more direct answer, and one with all the charms of simplicity, was the construction of a dam somewhere below the Delta to physically separate salt from fresh water and permanently limit the upstream incursion of salinity.

The idea of a barrier in the Carquinez Straits had been investigated by C. E. Grunsky, then assistant to the State Engineer, as a flood control measure as early as 1880:

> *It was thought possible that the checking of the tide by a barrier across the straits might make more space in Suisun Bay available for the river water, so that between tides the bay would not fill to the same level as it would under the combined influence of river discharge and an up-flowing tide.*[21]

Unfortunately, Suisun Bay was found to be too small for the scheme to succeed. At its flood stages the river carried enough water into the bay to more than fill it between low tides, so that instead of lowering water levels in the Delta by eliminating the effect of high tides, a barrier below Suisun Bay might even raise them. The idea of a flood control barrier was therefore abandoned without any consideration having been given to its potential use in controlling salinity.

At this early stage, the people most interested in promoting a dam across the Carquinez Straits, or at some other point below the Delta, were those whose legal claim to water was being challenged, the irrigators of the Sacramento Valley. Led by W. A. Beard of the Sacramento Valley Development Association, they proposed the barrier as an alternative to the legal action taken against them, arguing that the Delta could insure itself of all the fresh water it needed by the construction of a dam to keep out the salt water. Preliminary engineering studies were undertaken by Guy Hyde-Chick on behalf of the Association. He declared the project feasible if a geologic foundation strong enough to support the structure could be found:

> *A dam is proposed consisting of concrete abutments, each separated from the next by a big butterfly valve on a vertical axis. The abutments would reduce the clearance of the Straits by one-fifth. During low water season, the valves would be closed and the boats would cross the dams by locks. The dam itself, by raising the water level above it would eliminate the necessity for a great deal of dredging now required to keep the channel deep enough for big boats plying the upper river.*
>
> *In seasons of high water, which would automatically dam back salt water from the Delta, the valves would be left open and floods would run over the abutments also. The dam would form a base for a railway across the river here and probably also a highway.*[22]

From the start, Delta land owners were skeptical of the barrier proposal. They preferred to emphasize their legal claims to an adequate water supply. In addition, talk of raising the water level was disturbing to men with eyes always nervously scanning their levees for the first sign of weakness. These fears were reflected by S. E. Kieffer, a San Francisco engineer, who admitted that:

. . . while a dam might not be impracticable in a physical way, and would probably produce the effect desired in holding back salt water and permitting controlled navigation, still its effect on the Islands during flood periods due to raising of the backwater curve should be given most careful consideration.[23]

At a meeting of the River Lands Association, an organization of Delta land owners, held at Walnut Grove on May 22, 1920, proponents of the dam were given an opportunity to present their case, "but failed to convince the crowd that a dam would mend the immediate situation."[24] Deltans remained convinced that the safest and quickest way to combat the salt menace was to insure an adequate level of streamflow to maintain the rivers' natural barrier against the tide.

Writing in 1921, Captain C. S. Jarvis of the U. S. Army Corps of Engineers proposed placing a barrier "equipped with a movable crest and multiple locks between Suisun Bay and the junction of the two rivers."[25] This proposal, which would have located the structure in the vicinity of Chipps Island, gave no more comfort to Delta residents for the Captain hoped to raise the water level there some five to ten feet above high tide to create a reservoir of stored water. In fact, he even rejected alternative downstream locations on the grounds that they offered insufficient opportunity for that kind of increase in the water level.

By 1921 the basic arguments pro and con concerning the barrier had been defined, though in the course of the next decade they would be considerably elaborated. It was generally assumed that a barrier would be successful in preventing the encroachment of salinity above it, and that the water stored behind the dam would serve a number of useful purposes. Water would be made available for agricultural, municipal and industrial use and for the reclamation of marshlands around Suisun Bay. In the fresh water above the barrier, untreated wood pilings and waterfront structures would be protected from the ravages of a salt water borer, the toredo. These destructive shipworms that needed salt water to survive had followed the salinity through the Carquinez Straits and were costing the owners of wharves considerable sums in repair and replacement expenses. It was also widely believed that the barrier itself could serve as the foundation for railroad and highway bridges across the Straits, or from the East Bay to Marin County if the structure was built at Point San Pablo. Two principal drawbacks were readily apparent. One was the danger higher water levels posed for Delta levees, for even if the level of the lake impounded by the barrier was maintained at a height no greater than natural conditions, the fear persisted that a salt water dam, no matter how well designed, would block the free passage of floods and thereby increase the flood crests in the Delta. Objections were also raised to the difficulties imposed on shipping by locks in the barrier. Delays due to lockage meant added expense to ship operators with destinations above the barrier that might not be offset by the deeper channels and isolation from tidal influences that would aid navigation behind the structure. The hindrance to navigation interests depended somewhat on where the barrier was located, the Point San Pablo site being the most objectionable because of the volume of traffic bound for Suisun Bay, and because the Navy would probably protest any obstruction to warships on their way to and from Mare Island. All these arguments were known in a general way, but a great many engineering and economic questions remained to be solved. In fact, the engineers agreed completely on only one thing; more study was necessary.

In 1923 the salt water barrier received an official endorsement of a tentative sort from the state when the Division of Engineering and Irrigation of the California Department of Public Works issued Bulletin No. 4, Water Resources of California - A Report to the Legislature of 1923. Responding to the increasing demand for water, the legislature had, in 1921, ordered the preparation of a comprehensive plan for the full utilization of California's water. Already, in 1920, Col. Robert Bradford Marshall of the U. S. Geological Survey had suggested damming the Sacramento River near Red Bluff to feed two grand canals, one on each side of the Central Valley, designed to move excess northern water to the south. Diversion of the Kern River to Los Angeles and the Klamath River to augment the Sacramento rounded out his pioneer state-wide water development plan. As proposed in Bulletin No. 4, the state's plan called for the creation of storage reservoirs on the upper Sacramento River and the transfer of excess water from the Sacramento River to the San Joaquin Valley where water supplies in some areas were being dangerously depleted. A salt water barrier was an integral part of this plan:

In the comprehensive plan, the excess waters of the Sacramento drainage basin would be collected in the main river channels and, by means of a dam across Carquinez Straits below the mouth of both the Sacramento and San Joaquin rivers, this water would be diverted into the lower San Joaquin River from which the grand canal would take its water . . . The dam across Carquinez Straits would have many other advantages . . .

The practicability of locating and constructing such a dam below the mouth of the Sacramento and San Joaquin rivers, had been investigated as far as could be without exploration borings at the various possible sites for its location. It was concluded that a dam in this vicinity is feasible but that extended studies of all possible sites should be pursued before a selection is made.[26]

In a later supplementary report, Bulletin No. 9, the details of the proposed water transfer system were presented, along with the statement that, at least in the beginning, storage facilities on the upper Sacramento River could provide sufficient water for diversion to the San Joaquin Valley without the immediate construction of a salt water barrier. However, the barrier was still an important component of the comprehensive plan, for:

. . . although the barrier is not a physical necessity to the first unit of the comprehensive plan in the San Joaquin Valley it is an essential feature of the ultimate diversion of the Sacramento River water into the San Joaquin, for without it, there cannot be the complete conservation necessary to develop the large volumes of surplus Sacramento water for exportation; but unless its construction were assured, undoubtedly the first unit of the comprehensive plan would become embroiled in the water right controversies surrounding the incursions of salt water into the delta region of the Sacramento and San Joaquin river, and be subjected to court injunction.[27]

In other words, diversions to the San Joaquin Valley envisioned in the comprehensive plan would deplete streamflow to the point that salt water would be allowed to move into the Delta unless restrained by a barrier.

Rainfall conditions returned to normal in 1921 and remained favorable through 1923. Yet, the memory of 1920 lingered on, and even though Sacramento Valley irrigators had emerged victorious from their court battle, they continued to support the idea of a salt water barrier. Some Delta interests, perhaps because of the failure of litigation to solve the problem of salinity, also expressed an interest in at least further exploring the idea of a barrier. In a letter dated January 4, 1923, W. A. Beard of the Sacramento Valley Development Association and Dan Hadsell, chairman of the Delta Land Syndicate, requested that the United States Bureau of Reclamation undertake a survey, in cooperation with the State of California, of the "feasibility, probable effectiveness, and the approximate cost of the proposed work."[28] With the advice of Captain C. S. Jarvis, the petitioners estimated the cost of the survey at $25,000, the expense to be divided between the Bureau of Reclamation and private interests. A year later, on January 26, 1924, a contract was signed by the Bureau, California's Division of Engineering and Irrigation and the Sacramento Valley Development Association providing for the terms of the investigation and the means for financing it. Although the original document provided for funding of $30,000, that figure was soon exceeded. By the time it was completed over $77,000 had been spent on the survey, with the United States providing in excess of $37,000, and California, about $27,000. Local contributions, collected in large part by San Francisco attorney Hadsell's Lower Sacramento River Control Project, amounted to over $12,000.[29] Walker R. Young, an engineer from the Bureau of Reclamation, was placed in charge, while W. A. Perkins of the Division of Engineering and Irrigation was made his assistant.

While the investigation was getting underway another unusually dry year hit the Central Valley. In the fall of 1923 the Division of Water Rights in the Department of Public Works decided to hold a conference on Sacramento River problems in order to gather information necessary to its own operations. Since the Sacramento Chamber of Commerce was planning a similar gathering, the two meetings were combined and the conference met in Sacramento, January 25-26, 1924. By the time it assembled, the indications that 1924 would be another abnormally dry year made the meeting a timely one. With the threat of saline incursion once again imminent, the salt water barrier was a topic of discussion. However, a cautious approach prevailed, except perhaps in C. E. Grunsky's advocacy of a barrier located at Point San Pablo.[30]

To meet the problem of allocating the available water supplies in the dry year of 1924, the conference established a permanent committee that first met on April 8, 1924. They appointed, with the cooperation of the Division of Water Rights, Harlowe M. Stafford as Water Supervisor to oversee diversions and monitor the movement of salinity. By mid-July the flow in the Sacramento River at Sacramento had dropped to a meager 700 second-feet, while the San Joaquin River was contributing only 400 second-feet to the Delta. On July 25, 1924, an emergency meeting of water users with the Water Supervisor was held at Colusa that resulted in a reduction in diversions and redoubled efforts at conservation. The new policy paid speedy dividends for by the first week in August the flow had increased to 1,020 second-feet at Sacramento and by the end of that month had risen to 1,500 second-feet. At the time of the Colusa meeting salinity levels dangerous to irrigated crops had reached as far upriver as Isleton and Howard Ferry on the Sacramento and the Webb Tract on the San Joaquin River. With the increased flow in August, salinity retreated somewhat and irrigation was able to continue. Without the measures adopted at the Colusa meeting salinity would have extended much farther and led to significant crop damage. As it was, an estimated $6 million worth of Delta crops were saved.[31]

In 1924, too, another facet of the salinity problem reached a symbolic climax. The marine borer teredo had been moving upstream, and by 1924 the worms had invaded parts of Suisun Bay, destroying pilings and piers and forcing the replacement of untreated wood with creosoted timbers or even concrete structures. Among the teredo-attacked piers scheduled for renovation was one belonging to the Associated Oil Company at Avon. Before it could be rebuilt, however, it collapsed on the night of October 28, 1924, while the tanker Alden Anderson was unloading a cargo of oil. As the pier fell, electric light wires short-circuited, setting fire to gasoline stored in a shed on the wharf. The pier, and then the tanker, were almost immediately engulfed in flames. The ship drifted, a blazing wreck, into the center of Suisun Bay carrying with her the six members of her crew who died in the tragedy. And all because of a worm that had to have saline water to live.[32]

A Second Sacramento-San Joaquin River Problems Conference was held in December, 1924, to assess the season's accomplishments and consider future courses of action. Among the papers read at the second conference was one on "The Detrimental Effects of Salt Water on Industries," by Carl W. Schedler, general manager of the Great Western Electro-Chemical Company of Pittsburg, California. Schedler estimated that the use of salt water in boilers, pumps, locomotives, cooling and condensing works and other machinery had caused a loss of $150,000 for the industries from Crockett to Antioch in a year when salinity was as high as it was in 1924. The Great Western Electro-Chemical Company, makers of chemical products such as hydrochloric acid, was forced to abandon the use of river water, that had been satisfactory since the opening of the plant in 1916, and buy well water from the city of Pittsburg. Schedler concluded by pointing out that the Suisun Bay area had advantages as an industrial center that should not be overlooked and that:

> *We have in this section of the country everything that these large eastern industrial sections have, and a great deal more, but with one exception - 'WATER.' . . .*
>
> *In order to develop this great industrial section (and it is necessary to develop the industrial section as well as the agricultural section if we are going to have a proper balance in the State of California) we must have at our industrial sites plenty of good cheap water.*[33]

Schedler's presentation to the conference suggested that industrial interests were becoming aware of their vital stake in solving the water problem. He was especially active in this endeavor, being instrumental in establishing the Association of Industrial Water Users of Contra Costa and Solano Counties at the end of 1924 to collect and disseminate information on salinity and water supply problems as well as to insure that industrial interests were considered in the discussion and evaluation of proposed solutions. Most of the large industries in the Suisun Bay-Carquinez Straits area joined the Association, and in 1925 the group gathered factual data on these industries for use in the forthcoming Walker Young study, including detailed information on industrial water use and on navigation.

THE ENGINEERS REPORT -- From the signing of the contract in early 1924 until March, 1926, Walker R. Young conducted the first, and for thirty years the most thorough, feasibility study of the salt water barrier. Although it was originally intended that the survey would make preliminary drilling explorations of the foundation conditions at a number of sites and from that data select the most suitable locations for intensive study, it was later decided to fully develop the data on three typical sites for the barrier. These were at Point San Pablo below San Pablo Bay, and at Dillon Point and Army Point in the Carquinez Straits. This change in plans vastly increased the expenditures, and infusions of additional money were required to keep the study going. Several alternative plans were drawn up for each site that differed primarily in the arrangement of flood gates and the provision for railroad and highway crossings. In addition, two designs were submitted for a Benicia site although no drilling was conducted there and geological reports indicated that the presence of the Sunol fault made the location unsatisfactory.

Locks of several different dimensions were provided at each site for the efficient handling of a variety of vessels, including extremely large locks at the Point San Pablo site to accommodate battleships. Because of the difficulty of anchoring heavy structures to the streambed, the ship locks were generally located to one side, carved into the more solid foundation of the shoreline. Flood gates of the Stoney roller type that could be raised to pass almost any potential flood without increasing Delta water levels were placed either on a firm foundation next to the locks while the main channel was closed by an earth and rock fill, or situated in the middle of the channel between concrete piers sunk to bedrock. Cost estimates for the project varied widely depending on the site and the design. Figures that ranged from nearly $39,000,000 to $97,000,000 meant that a salt water barrier would be a costly undertaking no matter where it was built.[34]

Some operational problems of the barrier had long been foreseen, such as the obvious difficulties imposed on navigation, but the most potentially bothersome problem, simply maintaining the purity of the water behind the barrier, had not been generally appreciated. Some leakage around the gates was expected and salt water would also at times enter through the locks to pollute the fresh water lake impounded by the barrier. The accumulated salt water had to be periodically flushed out, and this, as well as normal operation of the locks and the fish ladder, would require a considerable amount of water. In additon, if the water level behind the structure fell below mean sea level it would be more difficult to keep salt water from polluting the barrier lake, to say nothing of the hindrance such low levels would pose for navigation. For these reasons it was necessary to hold water at the highest level possible, the limiting factor being the strength of the Delta levees. Young, on the advice of experienced Delta land owners, established mean high tide as the highest level compatible with maximum safety. However, mean high tide was only two and one-half feet higher than mean sea level, making the effective storage capacity between these maximum and minimum levels less than the amount required for operation of the barrier. Young hoped that eventually the level could be raised to four or five feet above mean sea level, but even then the storage capacity was not large. This meant that not enough water could be stored behind the barrier to operate it during the irrigation season. Sufficient supplemental supplies could be provided by streamflow in normal years, but would have to come from some other source in dry years. That is, the barrier could not be operated during a dry year unless water was released for that purpose during the summer from upstream storage reservoirs, reservoirs that did not then exist and would have to be built if the barrier was to function properly under adverse conditions.[35]

As a general conclusion to the extensive investigation, Young stated:

> *The studies made lead to the conclusion that it is physically feasible to construct a salt water barrier at any one of the sites investigated, but at great expense; and that it would be effective in controlling the salinity of the reservoir impounded above it . . .*
>
> *Without the barrier, salinity conditions will become more acute unless mountain storage is provided to be released during periods of low river discharge to act as a natural barrier against invasions of salt water. . . .*[36]

Although actual on-site work was completed by March 31, 1926, when the Berkeley office of the Bureau of Reclamation was closed and Walker Young transferred to Ellensburg, Washington, the report was not officially transmitted to the Bureau until the summer of 1927 and not officially released until June 22, 1928. The delay caused considerable consternation on the part of those who had contributed to the financing of the study. The report, Bulletin No. 22 of the Division of Water Resources, successor to the Divisions of Water Rights and Engineering and Irrigation, was finally published in 1929.

It had originally been expected, especially by those who helped finance it, that the Walker Young report would cover both the engineering and economic aspects of the salt water barrier but the finished report dealt only with the physical feasibility of the proposed structure without venturing an opinion on its economic usefulness. Insisting that the report had gone far enough, the federal government showed no interest in participating in any further studies of the economic aspects of a salt water barrier. In an effort to fill the gap, the Association of Industrial Water Users of Contra Costa and Solano Counties commissioned engineer Thomas H. Means in early 1928 to make an economic survey of the barrier based on the designs proposed by Walker Young and available to Means in manuscript form. The "Means' Report," of course, represented little if any original investigation and was turned out in a rather short period of time. The total cost of the report, borne entirely by the Association of Industrial Water Users, was only $3,421.50, printing included.[37]

Issued in June, 1928, the Means' Report featured a persistent emphasis on industry rather than agriculture, on water quality in the area around Suisun Bay rather than in the Delta. According to Means, California had passed through two stages of growth, the mining stage and the agricultural stage, and was embarking on a third stage, the industrial. In words reminiscent of Schedler's remarks at the 1924 conference, he stated:

> *The entire industrial area along Suisun Bay and Carquinez Straits may be said to be restricted in growth on account of the fact that there is no easily obtainable supply of fresh water, the result has been a restricted rate of growth of population and an increase in cost of water to those who are already in the community.*
>
> *The salt water barrier, to a large extent, will remove these difficulties. . . .* [38]

The report acknowledged that navigation would be hindered but argued that the extra traffic generated by industrial growth would compensate shipping interests for the nuisance of the barrier. The Delta, too, would benefit from a reliable supply of fresh water for irrigation. With all these factors favoring the barrier, the conclusion of the Means' Report was obvious:

> *The salt water problem may be partially solved in several ways but completely only in one way. Conditions may be ameliorated by storage and release of water from reservoirs to push back the salt water or water supply from outside sources may be brought in to supply fresh water through conduits or pipes.*
>
> *The only satisfactory solution of the problem is the salt water barrier.* [39]

NOTES

CHAPTER I - ORIGINS OF THE SALT WATER MENACE

1. John Thompson, "The Settlement Geography of the Sacramento-San Joaquin Delta, California," Ph. D. dissertation, Stanford University, 1957, p. 13.

2. Ibid., p. 52.

3. Division of Water Resources, Bulletin No. 27, Variation and Control of Salinity in Sacramento-San Joaquin Delta and Upper San Francisco Bay, 1931, p. 43.

4. Thomas H. Means, "Salt Water Problems of San Francisco Bay and Delta," Exhibit C., Joint Committee of the Senate and Assembly dealing with the Water Problems of the State, Report, January 18, 1929, p. 109.

5. H. E. Bolton (ed.), Fray Juan Crespi: Missionary Explorer on the Pacific Coast, 1769-1774, (New York, 1971), 294; Bulletin No. 27, pp. 46-47.

6. Bulletin No. 27, pp. 48-49.

7. Table 18, Divison of Water Rights, Biennial Report, 1922, p. 95.

8. Bulletin No. 27, p. 130.

9. Ibid.

10. Ibid., p. 161.

11. State Water Commission, Report, 1917, p. 88.

12. State Water Commission, Third Biennial Report, 1921, Appendix J.

13. Chart facing p. 212, Division of Water Rights, Bulletin No. 4, Proceedings of the Second Sacramento-San Joaquin River Problems Conference and Water Supervisor's Report, 1924.

14. State Water Commission, Third Biennial Report, p. 155.

15. Frank Adams, "Every Water Appropriator Involved," Pacific Rural Press, December 18, 1920, p. 791.

16. Town of Antioch v. Williams Irrigation District, 188 Cal 451, 456 (1922).

17. Ibid., p. 465.

18. Ibid., p. 461.

19. Burton J. Gindler and Myron B. Holburt, "Water Supply Problems: Approaches to Legal and Engineering Solutions," Natural Resources Journal, July, 1969, pp. 358-364.

20. State Water Rights Board, Decision D990, February 9, 1961, p. 45.

21. Letter to Sacramento Bee dated April 17, 1929, C. E. Grunsky, The Benefits of a Salt Water Barrier at the Narrows Below San Pablo Bay, California, Stockton, 1952, p. 2 of letter.

22. R. E. Hodges, "Dam Salt Water from Delta - But How?" Pacific Rural Press, June 5, 1920, p. 879.

23. Ibid.

24. Ibid.

25. C. S. Jarvis, "Control of Flood and Tidal Flow in the Sacramento and San Joaquin Rivers, California," American Society of Civil Engineers, Transactions, 1921, p. 458.

26. Division of Engineering and Irrigation, Bulletin No. 4, Water Resources of California, 1923, pp. 47-48.

27. Paul Bailey, Division of Engineering and Irrigation, Bulletin No. 9, Supplemental Report on Water Resources of California, 1925, p. 20.

28. Walker R. Young, Division of Water Resources, Bulletin No. 22, Report on Salt Water Barrier Below Confluence of Sacramento and San Joaquin Rivers, California, 1929, Exhibit J, pp. 229-230.

29. Bulletin No. 22, p. 26.

30. Division of Water Rights, Bulletin No. 3, Proceedings of the Sacramento River Problems Conference, 1924, pp. 143-147.

31. Division of Water Rights, Bulletin No. 4, pp. 213-215.

32. San Francisco Chronicle, October 29, 1924.

33. Division of Water Rights, Bulletin No. 4, p. 91.

34. Bulletin No. 22, p. 30.

35. Ibid., pp. 222-226.

36. Ibid., p. 28.

37. "History of the Salt Water Fight," no author, July 14, 1933, p. 2, in Schedler Files, Water Resources Center Archives, Berkeley.

38. Means, Exhibit C, Report, January 18, 1929, p. 131.

39. Ibid., p. 167.

II. The Great Crusade for Fresh Water, 1928-1931

THE SALT WATER BARRIER ASSOCIATION OF CALIFORNIA -- In spite of the stipulation that his report should impartially "get the facts,"[1] the work of Thomas H. Means was perfectly aligned with the views of his industrial sponsors, and Means' later actions marked him a supporter of the salt water barrier. The Association of Industrial Water Users was somewhat more cautious. On releasing the Means' Report, Schedler made it plain that the Association had not endorsed any particular scheme for solving the salinity problem. In the summer of 1928 the Association did adopt an innocuous, noncommittal resolution simply asking that the legislative committee on water problems consider the plight of the Contra Costa industrial district.

However, the legislators had more than salt water on their minds. The comprehensive water development plan was so ambitious that not all of its units could be built at once. Set up to make definite recommendations concerning project priorities and financing for the implementation of the plan, the committee of legislators had to consider the needs of irrigators in the Sacramento and San Joaquin Valleys, as well as problems in the Delta and Suisun Bay area. Southern California's water problems, notably the aqueduct from the Colorado River to Los Angeles and flood control along the Santa Ana River, were also before the committee. The Means' Report, besides its value as potential publicity for the barrier, was intended to influence the deliberations of the committee. Means himself, as well as Schedler, travelled to committee hearings to make sure no one forgot that salt was steadily creeping up the channels of the bays and was at the threshold of the Delta.

So far, the forces that can be identified as pro-barrier had operated a relatively quiet campaign. The Means' Report, although written in layman's language, could not by itself make a deep impression on the public consciousness; rather, it and the other limited activities of the Association of Industrial Water Users were directed at the members of the legislature in whose hands the fate of the barrier rested. By the end of 1928, however, campaigns of a more public nature were being contemplated. On December 14, 1928, Senator Will R. Sharkey of Martinez wrote to Schedler suggesting that "some well-timed publicity secured from data at hand might be very helpful in building a sentiment in favor of the project along the lines of the 'Save the Redwoods' campaign that was so successful a few years ago."[2] Schedler was reluctant, and replied that the Association of Industrial Water Users had discussed the possibility of a publicity campaign but preferred to wait until the legislative committee had made its report.[3]

The committee reported on January 18, 1929. The four assemblymen and four senators, led by Assemblyman B. S. Crittenden of Tracy, endorsed, in general terms, the coordinated water plan published in 1927 as Bulletin No. 12 of the Division of Engineering and Irrigation. They specifically recommended that the state build and operate Kennett Dam on the upper Sacramento River in order to secure the "most beneficial use of the surplus waters of the Sacramento River along lines favorably affecting flood control, salinity control, navigation and irrigation . . ."[4] They further concluded:

> *That the construction of a salt water barrier at or near Army Point at a cost of approximately $50,000,000 is necessary for a complete carrying out of the coordinated plan for the development of the water resources of California.*[5]

The declaration of the barrier's ultimate necessity and the inclusion of the pro-barrier Means' Report as an appendix to the committee report might have appeared to be the kind of endorsement that would start congratulations flowing between Schedler, Sharkey, Means and their cohorts, but what the committee had given with one hand it took away with the other. After outlining the proposed network of dams, pumps, canals, and levees that would move Sacramento River water into the San Joaquin Valley, and approving that scheme, the committee expressed some significant doubts as to the sequence of construction:

> *Fifth - That the question as to whether bonds for the construction of said salt water barrier and the dams, pumping plants and aqueducts for the San Joaquin Valley referred to in paragraphs three and four of these recommendations be voted at the same time as the bonds for the construction of the Kennett Dam is being held in abeyance by the committee for further consideration.*[6]

In other words, the immediate future of the salt water barrier was in jeopardy. Even so, the committee had been far more favorably disposed toward the barrier than had been the author of Bulletin No. 12, State Engineer Paul Bailey, who advocated the control of salinity by increased streamflow from the upstream reservoirs proposed in his plan, avoiding "the large cost of a barrier for many years to come."[7]

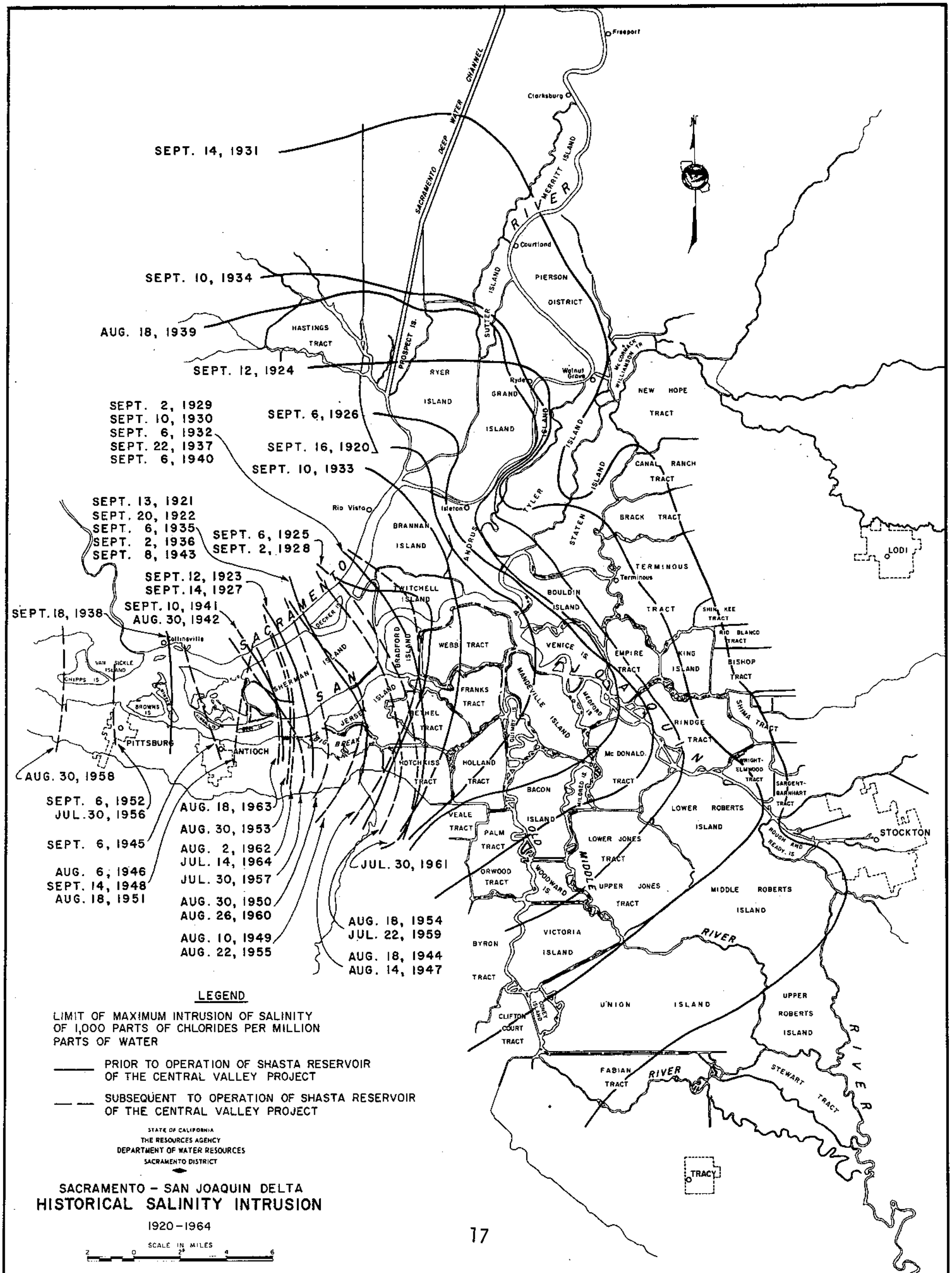
Sharkey, again urging Schedler to accept a more active publicity campaign, commented on January 21 that "There is opposition to the barrier,"[8] opposition that might make its strength felt when the committee made its recommendations on financing. Now that the initial report of the legislative committee had been filed Schedler became more receptive to the idea of widespread publicity. When Thomas H. Means suggested an article on the barrier for local magazines, the head of the Association of Industrial Water Users replied, " . . . now is the exact time at which to start our publicity campaign."[9] The great battle for the barrier was about to begin.

January, 1929, was a month of action for other supporters of the salt water barrier as well. While Schedler was being converted to an active, public relations effort on behalf of the structure, other elements had been organizing. A number of Contra Costa and Solano County representatives who were in Sacramento to promote the barrier met to establish a Bay Barrier Association to carry on the 1929 legislative fight.[10] Roy Davis of Antioch was named president of the loosely knit group, with L. E. Mullen of Martinez as secretary and Thomas M. Carlson of Richmond serving as attorney. Little information survives on this organization, perhaps because by its very nature lobbying tends to shun publicity and discourage documentation. The organization apparently conducted an active effort to sway the legislators. They raised $5,250 by subscription from the areas surrounding the Carquinez Straits and Suisun Bay and spent $5,000 of that sum to reimburse attorney Carlson. The final $250 was paid to "another group," never named, "to secure their cooperation in presenting the matter to the legislature."[11]

After the effort and money expended by the Bay Barrier Association, the supplemental report of the joint legislative committee, issued on April 9, 1929, came as a bitter disappointment:

> *The State Engineer and consulting engineers in the state report have continuously refused to recommend the salt water barrier as one of the first units to be constructed by the state on the ground that the Kennett project would produce greater benefits at a less expense to the state.*
>
> *During the past few months various proposals have been advanced by those interested in the construction of the salt water barrier relative to financing same and additional uses to be considered, such as transfer of Sacramento River water to southern California. And latest suggestion of use of such water in southern California presents problems of sufficiency of supply, engineering and financing that are of such magnitude that intelligent action thereon at this time is out of the question. The conditions prevailing in the delta, Sacramento and San Joaquin basins are of such critical nature that further delay in granting or at least recommending remedial measures seems unwarranted.*[12]

Senator Will R. Sharkey, the steadfast barrier backer from Martinez and member of the committee, filed the lone minority report to the committee recommendations. Reciting the numerous benefits expected from the salt water barrier, the Senator charged its exclusion from the report's immediate recommendations was due to political expediency rather than the merits of the case. The culprits, it seemed, were the southern Californians. Los Angeles had, during the further deliberations of the committee following the January 18 report, made it abundantly clear that it preferred to construct and operate the $150,000,000 Colorado River aqueduct on its own. With only the $10,000,000 Santa Ana flood control project in southern California, but $144,000,000 worth of projects in the north, all hope of a package balanced to satisfy both ends of California's traditional north-south rivalry seemed to vanish. Yet, balance was essential if a bond issue was to pass, for southern Californians would naturally look askance at paying part of the cost of northern California's expensive water system, while financing their own aqueduct as well. The answer finally accepted by the committee, according to Senator Sharkey, was to sacrifice the salt water barrier while keeping Kennett Dam and the San Joaquin water supply system, thereby trimming an estimated $50,000,000 from the northern part of the program.[13]


SEPT. 14, 1931
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AUG. 30, 1942
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SEPT. 6, 1952
JUL. 30, 1956
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SEPT. 14, 1948
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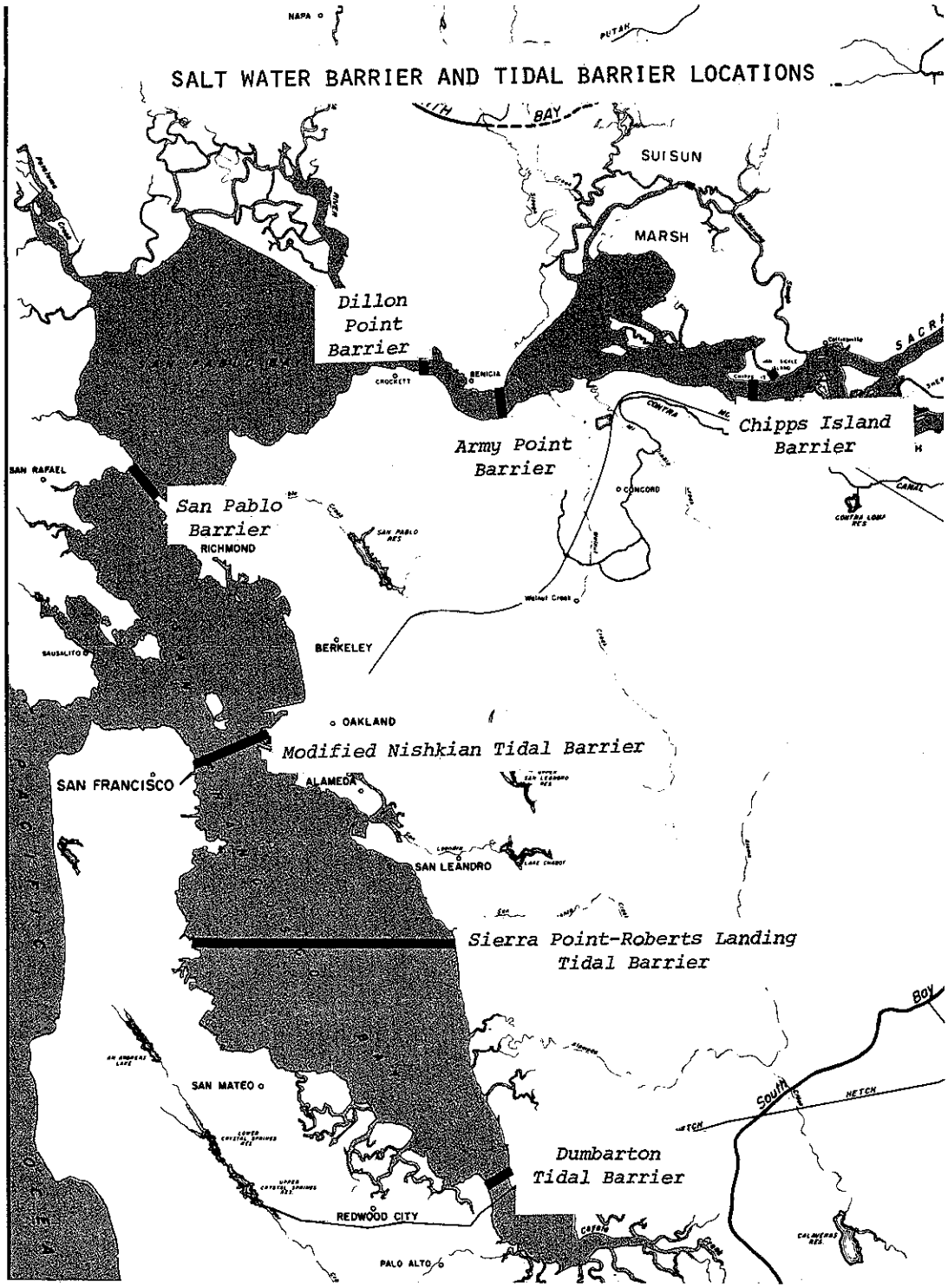
AUG. 18, 1963
AUG. 30, 1953
AUG. 2, 1962
JUL. 14, 1964
JUL. 30, 1957
AUG. 30, 1950
AUG. 26, 1960
AUG. 10, 1949
AUG. 22, 1955
JUL. 30, 1961
AUG. 18, 1954
JUL. 22, 1959
AUG. 18, 1944
AUG. 14, 1947
Freeport
Clarksburg
MERRITT ISLAND
SACRAMENTO DEEP WATER CHANNEL
RIVER
Courtland
PIERSON DISTRICT
SUTTER ISLAND
HASTINGS TRACT
PROSPECT IS.
RYER ISLAND
GRAND ISLAND
Ryde
Walnut Grove
McCORMACK WILLIAMSON TR.
NEW HOPE TRACT
TYLER ISLAND
CANAL RANCH TRACT
BRACK TRACT
STATEN ISLAND
Rio Vista
Isleton
BRANNAN ISLAND
ANDRUS
TERMINOUS
Terminous
LODI
TWITCHELL ISLAND
BOULDIN ISLAND
SHIN KEE TRACT
RIO BLANCO TRACT
BISHOP TRACT
SACRAMENTO
DECKER IS.
Collinsville
VAN SICKLE ISLAND
CHIPPS IS.
BROWNS IS.
SHERMAN ISLAND
SAN JOAQUIN
BRADFORD ISLAND
WEBB TRACT
VENICE IS.
EMPIRE TRACT
KING ISLAND
FRANKS TRACT
MANDEVILLE ISLAND
MEDFORD IS.
JERSEY ISLAND
BETHEL TRACT
BIG BREAK
PITTSBURG
ANTIOCH
HOTCHKISS TRACT
HOLLAND TRACT
RINDGE TRACT
SHIMA TRACT
McDONALD TRACT
WRIGHT-ELMWOOD TRACT
SARGENT-BARNHART TRACT
BACON ISLAND
MILDRED IS.
LOWER ROBERTS ISLAND
STOCKTON
ROUGH AND READY IS.
VEALE TRACT
PALM TRACT
OLD
LOWER JONES TRACT
MIDDLE
ORWOOD TRACT
WOODWARD IS.
UPPER JONES TRACT
MIDDLE ROBERTS ISLAND
BYRON TRACT
VICTORIA ISLAND
RIVER
UNION ISLAND
UPPER ROBERTS ISLAND
CLIFTON COURT TRACT
CONEY ISLAND
FABIAN TRACT
RIVER
STEWART TRACT
RIVER
TRACY
LEGEND
LIMIT OF MAXIMUM INTRUSION OF SALINITY OF 1,000 PARTS OF CHLORIDES PER MILLION PARTS OF WATER
PRIOR TO OPERATION OF SHASTA RESERVOIR OF THE CENTRAL VALLEY PROJECT
SUBSEQUENT TO OPERATION OF SHASTA RESERVOIR OF THE CENTRAL VALLEY PROJECT
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SACRAMENTO DISTRICT
SACRAMENTO - SAN JOAQUIN DELTA
HISTORICAL SALINITY INTRUSION
1920-1964
SCALE IN MILES
2 0 2 4 6


SALT WATER BARRIER AND TIDAL BARRIER LOCATIONS
NAPA
SUISUN
MARSH
Dillon Point Barrier
BENICIA
CROCKETT
Army Point Barrier
Chipps Island Barrier
CONCORD
SAN RAFAEL
San Pablo Barrier
RICHMOND
BERKELEY
OAKLAND
Modified Nishkian Tidal Barrier
SAN FRANCISCO
ALAMEDA
SAN LEANDRO
Sierra Point-Roberts Landing Tidal Barrier
SAN MATEO
Dumbarton Tidal Barrier
REDWOOD CITY
PALO ALTO
South
HETCH

Engineering doubts and political skulduggery aside, the barrier was down, but not out. The issue had gathered enough vocal support, and true believers like Senator Sharkey, that it could not simply be ignored. Thus, on May 15, 1929, Assembly Concurrent Resolution No. 38 was adopted by the legislature, calling for yet another joint committee, to be charged with the investigation of the "water problems of the state including the desirability for and the location of a salt water barrier at or near Carquinez Straits."[14] The eight man committee appointed was identical, save for one assemblyman, with the joint committee that had just rendered its report. Shortly thereafter, more engineering studies of salinity were commissioned and the crucial economic survey was inaugurated. In addition, a federal-state body, known as the Hoover-Young Commission after the President and the Governor who appointed it, was established to investigate national participation in solving the water problems of California, including salinity. The barrier would now be more exhaustively studied than ever before, making the stakes even higher for those interested in its construction.

The original Bay Barrier Association was neither highly organized nor broadly based, rather it existed for the sole purpose of legislative lobbying. Since it was felt that political pressures had led to the setback, the answer lay in exerting a counterpressure, and that could only be attained by the kind of public campaign urged by Senator Sharkey in 1928. Reorganization of the Bay Barrier Association was necessary and the meeting for that purpose was held on October 17, 1929, at the Contra Costa County courthouse in Martinez. A new constitution and by-laws were adopted by the more than 200 people attending. C. W. Schedler, long a leader in the fight against saline incursion, was elected president while Paul S. Wetmore, E. L. Dearborn, Joseph E. Caine, Fred D. Parr and E. M. Downer were named vice-presidents. L. E. Mullen and Thomas M. Carlson continued to act as secretary and attorney, respectively, Carlson serving the group without pay until September, 1930. Of more interest was the geographical distribution of the men nominated as directors of the revitalized organization. As might be expected, Contra Costa County had the most names submitted, 22, while Solano was a somewhat distant second with 10 nominees; some were from points as far away from the Carquinez Straits as Vacaville or Rio Vista. Other counties, in order of decreasing representation, were Napa, Alameda, San Joaquin, San Francisco, Marin, Sacramento, Yolo, Tehama and Glenn.[15] The barrier's base of support appeared to be fairly large but the list of counties is somewhat deceptive since the center of activity and enthusiasm was always Contra Costa and Solano Counties.

At a meeting on November 27, the name of the organization was changed to the Salt Water Barrier Association and about the first of December it was decided to incorporate "as a non-profit educational and research corporation,"[16] under the title of Salt Water Barrier Association of California, Inc. At the same time, Ben S. Allen was hired as publicity manager and assigned the task of raising the necessary revenues with the assistance of W. H. Jackson. The campaign itself was underway by November 21, when a presentation was made to the Commonwealth Club of California. Other meetings were addressed by representatives of the Association, all of whom were unpaid except Allen and Jackson. The drive for the salt water barrier was officially inaugurated when the organization's San Francisco headquarters opened in the Russ Building on January 6, 1930. At that time Schedler announced that the Association's goal was the enrolling of 200,000 members to serve as a political voice for the barrier, with each member paying $1.00 in dues. Hence, at the beginning of 1930, the Salt Water Barrier Association was organized and diligently preparing for what was to be its most active period - the first months of 1930.

Final incorporation papers were filed on April 18, 1930, and the list of incorporators gives a more accurate impression of the barrier's support than the organizational meeting of October, 1929.[17] All but one of the 24 incorporators were from Contra Costa or Solano Counties or had a clearly recognizable interest in that section. The absence of Delta or Sacramento Valley representatives underscored the regional concentration that had narrowed even as the campaign itself had expanded in scope and enthusiasm.

The Salt Water Barrier Association preferred, where possible, to operate through local barrier associations that served as subsidiaries of the parent group. By June, 1930, however, chapters had been formed in only eight communities: Antioch, Benicia, Concord, Pittsburg, Bay Point, Fairfield, Suisun and Walnut Creek.[18] Though some of these cities were miles from the bay and river system, all expected to receive some direct and tangible benefit from the proposed structure.

In their efforts to win friends for the project the Salt Water Barrier Association used a wide variety of promotional techniques. Bumper stickers reading "Build Bay Barrier" were printed and automobile spare tire covers with the same inscription were available for $1.00

apiece, though an October, 1930, resolution directing Schedler to give away the remaining covers indicated that the scheme may have been less than successful. A theater program from March, 1930, advertising Gary Cooper in "The Virginian" and other coming attractions, carried the legend "Boost the Salt Water Barrier for a Better Martinez,"[19] and an unsuccessful attempt was made to interest the telephone company in enclosing "a simple message regarding the necessity for the barrier"[20] with its telephone bills. Something of the fervor that the barrier campaign tried to generate, and the appeal it had for communities along Suisun Bay and the Carquinez Straits, was revealed in the announcement of a meeting sent out by the Martinez Chamber of Commerce:

> *WILL YOUR EMPLOYEES BE THERE?*
> *WILL YOU BE THERE?*
>
> *EVERYONE knows that Martinez will benefit more than almost anyone from the construction of a salt water barrier. The people of Martinez, EVERY LAST ONE OF THEM, should be its very strongest boosters. It is the largest, and most advantageous project which has EVER come before the people of this town. BUT THEY CAN'T be expected to boost for it until they know what it is all about. Next TUESDAY evening, March 4, in the Women's Clubhouse, there will be a MASS MEETING, at which some of the best speakers of this region will tell us why we need the barrier, and what it will mean to Martinez and the State of California.*
>
> *The unified support of ALL the people must be behind this, which means that we want you, Mr. Businessman, to get your EMPLOYEES, your WIVES, and YOURSELVES out to that meeting. There will be no soliciation of funds at the meeting. The sole purpose is to correctly inform Martinezans of "why the barrier." The great cry from every businessman in Martinez is, "When are we going to get some more factories?" All well and good, but until we have cheap, abundant fresh water for industries, we are bumping our heads against a wall in trying to get factories here.*
>
> *YOU MAY HELP THE CAUSE NOW BY URGING ALL OF YOUR FRIENDS AND EMPLOYEES TO BE THERE. THEN COME YOURSELF!!*[21]

Speakers were the principal means of spreading the barrier gospel, with Schedler, Ben Allen and W. H. Jackson carrying much of the load, assisted from time to time by other volunteers. The day before the Martinez meeting mentioned above, Allen wrote to Schedler regarding speakers:

> *The work of the speakers bureau is growing very fast and I find it in some respects easier to take on a talk than to find someone to take it on for us. For this reason, I am making five talks next week. Beginning on Monday, I have every day either a luncheon or a night talk scheduled for the week except Saturday.*[22]

Representatives of the Salt Water Barrier Association appeared at meetings set up to deal exclusively with the barrier and on the regular meeting programs of various civic groups. The message was always the same. Whether at the Foreign Trade Club, the San Francisco Advertising Club or the local Lions or Elks, the industrial growth of the Carquinez Straits-Suisun Bay area was always the principal theme, and the presentation invariably emphasized the approach that Schedler had employed as early as 1924; that industry would wither if salt water prevailed and that only the lack of fresh water prevented the growth of a potentially great industrial district. The use of superlatives indicated more was at stake than a return to the pre-1920 status quo, since the provision of unlimited fresh water would, in the words of an Association of Industrial Water Users resolution in 1928:

> *. . . continue to make this the largest and most important industrial center of the State of California, as well as the West and with increasing foreign trade with the Orient along the rim of the Pacific Ocean, make this the largest and most important industrial center in the United States if not the world.*[23]

These were heady visions, and echoed over and over by supporters of the barrier. For example, the San Francisco Chronicle, which endorsed the proposal, printed an editorial cartoon on February 2, 1930, showing the lake behind the barrier full of commerce and the shoreline

crowded with industries prosperously belching smoke. At times, as in testimony given before the Hoover-Young Commission, the Salt Water Barrier Association included agricultural spokesmen in its entourage but the most important motive for the active barrier advocates of 1930 was the greater economic, and especially industrial, glory of Contra Costa and Solano Counties, and thereby the San Francisco Bay Area in general.

The endorsements given the Salt Water Barrier Association are indicative of the kind of support it received.[24] Chambers of Commerce were the most enthusiastic in their approval of the project, with eleven different units giving it their backing. In addition, such diverse groups as the Contra Costa Federation of Women's Clubs, the Fairfield Lions Club, Kiwanis Club of Richmond, San Francisco Down Town Association, and others backed the barrier. It is probable that local businessmen, the backbone of the Chambers of Commerce, were more dedicated boosters than many of the industries along the rivers and bays since some firms, like the California and Hawaiian Sugar Company, had already solved their own immediate problems of water supply and were uninterested in any proposal that might bring with it higher taxes. In the expansive thinking of the barrier advocates there were overtones of old-fashioned civic boosterism mixed with the faith in economic progress so common in the 1920's. To the businessmen who envisioned the blossoming of their communities with the coming of the fresh water that they believed only a barrier could insure, the salt water barrier became something of a panacea, especially when set against the spreading stagnation of the Great Depression.

Hard times dealt a severe blow to the Salt Water Barrier Association. In an effort to generate the necessary revenue, manager Ben S. Allen, and particularly W. H. Jackson, called on businesses all over the Bay Area in search of contributions. A financial statement covering the period from October, 1929, to June 30, 1933, showed that the Association took in over $40,000, broken down as follows:

Received from 964 individuals and firms in amounts of $1.00 to $25.00	*$ 1,299.00*
Received from 43 companies in amounts in excess of $25.00	*7,421.69*
Received from cities in Contra Costa and Solano Counties	*1,250.00*
Received from Contra Costa County	*30,850.00*
Total	*$40,820.69* [25]

The principal expenses in 1929 and 1930 were salaries, office costs, and the work of a publicity agency.

Despite the activity of the Association, by the time it incorporated in April, 1930, it was in serious financial trouble. No longer able to make ends meet, Ben S. Allen, W. H. Jackson and their staff were terminated on May 1, 1930, and at the same time the San Francisco office, now manned by a lone stenographer, was moved to less pretentious surroundings in the Sharon Building. The financial woes of the Salt Water Barrier Association received a full airing at a meeting in Richmond on June 25, 1930, where it was decided to request the assistance of the Contra Costa County Board of Supervisors. That body agreed to finance the legislative lobbying of the Association, directed by Thomas M. Carlson, while other expenses were to be borne by private contributions. Carlson was paid a lump sum of $2,500 for the period of September through December, 1930, and was expected to pay assistants from that sum as he saw fit. By the fall of 1930, then, the Salt Water Barrier Association had come almost full circle from its creation the year before, having evolved from a small legislative pressure group into a mass organization that hoped to mold public opinion, and back to a smaller, less active, role directed once again at the legislature because it no longer had the wherewithall to carry on a broad publicity campaign.[26]

OPPOSITION AND DEFEAT -- While the Association's financial star was fading in the spring and summer of 1930, a similar fate awaited the salt water barrier itself. The best organized opposition came from Stockton, which was providing half of the $6,000,000 necessary to deepen the channels of the San Joaquin River and there establish a deep-water port. Naturally, any impediment to navigation could expect an unfriendly reception. In April, 1930, C. K. Griffin, president of the Stockton Chamber of Commerce, told the Hoover-Young Commission that Stockton's position had still not hardened into official opposition though caution and careful evaluation of the benefits were urged.[27] By July, however, the City Council was

considering an active battle to stop the barrier. On August 5, 1930, the San Joaquin County Supervisors informed the Chamber of Commerce that they would contribute $2,000 to an anti-barrier fund.[28] Stockton and San Joaquin County had taken their stand against the proposal.

Stockton was not alone in its opposition to the barrier on the grounds that locks would hinder, and perhaps discourage, navigation. The United States Army Corps of Engineers, whose official responsibility and overriding interest was the maintenance of navigation, had substantial doubts of its own on the wisdom of the project. As early as 1924, Major U. S. Grant III, District Engineer for the Second District, stated his personal feeling that the first priority should be upstream storage and that "the other project [the barrier] will be found a little bit more expensive and perhaps a great deal more expensive than the benefit that can be gotten from it will justify . . ."[29] The Major strengthened his comments in House Document No. 123, when he added the potential silting of navigation channels to the problems caused by the locks, and concluded:

> *In view of the above facts, the district engineer is of the opinion that the plan for a dam across the mouth of Suisun Bay is strictly an irrigation project which can have no beneficial effect upon the flood control and navigation projects to which the United States is committed; that the cost of any further investigation of this project and of the project itself, if adopted, should be borne by those whom it will benefit; that the War Department should limit itself to recommending against any special legislation intended to authorize it, unless reasonable provision is made in the plans for navigation and the safe passage of floods; that the sum of the cost and the inevitable injurious effects would far exceed the value of the benefits that could be obtained at the present time or for a considerable number of years.*[30]

Further study somewhat softened the Army's point of view of the barrier. In a report on the Sacramento, San Joaquin and Kern Rivers dated December 29, 1930, that refrained from outright criticism of the barrier, the Corps of Engineers named the Dillon Point site as the most suitable location for the structure. The Corps pointed out that adequate water supplies could be obtained by releases from upstream storage. Such releases, maintaining a minimum streamflow of 3,300 second-feet at Antioch, would not purify Suisun Bay but would keep salt water from the Delta, and a canal from the Delta could fill industrial requirements. Despite the temperate language of the record, the Army Engineers' sentiment was against the barrier.[31]

Private navigation interests were divided in their opinion of the barrier. All ship-owners and operators recognized that the necessity of moving through locks would entail additional expenses and hazards, especially during foggy weather, and some expressed a reluctance to call at ports above a barrier. Others, however, declared that if the claims of industrial growth circulated by the Salt Water Barrier Association were true, the increase in traffic would more than offset the additional time and expense involved in navigating through the locks. Much depended on where the barrier was to be located, for the farther upstream the fewer vessels would be affected, but it was obvious that the hindrance to navigation posed by a barrier at any location was a factor to be reckoned with in determining the overall value of the project.

Local agricultural interests joined the campaign against the barrier, and the few who supported it were generally on the western fringe of the Delta where the problem of salinity was most acute. Although a salt water barrier might eliminate the threat that saline water posed to agriculture on the Delta islands, it was feared that the barrier might imperil the very existence of some of those lands by subjecting the levees to unbearable strains. George A. Atherton, an engineer and manager of the California Delta Farms, was the most articulate spokesman for the Delta landowners, particularly those who, like Atherton himself, operated on the peat lands. In no part of the Delta was reclamation easy, but where peat soils predominated the problems of levee building were especially great. Peat is an organic soil that, when dry, has poor cohesion and tends to shrink, making peat levees rather delicate affairs, and more susceptible to damage by high water. Delta landowners had always expressed some concern over the possibility that the barrier might impede the passage of floods allowing water levels in the Delta to be dangerously increased. Atherton was as concerned over the problem of creating a bottleneck in Suisun Bay and backing up high water into the Delta as any other Delta farmer, but his principal contention was that the continuously high water level maintained behind the barrier could cause the failure of some Delta

levees. Walker Young had shown that to store sufficient water behind the barrier to operate it during the irrigation season water levels would have to be as high as possible, leading him to propose an ultimate level of four or even five feet above mean sea level. Talk of higher water levels worried farmers whose levees required constant vigilance even under the best of circumstances, and helped keep Delta interests opposed to the barrier.[32]

Levees and locks presented engineering and, once constructed, operational problems, but the political dilemma of financing was no less difficult to solve. Early in 1929 State Senator Thomas McCormack of Rio Vista, a supporter of the barrier, warned Schedler that:

> *The only apprehension that the delta land owner has regarding the bay barrier is the question of taxation. Owing to the large reclamation burden that the delta land owner has assumed, the thought of further taxation for water is one that might be opposed.*[33]

The industrial areas that hoped to benefit from the structure were no more willing than the Delta to pay for it. Responding to a question from the Hoover-Young Commission on the willingness of the industries to pay assessments to help offset the cost of the barrier, Schedler bluntly stated the industrial position:

> *. . . I can tell you that the industries up here will not accept an extra burden. We located our plants there when we had the water, and we are not going to be soaked because we made the mistake to go up there and had confidence in the State of California. That is our attitude and it is the attitude of these people up here.*[34]

The notion that the state and federal governments were to blame for the salt water menace, since they had allowed the upstream diversions, justified the pro-barrier position that state and federal funds rather than local financing should correct the situation. Notwithstanding this conviction, figures were prepared by the Salt Water Barrier Association showing that the project's cost was so modest that even nominal local assessments could pay for it. Such calculations were prepared only to emphasize that the barrier was a bargain, not to suggest that local interests were ready to undertake the work alone. The unwillingness on the part of any interest to accept financial responsibility created a major obstacle to its approval and construction.

While the Hoover-Young Commission and the joint legislative committee were holding hearings on the barrier and other state water problems, investigators in the Division of Water Resources were making comprehensive studies of salinity and the long sought economic survey of the salt water barrier that had been authorized by legislative action in the spring of 1929. By November, 1930, all these reports were nearing completion, and advance warning indicated a uniformly unfavorable attitude toward the salt water barrier.

Just before Christmas, 1930, newspaper reports outlined the conclusions of the economic feasibility study that would be published in 1932 as Bulletin No. 28 of the Division of Water Resources. That study evaluated the economic aspects of the barrier in comparison to a program of salinity control by the release of water from upstream storage that would keep streamflow levels high enough to repel salinity as far as the head of Suisun Bay. The conclusion was reached that:

> *Based upon this study of the comparative merits and costs of alternate plans of development, with and without a barrier, it is evident that the plan without a barrier would fully satisfy the basic needs of the upper bay and delta region at a cost of less than one-half of that for a plan with a barrier . . .*[35]

> *The final conclusion of this investigation of a salt water barrier located at any of the three typical sites is that this structure is not necessary or economically justified as a unit of the State Water Plan.*[36]

After almost a decade of investigations that ended with recommendations that further study be made, the unequivocal finality of this conclusion indicated that for the salt water barrier the game was finally up. The investigators, supported by an Engineering Advisory Committee that included George A. Atherton, B. A. Etcheverry, A. Kempky, and even Thomas H. Means,

reviewed the calculations of Walker Young and commissioned expert studies into specific problem areas before reaching their conclusions. As Young had pointed out, the barrier lake would not contain enough water, if held at levels satisfactory to the Delta, to operate the structure itself, making the project less useful in terms of water conservation and fresh water supply than had been hoped. Even without considering the threat to levees posed by an artificially high water level, seepage into the reclaimed islands, and with it the cost of drainage, would be increased. Navigation would suffer from the barrier.

The reports of the special investigations into the use of the barrier to support a roadway, the impact on the fishing industry, and the problem of sewage disposal were no more encouraging. Combining a highway with the barrier was considered unwarranted because it would cost nearly as much as building a separate bridge, which was not needed at that time. The migration of fish would be impeded by the barrier and might lead to a decline in the fishing industry in the region. Finally, the dumping of sewage and industrial wastes into the impounded water could result in a serious pollution hazard that did not exist when tidal action was allowed to remove the effluent.

The most damaging conclusions, especially in regard to the Salt Water Barrier Association, were found in Appendix A, the "Industrial Survey of Upper San Francisco Bay Area with Special Reference to a Salt Water Barrier Below Confluence of Sacramento and San Joaquin Rivers." The report was the work of Professor George W. Dowrie of the Graduate School of Business at Stanford University, under the supervision of a three-man committee headed by Dowrie's dean, Willard Hotchkiss. Point after point they disputed the claims of the barrier advocates. They found, for example, that when asked to give the reasons they chose a location in the Suisun Bay area, 63 industries mentioned water transportation facilities, 53 listed the availability of railroads, and 51 named good highways, while market and raw material availability ranked directly below these transportation factors. "Ample cheap fresh water at time of locating" was listed only ten times as a motive for selecting a Bay Area location. Frequent assertions by Schedler and others that industrial development had come to a virtual standstill since the upriver advance of salinity began were similarly challenged. Four industries, including the Shell Products Company and Johns-Manville, had located plants in the area after salt had become a problem. Obviously, fresh water was not as crucial a factor in industrial development as the barrier's promoters claimed.[37]

As early as 1924, Schedler had decried the damage done to industrial machinery forced to use saline water. In water used for cooling and condensing purposes, accounting for over 80 percent of industrial water consumption, the study found that salinity was a relatively unimportant factor although salt-resisting pipes, pumps, and equipment were necessary. Salt water was clearly detrimental to boilers and to most industrial purposes, calling for some means of securing a fresh water supply, though not necessarily a barrier. A final problem was that of financing any proposed salt water barrier. Unless the federal and state governments paid a major share of the cost, the increase in taxes in the district "benefitted" by the barrier would eliminate any saving gained from cheap water and would discourage new industries moving into the area.

Besides presenting facts distinctly different from those propounded by barrier advocates, the whole view of reality held by the Salt Water Barrier Association and its supporters was questioned. In the Association's opinion a great industrial future was being thwarted by salinity, but their obsession with that problem was a drawback in itself:

> *The upper bay industrial area at present may be said to be 'salinity conscious.' So long as this state of mind prevails, it is bound to serve as an impediment to securing the share of industrial activity which the excellence of the area's attractions warrants. Definite steps should be taken to wipe out both the actual and psychological handicaps which salt water encroachment has imposed.*[38]

The barrier, however, was not the way to overcome that handicap.

Before December, 1930, was allowed to fade into history another blow fell on the barrier. The Hoover-Young Commission issued its report to the President of the United States and the Governor of California on December 27. It recommended that the Kennett Dam be built on the Sacramento River and that water from that stream be transferred to the San Joaquin Valley. The salt water barrier seemed prohibitively expensive, particularly since upstream storage would be required to insure summertime operation. The Commission reasoned that the dam would do nearly as good a job by itself:

The building of the Kennett reservoir will make it possible at all times to maintain a flow past Antioch and into Suisun Bay, of not less than 3,300 second-feet. This flow will maintain fresh water to the lower end of the delta near Antioch, will substantially restore natural conditions in that area and will provide fresh water within reasonable distance and cost for the industries along Suisun Bay, which can easily be brought to these industries by a canal as a locally financed project. In view of these facts, we definitely recommend against the so-called "Salt Water Barrier," . . .[39]

The Salt Water Barrier Association at first refused to admit the defeat that was becoming more and more decisive. H. W. Crozier, an engineer from San Francisco, had been hired to review the findings of the Corps of Engineers. Unlike the various official investigators now submitting reports, Crozier still believed the barrier was practical and that the fight should be continued. Those attending a December strategy session on the barrier, including the Association's financial angels, the Contra Costa County Board of Supervisors, agreed. Again, the focus was to be legislative, and Thomas M. Carlson was chosen to direct the effort for a fee of $15,000 for five months. As before, Carlson was expected to use those funds to pay assistants he might decide to hire.[40] Another meeting of the executive committee on March 6, 1931, also failed to change the Association's stand in favor of a salt water barrier.

The final body to make its report on the barrier was the legislative committee. Four projects received their endorsement: the Kennett Dam, storage reservoirs in the San Joaquin Valley beginning with Friant Dam, the system of pumps to move Sacramento River water southward, and "the Contra Costa County conduit, to supply water to users heretofore dependent upon fresh Suisun Bay water at an estimated cost of $2,500,000."[41] The committee still refrained from an outright condemnation of the barrier, preferring to treat it as a project that might be necessary sometime in the future, depending on the efficacy of the proposed remedies to the salinity situation.

After this report the Salt Water Barrier Association drove the final nail in the coffin of the barrier with a letter apparently sent to supporters in April, 1931. The letter stated in part:

We are very pleased to announce that it will not be necessary for you to make any further contributions to the Salt Water Barrier Association, as we have enough money on hand to see the present legislative session through to completion. . . .

While disappointed that the Barrier will not be constructed among the first units, we feel that the latest engineering investigations upset Walker Young's figures to such an extent that the immediate construction of the Barrier is no longer a clear-cut necessity. Impartial engineers are justified now in questioning the advisability of its immediate construction.

In view of the above, the executive committee has approved the present state water plan which includes the Contra Costa County conduit previously referred to. We hope the amendment to also build a canal in Solano County to Benicia will be included.[42]

In May, 1931, the San Francisco office was closed, and the faithful stenographer, Miss Thelma M. Schroeder, let go.

NOTES

CHAPTER II - THE GREAT CRUSADE FOR FRESH WATER, 1928-1931

1. Schedler, "Preface," to Means, Exhibit C, Report, January 18, 1929, p. 108.
2. Senator Will R. Sharkey to Schedler, December 14, 1928, in Schedler Files, Water Resources Center Archives, University of California, Berkeley. All correspondence in this chapter is from Schedler Files.
3. Schedler to Sharkey, December 17, 1928.
4. Joint Committee of the Senate and Assembly dealing with the Water Problems of the State, Report, January 18, 1929, p. 20.
5. Ibid., p. 21.
6. Ibid.
7. Paul Bailey, Division of Engineering and Irrigation, Bulletin No. 12, Summary Report on the Water Resources of California, and a Coordinated Plan for their Development, 1927, p. 38.
8. Sharkey to Schedler, January 21, 1929.
9. Schedler to Means, January 26, 1929.
10. "History of the Salt Water Fight," July 14, 1933, p. 2, in Schedler Files.
11. Ibid., p. 3.
12. Joint Committee of the Senate and Assembly dealing with the Water Problems of the State, Supplemental Report, April 9, 1929, p. 11.
13. Statement by Senator Sharkey, Ibid., pp. 15-19.
14. Assembly Concurrent Resolution No. 38, May 15, 1929.
15. Minutes of Bay Barrier Association, October 17, 1929, in Schedler Files.
16. Sacramento Bee, January 6, 1930.
17. "Incorporators of Salt Water Barrier Association," April 7, 1930, in Schedler Files.
18. Schedler to L. E. Mullen, June 12, 1930.
19. Item in Schedler Files.
20. Ben S. Allen to Col. T. C. Blanck, March 5, 1930.
21. Item in Schedler Files.
22. Allen to Schedler, March 3, 1930.
23. Association of Industrial Water Users, Resolution, adopted June 21, 1928, in Schedler Files.
24. See folder on endorsements, Schedler Files.
25. "Receipts of the Bay Barrier Association from October, 1929, to June 30, 1933," in Schedler Files.
26. "History of the Salt Water Fight."

27. California Joint Federal-State Water Resources Commission (Hoover-Young Commission), Reporter's Transcript, April 8, 1930, pp. 103-107. This commission cited hereafter as "Hoover-Young Commission."

28. San Francisco Chronicle, August 5, 1930.

29. Division of Water Rights, Bulletin No. 4, Proceedings of the Second Sacramento-San Joaquin River Problems Conference and Water Supervisors Report, 1924, p. 86.

30. House Document No. 123, quoted in Edward Hyatt to Schedler, June 19, 1929.

31. Extract of Corps of Engineers Report on Sacramento, San Joaquin and Kern Rivers, December 29, 1930, Lt. Col. T. M. Robins to Schedler, March 14, 1931, in Schedler Files.

32. Hoover-Young Commission, Reporter's Transcript, pp. 113-138.

33. Senator Thomas McCormack to Schedler, January 6, 1929.

34. Hoover-Young Commission, Reporter's Transcript, p. 58.

35. Division of Water Resources, Bulletin No. 28, Economic Aspects of a Salt Water Barrier Below Confluence of Sacramento and San Joaquin Rivers, 1932, p. 41.

36. Bulletin No. 28, p. 44.

37. Ibid., Appendix A, p. 184.

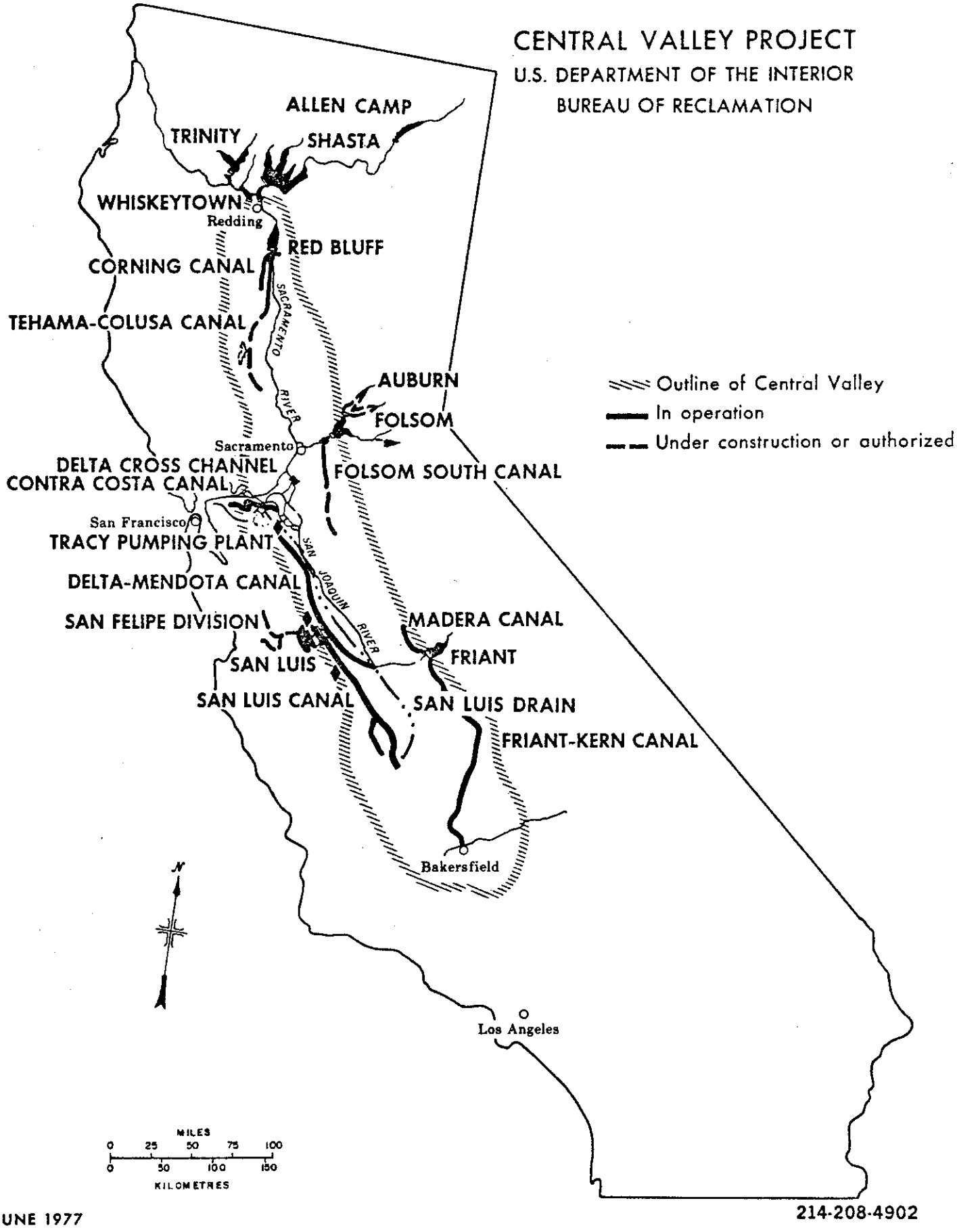
38. Ibid., p. 219.

39. Hoover-Young Commission, Report, December 27, 1930, p. 6.

40. "History of the Salt Water Fight," p. 7.

41. Joint Committee of the Senate and Assembly dealing with the Water Problems of the State, Report, March 23, 1931, p. 23.

42. Schedler to contributors, no date.


CENTRAL VALLEY PROJECT
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
ALLEN CAMP
TRINITY
SHASTA
WHISKEYTOWN
Redding
RED BLUFF
CORNING CANAL
TEHAMA-COLUSA CANAL
SACRAMENTO RIVER
AUBURN
FOLSOM
Sacramento
DELTA CROSS CHANNEL
CONTRA COSTA CANAL
FOLSOM SOUTH CANAL
San Francisco
TRACY PUMPING PLANT
DELTA-MENDOTA CANAL
SAN JOAQUIN RIVER
SAN FELIPE DIVISION
MADERA CANAL
FRIANT
SAN LUIS
SAN LUIS CANAL
SAN LUIS DRAIN
FRIANT-KERN CANAL
Bakersfield
Los Angeles
Outline of Central Valley
In operation
Under construction or authorized
N
MILES
0 25 50 75 100
0 50 100 150
KILOMETRES
JUNE 1977
214-208-4902

III. The Central Valley Project is Born

THE STATE DEVELOPS A PLAN -- While Contra Costa and Solano County businessmen campaigned for the salt water barrier, Delta water users continued to insist that since the salinity menace had been created by excessive upstream irrigation diversions, the proper remedy was the restoration of sufficient summer flows to control the incursion of tidal salinity. The storage of winter runoff in reservoirs would permit releases during the dry season to augment natural streamflows, assuring both upstream and Delta diverters a water supply sufficient for irrigation and salinity repulsion. The minimum rate of Delta outflow depended on the degree of salinity control desired and the location where that level was to be maintained. In 1929, California's Division of Water Resources made an extensive investigation of salinity conditions in the Delta region in order to understand as fully as possible the natural relationships between tides, streamflow, channel characteristics, and water quality in the San Francisco Bay estuary system. The results of these studies were published in 1931 as Bulletin No. 27, The Variation and Control of Salinity in Sacramento-San Joaquin Delta and Upper San Francisco Bay, which became the standard reference work on the encroachment of salt water into the Delta.

The engineers, however, did more than just describe the natural phenomena that determined Delta water quality; they made specific recommendations regarding measures designed to alleviate the salinity problem. As a practical solution Bulletin No. 27 recommended that a chloride level of not over 1,000 ppm, the maximum concentration for agricultural application, be maintained in the vicinity of Antioch.[1] Although Thomas H. Means and others had placed the line of "natural" saline penetration at approximately the Carquinez Straits, the state engineers based their recommendations on the premise that, "The invasion of salinity into Suisun Bay as far as the lower end of the Sacramento-San Joaquin Delta is a natural phenomenon which, in varying degree, has occurred each year as far back as historical records reveal."[2] Since the location of Antioch was thought to approximate the western edge of the Delta, control of salinity at that point would more or less restore minimum natural conditions of water quality. "This could be accomplished," the report stated, "by providing a net streamflow in the combined channels of the Sacramento and San Joaquin Rivers passing Antioch into Suisun Bay of not less than 3,300 second-feet."[3] The decision to establish a hydraulic barrier at Antioch and to define it in terms of the poorest water quality admissible for irrigation offered virtually no relief to the industrial water users of Contra Costa County. In fact, water quality would deteriorate so rapidly below the line of control that Pittsburg, less than ten miles downstream from Antioch, could expect to have salinity measured at 2,250 ppm when the concentration at Antioch reached the 1,000 ppm limit. An improvement of equal magnitude was predicted upstream with Emmaton on Sherman Island enjoying between 100 and 150 ppm of chlorine with a 3,300 second-foot outflow past Antioch.[4]

Though not published until 1931, the conclusions of Bulletin No. 27 and the concurrent salt water barrier economic studies contributed significantly to the final report on the State Water Plan transmitted to the legislature of 1931. That report, Bulletin No. 25 of the Division of Water Resources, was the culmination of a decade of planning for the comprehensive development of California's water resources, and presented to the legislature the State Engineer's suggestions regarding the construction and financing of the initial units of the system. The plan envisioned a dam at Kennett, on the Sacramento River north of Redding, that would, by controlled releases, supplement the natural flow of the Sacramento and tributary rivers to enhance river navigation, control floods, provide irrigation supplies, and repel salt water from the Delta. A series of improved channels would transfer a portion of the stored water across the Delta to the San Joaquin Pumping System where a stair-step series of dams would turn the San Joaquin River into a succession of pools supplementing and replacing San Joaquin River flows that would be blocked by Friant Dam east of Fresno and diverted through canals to serve parts of the Central Valley from Madera to Kern Counties. To satisfy Delta requirements as well as to insure the quality of water transferred through the Delta to the San Joaquin Valley, the State Water Plan proposed relief from saline incursion as one of the project's primary purposes.

Since the San Joaquin River Delta was approximately twice the size of the Sacramento River Delta and was supplied by a smaller, heavily depleted, stream, the most advantageous location for reservoir storage to combat salinity would have been on the San Joaquin River system. Unfortunately, only two reservoir sites in that basin could supply the necessary

water, the New Melones and the New Don Pedro sites, and the cost of developing those dams would have been at least double that of alternative Sacramento River storage facilities.[5] For that reason, the project's main weapon against salt water was to be Kennett Reservoir, which would "supplement unregulated flows and return waters"[6] and supply "a fresh water flow of not less than 3,300 second-feet past Antioch into Suisun Bay, which would have controlled salinity to the lower end of the Sacramento-San Joaquin Delta . . ."[7] in a year as critical as 1924.

Because the operation of Kennett Dam was not intended to insure the purity of Suisun Bay, some alternative source of fresh water had to be developed to supply the vociferous industrial interests of Contra Costa County. The State Water Plan included the proposal for a "Contra Costa County Conduit" to be constructed from Rock Slough in the San Joaquin Delta approximately fifty miles west along the south shore of Suisun Bay and into the Clayton and Ygnacio Valleys. Since the industrial survey had indicated that only 20 percent of the water used by Contra Costa industries had to be of low salinity, the canal offered a reasonable alternative to the large additional releases that would have been necessary to freshen Suisun Bay during the summer months. The $2,500,000 canal would supply industrial water users with the process and boiler water they required up to a predicted demand of 34 second-feet of flow by 1940. The remainder of the 120 second-foot capacity would be used for irrigation.[8]

Just as the Salt Water Barrier Association was finally accepting the demise of the plans to dam the Carquinez Straits and the State Water Plan was being presented to the legislature, water users throughout the Central Valley were bracing for what promised to be one of the most critically dry years on record. With little rain by late March of 1931, the Permanent Committee of the Sacramento-San Joaquin River Problems Conference set in motion the procedures perfected during the water shortage of 1924. Although the Corps of Engineers had the power to curtail diversions in order to maintain navigation, they refrained from doing so as long as irrigators conscientiously limited their water usage. Limitations proved necessary, for although runoff measured at Keswick on the Sacramento River was 29 percent of normal as compared to 28 percent in 1924, a greater acreage of rice in 1931 created a more serious situation.[9] River flow recorded at Sacramento had dropped as low as 705 second-feet in 1924, but fell to zero for a short time in 1931.[10] To insure that the little water remaining in the river would be efficiently used, the Water Supervisor ruled that where waste water was discovered draining off an irrigator's fields his diversion would be reduced by an equal amount. With little, if any, streamflow to oppose it, tidal salinity with a chloride content of 1,000 ppm or more spread over 90 percent of the Delta, the approximate limits of encroachment being Clarksburg and Stockton, while Antioch recorded a maximum salinity of over 11,500 ppm. Agricultural losses were estimated at $1,265,700, or 5.28 percent of the gross value of Delta crops.[11] It seems an ironic prank of nature to inundate the Delta and Suisun Bay with salt water only months after the proposal to build a solid barrier against the menace was eliminated from consideration.

Despite the obvious urgency of the Delta's salt water problem and the pressing need for water in the San Joaquin Valley, where a dropping water table was threatening some farms with abandonment, the legislature did not authorize the construction of the State Water Plan for two more years. Finally, in August, 1933, both houses passed, and Governor Rolph signed, the Central Valley Project Act. The Act provided for the construction of the facilities outlined in Bulletin No. 25, including Kennett Dam, its regulatory afterbay and power-generating facilities, the Delta cross-channel and the Contra Costa County Conduit. Of particular interest to the Delta were the provisions stating that the dam at Kennett was to be operated

> *primarily for the improvement of navigation on the Sacramento River to Red Bluff, for increasing flood protection in the Sacramento Valley, for salinity control in the Sacramento-San Joaquin Delta, and for storage and stabilization of the water supply of the Sacramento River for irrigation and domestic use, and secondarily for the generation of electric energy and other beneficial uses.*[12]

A Water Project Authority consisting of the Attorney General, State Controller, State Treasurer, Director of Finance, and Director of Public Works, with the State Engineer as executive secretary, was established to oversee the construction and operation of the project. Bonds totalling $170,000,000 secured by project revenues were expected to underwrite its construction.

The ink was scarcely dry on the legislation before its opponents launched an effort to submit the measure to a referendum vote. Led by San Francisco attorney Fred G. Athearn, the challengers charged that the project constituted an "almost revolutionary program"[13] and one likely to saddle the state with an incredible debt, since they believed that the revenue bonds would evolve into general state obligations. When enough signatures had been gathered to force the issue to a vote, Governor Rolph, a supporter of the Central Valley Project, scheduled a special election for December 19, 1933. In the ensuing campaign, Athearn's forces reported expenditures of over $21,000 by December 10, but that figure was dwarfed by the nearly $95,000 Pacific Gas and Electric poured into the effort to defeat the Central Valley Project.[14] Although power generation was intended as a secondary purpose of the water plan, debate on the question of public vs. private power threatened to overwhelm other aspects of the project throughout its early history. When the ballots were tallied, the Central Valley Project had been approved by a vote of 459,712 to 426,109 in an election that revealed distinct regional biases. Los Angeles rejected it by a two-to-one margin, while San Franciscans approved the Act by a similar ratio. Predictably, the parched San Joaquin Valley gave overwhelming support to the project.[15]

THE FEDERAL GOVERNMENT STEPS IN -- Under Section 15 of the Central Valley Project Act of 1933, the Water Project Authority was "empowered to enter into contracts with the United States of America, its instrumentalities or agencies, or any thereof, for the purpose of financing the construction, maintenance and operation of said Central Valley Project."[16] The Authority was also allowed to authorize federal supervision of the project until money advanced by the United States had been repaid. In addition to the expectation of a federal contribution for the enhancement of flood control and navigation, the state hoped to secure funds made available under the National Industrial Recovery Act of 1933. Proponents of the Central Valley Project often made the point that it was foolish, if not unpatriotic, not to accept Washington's generosity in the form of New Deal pump-priming at a time when other sources of money were scarce.

> *In helping the recovery program we are also helping ourselves. The Federal Government is advancing 30 percent of the costs of constructing public works throughout the country. If we want to take advantage of these allotments, we must be at the counter when the allotments are being made. These federal dispensations will not continue for long; they may end before the year is out; certainly they will end before the close of 1934.*[17]

During the referendum battle the State Water Plan Association was even more blatant in its appeal for voters to "Support President Roosevelt's National Recovery Program for California -- Vote YES . . . CREATE JOBS FOR 25,000 MEN FOR THREE YEARS! . . . This Project will put $170,000,000 in Federal money into immediate circulation in California . . ."[18] Governor James Rolph submitted California's request for an outright federal grant of $43,600,000 in addition to federal purchase of $123,000,000 of the project's revenue bonds on September 27, 1933, well before the voters had approved the project.[19] In its efforts to secure the money needed for construction, the state never put its revenue bonds on the market and it never faltered in its pleas for federal assistance. State Engineer Edward Hyatt established a virtual shuttle between Sacramento and Washington, D. C. in his efforts to secure funding from the Public Works Administration.

In his lobbying efforts in Washington, Hyatt was not alone. Among his prominent supporters was Thomas M. Carlson, attorney for the Salt Water Barrier Association. Far from collapsing when the barrier was rejected, the Association quietly redirected its efforts toward the Central Valley Project and the Contra Costa conduit, retaining Carlson for a fee of $3,000 a year, out of which he continued to pay any engineers or assistants he might require. Following passage of the Central Valley Project Act, Carlson had tried to stymie the attempt to subject the legislation to a referendum vote. When those efforts failed, he stumped the state arranging meetings and speaking in favor of the project. During the course of that campaign he consulted with state officials regarding preparation of the original loan application to the federal government.[20] Thereafter, he joined Hyatt's Washington entourage, and may have been singularly effective during 1934 for "it is reported that Attorney Carlson convinced President Roosevelt of the Project's value during a 20-minute personal presentation."[21] In 1935, the Association remained active in Washington and on the

local scene, where efforts were underway to create the district required for construction, operation and repayment of the conduit.[22] Carlson's service on behalf of the Salt Water Barrier Association and the industrial sector of Contra Costa County insured that the needs of the lower Delta for fresh water would not be forgotten.

The first sign of federal interest in the Central Valley Project came from the Army Corps of Engineers. Maintenance and improvement of navigation on inland waterways had long been a federal responsibility under the jurisdiction of the Corps, while flood control, first on the Mississippi in 1879 and then on the Sacramento River since 1916, had more recently become a nationwide obligation of the Army Engineers. At the request of California, the Corps conducted surveys of its own on the Sacramento, San Joaquin and Kern Rivers at the same time that the Division of Water Resources engineers were putting the finishing touches on the State Water Plan. In a report issued as House Document no. 791 in 1931, the Division Engineer of the South Pacific Division had ruled the salt water barrier detrimental to navigation and unjustified. The Board of Rivers and Harbors of the Corps of Engineers, in commenting on this report to the Chief of Engineers, stated that " . . . it is alleged that increase in the salinity of the Delta waters has been aggravated by channel enlargements made by the United States in the interests of navigation and flood control," but the increase in the tidal basin had been of no "material importance."[23] Since the Corps accepted no responsibility for the development of the problem it was the conclusion of the Board "that the United States should not contribute to the cost of any measures of salinity control in this Delta."[24]

However, House Document No. 791 had recommended a federal contribution of $6,000,000 toward the cost of Kennett Dam for flood control and navigation benefits. In the Final Report of the Chief of Engineers on the Sacramento, San Joaquin and Kern Rivers, California, dated June 27, 1933, that figure was raised to $7,570,000. Concerning salinity the Final Report said:

> *(e) The economic value of Kennett Reservoir for salinity control is estimated at about $355,000 per annum, but the United States is not concerned in consequential damages from the incursion of salt water and should make no direct contribution towards the cost of that reservoir in the interest of salinity control.*[25]

Once again the Corps of Engineers had in effect designated salinity control as a state rather than a federal function.

California's strenuous efforts to secure federal financial assistance for the Central Valley Project inevitably resulted in a new series of hearings and reports. Although the Bureau of Reclamation and other organizations had studied the stalled project, the most significant report came at the request of J. J. Mansfield, chairman of the House Committee on Rivers and Harbors, who asked that the Chief of Engineers, General E. M. Markham, review earlier reports of the Corps in light of recent developments and suggest any modifications that seemed to be required. Local Corps officials had already been confronted with California's insistence that Kennett Dam be built to a height of 420 feet rather than the 460 foot elevation the Corps had used as the basis for its calculations in 1933. Although continuing to recommend the larger dam, the Corps accepted the lower structure and eventually assigned a proportionately lower financial value to the flood control and navigation benefits expected from the facility. The report of the Chief of Engineers differed significantly, however, from the recommendations of the Board of Rivers and Harbors or the Division Engineer. While the report authorized a lower federal contribution to flood control and navigation aspects of Kennett, it unexpectedly increased the overall recommended federal grant to $12,000,000 stating that

> *remedying the instrusion of salt water into the delta of the Sacramento and San Joaquin Rivers, it eliminates from consideration Federal participation in the construction and operation at great cost of locks and structures to prevent such intrusion, and assures a free and open passage for the highly important navigation through the channels of the Delta.*[26]

By considering hydraulic salinity control as a navigation benefit, the Chief of Engineers made it a federal, and nonreimbursable, obligation. The Review Report, House Document No. 35, was a significant step forward for the Central Valley Project, for not only did it increase

prospective federal financing of the plan but it served a year later as the basis for the initial authorization of the project in the Rivers and Harbors Act of August 30, 1935. In that Act, the project that began as California's State Water Plan was "hereby adopted and authorized, to be prosecuted under the direction of the Secretary of War and supervision of the Chief of Engineers, in accordance with plans recommended in the respective reports . . ."[27] Despite the authorization, no money was appropriated to the project in that Act.

Financing was, however, being made available through the Emergency Relief Appropriation Act of 1935. On the recommendation of the Public Works Administration Advisory Committee on Allotments, President Roosevelt transferred $20,000,000 in relief funds to the Department of the Interior's Reclamation Service for construction of parts of the Central Valley Project. Although Kennett Dam was not specifically authorized, the purposes of the project, according to the President's September 10, 1935, Executive Order included, "the protection of the delta lands at the junction of the two rivers against injury from salt."[28] The President's action was separate and distinct from the nearly simultaneous authorization for construction contained in the Rivers and Harbors Act. While Rivers and Harbors funds for navigation and flood control were nonreimbursable, the money allocated by the President under the relief statutes was to be "reimbursable in accordance with the reclamation laws."[29] Because regulations required that such monies be spent to build complete units rather than sections of larger projects, it was decided to construct Friant Dam at an estimated cost of $14,000,000 and with the remaining money build some combination of lesser features that might include the Contra Costa conduit, the distribution canals from Friant, or the Antioch steam power plant intended to firm up Kennett's power output when that dam was finally built.

The piecemeal approach to federal financing once again galvanized Contra Costa industrialists into action. A month after Roosevelt had allocated funds to the project, Carl Schedler, in his capacity as president of the Salt Water Barrier Association, released a statement quoting Dr. Elwood Mead, Commissioner of Reclamation, to the effect that the Contra Costa water supply project would be among the first jobs undertaken.[30] Two days later, Mead announced that the unit rule had been discarded, allowing an early start on the construction of Kennett Dam and other project features.[31] Although funds were already being cut, the initial federal commitment had been made, and Walker R. Young returned to the Sacramento Valley to establish the Bureau of Reclamation's construction headquarters for the Central Valley Project.

The massive water development scheme was put on a firmer footing as a federal undertaking in its reauthorization as a reclamation project in the Rivers and Harbors Act of 1937. Because it was in effect the charter for the federal Central Valley Project, and because its language held considerable significance for the Delta, the 1937 enactment is quoted here at length.

> *Sec. 2. That the $12,000,000 recommended for expenditure for a part of the Central Valley Project, California, in accordance with the plans set forth in Rivers and Harbors Committee Document Numbered 35 . . . shall, when appropriated, be available for expenditure in accordance with the said plans by the Secretary of the Interior instead of the Secretary of War: Provided, That the transfer of authority from the Secretary of War to the Secretary of the Interior shall not render the expenditure of this fund reimbursable under the reclamation law: Provided further, That the entire Central Valley project, California, heretofore authorized and established under the provisions of the Emergency Relief Appropriation Act of 1935 . . . is hereby reauthorized and declared to be for the purposes of improving navigation, regulating the flow of the San Joaquin River and the Sacramento River, controlling floods, providing for storage and for the delivery of the stored waters thereof, for the reclamation of arid and semiarid lands and lands of Indian Reservations, and other beneficial uses, and for the generation and sale of electric energy as a means of financially aiding and assisting such undertakings and in order to permit the full utilization of the works constructed to accomplish the aforesaid purposes: Provided further, That, except as herein otherwise specifically provided, the provisions of the reclamation law, as amended, shall govern the repayment of expenditures and the construction, operation, and maintenance of the dams, canals, power plants, pumping stations, transmission lines, and incidental works deemed necessary . . . . And provided further, That the said dam and reservoirs shall be used, first, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses; and third, for power . . .*[32]

The reauthorization was based primarily on the President's Executive Order granting funds under the Emergency Relief Appropriation Act. In 1935 salinity control had been listed as a project objective, but that function went unmentioned in the congressional reauthorization.

The critical omission seemed to make little difference in the late 1930's. Reclamation officials continued to cite the elimination of tidal salinity from the Delta as a benefit of the project then under construction, and other state and federal leaders echoed the assurances. In October, 1941, for example, a publication of the Water Project Authority proclaimed that "one of the main purposes of the Central Valley Project will be to prevent saline invasion into the Delta channels so as to maintain fresh water at all times of the year."[33] Despite the persistent assumption that salinity control, to the extend proposed in California's Central Valley Project Act of 1933, would be a function of the federal project, the crucial Act of 1937 denied the Delta interests the most primary legal assurance that it would be so. The impact of that omission on the Delta was profound, though long in maturing.

NOTES

1. Division of Water Resources, Bulletin No. 27, Variation and Control of Salinity in Sacramento-San Joaquin Delta and Upper San Francisco Bay, 1931, pp. 40-41.
2. Thomas H. Means, "Salt Water Problems of San Francisco Bay and Delta," Exhibit C, Joint Committee of the Senate and Assembly dealing with the Water Problems of the State, Report, January 18, 1929, p. 109; and Bulletin No. 27, p. 42.
3. Bulletin No. 27, p. 41.
4. Ibid.
5. Division of Water Resources, Bulletin No. 25, State Water Plan, 1930, p. 129.
6. Ibid., p. 38.
7. Ibid.
8. Ibid., p. 146.
9. Division of Water Resources, Sacramento-San Joaquin Water Supervisor's Report for Year 1931, 1932, p. 5.
10. Ibid.
11. Harlowe M. Stafford, Office Report, Losses in the Sacramento-San Joaquin Delta Due to the Encroachment of Salinity from San Francisco Bay, 1932, letter of transmittal.
12. California Central Valley Project Act, 1933, in House Document No. 416, 84th Congress, 2nd. Session, 1956, Central Valley Project Documents, Part One, Authorizing Documents, p. 411. This volume will hereafter be cited as "CVP Documents, I."
13. San Francisco Chronicle, August 22, 1933.
14. Ibid., December 10, 1933.
15. Mary Montgomery and Marion Clawson, History of Legislation and Policy Formation of the Central Valley Project, U. S. Department of Agriculture, Bureau of Agricultural Economics, 1946, p. 61.

16. California Central Valley Project Act, 1933, CVP Documents, I, p. 421.

17. Dan Hadsell in The Commonwealth, Part Two, The Commonwealth Club of California, December 5, 1933, p. 273.

18. State Water Plan Association, promotional literature, 1933, in John Reber Papers, Corps of Engineers Bay-Delta Hydraulic Model, Sausalito. This collection will hereafter be cited as "Reber Papers."

19. San Francisco Chronicle, September 28, 1933, p. 1.

20. "History of the Salt Water Fight," no author, July 14, 1933; "History of Bay Barrier Association, July 1, 1933 to December 31, 1933," in Schedler Files.

21. "History of the Bay Barrier Association for the Year 1934," in Schedler Files; Walter Francis Rowland, "The Contra Costa Canal Project: A Study in Water Resource Development," Ph. D. dissertation, Stanford University, 1967, p. 23.

22. "History of the Bay Barrier Association for the Year 1935," in Schedler Files.

23. House Document No. 791, 71st Congress, 1931, in CVP Documents, I, p. 392, see also California Debris Commission, Review of Report on Sacramento-San Joaquin Delta, California; Flood Control, Fresh Water Canal, Suisun Bay, 1938.

24. Ibid.

25. House Document No. 191, 73rd Congress, 1933, in CVP Documents, I, p. 515.

26. House Document No. 35, 73rd Congress, 1934, in CVP Documents, I, p. 549.

27. River and Harbor Act, 1935, in CVP Documents, I, p. 558.

28. Executive Order of September 10, 1935, in CVP Documents, I, p. 560.

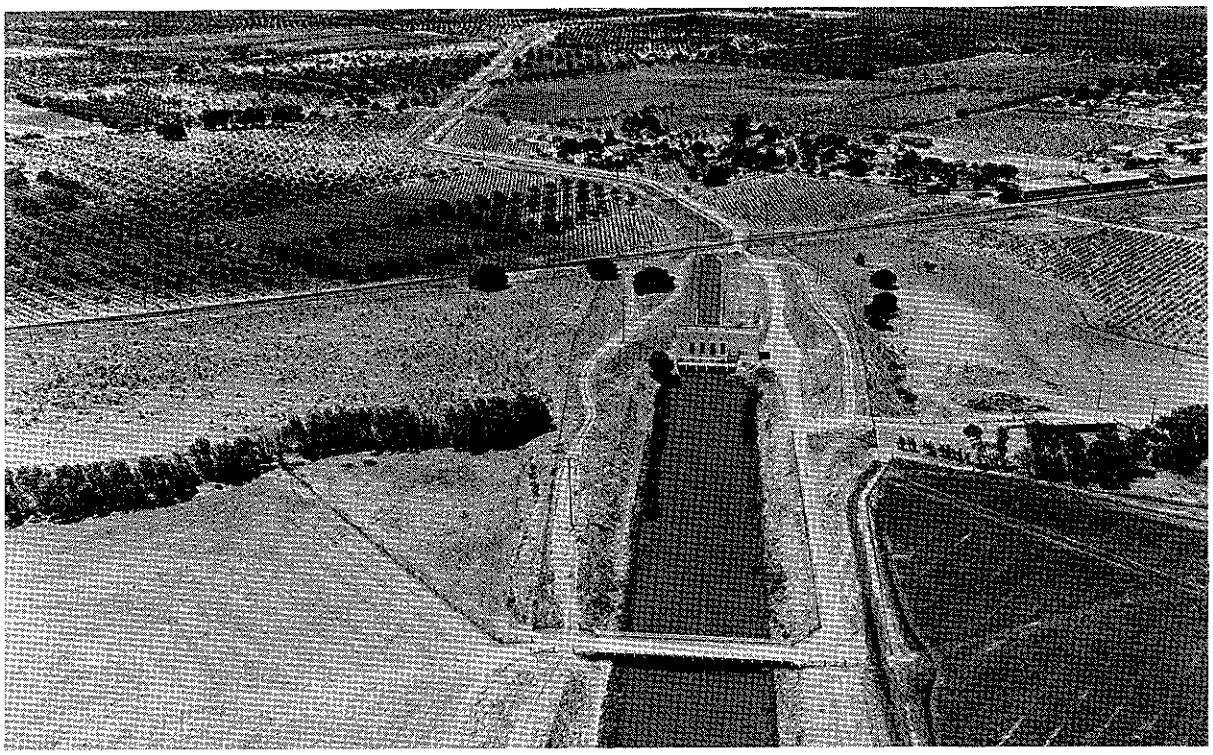
29. Ibid., p. 559.

30. San Francisco Chronicle, October 9, 1935, p. 7.

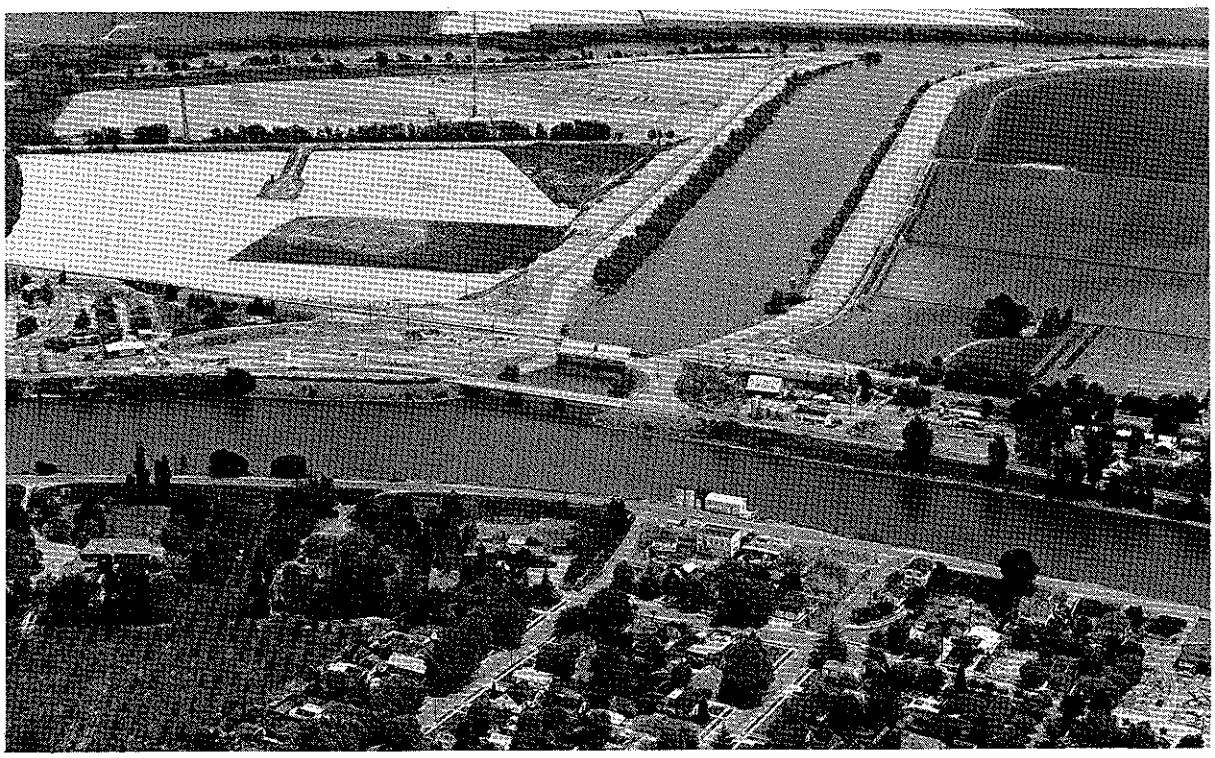
31. Ibid., October 11, 1935, p. 11.

32. River and Harbor Act, 1937, in CVP Documents, I, pp. 568-569.

33. Water Project Authority, Data and Information on the Central Valley Project and the Great Central Valley Basin of California, October, 1941, p. 18.



Contra Costa Canal, Central Valley Project. This facility was the first unit of the Central Valley Project to be placed in operation. It provides an alternative water supply for parts of Contra Costa County threatened by salt water intrusion into western Delta channels. (USBR photo)



Delta Cross-Channel, Central Valley Project. In order to enhance the transfer of water from the Sacramento River to the San Joaquin Delta through interior channels, this dredged cut was made to connect Snodgrass Slough and the Mokelumne River with the Sacramento River at Walnut Grove. Gates at the Sacramento River end of the channel control the flow of water through the artificial connection. (USBR photo)

IV. The Delta Facilities of the Central Valley Project

THE CONTRA COSTA CANAL -- From the time that the upstream penetration of salt water first became a serious menace to Delta and Suisun Bay water users, agitation for a solution to the problem of brackish water was centered in Contra Costa County. Beginning with the Antioch suit of 1920 and continuing through the salt water barrier campaign, Contra Costa industrial interests, together with other local businessmen, pursued the theme that the future greatness of their county depended on the economic advantages conferred by cheap, plentiful supplies of fresh water. Although the emphasis on fresh water as a principal determinant of industrial growth had been overstated, the activity of these development-minded interests had insured that relief for Contra Costa County would be provided by the State Water Plan. Since releases from storage sufficient to freshen the whole of Suisun Bay would have allowed a substantial volume of water to flow out to sea otherwise unused, it had been decided to draw a line of salinity control at the very edge of the Delta, upstream from the industrial district along Suisun Bay, furnishing the downstream area with water imported from the Delta by means of a canal.

In their promotion of the scheme to physically prevent the encroachment of salt water into Suisun Bay, the Salt Water Barrier Association might have seemed dogmatically attached to the barrier concept. Their commitment, however, extended only to securing a reliable supply of fresh water for present and future demands. When engineering and economic studies condemned the barrier as infeasible, the Association proved flexible enough to embrace the alternative offered by the State Water Plan, the Contra Costa County Conduit, later known as the Contra Costa Canal. Though the missionary zeal of the barrier battle faded, the Salt Water Barrier Association sustained a continuous and effective lobbying effort at state and national levels on behalf of the Central Valley Project and the early construction of the Contra Costa Canal. With its promotion of the canal, the Association embarked on the final stage of its struggle for a fresh water supply.

Getting the approval of Sacramento and Washington was only part of the problem; the conduit had to be sold to Contra Costa County as well, since some sort of repayment arrangement would have to be worked out with the construction agency. A flurry of local interest in alternate water schemes promising an earlier solution to the region's water problem erupted before the financial support of the federal government for the canal was forthcoming. In 1935-1936, consulting engineer A. Kempky reviewed the various proposals and recommended a reservoir on Kellogg Creek drawing water from Indian Slough, but the high cost of water developed by the project put a damper on enthusiasm for an independent initiative.[1] The Association continued to favor the public project with its interest-free financing but the talk of alternate plans did underline the need for a broader base of support. As first proposed in Bulletin No. 25, canal capacity was "based upon the irrigation of 80 percent of the gross area of 13,000 acres of agricultural lands . . . requiring a maximum rate of 86 second-feet."[2] Since farmers were expected to take over two-thirds of the water made available through the conduit, their backing was essential to its success. That fact became especially important with the involvement of the Bureau of Reclamation, an agency established primarily for the construction of irrigation projects in the arid West. Although the Bureau was empowered to sell water for nonagricultural purposes if such deliveries were not detrimental to irrigation, the building of an entirely industrial canal might prove difficult to rationalize.

During the 1920's, saline incursion through Suisun Bay and the west Delta had been accompanied by salt water seepage into groundwater reserves adjacent to the bay, while the water table was dropping sharply in the developed agricultural areas of Contra Costa County. In his study of the Contra Costa Canal, Walter Francis Rowland found that "the local farmers were not indifferent to the various water plans . . . However, the principal interest was shown by the farmers who were already irrigating tree and vine crops with well water,"[3] a source that was becoming increasingly inadequate. Other agriculturists were inexperienced in irrigated farming and suspicious of the potential costs and obligations involved in the canal plan.

Shortly after the President approved the first allocation of funds for the Central Valley Project, C. W. Schedler of the Salt Water Barrier Association secured the cooperation of the Concord Chamber of Commerce and the Contra Costa Farm Bureau in arranging a meeting for farmers to discuss canal construction. The conduit planned and promoted as an answer to industrial water problems was placed in the hands of the farmers at the November, 1935, gathering. Both Schedler and a spokesman for the Bureau of Reclamation made it clear that without agricultural support the proposed public conduit would be scrapped in favor of an industrial pipe line costing a mere $375,000. Agriculturists remained somewhat skeptical about the eventual price of water, predicted at $6.90 per acre foot in Bulletin No. 25, as well as the financial stability of the proposed water district in light of numerous irrigation district defaults. Apparently Schedler proved sufficiently persuasive, for a Farmers' Committee headed by Anthony Crafton agreed shortly thereafter to support the formation of a district under provisions of the County Water District Act of 1913, a step that had been recommended by the Salt Water Barrier Association as the most favorable avenue of organization. Farmers were assured that the price of water would cover only operation of the system, with capital costs to be repaid by an ad valorum tax on property that would insure a significant industrial contribution to the project.[4]

With the support of the Farmers' Committee, Schedler and his associates staged their last public campaign in early 1936 to secure voter approval for the Contra Costa County Water District. District organization was an essential step, for without a competent body to contract for water delivery and repayment, no canal could be built. According to the law, a majority of voters in each incorporated area within the proposed district, as well as a majority in the district as a whole, had to approve the organization, so although the project enjoyed wide support, its backers could afford to leave little to chance. The Contra Costa Water Conduit Association, which issued promotional material on the canal and proposed district, played an active role, as did the Farmers' Committee. It seems probable that the Conduit Association was an off-shoot of the Salt Water Barrier Association, with L. E. Mullen once again occupying the position of secretary.[5] Voters went to the polls on May 5, 1936, and gave the canal an overwhelming endorsement, approving district formation by a vote of 8,932 to 1,068.[6] In July, a balanced slate of five directors, endorsed by district sponsors, was elected and Thomas M. Carlson became the new district's attorney.

With local support assured, the Bureau of Reclamation opened an office at Antioch in 1936 and began surveys of the canal route. Actual design of the facility, however, became embroiled in a minor federal-state controversy. The Water Project Authority established by the state's Central Valley Project Act in 1933 was charged with construction of the State Water Plan and specifically authorized to accept aid from the federal government in that undertaking. In giving the Authority permission to enter into contracts with the United States for the construction and supervision of the project until repayment had been completed, eventual state control of the project had been comtemplated. Funding construction of the Central Valley Project by the Secretary of the Interior under the reclamation laws weakened the state's already tenuous grip on an enterprise it had so zealously sold to the federal government, though state officials still hoped to guide the project they had first designed. A working arrangement with the Bureau of Reclamation was established in a contract signed March 25, 1936, and a supplemental contract of March 13, 1937, that gave the Authority the responsibility, subject to the approval of the Secretary of the Interior, of determining the location, capacity, and construction sequence of major project units, while final design and construction would be carried out by the Bureau. The rationale behind this arrangement was explained in the August, 1936, Report on Capacity of Madera Canal and applied equally to the Contra Costa Canal.

> *In view of the fact that it is contemplated that the Authority will enter into a contract with the United States whereby the Authority will obligate itself and assume the responsiblity to repay the cost of the project to the United States upon its completion by and through revenues to be obtained from the sale of water, electric energy and other facilities of the project, it is a matter of great concern to the Authority that the proper and economic size of each unit of the project be determined . . .*[7]

Operation of the agreement was put to the test in deciding the proper capacity for the Contra Costa Canal. The state had originally designated a capacity of 120 second-feet for the canal's initial section on the basis of then-current water needs and projections for the immediate future. With the promise of more favorable financial terms made available by the federal government, consideration was given to increases in capacity to meet longer-range water requirements. Professor George Dowrie, whose credentials included the earlier industrial survey of the Suisun Bay area, was hired by the Water Project Authority to

determine the extent of the potential industrial demand for fresh water in the Contra Costa Canal service area. Dowrie predicted a 30-year increase in industrial fresh water demands of 166-2/3 percent while municipal needs would rise 333-1/3 percent over the same period, requiring a total capacity of 66 second-feet for nonagricultural supply in the Contra Costa County Water District by 1966. Although Dowrie's projections seemed reasonable, if not optimistic, during the Depression, reality subsequently far outstripped the growth levels he had postulated.[8]

Meanwhile, the Bureau of Reclamation in its design studies had been raising the capacity of the canal primarily in response to anticipated economies of scale. From a revised base figure of 200 second-feet the suggested capacity was increased to 275 second-feet largely because a canal 37 percent larger could be built for only a 12 percent increase in cost.[9] Extending the same logic a bit further, Resident Engineer O. G. Boden recommended, in November, 1936, that design capacity again be increased, this time to 350 second-feet, and Boden's request received Bureau approval.[10]

The Water Project Authority, however, did not concur in the figures adopted by the Bureau of Reclamation. In its Report on Capacity and Location of Contra Costa Conduit, dated January, 1938, the Authority based its estimates for future needs on the findings of Professor Dowrie:

> *It is believed that 25 to 30 years growth in water demands constitutes the minimum for which provision should be made. Such provisions would require a capacity of 200 to 220 second-feet in the initial section of the conduit. The capacity required to provide for 40 years estimated growth in demands would be 250 second-feet, and the estimated ultimate capacity required would be 285 second-feet, both referring to the initial section of the conduit.*[11]

The Authority noted the Bureau's selection of a larger capacity, and charged that a flow of 350 second-feet was excessive and unnecessarily expensive. The state contended that the Bureau's cost estimates for smaller capacity canals had been unjustifiably inflated by the development of designs incorporating provisions for later expansion of the facilities. The Water Project Authority recommended that the canal have a design capacity of 275 second-feet in the initial section, leaving it capable of carrying the estimated ultimate demand of 285 second-feet, "with but a slight encroachment on normal freeboard."[12]

The state's position was undermined by the Contra Costa County Water District, which was willing to pay for the additional capacity recommended by federal engineers so long as the total cost of the project did not exceed the $4,000,000 limit set by the District's Board. On March 29, 1938, the Water District's attorney, Thomas M. Carlson, appeared before the Water Project Authority with the request that the Authority approve the increased capacity with the understanding that the District would pay the $500,000 cost of expansion.[13] At its April 12, 1938, meeting, the Authority found it could not reasonably deny the District's request, and approved the 350 second-foot capacity proposed by the Bureau. The District repeated its pledge that expenditures up to $4,000,000 would be repaid, and "State Engineer Edward Hyatt placed in the record his opinion [that] a capacity of 275 second-feet in the initial section of the conduit would be adequate to meet the requirements for the next 40 years."[14] The Water Project Authority was forced to recognize that in dealing with a federal project having repayment guarantees from local agencies, the state had little actual power. Although the Authority continued in existence until 1957, its participation in the construction of the Central Valley Project soon became little more than a formality.

While the haggling over the size of the canal had been going on in early 1938, actual construction of the ditch was already underway. Governor Merriam had participated in a groundbreaking ceremony on November 7, 1937, and work was progressing on the section from Rock Slough to the first pumping station.[15] Construction did not proceed as quickly as canal boosters had hoped, so that by 1940 the facility was completed only as far as Pittsburg. The first test pumping of water took place near Oakley on July 8, 1940.

Unmarked by any public observance, the operation of the pumps began, coincidentally, just six minutes after another significant development on the Central Valley Project more than 200 miles away -- the first placement of concrete in Shasta Dam. . . . At Contra Costa, Supervising Engineer Walker R. Young threw a switch that started a motor in Pumping Plant No. 1 and the first water gushed into the concrete-lined canal from a tidewater section of the canal which extends from Rock Slough . . . [16]

Water had originally been scheduled to flow into the canal on April 1, 1938, but had been delayed by a last minute revision of financial arrangements. The Bureau of Reclamation demanded payment by the District of $10,500 to cover the cost of canal operation until completion of the entire system. Shortly before the projected inauguration of the canal, these interim funding arrangements were upset by the "withdrawal of the Great Western Electro Chemical Company as a prospective water user."[17] During his long association with the chemical company Carl W. Schedler had led the fight for fresh water, only to have his company decline to use the water from the Contra Costa Canal when at long last that supply of fresh water became available. In the wake of the chemical company's ironic announcement, a restructuring of the financial commitments transferred the burden to the City of Pittsburg and the Columbia Steel Company. It was August 19, 1940, before the first project water reached Pittsburg, and civic leaders planned a "Water Festival" for October to celebrate the event.[18]

With 38 miles of the canal completed, work was suspended on May 23, 1942, for the duration of the Second World War. During the war, a series of reports on various aspects of Central Valley Project operations, policy, or problems were prepared under the label of Central Valley Project Studies. The report on Problem 24, The Effect of the Central Valley Project on the Agricultural and Industrial Economy and on the Social Character of California, issued in 1945 echoes in large measure the conclusions published by the Division of Water Resources in the appendix to Bulletin No. 28 concerning fresh water as a determinant of industrial activity. By 1931, most industries had modified their equipment to handle brackish water so that:

By 1944, therefore, neither Contra Costa Canal water nor salinity control in the San Joaquin River could offer important advantages to existing industries. Some new plants might take Canal water in preference to pumping from the river or bay, but it would be difficult to show that inadequate or inferior water had inhibited industrial development in the potential service area of the Contra Costa Canal.[19]

The canal was not unused by industries, however, for many tended to switch from river water to canal supplies when off-shore salinity rose to bothersome levels. In subsequent years, as changes in land-use patterns growing out of the post-war urbanization of the San Francisco Bay Area diminished the demand for irrigation water while increasing municipal and industrial needs, utilization of the Contra Costa Canal grew, making the alternative to the salt water barrier an important source of fresh water in northern Contra Costa County.

As an answer to the problem of salinity, the canal was less than an unqualified success. Even before the pumps were turned on for the first time, low-quality water had accumulated in the unlined intake channel from Rock Slough, where highly saline groundwater had seeped into the channel. Flushing was required to bring the salt concentration down to reasonable levels and was paid for by the District, but again in 1941 poor water quality plagued the canal. Heavy rains that had raised the water table were blamed for the second deterioration of canal water quality. The Columbia Steel Company reimbursed the Bureau for flushing the canal on that occasion.[20]

From 1940 until 1951 the canal was operated under interim contracts with the District that contained no specific water quality standards, though they did not require the District to pay for water it deemed to be unsuitable in quality. The water service contract signed on September 18, 1951, included the provision that "the United States assumes no responsibility with respect to the quality of the water to be furnished pursuant to this contract,"[21] but did not obligate the District to pay for water with a chloride concentration of over 250 ppm. That figure had been chosen because it was thought to be the approximate level of river salinity at which industrial water users switched from the inexpensive offshore supplies to

canal water, therefore indicating that it was the maximum tolerable salinity level. In 1952, the Bureau declared that it would maintain the highest water quality possible in the canal, including provision for periodic flushings. Though pumping would be provided free of charge, the Bureau planned to assess the District the $10 per acre foot municipal and industrial rate for water used in flushing. District protests over that price brought an agreement in 1953 to provide three flushings each year with water supplied at the rate of only 50 cents an acre foot.[22]

Seepage of groundwater into the intake channel was only one of the major threats to Contra Costa Canal water quality. If Delta outflow dropped below the level necessary to prevent saline incursion, Rock Slough might suffer from the pentration of ocean salinity. It was incumbent on the Bureau, therefore, to insure, through releases from upstream storage, at least the minimum level of Delta salinity control necessary to maintain suitable water quality standards at the canal pumps. To slow the movement of salinity toward the pumps, a dam with tide-gates that allowed only the passage of downstream flows was installed on Sand Mound Slough, just north of Rock Slough, in 1940. The so-called "Dutch Slough Dam" replaced an earlier tide-gate structure on Rock Slough itself and meant that under conditions of low outflow from the Delta, salinity would have to spread through Franks Tract and Old River before contaminating Rock Slough and the canal.

Even if ocean salinity was prevented by streamflow and tide-gates from fouling canal diversions, another danger existed in the poor quality outflow of the San Joaquin River. With its natural flows impounded at Friant Dam, the lower San Joaquin carried only the minimal releases from the Mendota Pool, the contributions of tributary streams and salt-laden return flows drained from irrigated fields. While San Joaquin River salinity might measure 50 ppm total dissolved solids (TDS) near Fresno, by the time the sluggish stream emptied into the Delta its quality might have deteriorated to a level of 500 or 600 ppm TDS.[23] The effect of San Joaquin River quality on Contra Costa Canal pumping operations was indicated by a comparison of salinity levels at the Rock Slough intake and Central Landing on Bouldin Island. Both sites are in approximately the same relationship to the ocean, yet Rock Slough recorded 750 ppm TDS, while Central Landing had a reading of only 300 ppm TDS, a difference attributed by the Bureau of Reclamation to the distribution of salinity carried by the San Joaquin River.[24] Further measurements made during 1960, described by the Bureau as a normal year, indicated an August salinity at the Delta-Mendota pumps near Tracy of 375 ppm TDS as opposed to a Sacramento River salinity of 125 ppm TDS. The Bureau credited "the difference to the concentration of salts due to the consumptive use in the Delta such as occurs in any irrigated area."[25] However, in February, 1960, low quality San Joaquin River flows were blamed for levels of up to 700 ppm TDS at the pumps.

If water quality in the canal was not all the project's enthusiasts might have hoped, it did provide an important alternative water supply. The canal's construction had marked the apparent culmination of the efforts to secure fresh water for urban and industrial uses in Contra Costa County. While it did represent an important milestone, subsequent events would once again revive the region's crusade against salt water.

THE DELTA CROSS CHANNEL

> *It has been pointed out previously that the greater portion of the stream flow into the delta comes from the Sacramento River. In certain periods when there is very little inflow from the San Joaquin River system, the portion of the delta embracing the San Joaquin River and its tributaries is largely dependent for its consumptive requirements on supplies from the Sacramento River. This supply from the Sacramento River to the San Joaquin Delta is limited to the flow which passes through two sloughs; namely, Georgiana and Three Mile Sloughs. . . . the flow through Georgiana Slough is directly related to the flow passing Sacramento, whereas the flow through Three Mile Slough . . . results entirely from tidal movement, at least during the period of low stream flow. . . .*
>
> *. . . The portion flowing into the San Joaquin Delta through the present connecting channels would not be sufficient for the combined needs of the San Joaquin Delta.*

. . . . The extent of saline invasion has been proportionately greater in the San Joaquin Delta than in the Sacramento Delta. Moreover, salinity tends to remain in the San Joaquin Delta for a considerable period after increased stream flow in the Sacramento River has almost entirely removed salinity from the Sacramento Delta channels.[26]

With these words the state's Bulletin No. 27 explained the hydraulic relationship between the Sacramento and San Joaquin River Deltas. In designing the State Water Plan, engineers recognized the necessity of modifying the Delta to allow more water to move from the Sacramento River to the San Joaquin Delta. Not only was there a need to redistribute consumptive and salinity repulsion flows but water destined for the San Joaquin Pumping System had to be transferred across the Delta. If no other provisions were made, most of the Sacramento River flows moving toward the pumps would have flowed down the Sacramento, around the end of Sherman Island and then up the San Joaquin River. Bulletin No. 25 proposed cutting an artificial channel from the Sacramento River below Hood to the head of Snodgrass Slough, and using the improved natural channel to make connections with the north and south forks of the Mokelumne River and Georgiana Slough, which would carry the water to Central Landing. From that point natural and man-made San Joaquin River channels would convey southbound flows to the head of the pumping system at Mossdale. The route as proposed by the state totalled 24 miles.[27]

As in the case of the Contra Costa Canal, Bureau of Reclamation engineers soon developed ideas of their own concerning the proper design of the cross-channel. Preliminary surveys of potential routes had begun about 1938 and by 1941 several routes were under consideration by the Bureau. Unlike the state's proposal for the utilization and improvement of natural channels, Bureau engineers routed their facilities around the edge of the Delta, including one that diverted water from the Sacramento River north of Freeport, then travelled south and east to a point just west of Stockton. Crossing the San Joaquin River bothered the Bureau and in the view of one engineer in a memorandum dated October 30, 1941, "It is my opinion that . . . it is not feasible to blend Sacramento River water with water in the Stockton Ship Channel and yet make delivery of water at Mendota within the requirements of the 'Exchange Contract'."*[28] Consideration was given to a siphon beneath the San Joaquin River that would complete the hydraulic isolation of the cross-channel. On December 27, 1941, Senior Engineer H. R. McBirney reported to the Chief Engineer of the Bureau of Reclamation that he had inspected the cross-channel routes and the Delta region personally, and had reached a conclusion at odds with earlier state proposals but in agreement with opinion in the Bureau of Reclamation.

I believe earlier studies by the State and Bureau gave most consideration to the river-and-slough route. One needs only to follow the river-and-slough route, as I did, to acquire a feeling that, after all, there must be some better location on which to build a channel.[29]

The "better" location would have been one of the routes around the periphery of the Delta. In a letter to Reclamation Commissioner John Page, State Engineer Edward Hyatt recommended that California's plans for the cross-channel be revived, but by October, 1942, the project was being described as a diversion from the Sacramento River at Hood with a 12-foot pumping lift and initial capacity of 10,200 second-feet. The route would follow high ground all the way with an inverted siphon to carry water under the Stockton Ship Channel on the San Joaquin River. There another pumping station would lift water into the final section of the canal.[30]

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* Exchange Contract: A water supply agreement with San Joaquin irrigators to "exchange" northern water for the natural flows of the San Joaquin River diverted at Friant Dam. The original Exchange Contract specified that the "weighted average of dissolved solids" should not exceed 200 ppm from October through June, and 300 ppm the remainder of the year. (CVP Documents, II, p. 560)

An Amended Exchange Contract signed March 17, 1956, revised quality standards in light of operational experience. New criteria ranged from a daily maximum average of 800 ppm TDS to a five-year average of 400 ppm TDS, with monthly and annual averages as well.

Recognizing the need for a more precise understanding of Delta flows and hydraulic relationships, Bureau of Reclamation engineers constructed a working model of the Delta in their Denver laboratories. Results of tests run on the model altered the Bureau's approach to cross-channel design. Hydraulic Laboratory Report No. 145, released on July 10, 1944, asserted that the principal determinant of water quality at the Delta-Mendota Canal pumps near Tracy, which had replaced the original concept of dams in the San Joaquin River, would be the quality of San Joaquin River water arriving in the Delta. Since these river flows were of notoriously low quality, water destined for the San Joaquin Valley would have to be kept separate to avoid contamination. One means of accomplishing that separation would be the construction of a closed or hydraulically-isolated cross-channel carrying Sacramento River water directly to the pumps. Approaching the problem from another angle, the report suggested that it was

> *necessary to insure that very little if any of the poor quality San Joaquin River water reaches the Delta-Mendota pumping plant intake. Ultimately this could be accomplished by building a bypass along the south and west sides of the delta to carry the San Joaquin flow from a point near Mossdale to Suisun Bay at some point west of Antioch.*[31]

If salinity became more troublesome, the report recommended construction of the Snodgrass Slough route, though if conditions continued to worsen the closed cross-channel or even the salt water barrier might eventually become necessary. Although the closed channel concept was not entirely discarded, emphasis shifted to the river-and-slough route as a result of the model investigations and because the closed channel entailed significantly higher costs and substantial engineering difficulties, particularly in the design of the San Joaquin River siphon. Preliminary surveys for the large canal around the Delta had also stirred the opposition of local landowners, who objected to any route other than one following natural sloughs.

By the end of 1944 attention was centered on two problems: where to make the initial diversion from the Sacramento River, and whether pumps or a diversion dam would be used to force water into the channel. On the second question, a decision came fairly easily; at a public meeting in 1946, "no one present submitted any testimony favoring the proposed dam"[32] and the idea was quietly dropped. A diversion dam would have been cheaper to operate than a pumping facility but the detrimental impact on navigation made it an unpopular alternative.

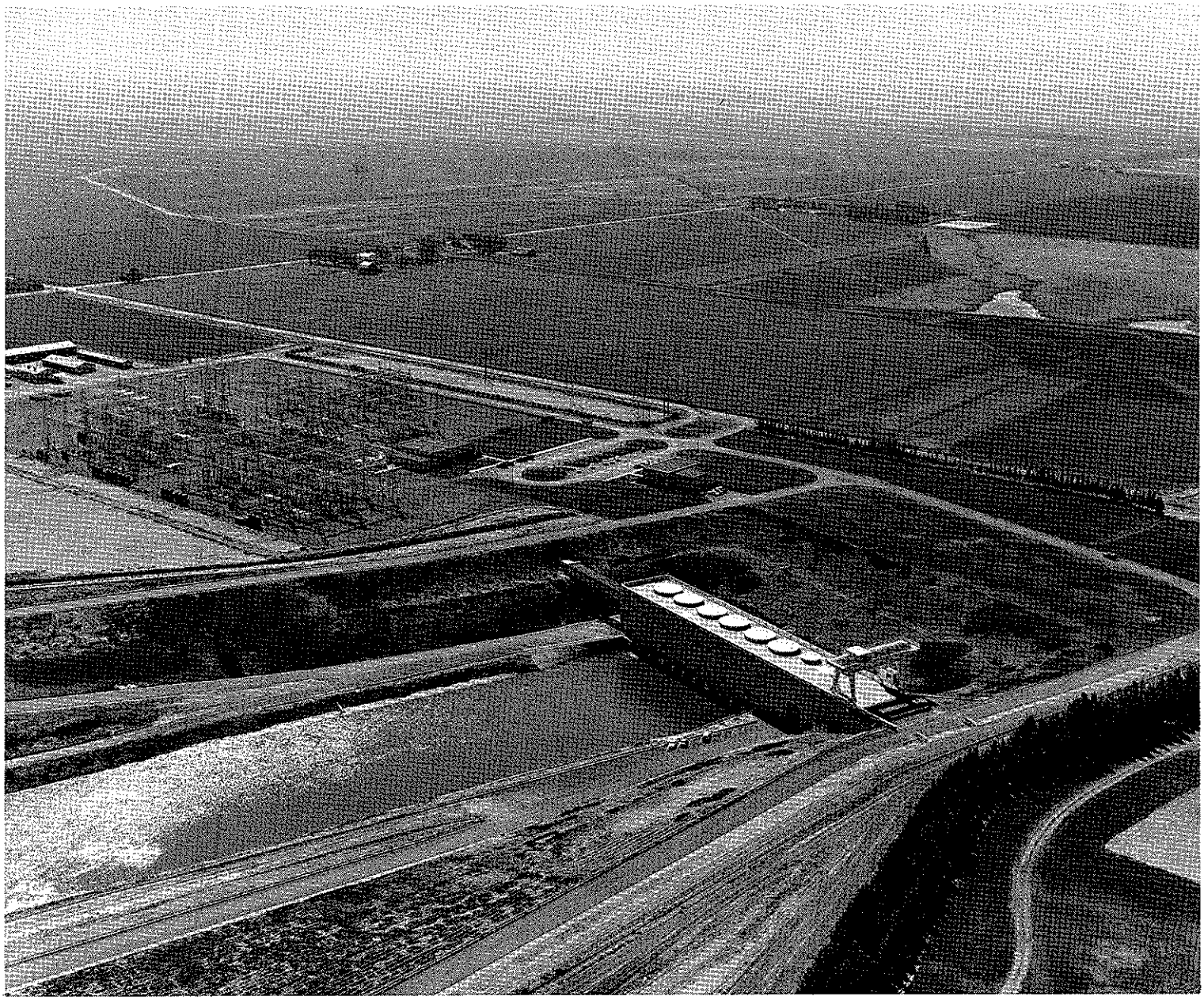
While Bureau engineers and local interests discussed the most favorable site for the cross-channel, the closed cross-channel received one more endorsement, and, in terms of the isolated channel's revival in the 1960's as the basis of the Peripheral Canal proposal, a portentious one. In commenting on the Bureau of Reclamation's comprehensive plan for the Central Valley Basin about 1947, the Bureau of Marine Fisheries in the California Division of Fish and Game heavily favored the isolated cross-channel for benefits they believed it held for the fish population.

> *Unfortunately the Bureau of Reclamation insists that the closed system is too expensive to build and maintain. The alternative is the so-called open system which will involve the use of improved natural channels. This method will probably result in the almost complete loss of the salmon runs of the Mokelumne and San Joaquin River systems unless a 35 mile canal is build to handle the salmon run. Even if the salmon are entirely disregarded, this canal (called the Drainage By-Pass) may have to be built to keep return irrigation water out of the Delta Cross Channel.*[33]

The Bureau of Marine Fisheries assumed, or hoped, that salmon would use the open drainage by-pass and avoid losses at the pumps and confusion in the reversed flows in some Delta channels that would be the result of pumping operations.

Despite pleas on behalf of the fish, the closed cross-channel had already been effectively eliminated from consideration. Refinements in cross-channel design, meanwhile, continued to simplify the proposed facility. The pumping plant at the point of diversion was eliminated in favor of a short artifical channel dredged from the Sacramento River to

one of the sloughs. By 1949, the choice had been narrowed down to a cut at Isleton to Georgiana Slough, or at Walnut Grove to Snodgrass Slough. A meeting in Denver that brought together representatives of the Bureau, the Corps of Engineers, the State Reclamation Board and the Division of Water Resources in early October, 1949, made the final decision in favor of the Walnut Grove site. Besides better foundation conditions and fewer road and railroad obstacles, the more northerly site guaranteed better water quality in case of serious saline invasion of the Delta.[34] Dredging of the cross-channel's 4,200 foot long cut between the Sacramento River and Snodgrass Slough, that would allow most of the nearly 5,000 second-feet of water required by project pumps to flow through interior Delta channels, was completed shortly after the export pumps at Tracy went into operation in 1951.



Tracy Pumping Plant, Central Valley Project. Water released from Shasta Dam and other upstream reservoirs is transferred across the Delta to the Bureau of Reclamation's pumps near Tracy. There, electric power generated at the Bureau's reservoirs is used to boost water almost 200 feet higher into the Delta-Mendota Canal for delivery to the San Joaquin Valley. (USBR photo)

NOTES

CHAPTER IV - THE DELTA FACILITIES OF THE CENTRAL VALLEY PROJECT

1. Walter F. Rowland, "The Contra Costa Canal Project: A Study In Water Resource Development," Ph. D. dissertation, Stanford University, 1967, pp. 25-26.
2. Division of Water Resources, Bulletin No. 25, State Water Plan, 1930, p. 146.
3. Rowland, op. cit., p. 21.
4. Ibid., pp. 22, 26-27; "History of the Bay Barrier Association for 1931," in Schedler Files.
5. Contra Costa County Water Conduit Association, election material, 1936, in Water Resources Center Archives, Berkeley.
6. Rowland, op. cit., p. 29.
7. Water Project Authority, Report on Capacity and Location of Contra Costa Conduit, January, 1938, p. 4.
8. George W. Dowrie, A Forecast of the Consumption of Water for Industrial and Municipal Uses in the Area to be served by the Contra Costa Conduit of the Central Valley Project, Water Project Authority, June 15, 1936, p. 1.
9. Rowland, op. cit., p. 30.
10. Ibid., pp. 30-31.
11. Water Project Authority, Report on Capacity and Location of Contra Costa Conduit, p. 27.
12. Ibid., p. 35.
13. San Francisco Chronicle, March 30, 1938.
14. Ibid., April 13, 1938.
15. Ibid., November 7, 1937.
16. U. S. Bureau of Reclamation, press release, July 9, 1940, in Water Resources Center Archives, Berkeley. The U. S. Bureau of Reclamation will hereafter be cited as "USBR."
17. San Francisco Chronicle, March 21, 1940.
18. USBR, press release, August 19, 1940.
19. USBR, Central Valley Project Studies, Report on Problem 24, March, 1945, p. 205.
20. Rowland, op. cit., p. 58.
21. USBR, "Contract of United States with Contra Costa County Water District for Water Service and Distribution System Construction," September 18, 1951, p. 11.
22. Rowland, op. cit., p. 59.
23. Harvey O. Banks, Director, Department of Water Resources, Statement before Senate Interim Committee on Proposed Water Projects, January 22, 1958, p. 8. Department of Water Resources will hereafter be cited as "DWR."
24. USBR, Water Supply Committee to Regional Director, memorandum, February 17, 1953, in H. E. Wittig, Salinity Repulsion Flows of the Sacramento-San Joaquin Delta, June, 1964, Appendix B.

25. Archie J. Hanson, Project Engineer, "Activities of the Bureau of Reclamation in the Sacramento-San Joaquin River Delta Area," presentation before University of California, Berkeley seminar and lecture, March 3, 1964, p. 5.

26. Division of Water Resources, Bulletin No. 27, Variation and Control of Salinity in Sacramento-San Joaquin Delta and Upper San Francisco Bay, 1931, p. 37.

27. Bulletin No. 25, pp. 95-96.

28. E. B. Debler, memorandum, October 30, 1941, in H. E. Wittig, Pre-Project Aspects of the Sacramento-San Joaquin Delta, USBR, January, 1964, p. 33.

29. H. R. McBirney, Senior Engineer to Chief Engineer, December 27, 1941, in Wittig, Pre-Project Aspects, Appendix C.

30. Wittig, Pre-Project Aspects, p. 34.

31. USBR, Hydraulic Laboratory Report No. 145, July 10, 1944, p. 2.

32. Phil Dickinson, Acting Regional Director, to Col. Lester F. Rhodes, Sacramento District, Corps of Engineers, April 8, 1946, in Wittig, Pre-Project Aspects, Appendix C.

33. California Bureau of Marine Fisheries, Comments on Bureau of Reclamation's Comprehensive Plan for Water Resources Development, Central Valley Basin, California, 1947, p. 1.

34. A. W. Kidder, R. E. Glover, F. E. Swain, Compilation of Technical Data on the Delta Cross Channel, Central Valley Project, California, USBR, pp. 1-7.

Delta-Mendota Canal, Central Valley Project. From the Tracy Pumping Plant, the canal runs 117 miles to the Mendota Pool on the San Joaquin River west of Fresno. It provides water for the San Joaquin River to replace flows impounted by Friant Dam, as well as serving irrigators along the west side of the San Joaquin Valley. (USBR photo)

V. The Central Valley Project and the Obligation to Control Salinity

ROOTS OF A CONTROVERSY -- Shasta Dam began impounding the waters of the upper Sacramento River in January, 1944. By April of that year, the California legislature's Joint Committee on Water Problems was hearing the complaints of farmers along Montezuma Slough in Solano County that instead of solving the salinity problem the dam was making it worse. These operators, below the mouth of the Delta, stated that high winter outflows normally pushed the salt water back far enough to make irrigation feasible in the winter, spring, and even early summer months. In that year of below normal rainfall, Shasta was reducing winter outflow levels to the point that above normal salinity was occurring. In responding to these charges before the Committee, Bureau of Reclamation Acting Regional Director R. S. Calland admitted it was unfortunate that the dam had to be filled in a year when runoff at Keswick measured only 64 percent of normal, but he pointed out that there had never been any intention of controlling salinity in Suisun Bay. According to Calland's testimony, "Collinsville is as far down the river as fresh water from Shasta Dam was meant to have any effect."[1] Because the storage of wet season flows reduced the extent to which Suisun Bay could be flushed out, farmers along the bay were, in effect, expendable in the concept of the Central Valley Project, but their complaints were the opening shots in a long battle over defining the Central Valley Project's obligation, if any, to control Delta salinity.

There was no doubt that the project, as originally proposed, was committed to the control of tidal salinity and that it was intended that at least 3,300 second-feet of water would be allowed to flow past Antioch to obtain that end. How firm the state's actual commitment was will never be known because of the transfer to federal authority, but the intention to collect assessments from Delta irrigators to help repay the cost of the project suggests that California's obligation for salinity control may have been conditional.[2]

It has often been contended that when the federal government took over the project, it also inherited responsibility for the maintenance of salinity control. The original congressional authorization of the Central Valley Project in the Rivers and Harbors Act of 1935 was based specifically on House Document No. 35, 73rd Congress, the Review Report of the Chief of Engineers, which analyzed and approved, so far as they concerned the federal government, California's proposed water development plans. Congress, therefore, accepted California's stated intentions, including the provision of salinity control. Since the Review Report computed an additional navigation benefit from the maintenance of a hydraulic barrier rather than a physical one, congressional adoption of the Central Valley Project not only assured that salinity control would be a vital project function but that it would also become a nonreimbursable benefit.

Though Congress authorized construction of the Central Valley Project, its failure to allocate funds for the work left the project in limbo. President Roosevelt's allocation of money under terms of the Emergency Relief Appropriation Act, therefore, became the effective federal authorization of the Central Valley Project, made entirely without reference to the nearly simultaneous congressional action in the Rivers and Harbors Act of 1935. The 1937 reauthorization attempted to sort out the situation. It reauthorized the project on the basis of the President's Executive Order rather than on the 1935 Rivers and Harbors Act, though it recognized the authorization for Corps of Engineers construction by agreeing to transfer the authorized expenditure of $12,000,000, whenever it was finally appropriated, to the Secretary of the Interior. Although it has been argued that the federal government was obligated to control salinity on the basis of the 1935 Rivers and Harbors Act, the apparent failure of Congress to appropriate the $12,000,000 authorized in the Act rendered the provisions of the Act inoperative.

Failure to appropriate the nonreimbursable navigation and flood control funds was only half the congressional blow at the responsibility for salinity control by the federal government. The President's Executive Order of September 10, 1935, stipulated that the Central Valley Project was intended, among other things, for "the protection of the delta lands at the junction of the two rivers against injury from salt."[3] Since that order became the basis for reauthorization, Congress should logically have included salinity repulsion in the list of enumerated functions, yet for some inexplicable reason it did not. Promising as the federal actions might have been to the Delta, by 1937 it appeared that the federal government's legal obligation was limited indeed.

The congressional "oversight" on salinity control did not go unnoticed by Delta interests. Thomas M. Carlson, attorney for the Contra Costa County Water District, submitted a statement to the Joint Legislative Committee on Water Problems in 1943 noting that the reauthorization had not listed salinity control as a project function but that sufficient other statements of intent existed to insure protection.[4] He also observed:

> *Recent discussions of the Central Valley Project seem to have been preoccupied with the production and disposal of power. Too little has been said about irrigation; but salinity control, which is quite important and urgent as any other purpose of the project, seems to have been hardly mentioned . . . they [delta people] have lost neither rights nor interest in the project.*[5]

Indeed, Delta diverters continued to receive reassurance that salt water would be banished from the Delta, as officials at all levels pointed to the control of salinity as one of the Central Valley Project's many benefits. In his 1975 M. A. thesis on salinity control, John M. MacDiarmid presented, in tabular form, a review of 129 references to salt water repulsion in "Publications and Speeches Containing References to Salinity Control by Federal Officials," between 1935 and 1973.[6] Salinity control was consistently endorsed as a project benefit, sometimes in extreme terms, as when Reclamation Commissioner John Page announced that for the Delta, "Wholesale abandonment must result if the salt water invasion is not stopped."[7] The vehemence of these statements abated as construction and operation of the project progressed, but the message seemed clear that the Central Valley Project intended to save the Delta from tidal salinity. And the Deltans believed what they had heard and assumed, as they always did, that they had a right to such protection.

The project's operators likewise assumed their facilities would perform that function, though they assumed further that the Delta water users would be willing to pay for project benefits. In 1942, a series of investigations termed the Central Valley Project Studies was begun to review outstanding questions of policy and examine the impact, actual and potential, of the project. Problem 10 dealt specifically with salinity control, asking, "What means exist or can be created for obtaining equitable payments toward the cost of the project from the beneficiaries of salinity control? What amounts should be paid by such beneficiaries?"[8] In its September, 1944, report, the committee assigned to that problem wrote:

> *For purposes of this report it has been assumed: (a) That discharge of 3,300 second-feet of water from the delta past Antioch will prevent damage from ocean salinity in the delta, and, (b) that releases of water from Shasta Reservoir will be made at such times and in such amounts as to assure the desired discharge at all times.*[9]

The usual assumptions had been made by the committee, including that repayment would be forthcoming. At the risk of reading more into the committee's statement than it intended to put there, one might observe the word "will" implies an intention to perform the function, though not necessarily an obligation. Since statements indicating that the project "will" control salinity, or later, "is controlling" salinity, were not infrequent, some of these so-called assurances might actually have been less emphatic than they seemed.

With the features of the original Central Valley Project either in operation or authorized for construction, the Bureau of Reclamation turned its attention to longer-range planning for the full utilization of water in the Central Valley Basin. A comprehensive plan appeared in preliminary form shortly after World War II and was finally published in 1949. On the subject of salinity control the report had nothing to say that seemed especially remarkable.

> *Salinity Control Benefits. -- Controlled releases of water to the Sacramento-San Joaquin Delta for salinity repulsion will result in increased crop production, make possible a wider choice of crops to be grown, permit double-cropping, and benefit areas now served from delta channels. The estimated annual benefit from these items is $1,600,000. These benefits are based upon improving past conditions. The large future diversions which will be required for Central Valley lands could not equitably be made without maintaining salinity control for delta lands.*[10]

The last sentence, however, plainly indicated that benefits for Delta irrigators were not the only reasons for maintaining a hydraulic barrier. The usefulness of the Delta as a pool from which water could be exported depended on the maintenance of fresh water in most of the

Delta. Full salinity control was apparently still comtemplated, but if project diversions rather than protection of the Delta became the primary concern of project operators, the implication could be drawn that salinity control might be maintained only to the extent necessary for project export operations. Further comments in the same report do little to weaken those implications. Instead of a barrier,

> *. . . releases of stored water will be depended upon to repel salinity during at least the early life of the Central Valley Project. Hydraulic model studies of the delta channels have been made at the hydraulics laboratory of the Bureau of Reclamation in Denver to secure data relative to the effect on salinity conditions of releases of varying quantities of water in different channels. These studies and further Central Valley project operations may indicate the desirability of modifying the locations and amounts of water released for salinity control.*
>
> *In this report it has been assumed that a discharge of 3,300 second-feet of water from the delta past Antioch would prevent serious damage from ocean salinity in the delta, and that releases would be made from Central Valley reservoirs at such times and in such amounts as to assure the desired discharge at all times. This outflow is equal to 2,400,000 acre-feet of water per year.*[11]

In a sense then, the Central Valley Basin was an ambiguous document in terms of the salinity control function of the Central Valley. While the importance of keeping salt water out of the Delta was clearly appreciated there was no commitment by the Bureau of Reclamation to provide salinity repulsion beyond the requirements of project operation.

OPERATIONAL REQUIREMENTS AND SALINITY CONTROL -- The ambiguities in the Central Valley Basin reflected the transitional state of Bureau of Reclamation policy in the late 1940's. Completion of Shasta Dam and the pending construction of the cross-channel and Delta-Mendota Canal forced the Bureau to reevaluate its operational priorities and establish working policies to replace earlier generalized conceptions of project performance. Salinity control posed a particular problem. It had been assumed that the project would provide relief for the Delta from the influx of salinity, yet no direct authorization for the function existed and Delta water users had expressed no interest in signing a repayment contract covering salinity repulsion flows. Regardless, some salinity control was required for project operations, but outflow levels involved were still undefined. In an effort to resolve some technical uncertainties, tests were run on the Delta hydraulic model at Denver. In Hydraulic Laboratory Report No. 155, issued on September 29, 1944, Bureau engineers concluded that some changes might have to be made in calculations of salinity control flows.

> *The net streamflow in both rivers past Antioch required to maintain 100 parts of chlorine per 100,000 parts of water over an extended period of time, was indicated to be 6,000 second-feet instead of the 3,300 second-feet predicted in Bulletin No. 27.*[12]

Engineers of the Division of Water Resources promptly rose to the defense of the original 3,300 second-foot estimate on the basis of prototype experience, though in that experience flows had not been sustained at the minimum level "over an extended period of time."

Between the time the first draft of the Central Valley Basin report was transmitted to the Commissioner of Reclamation in late 1945 and the final document was issued nearly four years later, Bureau engineers were at work on an operating policy for the Central Valley Project. While in their public pronouncements, the Bureau was hedging toward a salinity control policy based primarily on operational requirements of the export pumps, the engineers plainly advocated a limited definition of salinity control. In a letter from the District Manager at Sacramento to the Regional Director, dated July 7, 1948, the new policy was stated:

> *The Bureau will not attempt to maintain salinity control to the degree described in State Bulletin No. 27 and, tentatively accepted by the Bureau in previous planning. Salinity control will be maintained to only the degree necessary for operation of the Delta Cross Channel. It is estimated that this degree will require a net outflow of 4,500 c.f.s. . . .*[13]

Cross-channel requirements were, of course, predicated on the quality standards contained in water supply contracts with San Joaquin Valley and Contra Costa County users. If the cross-channel failed to supply the full demand of the pumps, salinity control to some point in the western Delta would still be required to protect water flowing around the end of Sherman Island on its way to the San Joaquin Delta.

Evidence that the Bureau's policies had matured came in 1951, when it filed amendments to its applications for water rights permits that stated:

> *In order to provide irrigation of suitable quality to the Delta-Mendota and Contra Costa Canals, it is believed that up to 6,000 c.f.s. of direct diversion and/or storage releases may be required to flow into Suisun Bay in order to dispose of the chemical elements that would otherwise accumulate in the irrigation waters flowing in the Delta channels of the Sacramento-San Joaquin Rivers.*[14]

The essential point was that the preservation of freshness in the canals had emerged as the underlying concern of project operation, not the maintenance of 1,000 ppm salinity near Antioch.

The Operating Plan of the Central Valley Project, released in 1952, recognized that fact and because it represented the official and published position of the Bureau of Reclamation, it warrants special attention. "The initial motivating force behind the Central Valley Project," the Plan states, "was the need to prevent floods, conserve water and transport it from areas of surplus in the north to areas of deficiency in the south."[15] The project was to be operated to yield maximum benefits and if priorities had to be assigned, purposes of lesser priority "shall be sacrificed to purpose(s) of higher priority . . . only to the extent necessary consistent with the law . . . "[16] The law, of course, was silent on salinity control.

> *The critical factor in salinity control is the quality of water in the channels of the Delta available for diversion to the Delta Mendota and Contra Costa Canals. Limiting the area of land affected by salinity is an important, but essentially a derivative, purpose. . . . A line of salinity encroachment covering no more than 5,000 to 10,000 acres of the delta area is considered satisfactory for project purposes, because water pumped while the line of encroachment extends only that far is of suitable quality for project delivery.*[17]

By 1952, then, the Delta had been deprived of any commitment by the Bureau of Reclamation to control tidal salinity beyond the point required for the transferal of sufficiently pure water south. The volume of flow from the Delta necessary to perform even that task was still being debated. The Bureau's Water Supply Committee under R. J. Shuckle tried to clarify the situation in a memorandum to the Regional Director on February 17, 1953. The necessary Delta outflows had been variously estimated at from 500 to 5,500 second-feet, while inflows from the rivers had actually dropped below 4,000 second-feet during the summer months, indicating that if consumptive uses within the Delta were subtracted from that figure, the actual outflow into Suisun Bay was quite low.[18] Only in 1944 and 1947 had salinity in excess of 1,000 ppm advanced beyond the pre-Shasta median limit of encroachment, which coincidentally was also the line of maximum incursion corresponding to the project's operating criteria for water quality. The first year of Shasta operations, 1944, could not be considered typical, while in 1947 an operational error resulted in the advance of salinity.[19] The Water Supply Committee, hoping to conserve as much water as possible, urged a reduction in releases from Shasta to achieve limited inflow of 5,000 second-feet in July and 4,000 second-feet in August. Further experience and continuing study would still be required, however, to adjust inflows, and thus outflows, to the minimum level necessary to permit operation of the export pumps.[20]

Although Regional Director C. H. Spencer's letter of July 10, 1957, denying Bureau of Reclamation responsibility for general salinity control has often been treated as a sudden departure from long established policies, Bureau policy had in fact changed gradually during the late 1940's. At that point the requirements of actual project operation, combined with the absence of a legal mandate, had finally forced a definition of priorities. The decision to limit salinity control to the minimum practicable level had not been widely publicized due partly to an attempt to maintain good public relations. Moreover, a significant degree

of salinity control would still be maintained. The Bureau had not, however, tried to hide its salinity control policy, as the 1952 Operating Plan and the 1951 amended water rights applications indicated. That the policy was plainly stated on request was revealed by the response of Acting Regional Director R. S. Calland on April 27, 1956, to an inquiry from B. J. Badger of Petaluma, an associate of barrier promoter John Reber.

> *No agreement has been made by the Bureau of Reclamation to supply a fixed amount of fresh water for salinity control in the Delta. The Central Valley Project is operated to deliver a quality of water that meets our contractual obligation for water delivery from the Delta-Mendota and Contra Costa Canals. Our operations to date have achieved a high degree of salinity control to 90 per cent of the Delta lands . . . The State Engineer has estimated only that an inflow of 3,300 second-feet for salinity will control salinity at Antioch at high tide to 1,000 parts of chloride per million parts of water. Since our Tracy Pumping Plant is about 25 miles upstream from Antioch, the salinity at Tracy is not related to the salinity at Antioch.*[21]

B. J. Badger, of course, enjoyed no official position so Calland's letter received an extremely limited audience. A little over a year later, Regional Director C. H. Spencer wrote to Harvey O. Banks, Director of the state's Department of Water Resources, and Clair A. Hill, chairman of the State Water Board, regarding the Department's Bulletin No. 60, an interim report on California's salinity control barrier investigation. That report endorsed a project for Delta development, known as the Biemond Plan, that envisioned a system of dams on the Sacramento River above Rio Vista, along with an isolated cross-Delta canal for water transfer. In computing the expected benefits from the project, state engineers had assumed that outflow under then-current conditions consisted of the 3,300 second-feet proposed in Bulletin No. 27 for salinity control and 500 second-feet of Delta accretions for a total of 3,800 second-feet. It was anticipated that a significant portion of these salinity control flows would be "saved" by the Biemond Plan. Spencer, however, found that the stated premise of a 3,800 second-foot minimum outflow was "not an accurate reflection of operations of the Central Valley Project."[22] The basic figure of 3,300 second-feet had been adopted from Bulletin No. 27 prior to actual operations. The Regional Director went on to make the extent of the Bureau's obligation for salinity control unmistakably clear.

> *The discussion on page 24 of Bulletin No. 60 might be construed as implying that the Central Valley Project is obligated legally to control salinity to a certain standard point near Antioch. In particular, the reference to House Document No. 146, 80th Congress, 1st Session, carries this implication. Such an assumption as to the legal obligation of the Project is unwarranted . . . 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.*[23]

Although the Bureau's thinking on salinity control had not changed overnight, Spencer's letter struck like a thunderbolt at the prevalent belief that the Delta region was entitled, as a matter of legal right as well as legislative intent, to a usable water supply, protected by releases from upstream storage. State Senator George Miller, Jr., and other Contra Costans, prepared to use the upcoming deliberations of the State Water Rights Board on the longstanding Bureau applications for water rights to force the federal agency to accept the obligation of salinity control.[24] It was hoped that the Board could be persuaded to make the control of salinity a condition for the granting of water rights permits to the federal government. The Board began hearing testimony on September 15, 1959, but after twenty days the Bureau of Reclamation requested a recess for the purpose of conducting negotiations on Delta water rights. Hearings resumed in April, 1960, the negotiations having proven unproductive except for the agreement signed on May 16, 1960, by the Department of Water Resources and the Bureau concerning the apportionment of water between state and federal projects in dry years, including the satisfaction of undefined Delta requirements.[25]

At those hearings, Delta interests sought not only to prove that the Bureau of Reclamation had, in taking over the project, inherited the state's obligation to control salinity, but endeavored to define precisely the extent of the obligation. The Contra Costa County Water Agency, a countywide water authority formed in 1957, reported that current industrial needs were being met by pumping from the channels of Suisun Bay, by wells and from the Contra Costa Canal. To assure that water of sufficient quality would be available to accomodate the anticipated future growth of the region, they proposed that the Central Valley Project be operated to

. . . provide that during the 150 consecutive days following the annual winter runoff season, water containing in excess of 250 ppm should not be allowed to advance upstream from the Mallard Slough intake of the California Water Service Company two miles west of the City of Pittsburg and that the average chloride ion concentration above Mallard Slough should not be allowed to exceed 150 ppm during this 150-day period; that water in excess of 350 ppm should never be permitted above Antioch.[26]

The Water Agency's proposed standard was preeminently an industrial one and maintained a Contra Costa tradition of activity to safeguard industrial water supplies and accommodate industrial expansion. The criteria proposed in 1959 would have forced the Bureau of Reclamation to maintain a water quality at Antioch far superior to the standards recommended by Bulletin No. 27, and was apparently devoid of any specific historic justification. Over a million acre-feet of additional reservoir releases would be required annually to maintain salinity at the levels suggested by Contra Costa rather than the minimum levels required for Central Valley Project operation.[27] By contrast, agricultural interests, led by the Sacramento River Delta Water Association and the San Joaquin County Flood Control and Water Conservation District, limited their claims for salinity protection to the Antioch limit provided for in state studies. Evidence presented to the Board, however, indicated that irrigation could be carried on even with outflows below 3,300 second-feet. It was estimated that an outflow of only 2,650 second-feet was required to hold the 1,000 ppm line at the lower end of Sherman Island, while an even lower flow would be acceptable if modifications in the Sherman Island irrigation system were made to divert fresher water from the upper end of the island.[28]

The Board issued its decision, known as D990, on February 9, 1961, having heard 75 days of testimony. Before addressing the specific problem of salinity control obligations, the Board had to consider its ability to enforce its conditions on the federal government, since the Bureau of Reclamation had denied that the state had any such right. The Board disagreed with the federal contention, citing both California and federal statutes, including the terms of the 1902 Reclamation Act that required the Bureau to abide by state law in securing water rights. Furthermore, by denying the Board's competence to attach conditions to its permits, the Bureau had, in effect, requested an unconditional water right, something the Board insisted did not exist in California law.

Having dealt with the issue of its competence, the Board next turned its attention to the question of a general obligation for salinity repulsion. It ruled that such an obligation did exist by virtue of the federal government's adoption of the State Water Plan involving salinity control as a major function. The United States Supreme Court had recognized the federal obligation in the Ivanhoe Case when it wrote:

The water supply facilities along the Sacramento River will regulate its flow, store surplus winter runoff for use in the Sacramento valley, maintain navigation in the channel, protect the Sacramento-San Joaquin Delta from salt intrusion from the Pacific, provide a water supply for the Contra Costa and Delta-Mendota Canals and generate a great deal of hydro-electric energy. . . .

Moreover, the Federal Government will receive no reimbursement from that portion of the cost allocated to numerous aspects of the project, such as navigation, flood control, salinity prevention, fish and wildlife preservation and recreation.[29]

The Ivanhoe Case did not deal with salinity control, however, and the Court's remark was only descriptive. Finally, water rights applications then before the Board had originally been filed by the state with salinity control as one of the purposes to which the water concerned was to be put. "It is clear," the Board argued, "that protection of the Delta from salinity incursion constituted a material part of the consideration for which the State of California assigned to the United States the applications which it had filed to provide adequate water for the Project."[30]

In more specific terms, the Board decided that to require release of the massive amounts of water necessary to satisfy all the requests made before it, would be an unreasonable waste of a valuable resource and that supply by substitute overland facilities would be a suitable alternative. Regardless, it was not the Board's intention to relieve either the Bureau of Reclamation or the Department of Water Resources of their respective responsibilities in the

matter of salinity control. There was, in 1961, no impending shortage of water for the performance of that function, so the Board refrained from attaching specific regulations to the permits. It did, however, reserve the right to make such specific conditions as it might deem necessary in the future. The Board urged the state and federal agencies to meet with Delta interests to work out an agreement for water supply by which water users would reimburse the project operators for benefits received. How the Board reconciled that position in favor of repayment with its argument on the Ivanhoe decision that seemed to declare the salinity control function nonreimbursable is unclear. The Board decided to allow three years or more to pass before ruling on the final form of the permits in hope that some agreement would be reached by all parties before that time, so terms of the final permits might be written accordingly.[31]

Decision D990 actually decided very little. The Bureau continued to insist that as a federal agency it was not required to obey state directives on the operation of its projects, while California continued to argue that the Bureau did not stand apart from or above California law. Contra Costa County continued to insist that its entitlements, as it defined them, should be respected. About all the extensive hearings and lengthy decision accomplished was a full airing of all conflicting claims regarding the Central Valley Project's obligation to control salinity. The Bureau put its faith in the language of the federal statutes, recognizing no legal responsibility for the repulsion of salt water. Local interests found solace on the other hand in the stated intentions of the original legislation in California and subsequent federal pronouncements on the protection of the Delta. And, in 1961, neither side was willing to give up the battle.

NOTES

1. Joint Committee on Water Problems, hearing, April 26-28, 1944, p. 54.
2. For a fuller discussion of the repayment problem, see Chapter VI.
3. Executive order of September 10, 1935, in CVP Documents, I, p. 560.
4. A. N. Murray, then with the Bureau of Reclamation, remembers meeting Thomas Carlson in late 1953 or early 1954. At that time Mr. Carlson insisted that the state had promised to control salinity at Antioch but that the Bureau had never made the same promise, though he had assumed the state's original plans would be followed. A. N. Murray to W. Turrentine Jackson, August 17, 1976.
5. Joint Legislative Committee on Water Problems, Report to the Legislature on Water Problems of the State of California, April, 1943, p. 53.
6. John M. MacDiarmid, The Central Valley Project, State Water Project and Salinity Control in the Sacramento-San Joaquin Delta, Masters thesis, Chico State University, 1975, Table XIII, pp. 145-149.
7. Ibid., p. 152.
8. USBR, Report of Committee on Problem 10, September, 1944, p. v.
9. Ibid., p. 4.
10. USBR, Central Valley Basin; A Comprehensive Report on the Development of the Water and Related Resources of the Central Valley Basin, August, 1949, p. 78.
11. Ibid., p. 109.
12. USBR, Hydraulic Laboratory Report No. 155, September 29, 1944, in Wittig, Salinity Repulsion Flows, p. 14.

13. Carl Kadie, District Manager, to Regional Director, July 7, 1948, in H. E. Wittig, Pre-Project Aspects of the Sacramento-San Joaquin Delta, USBR, January, 1964, p. 35.

14. DWR, Bulletin No. 60, Iterim Report to the California State Legislature on the Salinity Control Barrier Investigation, March, 1957, p. 24.

15. USBR, Operating Plan -- Central Valley Project, October, 1952, p. 8.

16. Ibid., pp. 8-9.

17. Ibid., p. 40.

18. USBR, Water Supply Committee to Regional Director, February 17, 1953, in Wittig, Salinity Repulsion Flows, Appendix B.

19. State Water Rights Board, Decision D990, February 9, 1961, p. 50.

20. Water Supply Committee to Regional Director, February 17, 1953, loc. cit.

21. R. J. Calland to B. J. Badger, April 27, 1956, in Reber Papers.

22. C. H. Spencer to Harvey O. Banks and Clair A. Hill, July 10, 1957, in Wittig, op. cit., Appendix.

23. Ibid.

24. Summary of Minutes of an Informal Conference Between Directors and Officials of the Contra Costa County Water Agency, Representatives of the State Department of Water Resources . . . July 30, 1958 at Martinez, California.

25. Decision D990, p. 6.

26. Ibid., p. 52.

27. Ibid.

28. Ibid., p. 54.

29. Ivanhoe Irrigation District v. McCracken, 357 US 275, 282-283 (1958).

30. Decision D990, p. 49.

31. Ibid., pp. 56-62.

VI. A Little Matter of Repayment:
THE CENTRAL VALLEY PROJECT AND THE DELTA

"REIMBURSABLE IN ACCORDANCE WITH THE RECLAMATION LAWS" -- Although complicated by the lengthy debate over salinity repulsion obligations, the repayment of project costs chargeable to Delta benefits has generally been accepted in principle but avoided in fact. The State of California assumed that Delta land owners would repay that portion of the costs of the proposed State Water Plan justified by their use of project water to insure a more reliable salt-free irrigation supply. In the amended application for a federal loan and grant for construction of the Central Valley Project, made January 25, 1934, to the Federal Emergency Administration of Public Works, the state estimated that

> *a regulated water supply will be required immediately by the 400,000 acres of delta lands in order to meet their full consumptive needs and maintain continuous fresh water, free from incursion of salt water, in the delta channels from which irrigation supplies are obtained. Therefore it is believed that an average annual supply of 230,000 acre-feet of stored water from Kennett Reservoir will be used and sold in the delta at a unit price of $1.00 an acre-foot as soon as Kennett Reservoir is constructed and put into operation. The revenues from sale of water in this area are calculated upon this basis.*[1]

As previously stated, when federal funding was provided through the Emergency Relief Appropriation Act, the President's Executive Order included the provision that those funds should be "reimbursable in accordance with the reclamation laws."[2] The same requirement was included in the 1937 reauthorization of the Central Valley Project as a reclamation project. Under reclamation law, stemming from the Newlands Act of 1902, project beneficiaries were expected to enter into contracts to repay the cost of dams, canals, pumping plants and other facilities. Services such as flood control and the maintenance of navigation were considered nonreimbursable obligations of the federal government, reducing the amount beneficiaries were expected to repay. Costs were to be allocated among project services according to the distribution of benefits or the ability of the beneficiaries to pay, all with the underlying commitment of supplying water to Western farmers at the lowest possible cost. In addition to charges for irrigation water, sales of electric power and water for municipal and industrial purposes were also employed to aid in the repayment of construction and operation expenses.

When the Central Valley Project was reauthorized in the Rivers and Harbors Act of 1937 no mention was included of salinity control, though it was widely assumed that even without specific authorization the repulsion of salt water remained an operational purpose of the project. Repayment by Delta beneficiaries was also assumed by the Bureau of Reclamation, though until the completion of Shasta Dam and other project features, questions of repayment could be deferred, despite the fact that construction was nominally to follow rather than precede contract negotiations. By the early 1940's the approaching completion of Shasta Dam underscored the need to resolve a number of questions, including that of Delta repayment obligations. Two of the 24 problems examined in the Central Valley Project Studies dealt with repayment for salinity control: Problem 9, which asked, "What allocation of cost should be made respectively to navigation, flood control, salinity repulsion, and national security?"[3] and Problem 10, dealing with the amount that should be assessed and how it could be collected. The reports on these problems were published in September, 1944, just months after Shasta Dam went into operation.

In the case of Problem 9, a subcommittee on salinity composed of Raymond Matthew, O. G. Stanley and S. A. Kerr investigated allocation of benefits and obligations from several different approaches. The State Engineer had estimated that saline encroachment cost Delta irrigators $200,000 a year in reduced yields, leading the subcommittee to assume that alleviation of the salinity menace would create an annual benefit in that amount. In determining that full salinity control could save the Delta $200,000 annually, the subcommittee was on safe ground, but additional benefits were postulated as well. O. C. Magistad, of the U. S. Bureau of Plant Industry's Regional Salinity Laboratory at Riverside, estimated

that the reduction of salt concentrations in irrigation supplies from 60 to 100 ppm would not only eliminate losses but would increase production by up to five percent per annum. Because this benefit was difficult to demonstrate, the committee on Problem 10, dealing with essentially the same assignment, had not included it in their report. The Problem 9 committee, however, remained convinced the benefits were more substantial.

> *Even discounting to some extent the five per cent increase named by Mr. Magistad, the value of such increased production, added to the increased value due to higher-price crops and double-cropping, should amount to at least 5 per cent of the value of the annual delta crops. Based on the average annual crop value of $25,910,000 for the period 1924-1942, as estimated by the State Engineer, the increased value of crops in the delta creditable to Shasta reservoir and the east delta channel would be $1,400,000 annually.*[4]

These benefits were over and above the $200,000 in annual damages that would be prevented by salinity control covering the entire Delta. Total benefits could therefore be set at $1,600,000 annually for the Delta as a result of project operations.

The subcommittee was in something of a quandary over that portion of the nonreimbursable navigation authorization involving salinity control. The subcommittee on navigation had failed to include the $5,630,000 as a navigation benefit, preferring to pass the problem on to the salinity subcommittee. That group studied the authorization and broke the arbitrary lump sum into annual benefits, but was unable to do more that observe, "that this benefit is entirely independent of and in addition to the benefits which will accrue to the agricultural interests of the delta."[5]

In making their recommendations to the full committee, the subcommittee on salinity took into consideration the deliberations of the Problem 10 committee and designated $200,000 in annual benefits stemming from reduced crop losses as the amount that should be collected. In its final report, the committee on Problems 8 and 9 (cost allocations) accepted the figure $200,000 but added:

> *The salinity repulsion allocation is calculated as the amount which the direct beneficiaries in the delta should repay, but for which direct assessment are considered to be impracticable. . . . Should later a practicable means of reimbursement from salinity repulsion . . . beneficiaries be secured then the burden on other users would be lessened.*[6]

The committee studying Problem 10 had taken a somewhat more cautious approach to the question of Delta repayments since they had been assigned the task of not only deciding how much should be collected but, more importantly, how it could be accomplished. More optimistic than their colleagues studying cost allocations, the Problem 10 investigators believed a way might be found to collect assessments for salinity control. Limiting their reimbursable benefits to preventable crop damages from salinity, they established a legal subcommittee to examine the ways and means of obtaining repayment. That group disposed of the navigation authorization by pointing out that "so far the appropriation has not been made,"[7] and concluded that salinity control could legally be performed by the project under the heading "river regulation" as provided for in the terms of the 1937 reauthorization of the project. Because nothing in the reauthorization indicated that salinity control could be considered a nonreimbursable benefit and because there was no authority elsewhere in the reclamation law to declare it nonreimbursable, the subcommittee determined that repayment could be demanded.

> *Contracts having the objective of securing payment of salinity control benefits appear authorized by Federal law under the "Carter amendment" as well as under the Reclamation Project Act of 1939. Certainly no other means exist at present to accomplish the objective. In further consideration of the subject it will therefore be assumed . . . that such reimbursement shall be accomplished by means of a contract or contracts executed by the Secretary of the Interior with salinity control beneficiaries.*[8]

There were already over fifty reclamation districts in the Delta with the legal power to sign contracts for salinity control reimbursements. However, the disadvantages of dealing with so many separate entities outweighed the advantages, while a contract with the Water Project Authority was also considered a relatively unfavorable alternative. Instead, the subcommittee recommended legislative action,

> *. . . to enact a measure delimiting district boundaries to include the entire benefitted delta area; zoning, or providing for zoning the area according to benefits, and providing for levy of assessments therein to accord with the determined past frequency and intensity of salinity intrusion which would be obviated by project operation.*[9]

The subcommittee recognized that persuading Delta operators to pay for their benefits would be difficult despite the obvious advantages salinity control offered through project releases. They therefore advised that an educational program be undertaken in the Delta to provide groundwork for repayment contract negotiations. The ultimate penalty for nonpayment, they warned, could be a decrease in salinity control flows, though that would be a difficult step and taken only as a last resort.[10]

In 1947, the Department of the Interior submitted to Congress a financial feasibility report on the Central Valley Project that became known as House Document No. 146 summarizing the allocation of project costs and repayment probabilities. The letter of transmittal from Secretary of the Interior J. A. Krug to President Truman referred to salinity control as an incidental benefit "of a well-rounded program of river regulation."[11] However, in the report itself, maintenance of a hydraulic barrier against saline intrusion was classified as a "supplemental irrigation function,"[12] perhaps because water quality had to be maintained in the Delta to supply San Joaquin Valley and Contra Costa irrigators. In allocating expenditures among the various project purposes, salinity control and fish protection received

> *. . . no allocation as project functions because no provision in law exists whereby they could be declared non-reimbursable, and means are not available to collect revenues for services in this category. The burden of these costs therefore falls upon the revenue producing functions.*[13]

Using figures derived from the Central Valley Project Studies, the level of all annual benefits chargeable to the Delta was reported to be $1,600,000. A repayment obligation was assumed, as it always had been, but since no means to enforce collection then existed, the benefits to the Delta from salinity control were added to the total irrigation benefits and allocated for repayment by other water users. To the extent that salinity was controlled for the operation of export pumps, such an allocation might be justified, but no obligation to protect the Delta was created since other means of supplying the export system with water might someday be employed.

One nagging headache remained in the allocation process -- the $5,630,000 authorized toward the initial costs of Shasta Dam for salinity control in lieu of a salt water barrier. These funds, recommended by the Chief of Engineers and authorized in 1935, were included in the more than $18,000,000 of project costs allocated to the nonreimbursable function of navigation.[14] A contradiction is apparent in these calculations, for if salinity control was performed as a navigation function and therefore a nonreimbursable item, then the allocation assigned to salinity control as a reimbursable supplementary irrigation function has no merit. The matter could be complicated by a debate over the legal intentions of Congress, but the fact remains that if the release of water from project storage to prevent incursion of tidal salinity was performed without charge for purposes of navigation, these same releases could not be charged to irrigation, either directly or as a supplementary benefit. Congressional failure to provide the nonreimbursable funds effectively rescued the Bureau of Reclamation from its contradictions in allocation and repayment policy.

The comprehensive plan for the Central Valley Basin published in August, 1949, offered little that was new on the question of salinity. Endorsing, in a general way, salinity repulsion as one of the purposes of the project, the specific dilemma of repayment went unmentioned in the body of the report, though the virtually standard figure of $1,600,000 worth of benefits was cited. However, in the letter of transmittal from Kenneth Markwell, Acting Commissioner of Reclamation to the Secretary of the Interior, dated July 26, 1948, an interesting item was included among his recommendations.

The portion of the construction costs properly allocable to pollution abatement, recreation, general salinity control, and silt control, as well as to flood control, navigation and fish and wildlife, shall be nonreimbursable pursuant to findings by the Secretary of the Interior.[15]

The idea of making salinity control nonreimbursable as a matter of basic policy without reference to the navigation authorization, seems to have occurred only in Markwell's letter, for nowhere else in the report or in subsequent documents was the matter mentioned again. Exactly what prompted Markwell to make the suggestion remains a mystery, though the obvious difficulty of securing repayment for the service might have convinced him to recommend a strategic withdrawal of sorts. Clearly it was an idea whose time had not come.

In 1951, with the initial features of the project going into operation, a Special Subcommittee on Irrigation and Reclamation of the House Interior and Insular Affairs Committee chaired by Congressman Clair Engle of California came west to investigate the sufficiency of project water rights and other problems. During the course of those hearings, the Subcommittee came into contact with the problem of salinity control and repayment for the service by Delta beneficiaries. In hearings held in Sacramento at the end of October, 1951, the Subcommittee heard California Congressman George Miller of southern Contra Costa County comment on salinity control as a feature of the Central Valley Project. Miller felt that the service would not be abandoned by the Bureau of Reclamation but when asked if repayment for the benefit should be made, he answered that he had "never given any thought to that."[16] Miller's response was indicative of an underlying Delta attitude that accepted the benefits of project operation either as the restoration of the area's rightful entitlement to fresh water or as a quality that the Bureau of Reclamation had, in large measure, to maintain if it expected to export decent water from the Delta. The Bureau's deletion of salinity control as a project purpose from its application for water rights had an effect on the feeling of complacency, but Delta diverters on the whole were far from being stampeded into offering to pay for salinity control.

Overall, the Engle Subcommittee was unimpressed with the attitude of Delta water users, and their final report to the full Committee, dated February 6, 1952, carried an undertone of indignation on the subject of salinity control. The congressmen pointed out that rather than the 3,300 second-foot Delta outflow proposed in studies performed by the State Engineer that had formed the basis of the project, 4,500 second-feet were actually being used. That outflow represented sufficient water for the "combined needs of the cities of Los Angeles, San Francisco, Seattle, Chicago and the District of Columbia,"[17] and therefore constituted a reprehensible waste of a valuable commodity. "This wasteful and inefficient use of California's precious water supply cannot be condoned further," the Subcommittee asserted, "and alternative methods of providing salinity control should be investigated."[18] Further shock was expressed that Delta interests were not paying a cent for benefits from the project. As a recommendation, the Subcommittee believed that

. . . the state of California should seriously study the advisability of forming a suitable 'conservancy district' to share the cost and pay for the project benefits which accrue to the area benefitted by repulsion of salt water from the Central Valley Project, inasmuch as the State of California requested Federal funds to build the project and assured the Congress a suitable repayment plan could be prepared.[19]

It may be remembered that the Subcommittee's advice coincided exactly with the recommendations of the Central Valley Project Studies Report on Problem 10 in urging that the state organize a Delta district competent to sign a comprehensive repayment agreement.

At that very moment, however, the State of California was considering repayment possibilities from another point of view. Dissatisfaction had been growing in California over the Bureau of Reclamation's policies in operating the Central Valley Project. Large agricultural interests in the San Joaquin Valley had become particularly upset over the 160 acre limitation on irrigation deliveries to a single landowner that had been written into the original reclamation law. Antagonism against the provision for "family farms" in reclamation projects sparked a general movement against federal control of the Central Valley Project that gained a variety of supporters, including State Engineer A. D. Edmonston, who perhaps regretted California's loss of control to the Bureau of Reclamation in the 1930's. Attacks on the Central Valley Project culminated in an effort to have the State of California buy back the project it had once abandoned on the federal doorstep. One result of the buy-back crusade was a fresh analysis of cost allocations and repayment policies that might once

again become state responsibilities. The once nearly extinct Water Project Authority issued a thick report on Feasibility of State Ownership and Operation of the Central Valley Project of California in March, 1952. In reference to the financial obligation of the Delta it said:

> *. . . salinity has been in permissible amounts since Shasta Reservoir has been in operation, beginning in 1944. The resulting benefits to the Sacramento-San Joaquin Delta are evident. Therefore, in the financial analysis presented herein, an annual revenue of $0.50 per acre from the 367,000 acres of irrigated land in the delta is used as representing an equitable charge for the benefits received from a firm water supply.*[20]

Federal officials listened politely to the California delegations led by State Engineer Edmonston, who journeyed to Washington to undo the results of Hyatt's travels two decades earlier, and then rejected the thought of selling the Central Valley Project. The federal government was in California water to stay.

The terms on which the government would remain, however, were shifting. The lingering problem of repayment was entangled with the determination of both the obligations of the project's operators to provide salinity control and the legal water rights of the Delta. Changes made in the Bureau's applications for water rights in 1951 stirred some water users into action to define, and defend, their water entitlements, for although project operation seemed to demand some salinity control regardless of repayment, the action by the Bureau carried the implication that without a contractual agreement benefits might be limited or even, if a way could be found, eliminated.

WATER RIGHTS AND REPAYMENT -- Before repayment could be made, the status of water rights in the Delta had to be settled, since only water supplied in excess of legal entitlements could be considered subject to repayment. Reasoning that negotiations leading to an acceptable determination of water rights would be preferable to lengthy and expensive litigation, the Sacramento Valley Water Users Committee of the California Central Valleys Flood Control Association signed an agreement with the Bureau of Reclamation and the California Division of Water Resources that carried the imposing title of Memorandum of Understanding Relating to a General Approach to Negotiations for Settlement of Water Diversions from the Sacramento River and the Sacramento-San Joaquin Delta with the Objective of Avoiding Litigation. The July, 1952, document was intended as the definition of an approach to the negotiations, and did not in any way prejudice rights or assign obligations. The agreement encompassed the entire length of the Sacramento River below Shasta Dam as well as the Delta, though in dividing the territory at Sacramento, it recognized fundamental differences in the problems faced by river and Delta diverters. Since project water from Shasta, and eventually from the Trinity River, mingled with nonproject flows contributed by tributaries, Sacramento Valley diverters received benefits from project operations without expense. As early as 1942, state attorney Henry Holsinger had identified the legal dilemmas that existed whenever, as on the Sacramento River, the point of storage is separated from the point of diversion.[21] Diverters in that situation received only part of their irrigation supplies from the project, the remainder having been available under natural conditions. The 1952 Memorandum of Understanding looked toward a definition of pre-project water rights that could be expressed in terms of diversion schedules granting rights to a specified number of acre-feet per year. Water diverted beyond that amount would be considered project water and subject to the repayment provisions of reclamation law. The Delta presented a more complex case in that water quality rather than quantity was the essential consideration and because more individual diverters were involved with fewer reliable records on how much water they diverted. The use of water from project storage to enhance irrigation supplies was acknowledged, but further study was required to determine the consumptive use of water in the Delta region. The Memorandum of Understanding also stated that, "Salinity control in the delta to the extent to be determined is an obligation of the Federal Government."[22]

Studies inaugurated in a general way in 1952 continued for several years, including the Trial Water Distributions of 1954 and 1955, that established targets for project releases and diversions. Water users were represented by the Sacramento River Delta Water Association (SRDWA), a voluntary organization supported by assessments on its members, that had grown out of the earlier Sacramento Valley Water Users Committee. Culmination of these cooperative efforts was a study undertaken by the Department of Water Resources, the Bureau of Reclamation and SRDWA on the initiative of Harvey O. Banks, head of California's Department of Water Resources. Issued in 1957, the Report on 1956 Cooperative Study of Water Rights in Sacramento River and Sacramento-San Joaquin Delta published data derived from an extensive survey of

Delta and Sacramento River diversions, water requirements and legal entitlements, but impressive as the results appeared to be, there was still no firm agreement over exactly what rights the Delta possessed. An independent review of the apportionment of Sacramento River water was performed by the firm of Bleifuss, Hostetter and Associates, consulting engineers, of Sacramento in 1957. On the question of salinity control they reported that although the cooperative studies had used two alternative values for salinity control releases, 2,000 and 3,300 second-feet, actual project outflows from the Delta had dropped as low as an estimated 1,000 second-feet during the summers of 1954 and 1955. A degree of salt water encroachment had taken place in those years, leading to the conclusion that a 3,300 second-foot flow would have controlled salinity to the area of Antioch. The consultants considered the problem of financial responsibility and found that since the Bureau, the state and the water users all benefitted from the repulsion of tidal salinity, "the cost of salinity control should be borne equally by all those who benefit by its operation."[23]

The Bureau, of course, had never doubted that western Delta water users anxious to guarantee salinity control flows should pay for them. In 1955, farmers in eastern Contra Costa County requested increased releases from Shasta Dam to freshen the Delta as far west as Antioch. Ralph Emerson of Oakley reported to the Contra Costa County Development Association that the petitioners were informed the service would cost $600,000 annually. "There seems to be a view," he concluded, "the area is expendable."[24]

Delta and Contra Costa interests still refused to surrender without a fight. Though low key discussions on water rights and repayment followed the conclusion of the cooperative studies, attention of the Delta combatants turned to the State Water Rights Board's hearing on Bureau of Reclamation applications for water rights. Despite a longstanding Bureau policy regarding Delta repayment responsibilities, the counsel for the Contra Costa County Water Agency commented during the hearing that

> *. . . I know of no letter, no telephone call, [or] oral conversation in which any demand whatsoever has been made upon us to pay except at this hearing before this board . . . There has been no negotiation or serious discussion . . . of this subject with any responsible people.*[25]

In light of this and similar comments, the Board observed in its 1961 Decision D990 that, "the parties concerned apparently believe that no directive has yet been given or real incentive provided for them to aggressively approach the problem."[26] The Board added whatever incentive it could, pointing out that without a negotiated agreement costly litigation might result.

Certainly without an agreement, salinity repulsion would be provided only to the degree the Bureau of Reclamation judged sufficient to operate their Delta diversions, as the Assembly Interim Committee on Water discovered in 1961, when R. J. Shukle, Assistant Regional Project Development Engineer for the Bureau, testified.

> *ASSEMBLYMAN Z'BERG: So long as you are maintaining your contract requirement, if a by-product of that would be that some of the people in the Delta would be getting a lot of salt in their water . . . this would be a natural by-product of your main function and you are not primarily concerned with that aspect?*
>
> *MR. SHUKLE: To put it another way, nobody is paying for any salinity control.*[27]

Regardless, most of the Delta was kept fresh by the project operators without reimbursement. The Bureau of Reclamation, having made little visible progress in remedying that situation after years of effort, soon abandoned the tactics of gentle persuasion in favor of a demand in 1962 that water users along the Sacramento River and in the upland Delta sign repayment contracts or face court proceedings in which the Bureau would attempt to collect on retroactive as well as current benefits. Since the Delta was not yet ready for the necessary negotiations, the decision was made, on the advice of a fact-finding committee, to concentrate on the Sacramento River diverters. Contracts with those water users were signed in 1964.

In 1964, negotiation over Delta water rights leading to a repayment agreement got under way again between the Bureau of Reclamation and SRDWA. Later, the California Department of Water Resources and the San Joaquin Water Rights Committee joined the talks that resulted in the November 19, 1965, water quality criteria for the Delta. Since 1931, salinity control had been expressed primarily in terms of the outflow levels assumed necessary to maintain a specified standard of salinity control. The 1965 criteria shifted the discussion back to water quality standards themselves. However, agreement and a repayment contract covering the Delta remained a distant goal.

NOTES

1. Water Project Authority, Amended Application to Federal Emergency Administration of Public Works . . ., January 25, 1934, pp. 145-146, quoted in Hugh Hansen, Central Valley Project: Federal or State, California Assembly, 1955, p. 241.
2. Franklin D. Roosevelt, Executive Order, September 10, 1935, in CVP Documents, I, p. 559.
3. USBR, Central Valley Project Studies, Report on Problems 8 - 9, p. 167.
4. Ibid., p. 171.
5. Ibid., p. 173.
6. Ibid., pp. 14-15.
7. USBR, Central Valley Project Studies, Report on Problems 10 - 13, p. 53.
8. Ibid., p. 55.
9. Ibid., p. 62.
10. Ibid., pp. 62-63.
11. House Document 146, p. 2.
12. Ibid., p. 7.
13. Ibid., p. 16.
14. Ibid., pp. 27-28.
15. USBR, Central Valley Basin, p. 16.
16. Special Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives, 82nd Congress, 1st Session, Hearings at Sacramento with Joint Interim Committee on Water Problems of the California State Legislature on Central Valley Project, California, Water Rights, Supplies and Uses, October 29, 30, 31, 1951, p. 53. This subcommittee will hereafter be cited as "Engle Subcommittee."
17. Engle Subcommittee, Report, in CVP Documents, I, p. 683.
18. Ibid.
19. Ibid., p. 684.
20. Water Project Authority, Feasibility of State Ownership and Operation of the Central Valley Project of California, March, 1952, p. 77.

21. Henry Holsinger, "Necessity for Comprehensive Adjudication of Water Rights on the Sacramento and San Joaquin Rivers in Aid of the Central Valley Project," December 10, 1942.

22. Memorandum of Understanding . . ., in House Document No. 246, 85th Congress, 1st Session, Central Valley Project Documents, Part Two, Operating Documents, 1957, p. 627. This volume will hereafter be cited as "CVP Documents, II."

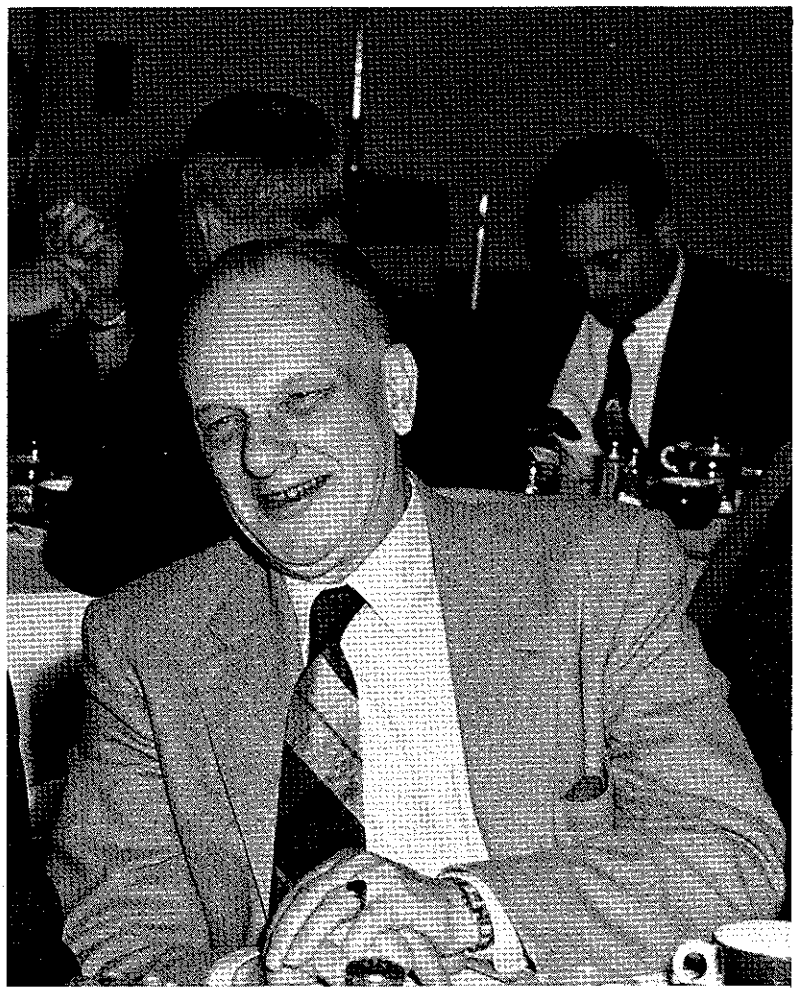
23. Bleifuss, Hostetter and Associates, Consulting Engineers, Report on Apportionment of Sacramento River Water in the Sacramento Valley and Sacramento-San Joaquin Delta under Conditions of the Central Valley Project Operation, April, 1957, p. 31.

24. Contra Costa County Development Association, News Letter, April, 1955, p. 1.

25. State Water Rights Board, Decision D990, p. 60.

26. Ibid.

27. Assembly Interim Committee on Water, The Delta, hearing, December 13, 1961, pp. 14-15.



JOHN REBER -- the theaterical producer whose penchant for ambitious planning resulted in the Reber Plan for the reconstruction of San Francisco Bay. Reber's faith in his scheme and his hard work in its behalf made the plan a force to be reckoned with, and led to comprehensive studies of San Francisco Bay. He was also among the first to approach integrated planning from a regional viewpoint.

VII. Barriers to Progress:
JOHN REBER AND THE SECOND BATTLE OF THE SALT WATER BARRIERS

THE VISIONARY PLANNER -- Nineteen hundred and thirty-three was a momentous year in the history of California water. The Central Valley Project Act passed the legislature and finally put into motion the construction of the comprehensive system of water development that had been talked about and studied for over ten years. And in that same year another scheme, perhaps even more far-reaching, first saw the light of day. It was in 1933 that John Reber, a producer of amateur theatricals, first presented his ambitious plan for reconstructing San Francisco Bay for former President Herbert Hoover at the Stanford University campus. Hoover called the design "the most complete proposal for the development of the Bay he had ever seen,"[1] and with that the Reber Plan was launched on a thirty year campaign to reshape California's water destiny.

John Reber first came to California in 1907 and was dismayed at the difficulty of travelling across the Bay from Oakland to San Francisco. It seemed to young Reber that San Francisco should not be without direct rail connections with the East, and he resolved to do something about the problem. Except for service in the Army during the First World War, when he promoted another of his imaginative schemes for "hydraulic combat," Reber travelled the length and breadth of California, learning first-hand the people and problems of his adopted state. During his travels, Reber worked out a comprehensive master plan for Bay Area development that soon encompassed far more than a solution to the problems of a bay crossing. The plan that reached completion in 1932 had never been publically presented when George Rucker, a San Jose real estate man and chairman of an Elks show Reber was arranging, discovered maps of the scheme. Rucker's friend, Congressman Arthur Free, then introduced Reber to Herbert Hoover.[2]

The Reber Plan, also known as the San Francisco Bay Project, was a design of breathtaking magnitude.

> *. . . San Francisco Bay would be divided into three parts under the proposed plan. The central portion of the bay from a line south of the San Francisco-Oakland Bay Bridge to a line from Point San Quentin to Castro Point would constitute a deep, salt water harbor. The southern arm of the bay would be transformed into a fresh water lake . . . (and) . . . the north arm of the bay . . . would likewise become a fresh water lake, with the surface elevation also held at high tide level.*
>
> *Division of the bay into these three parts would be accomplished primarily by two large earth and rock fill dams. The larger of these would extend from the San Francisco shoreline at Rincon Point to a point in the bay opposite the mouth of the Oakland estuary. The embankment to be constructed in this location is proposed to be about 2,000 ft. wide and 4 mi. long . . . The second, somewhat smaller than the first, would be 600 ft. wide and about 4 mi. long, extending from Castro Point, west of the Standard Oil refinery at Richmond, to San Quentin Point in Marin County . . .*
>
> *The upper and lower moles would be directly connected by a hydraulic fill which would be constructed in the shallow waters on the eastern side of the bay. The hydraulic fill would extend about 3 mi. west of the Oakland-Berkeley shoreline and from a point opposite the Alameda ferry slip on the south to Castro Point on the north . . .*
>
> *Bisecting the hydraulic fill off the east shore of the bay would be a fresh water ship channel designed to handle the largest ocean-going vessels. . . . A portion of the normal flow of the Sacramento and San Joaquin Rivers . . . would be brought down through the ship channel and used to supply fresh water to the lower arm of the bay . . .*
>
> *The Reber Plan contemplates construction of 6 locks of varying sizes . . .*
>
> *Creation of additional lands is also proposed for Marin County, where an 800-ac. fill might be constructed southwest of San Quentin Point and a 900-ac. area between Tiburon Peninsula and Sausalito . . .*

From three quarries in the hills of Richmond Point, rock for the seawalls could be excavated in such a manner that large underground storage spaces would be left available for use as hangers and as gasoline and ammunition storage. . . ,

The lower mole, between Oakland and San Francisco, would carry a complicated highway system, consisting of four 6-lane roads . . . All railroads . . . would be routed through a common tube from West Oakland to the mole, where as many tracks as necessary could be provided for transportation directly to San Francisco . . .

. . . there are proposed two airports, larger than any now existing, a naval base site, a submarine base site and a torpedo boat base. The largest airport would be situated north of Point Richmond, and include some 2,300 ac. . . .

Between Yerba Buena Island and the east shore of the bay, the plan proposes location of a Grand Central Terminal which would serve ocean-going passenger ships, all railroad lines, all overland bus lines and air lines . . . Immediately to the north of the terminal could be located a central commercial airport, with facilities for handling both land planes and sea planes. . . .

Twelve miles of water frontage would be constructed which could be improved with the construction of piers and would provide 60 mi. of docking space on the salt water harbor, and an additional 20 mi. of harborline would be available on fresh water . . . The total area of industrial land which could be created under the project would be about 20,000 ac. . . .

Though the capacity of the fresh water lakes as conceived in the plan would be about 10,000,000 ac. ft., the water report on the project indicates that these lakes can be held at capacity at all times including allowances for losses by evaporation, ship lock and fish ladder operations . . .[3]

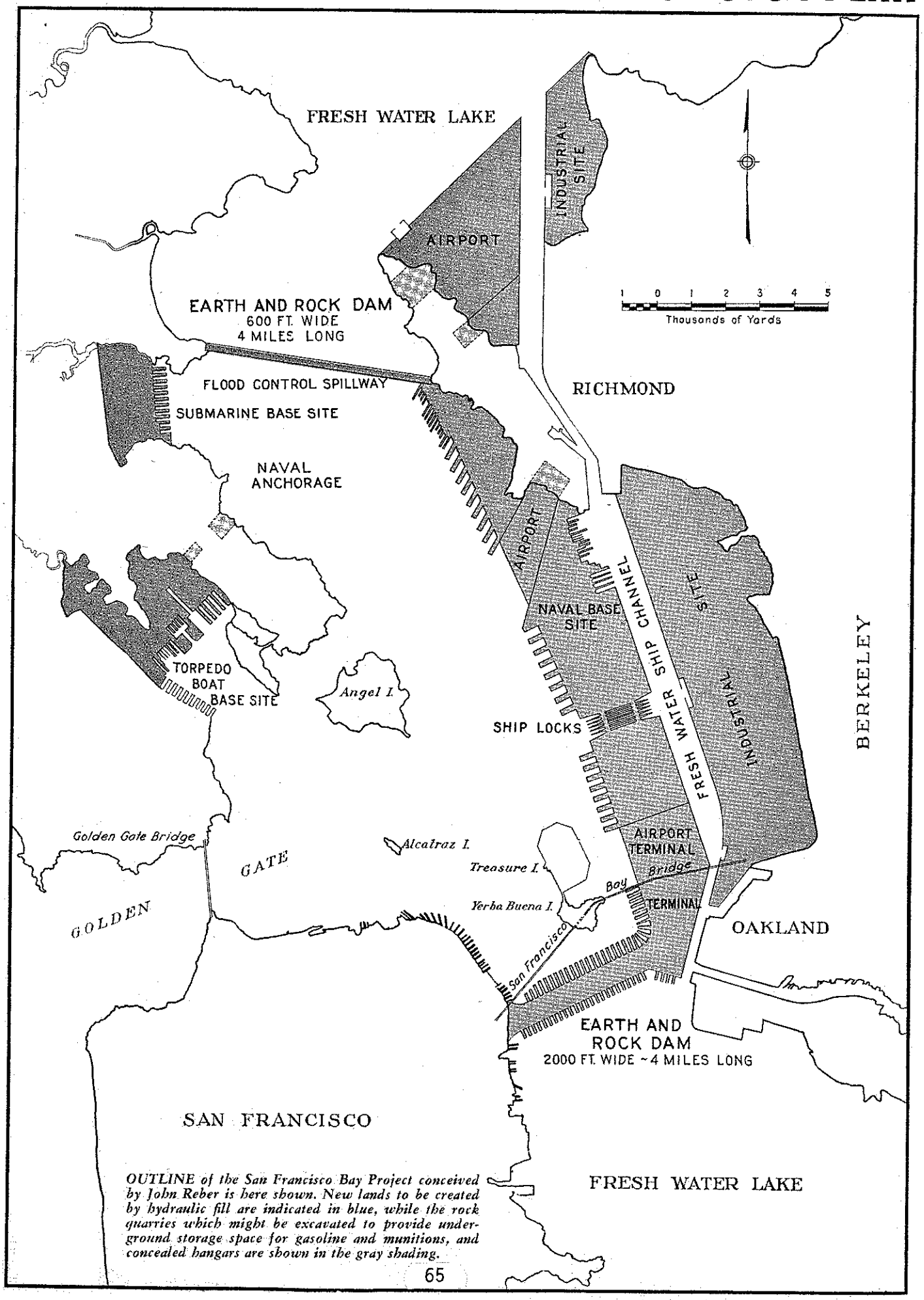
The litany of benefits Reber expected from this stupendous engineering undertaking was similarly impressive. Industrial, agricultural and domestic water users throughout the Bay-Delta system would be supplied with all the fresh water they could conceivably want, conveniently available for no more than the cost of pumping it from the fresh water lakes. Transportation would be made more efficient, new lands reclaimed, the military security of the Bay Area enhanced, and the possibility of almost unlimited future growth guaranteed. Beyond its sheer scope, the Reber Plan was a remarkable exercise, at an early date, in multifunctional regional planning.

Following the presentation to Hoover, Reber began to circulate his plans to state and federal officials, while continuing to refine the technical aspects of his grand design. By 1935, Reber had attracted the attention of the state legislature, and with the backing of Lt. Gov. George Hatfield, secured an Assembly Joint Resolution urging federal-state cooperation in consideration of the plan. The same year, Reber presented his plan to Secretary of War George Dern who was reportedly impressed with its military aspects. Reber always contended that the wide causeways provided transportation arteries, not easily destroyed, as well as giving the metropolitan area a supply of fresh water more reliable and less amenable to sabotage than the pipelines that carried water from Hetch Hetchy or the Mokelumne River.[4] Reber's scheme remained virtually unknown to the general public until 1940, when, despite legal roadblocks, the plan was exhibited at the Golden Gate International Exposition on Treasure Island during the closing weeks of the fair. Thereafter, the pace of the campaign accelerated rapidly as Reber gained the support of engineer L. H. Nishkian. Nishkian estimated the overall cost of the plan at $120,000,000 in 1940, and supported Reber consistently during the final seven years of his life. In 1945, he wrote to the Bureau of Reclamation,

I have studied this plan for over 5 years and have seen no serious engineering objection or insurmountable difficulties. The advantages in water conserved, land area developed, recreation facilities, transportation and dock facilities provided for, and many other advantages developed can be shown to exceed in value three to four billion dollars.[5]

Reber's methods of advancing the San Francisco Bay Project were, from the first, highly personal. Reber claimed that California's U. S. Senator Hiram Johnson had once said to him, "You undoubtedly know more Californians well than any other person,"[6] and he used that

SAN FRANCISCO BAY PROJECT—THE REBER PLAN



OUTLINE of the San Francisco Bay Project conceived by John Reber is here shown. New lands to be created by hydraulic fill are indicated in blue, while the rock quarries which might be excavated to provide underground storage space for gasoline and munitions, and concealed hangars are shown in the gray shading.

background to mount a remarkably effective promotional effort. Working primarily out of his 706 Ashbury Street residence, the now-retired producer spent long hours at the typewriter, carrying on an almost incredible volume of correspondence with supporters and those whose support he wished to gain. He spoke at every available opportunity before civic and social organizations around the Bay Area and later in California as a whole, spreading the gospel of a brighter future through construction of the Reber Plan.

Reber's cadre of loyalists came from diverse backgrounds. Though his plans would later be considered impractical, several respected engineers joined his entourage. His most ardent boosters, however, ranged from journalists to local labor leaders, from small businessmen in a variety of trades to farmers. His Bay Area supporters implicitly believed, as had the earlier backers of a salt water barrier in the Carquinez Straits, in the virtues of economic growth, especially that of their own area, and for them the Reber Plan seemed to promise billions of dollars worth of future expansion and prosperity. The center of Reber's extensive and active agricultural support, however, lay far from San Francisco Bay. Throughout the San Joaquin Valley, farmers were keenly interested in all proposed water developments, and the possibility of tapping some of the fresh water Reber intended to impound in the upper Bay and Delta attracted a good deal of attention. In 1941, Reber had extended his planning to include a five-hour military highway to southern California along the west side of the San Joaquin Valley that would straddle a canal carrying water to valley growers as well as domestic water through a tunnel to the Los Angeles basin. During the subsequent history of Reber's campaign, farmers provided Reber a generally sympathetic audience while John E. Pickett, editor of the California Farmer, a leading agricultural journal, served as president of the non-profit San Francisco Bay Project corporation set up to promote the Reber Plan.

Not long after the plan became public knowledge, objections to it began to emanate from Oakland. That city saw the scheme as a dire threat to the future of its port facilities. Barricaded behind the locks of the Reber Plan, Oakland would be placed at a distinct disadvantage in comparison to San Francisco, and James McElroy, chairman of the Oakland Board of Port Commissioners, asserted that Oakland saw "no reason for taking the bay and chopping it into a pond."[7] San Francisco supervisors, on the other hand, were favorable in their reactions to Reber's blueprint for development and urged a thorough investigation of it. San Francisco's benevolent interest in the Reber Plan would continue for nearly twenty years.

The first real examination of Reber's scheme came in 1946, when a Joint Army-Navy Board met in San Francisco to review plans for additional traffic crossings of San Francisco Bay. Twenty-nine plans were submitted for the Board's consideration of which the Reber Plan was probably the most prominent. In the first official position on the plan taken by an agency of the State of California, A. M. Barton, General Manager of the State Reclamation Board, criticized the proposal on the basis of the threat that the high water levels behind its northern barrier might pose to Delta levees. Barton was disturbed by Reber's intention to maintain a constant level of mean high tide in the fresh water lake for

> *. . . the discharge of the combined flood waters of the valleys into the Delta area would create a rise estimated at a maximum of two feet above that which now applies in the Delta area with tidal fluctuation.*
>
> *This rise in elevation would remove two feet from the present freeboard, which under existing conditions is the minimum that will assure safety. A combination of high winds, plus a freeboard reduced to one foot, would create a condition that would be disastrous.*[8]

Barton based his analysis on a level of mean high tide, while Reber in 1941 had written of his intention to "hold the water in the fresh water lakes at an elevation 6 inches higher than extreme high tide,"[9] a level that would have been even more of a threat to the Delta. State Engineer Edward Hyatt took a similarly dim view of Reber's grand plan and the accomplishments its author claimed for it, particularly the assertions that the plan could provide the Bay Area with all the water it could conceivably use.[10] Joining Barton and Hyatt in opposition to the Reber Plan was Carl W. Schedler, formerly president of the Salt Water Barrier Association, and now a consulting engineer. Schedler recalled testimony from Delta farmers during the salt water barrier investigations nearly two decades before that sustained high water levels might cause the collapse of peat levees. Like Barton, Schedler feared that the Reber Plan would lead to the inundation of the Delta. Echoing Hyatt's argument that no storage water would be made available by the Reber Plan, Schedler contended that the plan would require so much water for operation of the locks and maintenance of lake levels in the face of heavy evaporation that in a dry year it would run out of water unless

cyclic storage in upstream reservoirs was provided. The former barrier booster concluded that the cost of the whole plan, as well as disagreeable questions of pollution from sewage and industrial wastes, would make the undertaking untenable. "The building of the Plan," he said, "will undoubtedly bankrupt those it seeks to help."[11]

Though it had been constituted to consider only the military implications of the various crossing proposals, the Board denounced the Reber Plan in its final report and recommended a hybrid trestle and tube combination from Army Street in San Francisco to Alameda. Apart from such serious obstacles as navigation delays and water pollution, the Board found that

> *None of the claims of water conservation by the proponents of the Reber Plan have been documented by mathematical analysis or engineering study. Separate studies by the Board, and the examination of the reports of the State & Federal agencies confirm the fact that the Reber Plan would require large quantities of fresh water from surface storage elsewhere in order to maintain the upper and lower arms of San Francisco Bay as fresh water lakes.*[12]

Finally, they concluded:

> *. . . overwhelming opposition to the Plan by State, County and city authorities, together with commercial and military interests was presented at the public hearings. After careful consideration of this and all other factors involved the Board has reached the conclusion that the Reber Plan would result in a dislocation of industry, is economically infeasible and is untenable from the standpoint of navigation and national defense.*[13]

The verdict failed to shake the confidence of John Reber. Charging that state objections had been based on the desire of state officials to build another bridge across the Bay, he kept up his avalanche of letters and maintained the momentum of his promotional efforts. The same year, however, death took L. H. Nishkian, an event Reber referred to as the "blow of blows," but he was gratified to find that he would have no troubled in finding a new engineer.

> *24 Engineers and Technicians came forward to fill the void created by the death of L. H. Nishkian. These 24 experts held bi-monthly meetings for two years to prepare for the U. S. Senate Hearings. Never in the annals of any project has their sincerity and quality and devotion been excelled. They all volunteered. None was paid.*[14]

Led by General Philip G. Bruton, a retired Division Engineer of the Corps of Engineers, and retired Captain O. W. Swainson of the Coast and Geodetic Survey, twenty engineers followed John Reber's two-hour presentation before a special subcommittee of the United States Senate Public Works Committee, chaired by Senator Sheridan Downey of California, in 1949. Although not endorsing the engineering feasibility or wisdom of the Reber Plan, the subcommittee did recommend that further study be made of the elaborate scheme. As a result of the hearings and a Senate Resolution calling for an investigation of the San Francisco Bay Area, funding was provided in 1950 for the San Francisco District of the Corps of Engineers to begin a preliminary examination of the Bay region. The Korean War delayed the work, but a beginning had been made on what would become an exhaustive federal survey of San Francisco Bay and the Reber Plan.

CALIFORNIA HAS ITS DOUBTS -- Outside of testimony before the Joint Army-Navy Board and the interest of the legislature in the plan, California had done little to investigate Reber's wide-ranging scheme. Action was finally taken by Richard J. Dolwig's Assembly Committee on Tidelands Reclamation and Development in 1950 when it hired John Lucien Savage, a noted Denver-based reclamation engineering consultant, to make a thorough study of the Reber Plan. Savage began his work with a conference attended by Reber and his engineering staff in San Francisco, but when the consultant made his report to the Committee in February, 1951, his overall reaction to the plan was negative. Savage concluded that:

> *1. The Reber Plan is physically feasible; that is, the various structures contemplated could be built.*
>
> *2. The Reber Plan in its entirety is neither functionally nor economically*

feasible; that is, its realization would not produce the desired results, and would seriously hamper the national defense, and its costs would exceed the value of the benefits.

3. The Reber Plan in its entirety should be given no more consideration.[15]

Doubt was expressed that Reber's southern lake would ever be completely fresh, although a redesigned south bay barrier allowing for the passage of tidal flow might prove useful as a future crossing. Once again the water conservation arguments of the Reber supporters were assailed.

It would be unthinkable to divert water from a possible higher use to make up for evaporation losses in the . . . fresh water lakes. Without the Reber Plan there would be a small margin of safety in the water supply; with it, there would be a deficit. . . . it wastes fresh water and cannot possibly conserve it.[16]

In order to put the Reber Plan, estimated at $1,638,546,000 in the report, on a more favorable financial footing, Savage modified it to eliminate some of the expensive land fill features, with the skeletonized design being referred to thereafter as the Savage Plan.

Searching for the bright side of a darkening cloud, Reber's supporters found reason for cheer even in the gloomy Savage Report. John Pickett considered the report "an outstanding endorsement of the Reber Plan,"[17] because it did declare feasible the basic features of the north and south barriers and the connecting canal, although the feasibility might have been limited to engineering aspects of the plan rather than its economic value. In a hearing before the Committee on March 31, 1951, half a dozen of Reber's engineers "characterized the Savage Report as incomplete, inconclusive, and a 'rehash' of previous arguments against the undertaking."[18] Reber Plan backers called for a governmental authority to draft a master plan for the Bay Area, and demanded further study of their plan.

Another investigation was not long in coming. In 1952 a proposal for a study of north bay barriers had been blocked in the Senate Finance Committee of the California legislature, but in 1953 legislation, enjoying the support of Governor Earl Warren for a new report on barriers at all locations, was passed into law. Under terms of the Abshire-Kelly Salinity Control Barrier Act, half a million dollars was appropriated for a two-year study of barriers in the San Francisco Bay system to be performed by the Water Project Authority with the assistance of the Division of Water Resources. The Abshire-Kelly investigations were intended to cover far more than just the Reber Plan, though without the clamor created by that scheme it is doubtful if the matter would have received legislative attention. Recognizing "the fact that the Division of Water Resources, under State Engineer A. D. Edmonston, has been accused by pro-barrier elements of being already predisposed against the barrier,"[19] the Authority appointed a special Board of Consultants led by Raymond A. Hill. The Board met with the Division of Water Resources and it retained a Dutch consultant, Cornelius Biemond. In seeking to apply the Dutch experience to California conditions, the Board of Consultants was taking a bold and rather imaginative step. Biemond was Director of Water Supply for Metropolitan Amsterdam and a member of the Zuyderzee commission, which had long experience with problems of barriers and fresh water supply.[20]

Biemond, who was hired in 1954, spent eight weeks in California examining the problem of barriers and the general situation in the Delta. By September, 1954, his doubts concerning water quality behind any of the proposed barriers had become known. While under present conditions of upstream development enough water regularly entered Suisun Bay to flush out pollutants, future prospects for the maintenance of water quality were less optimistic. As Raymond A. Hill said,

Biemond found that during a series of dry years after construction of upstream storage works now contemplated, flood discharges entering Suisun Bay would not be sufficient to offset accumulations of salinity, which are caused by diffusion from the bottoms of the lakes, by transfers of salt water through lockage, and by contamination from other sources, with the result that the waters impounded by a barrier or barriers would probably not meet accepted standards of quality.[21]

The Board of Consultants therefore requested the Division of Water Resources to "give precedence to determination of the quality of water that could be available for use if a barrier or barriers were constructed,"[22] and Edmonston readily complied.

In March, 1955, two reports on barriers were submitted to the Water Project Authority, one by the Board of Consultants and another larger report, detailing financial feasibility, by the Division of Water Resources. Studies had been conducted on barriers at Chipps Island near Pittsburg, Dillon Point in the Carquinez Straits, Point San Pablo, and a Candlestick Point-Bay Farm Island barrier in the south bay, as well as the Reber and Savage Plans. The two reports were uniformly critical of the various schemes, though each recommended that further study be given to a suggestion by Biemond for dams or "control structures" on the Sacramento River above Rio Vista to regulate the river and divert water into a closed cross-Delta canal leading to the export pumps at the south end of the Delta. The Division of Water Resources also recommended that further study be given to the Chipps Island barrier, though the Board of Consultants did not. In presenting the case against barriers below the mouth of the Delta, the Division seemed plentifully supplied with arguments. Problems of siltation and flood control could be serious, the structures could have devastating effects on some species of fish, and the utilization of the barriers as bridges was far from certain. The most telling point was much as it had been in the 1920's, that the barrier lakes would be susceptible to pollution from a wide variety of domestic and industrial sources that would reduce water quality to substandard levels. Refuting the claims of Reber and other barrier enthusiasts concerning the value of barriers for water conservation, the Divison pointed out that "a barrier is essentially a diversion structure, and cannot be considered a major water storage facility."[23] A joint military report submitted to the State Engineer indicated that none of the barriers at or below Chipps Island "offers any advantages to national defense and each presents disadvantages in varying degrees."[24] The Division, therefore, found no significant advantages to barriers to offset the all too obvious disadvantages.

If anything, the Board of Consultants report was a harsher indictment of barriers than the Division of Water Resources study. The consultants found that " . . . all barrier plans are fatally defective in their failure to assure a water supply of acceptable quality and that the Biemond Plan overcomes the functional deficiencies of barriers and at least cost meets the objectives for which this study was undertaken."[25] They were especially critical of the Reber Plan, estimating its cost at over 1.37 billion dollars and declaring that, "Although intended to foster industrial expansion, it would actually be most disruptive of present conditions. It would transform a great natural harbor into an artificial bottle-neck."[26]

No attack against the Reber Plan or barriers in general had been more devastating in magnitude or finality, yet John Reber remained undeterred. In response to the release of the reports he was quoted as saying, "It's shameful. With the opportunity presented, they just ditched the whole works. They didn't have enough time, they didn't have enough money and they didn't have the facilities to come to the final conclusions they say they reached."[27] In a long letter to the San Francisco Chronicle, Reber expressed bewilderment at the cost estimates used to discredit his plan, and replied to the charges of water contamination.

> *The report's most amazing conclusion is that the water conserved by the Reber Plan will be no good. Why? Ninety-five per cent of this water flows off the high Sierra Nevada mountains and no water anywhere in the world is purer. It is pure passing Sacramento, or the Geologic Survey is 100 per cent wrong. When this water enters the upper areas of the Bay, it mixes with salt water from the ocean brought in by the tides. And that's exactly what a barrier is for -- to keep the ocean out of there. So without ocean water, the original water is still pure. Thus, any contamination would be man-made. Simply cure these man-made contamination elements, and you have absolutely pure water.*[28]

Reber's personal crusade continued undiminished and he rallied his forces for renewed battle. Charges were heard that the state was attempting to discredit barriers to enhance the future of State Engineer Edmonston's proposed Feather River Project for water transfer. Conveniently, Biemond's design would dovetail neatly with those plans. Apart from the outraged Reberites, a degree of general skepticism seemed to meet the reports, and the Chronicle observed editorially that more study was needed before any final conclusions were reached. Like Reber, they placed their faith in an investigation being undertaken by the Corps of Engineers.[29]

THE END OF REBER'S DREAM -- Although interrupted by the Korean conflict, the Corps of Engineers completed its preliminary report on the San Francisco Bay region in 1953, and recommended that a comprehensive survey of San Francisco Bay be undertaken. The Board of Engineers for Rivers and Harbors met in San Francisco and authorized a complete survey, which received funding in the 1955 federal budget. The major tool to be employed by the San Francisco District was a scale hydraulic model of the Bay, the first such model to be constructed by the Army outside of their Vicksburg laboratories. John Reber was an active influence in securing the construction of the model, directing his not inconsiderable efforts toward the study he felt would vindicate his blueprint for the Bay Area. Building of the model at the Corps' Sausalito base began in 1956 and reached completion in 1957. Reber considered the dedication of the model on June 14, 1957, a milestone in his career and frequent references to activities at the facility fill his correspondence.

John Reber died in October, 1960, long before the Army's report on barriers was released in July, 1963. Besides the Reber Plan and the derivative Savage Plan, the Corps of Engineers had examined barriers at Chipps Island, Dillon Point and Point San Pablo as well as tidal barriers in the southern reaches of the Bay that included the modified Nishkian barrier (essentially the south mole of the Reber Plan), the Sierra Point-Roberts Landing barrier and the Dumbarton tidal barrier. The last three, of course, had little or no impact on the Delta since their purpose was the control of tidal patterns in the south bay, a purpose effectively served only by the Sierra Point-Roberts Landing structure. Another major water development plan, proposed in considerable detail by Charles M. Weber, a former legislator and civil engineer, came too late to be included in the Corp's study. The rather grandiose Weber Plan, that envisioned a state-wide system of dams and canals, included barriers in the Bay system similar to Reber's but with extensive reclamation planned in San Pablo and Suisun Bays.[30]

The Reber Plan, because it was largely responsible for the study and because of John Reber's continuing interest in the Corps' survey, was "given a most careful and thoughtful appraisal."[31] General Frye, South Pacific Division Engineer, upon the release of the report, added that, "We studied his plan in every form possible, with and without transportation features; as originally planned, and in a skeletonized form."[32] Study it however they might, the Corps were forced to conclude that the Reber Plan and the other comprehensive plans were infeasible. The familiar problems of water quality were raised, in addition to volumes of detailed studies suggesting that, among other drawbacks, some types of disease-carrying mosquitos would be likely to flourish in the barrier lake, navigation would be impaired, and fish life jeopardized. But the most telling criticism came with the study of the fresh water lakes that would result from the plan and in which John Reber had himself put so much faith. The potential storage envisioned was "but momentary."

> *It is entirely negated by the possible and probable effective control of the runoff from the Sacramento-San Joaquin watershed for transfer flows. Local inflow into the Bay System, averaging around 550,000 acre-feet annually, would fail to meet the losses from evaporation, evapotranspiration, fish ladders and lockage, estimated to be 3,101,000 acre-feet annually under present conditions and to reach 4,732,000 by 2015. Should the effectual control of the delta inflow so throttle down the supply to a volume below the capability of local inflow to meet these losses, i. e., fall below a contribution of 2.6 million acre-feet at present and 4.2 million acre-feet by 2015, the lakes created under the Reber Plan would shrink in a matter of several years to below mean sea level. For effective passage of navigation under such circumstances the lake levels would then necessarily have to be maintained by reversion to present conditions, i. e., opening the barriers for full access of the tidal prism, eliminating the salinity control and water conservation function for which the barriers would have been designed.*[33]

Another substantial headache with the barriers would have been the costs of off-site construction necessitated by the projects. These costs would have included sewage control measures, changes in wharves and piers, raised and strengthened levees and ground water control to protect foundations and utilities. With off-site costs of up to $867,131,000 added to the already substantial on-site costs of the Reber Plan, the total would come to a whopping four and one-half billion dollars.[34]

To provide a comparative evaluation of the Reber and other plans, the Army Engineers published a table comparing the predicted annual costs of the barriers with annual yields, and showing the costs of water to local users derived by dividing the annual yield into the annual cost.

Barrier	Annual Cost (1,000s)	Annual Yield 1,000 ac.-ft. Present 1/	Annual Yield 1,000 ac.-ft. Future 1/	Cost of Water $ per ac. ft. Present 1/	Cost of Water $ per ac. ft. Future 1/
Chipps Island	11,628	1,365	4,775	8.52	2.44
Dillon Point	14,761	1,325	4,460	11.14	3.31
Pt. San Pablo	25,828	1,250	4,025	20.66	6.42
Savage Plan	59,216	525	1,380	112.79	42.91
Reber Plan	110,639	525	1,380	210.74	80.17

1/1965 -- 3,800 c. f. s. assumed for salinity repulsion
2/2020 -- 7,500 c. f. s. " " " " 35

The increased annual yields were based in large part on the anticipated reduction in the amounts of water required for salinity repulsion; amounts that would otherwise increase as export demands on the Delta pool rose. It was only by postulating future savings in water that would be lost to salinity control that the barriers could offer low-cost water, and even then only the upstream sites presented attractive possibilities for development. The Corps concluded that either the Dillon Point or Chipps Island barrier, with lower off-site costs and fewer pollution risks, could be incorporated into the California Water Plan (Feather River Project) to protect Delta and export water supplies from salinity. The final recommendation was that the Chipps Island and Dillon Point barriers receive further study.

The Chipps Island site had been receiving closer scrutiny from the state as an alternative to the proposed Biemond system of controlling the Sacramento River and insuring the quality of water exported from the Delta. Although as late as 1962 the state still presented the barrier as an alternative plan of development, the proposal was obviously considered unfavorable in comparison with the Biemond Plan. However, the Corps continued to advance the barrier concept during the Interagency Delta Committee studies that led to the Peripheral Canal proposal in 1965.

The last battle in the second campaign for salt water barriers had been waged at the Corps of Engineer's model in Sausalito, and, as in the original encounter, the proposal had been dealt a crushing blow. While the idea of preventing salt water incursion and at the same time conserving fresh water had had an undeniable attraction since 1920, the revival of interest in barriers was due almost entirely to one man, John Reber. Where the first campaign, waged by Schedler, Carlson and company, was primarily in the interest of the industrial development of Contra Costa, and to a lesser extent Solano County, John Reber's efforts were essentially personal, his vision a wider one of multipurpose regional development. In the face of adverse reports from 1947 onward, Reber maintained an optimism as remarkable as his energy; an optimism not only in his own plans but in the capacity of engineers and scientists to overcome conceptual or operational difficulties that critics discovered in his scheme. It may be that John Reber's massive plan died not only because it was unworkable or expensive but also because it had become something of a dinosaur -- a huge carryover from a time when grand engineering solutions to problems of human development were more fashionable, when dams of all kinds seemed to possess a kind of virtue in themselves. Hoover Dam and the Tennessee Valley Authority, Grand Coulee and the Colorado River Aqueduct had been the sort of projects that stirred the public imagination, but times and attitudes change, and by the early 1950's a caution, perhaps even a faint skepticism, had crept into the popular reaction to large-scale environmental alterations. By the time the Army issued its report on barriers the idea of so drastically rearranging nature as John Reber proposed to do was fast becoming an anachronism.

NOTES

CHAPTER VII - BARRIERS TO PROGRESS: JOHN REBER AND THE SECOND BATTLE OF THE SALT WATER BARRIERS

1. San Francisco News, July 22, 1949.
2. Ibid.
3. "San Francisco Bay Project," Western Construction News, March, 1942, pp. 103-105.
4. John Reber, "Annals of a Plan," promotional release, 1955 (?), p. 2.
5. L. H. Nishkian, consulting engineer, to U. S. Bureau of Reclamation, October 10, 1945, in Reber Papers. All correspondence cited in this chapter will be found in the Reber Papers.
6. Reber, "Annals of a Plan," p. 1.
7. San Francisco Chronicle, April 25, 1942, p. 4.
8. A. M. Barton to Joint Army-Navy Board, August 9, 1946.
9. John Reber to Hilary Crawford, June 20, 1941.
10. Edward Hyatt to Joint Army-Navy Board, August 10, 1946.
11. C. W. Schedler, Disadvantages of the Reber Plan, Presented Before Joint Army-Navy Board on Second Bay Crossing, August, 1946, p. 13.
12. Report of the Joint Army-Navy Board . . . , in C. W. Schedler, Comments on the Reber Plan, Prepared for Senator Downey at the Hearing of the Public Works Committee, December, 1949, pp. 20-21.
13. Report of the Joint Army-Navy Board, in Schedler, Comments on the Reber Plan, p. 21.
14. Reber, "Annals of a Plan," p. 4.
15. C. W. Schedler, The Reber Plan: Quotations from the Savage Report, March 8, 1951, pp. 1-2.
16. Schedler, The Reber Plan, p. 4.
17. San Francisco Chronicle, March 8, 1951.
18. Ibid., April 1, 1951.
19. Ibid., July 4, 1953.
20. Ibid., March 30, 1955.
21. Ibid., September 15, 1954.
22. Ibid.
23. Division of Water Resources, Feasibility of Construction by the State of Barriers in the San Francisco Bay System, March, 1955, p. 183.
24. San Francisco Chronicle, March 30, 1955.
25. Board of Consultants on Salinity Control Barriers in San Francisco Bay Region, Report, March 12, 1955, p. 65.
26. San Francisco Chronicle, March 30, 1955.

27. Ibid.

28. Ibid., May 29, 1955, "This World."

29. Ibid., March 31, 1955.

30. Weber had been impressed with Holland's success in reclaiming land from the sea and envisioned almost completely filling the bays upstream from the proposed north barrier. The privately produced plan was remarkable in its scope -- from the Smith River on the north coast to the southern deserts virtually every available drop of water was to be developed and most potential reservoir sites, including significant offstream storage, were to be utilized. Planning to develop carryover capacity sufficient to see the state through several dry years, the Weber Plan proposed an annual assured yield from its various components of approximately 26 million acre-feet.

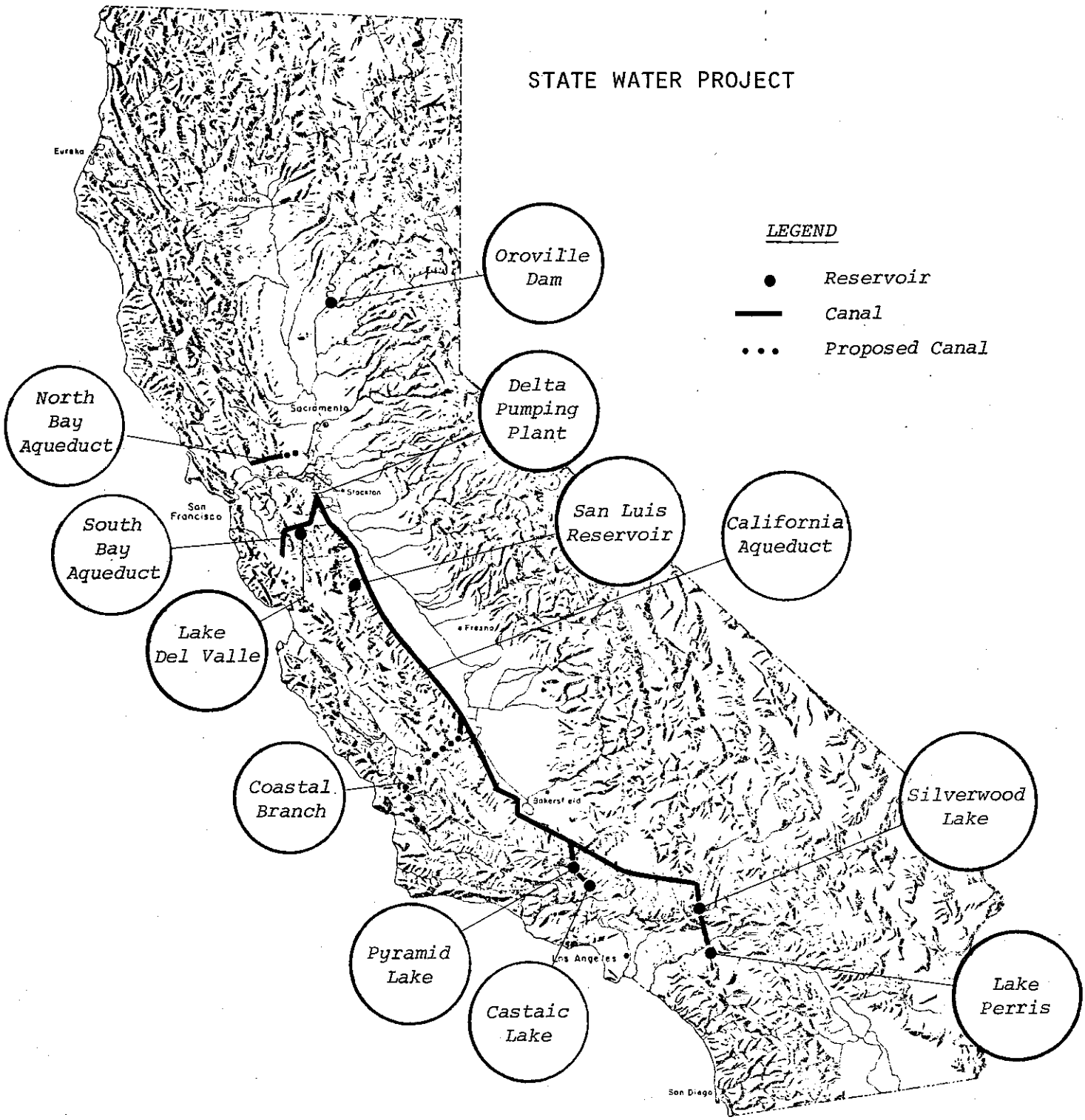
31. Corps of Engineers, San Francisco District, Technical Report on Barriers, July, 1963, p. 180.

32. Remarks of Brig. Gen. Arthur H. Frye, Jr., on Release of Barrier Studies, July 30, 1963, p. 9.

33. Technical Report on Barriers, p. 184.

34. Ibid., p. 119.

35. Ibid., p. 213.


STATE WATER PROJECT
LEGEND
Reservoir
Canal
Proposed Canal
Oroville Dam
Delta Pumping Plant
North Bay Aqueduct
South Bay Aqueduct
San Luis Reservoir
California Aqueduct
Lake Del Valle
Coastal Branch
Silverwood Lake
Pyramid Lake
Castaic Lake
Lake Perris
Eureka
Redding
Sacramento
Stockton
San Francisco
Fresno
Bakersfield
Los Angeles
San Diego

VIII. Beyond Barriers

REPLUMBING THE DELTA -- Although the state's twin reports on barriers in the San Francisco Bay system in 1955 failed to dampen John Reber's faith in his far-reaching plan, they did open a new chapter in the history of the Sacramento-San Joaquin Delta. The Board of Consultants and the Division of Water Resources, though opposed to barriers in general, had been quick to approve a new scheme proposed by the Dutch consultant, Cornelius Biemond, for placing barriers within the Delta itself. Where earlier barrier plans had emphasized saltwater protection, water conservation, and provisions for transportation facilities, Biemond's plan featured none of these things. Instead, the Dutch engineer had developed an approach emphasizing the transfer of water across the Delta from the Sacramento River to the export pumping plants and a corollary program of levee improvements. Key elements in the plan were two "control structures" blocking the Sacramento River and Steamboat Slough at the southwestern tip of Grand Island. At Isleton, upstream from the river dams, another control structure would admit water into a channel connecting to Georgiana Slough and the hydraulically isolated cross-Delta canal. In operation, the two primary control structures would insure maintenance of water levels sufficient to keep water flowing into the canal, while guarantying that no salt water would advance beyond the Rio Vista vicinity, even under the severest of conditions. A series of large master levees encompassing groups of islands would cut off a number of sloughs, leaving Georgiana Slough, the Mokelumne River and the Middle River of the San Joaquin as closed or isolated channels, the cross-Delta canal, leading to the pumps at the southern end of the Delta. A siphon was expected to pass fresh water from the Sacramento River beneath the Stockton Ship Channel, which would be left open to tidal and other sources of pollution. It was hoped that the control structures and the master levees, by shutting off much of the Delta from the sea, would reduce the tidal basin to the point that lower outflows would be sufficient to control salinity. Deepwater shipping would be unhindered by the plan since the Stockton channel would remain free and the Sacramento channel, not yet constructed, would pass through Cache Slough and the Yolo By-Pass rather than the river itself. Barges and small craft bound up the river or into the sloughs cut off by the master levees would have to use locks.

Biemond's plan was tailor-made for the development program being prepared by State Engineer A. D. Edmonston and the Division of Water Resources. In 1951, the Division had published a Report on Feasibility of Feather River Project and Sacramento-San Joaquin Delta Diversion Projects Proposed as Features of the California Water Plan, that outlined a proposal for a dam on the Feather River and a diversion from the Delta into a state-owned aqueduct carrying water to the San Joaquin Valley and over the mountains into Los Angeles. Biemond's Junction Point barrier design would serve admirably as a conveyance system for high-quality Sacramento River flows on their way to the new pumps as well as to the Bureau of Reclamation's Tracy pumping facility. The barrier report, therefore, placed a useful tool in the hands of state planners, while disastrous flooding at Yuba City when the Feather River broke a levee at Shanghai Bend in December, 1955, emphasized the utility of damming the Feather River.[1]

Since 1935, the Bureau of Reclamation, through its Central Valley Project, had been the dominant force in large-scale planning and construction involving northern California water, and the Bureau's comprehensive plans for the Central Valley Basin, published in 1949, indicated the extent to which they were willing to accept responsibility for the state's water resources. California officials and engineers had regretted their loss of control of the Central Valley Project to the federal government, and in 1945 California moved to reassert its interest in water management and planning by passing a Water Resources Act. Under that statute, a Water Resources Board was established and in 1947 a series of investigations were begun under its auspices that resulted in two bulletins detailing the extent of the state's water resources and the probable future demands on those resources. Following a 1956 administrative reorganization that eliminated the Board and raised the Division of Water Resources to departmental status, Bulletin No. 3, The California Water Plan, was released in 1957. Drawing on the inventories compiled in Bulletins Nos. 1 and 2, Bulletin No. 3 provided a comprehensive plan for state-wide water development that included some 370 reservoir and canal sites for possible construction. The initial unit recommended was the Feather River Project as outlined by Edmonston and his co-workers. The state now seemed on the verge of a significant new development in water resources.

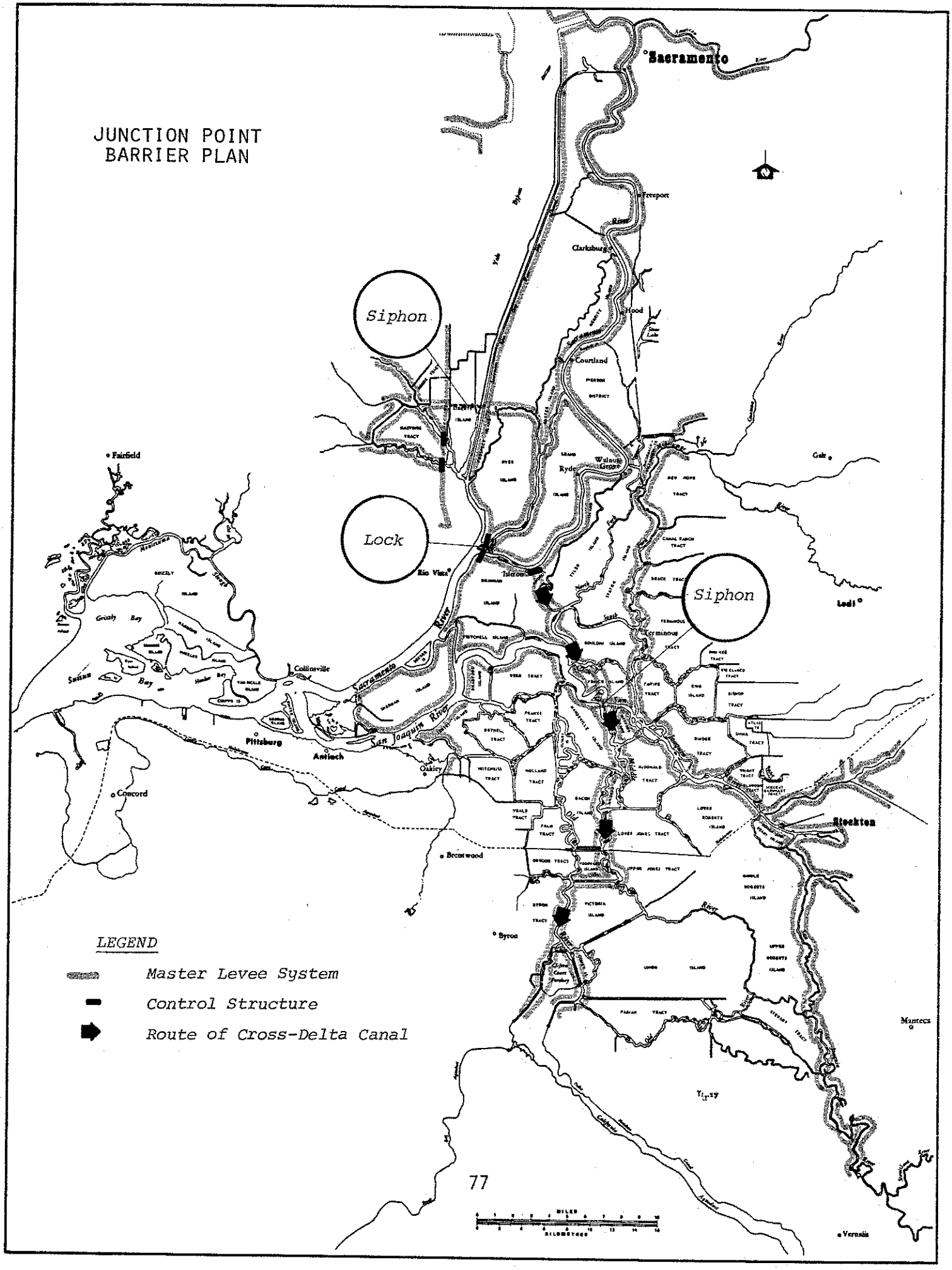
In 1957, further barrier studies, conducted by the Department of Water Resources under the authorization of another Abshire-Kelly bill, yielded an interim report on the investigation known as Bulletin No. 60. In the two years since the original barrier reports had been made, Department personnel had examined the two alternatives recommended for further study in 1955; the Junction Point barrier plan and the Chipps Island barrier at the head of Suisun Bay. Bulletin No. 60 recommended elimination of the Chipps Island structure from further consideration because its $198 million price tag and poor benefit-cost ratio compared unfavorably with the other plan.[2]

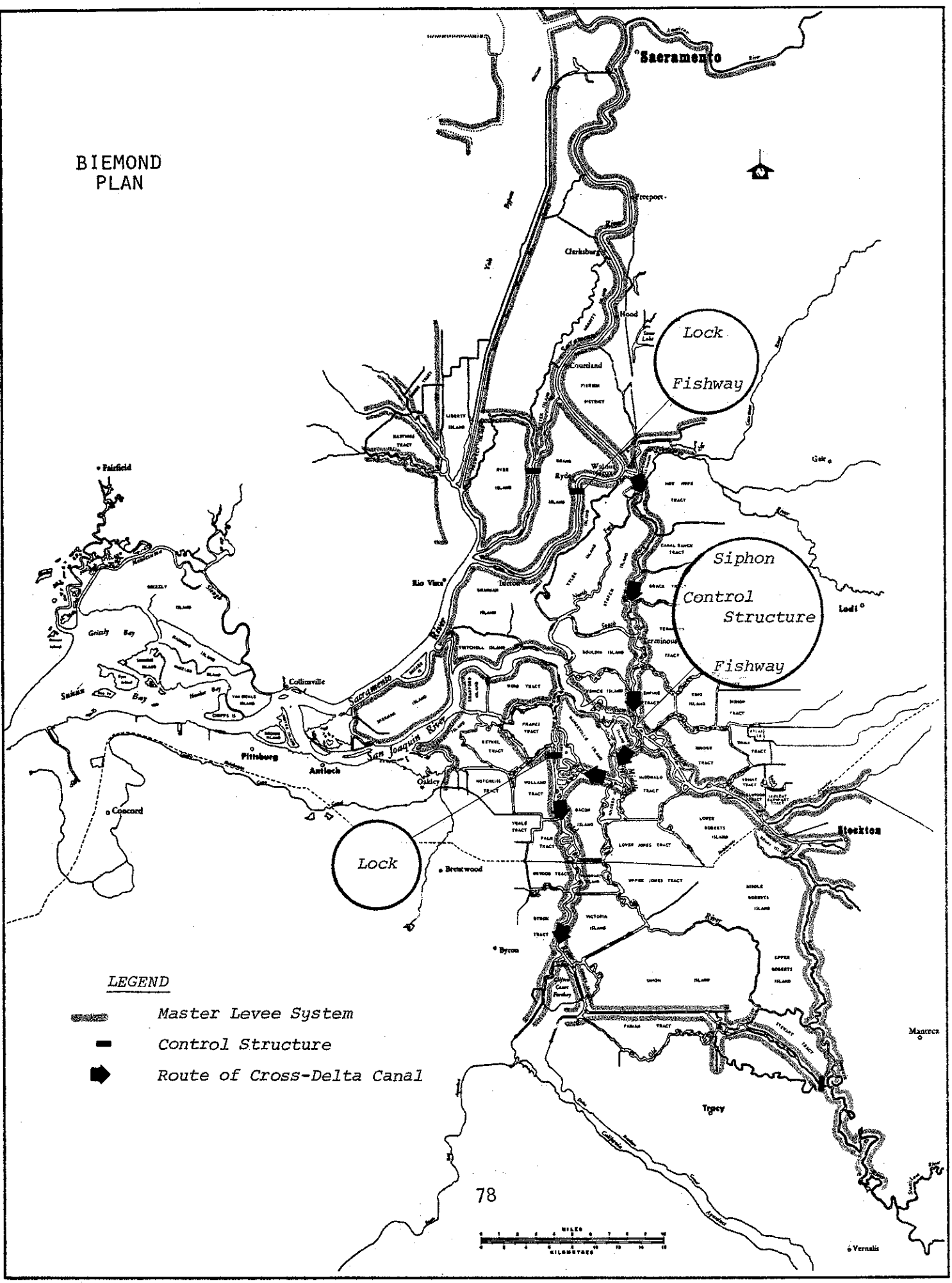
During the course of their investigations, state engineers had discovered a number of modifications to the original plan proposed by Biemond that would lower the cost while improving the system's efficiency, though it was the altered version that was named the Biemond Plan, while its predecessor retained the Junction Point label. The Biemond Plan varied from the earlier design in several important ways. The main control structures were moved upstream to block the Sacramento River near Ryde, and Steamboat Slough just downstream from its confluence with Sutter Slough. The diversion at Isleton to the cross-Delta canal was abandoned in favor of the Bureau of Reclamation's Walnut Grove cross-channel intake site. The cross-Delta canal, enclosed by master levees, followed the south fork of the Mokelumne River southward, then through Columbia Cut and Connection Slough to Old River. The canal was designed to carry 20,000 second-feet to serve a combined federal and state export demand of almost 16,000 second-feet with the remainder being made available for Delta irrigation. Water delivered at the pumps would be at sea level, while it was expected that the control structures would hold the water level at Walnut Grove about five feet above mean sea level to provide a gravity flow through the canal. Other modifications included an expansion of the master levee system that would provide new and stronger levees, while reducing the total length of the dikes subject to flood and tidal flows. Some of the channels of the Biemond Plan would carry flood flows as well as fresh water. Significantly, releases of fresh water to repel salinity were anticipated in the Biemond Plan, while they had not been in the Junction Point plan. For that reason, the original plan had envisioned siphons under the Yolo By-Pass to supply fresh water to the proposed North Bay Aqueduct via Lindsey Slough. The revised plan eliminated the siphons or control structures from that part of the Delta. Bulletin No. 60 recommended that further study of Delta water systems be limited to the Biemond Plan on the basis of its more favorable benefit-cost ratio, as well as an estimated capital outlay of only $86,200,000 as compared to a figure of $125,300,000 for the Junction Point plan.[3]

THE AWAKENING DELTA -- Though never entirely somnolent, by 1957 the Delta had been roused by as yet unclear visions of a brave new world that seemed likely to alter even the physical shape of the region. Bulletin No. 60 stirred an immediate controversy over the Bureau of Reclamation's obligation to maintain salinity control flows of at least 3,300 second-feet past Antioch when it made the assumption that a portion of those flows would be saved by the Biemond Plan. Regional Director C. H. Spencer's letter contended that the Bureau's salinity repulsion obligation extended only to the protection of its own pumps drawing water from the Delta for the Delta-Mendota and Contra Costa Canals. The Bureau's denial of any general obligation to limit saline incursion sent a shiver through the Delta in 1957, but the first chill of the impending crisis had come even earlier.

The barrier report of 1955 had attracted the unfavorable attention of Contra Costa County with its espousal of the original Biemond scheme for redesigning the Delta. That county, perennial guardian of Delta water rights, because of its vulnerable geographical location on the western edge of the Delta and because its industries and homes required high quality water, had concentrated its energies from 1935 to 1955 primarily on the Contra Costa Canal. They noticed uneasily the Bureau of Reclamation's amendment of its water rights applications to delete salinity control as a project function but still remained relatively calm concerning future water supplies. In the 1955 barrier reports, however, the County had discerned the seeds of a new plot to deprive the Delta of its rightful entitlements to fresh water. In a 1956 statement, the County Board of Supervisors condemned the proposal.

> *The Biemond Plan as described in the March 1955 report from the "Board of Consultants on Salinity Control Barriers" proposes further confiscation of our riparian rights, as a watershed county for the San Joaquin Watershed. We must know that our supply to the Contra Costa Canal is not jeopardized and the land holders in the delta will be given voice in determining whether they want such drastic changes of their properties as will occur through the proposed leveeing.*[4]


JUNCTION POINT
BARRIER PLAN
Siphon
Lock
Siphon
Sacramento
Freeport
Clarksburg
Courtland
Hood
Fairfield
Rio Vista
Isleton
Ryde
Walnut Grove
Galt
Lodi
Terminous
Collinsville
Pittsburg
Antioch
Oakley
Concord
Brentwood
Byron
Stockton
Manteca
Vernalis
Grizzly Bay
Suisun Bay
Sacramento River
San Joaquin River
LEGEND
Master Levee System
Control Structure
Route of Cross-Delta Canal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Stockton
Collinsville
Sacramento River
San Joaquin River
Grizzly Bay
Suisun Bay
Pittsburg
Antioch
Oakley
Concord
Lock
Brentwood
Byron
Tracy
Manteca
Vernalis
LEGEND
Master Levee System
Control Structure
Route of Cross-Delta Canal

Viewing the state's new plans as a direct threat to the Delta, Contra Costa County began to watch more carefully than ever the planning process as it applied to the Delta. It's response to Bulletin No. 60 was at once cautious and cooperative. In an outline prepared by County water consultant W. J. O'Connell in February, 1958, it was proposed that Bulletin No. 60 be included in Bulletin No. 3, The California Water Plan, perhaps to secure the supplemental water supplies it put forward. Yet at the same time the County felt a need to reassert its rights, and even, on a basic level, to define them. O'Connell himself suggested that water rights be construed in an extremely broad sense.

> *IV. Present beneficial uses and the reasonable extensions of use of flows presently available in any area of the State, should be recognized and treated as rights, where such usages have been continuous and now support an established economy.*[5]

Such an assertion was indeed far-reaching. But regardless of the ramifications of O'Connell's statement, it indicates the development of an aggressive interest on the part of Contra Costa County in protecting Delta water rights.

Conferences with state officials held on an informal basis during 1958 allowed the County to respond to proposals embodied in the two Abshire-Kelly reports and express its concern over the potential impact of massive new diversions from Delta fresh water supplies. The threats perceived by the County remained agonizingly ill-defined since planning for Delta facilities was still tentative and incomplete, leaving local interests unable to do more than protest the tendencies apparent in the reports. The general expectation emerged, however, that control of the Sacramento River as proposed by the Biemond Plan might significantly reduce Delta outflows and permit increased saline pollution. The deficiency thus created in western Delta water supplies would be compensated by substitute or replacement water furnished through overland conduits from the State Water Project. There was little question that replacement water should entail no increase in costs to those deprived of offshore sources of fresh water, but divergent opinions were evident on the definition of the amount to be considered "replacement" water. The County, represented by the newly-formed Contra Costa County Water Agency and the older Contra Costa County Water District, tended to follow the lines of O'Connell's suggestion that County water rights extended to all the water that could be put to beneficial use. Director of Water Resources Harvey O. Banks' reply that no more unappropriated water existed in the Sacramento River and that riparian rights would be narrowly construed to include only those diverters actually on the channels, indicated that by "replacement" water the state meant only substitution for existing rather than future needs. Provision for more water would be termed "supplemental" and carry with it an obligation for repayment from beneficiaries. In the state's newly emerging water policy, the conception of the Delta as a pool serving an expanded water transfer system became paramount, while protection of the Delta from tidal salinity was relegated from an important function of state planning to an incidental necessity to satisfy minimum Delta water entitlements, and then in all likelihood through overland facilities rather than by maintenance of usable water in offshore channels. For Delta water users the future seemed to be darkening.[6]

The future came sooner than anyone had anticipated. Although the Bureau of Reclamation had declared its freedom from any legal compulsion to control salinity it still had to protect its own operations. C. H. Spencer's estimate of a 1,500 second-foot outflow as the minimum necessary to provide the Bureau of "carriage water" to insure the purity of project exports was only an estimate; the only certain method of finding the minimum satisfactory flow level was actual experimentation. Accordingly, in 1959, a dry year, the Bureau controlled releases from Shasta Reservoir to limit Delta outflow and by early July, with outflow virtually eliminated, salinity was climbing to critical levels both offshore and at the intakes of the Contra Costa Canal. From July 20 to August 17, 1959, water pumped into the canal from Rock Slough exceeded the 250 ppm limit that had been established for chloride concentration in the 1951 contract, and on July 28 a maximum level of 376 ppm was reached in the canal. With water in the adjacent river channels registering around 4,000 ppm, the industrial water users were forced to continue using the now unsatisfactory canal supply, though one user temporarily suspended operations.[7] When salinity levels in the canal reached a point in excess of contractual targets, a delegation from the County Water Agency journeyed to Sacramento to confer with the Bureau's Regional Director and request additional releases from Shasta and Folsom reservoirs to drive out the salinity. Characterizing the local Bureau response as "unsatifactory" a contingent that included State Senator George Miller, attorney Thomas Carlson, Water Agency Manager Victor Sauer and engineer William O'Connell travelled to Washington, D.C., to seek relief from local congressmen and top reclamation officials. Perhaps as a result of their activity, additional releases were

NOTES

CHAPTER VIII - BEYOND BARRIERS

1. Basic information on the development and adoption of the Feather River Project is found in Erwin Cooper, Aqueduct Empire, (Arthur H. Clark Co., 1968).

2. Department of Water Resources, Bulletin No. 60, Interim Report to the California Legislature on the Salinity Control Barrier Investigation, March, 1957, p. 76.

3. Ibid., p. 37.

4. Water Resources Committee, Contra Costa County Board of Supervisors, Statement to Natural Resources Section, Central Coast Council, California State Chamber of Commerce, September 28, 1956.

5. Contra Costa County Board of Supervisors, Outline of Suggestions, (William J. O'Connell), February 28, 1958, p. 1.

6. See Summary of Minutes of an Informal Conference Between Directors and Officials of the Contra Costa County Water Agency, Representatives of the State Department of Water Resources, and Interested Industrialists and Agriculturists of Contra Costa County on July 30, 1958.

7. Walter F. Rowland, "The Contra Costa Canal Project: A Study in Water Resources Development," Ph. D. dissertation, Stanford University, 1967, p. 60.

8. Contra Costa County Water Agency (?), Contra Costa County's Water Requirements, 2nd. edition, September, 1959, n.p.

9. Rowland, op. cit., p. 60.

10. Ibid., pp. 60-62.

11. California Water Code, Section 12202.

12. California Water Code, Section 12934 (d) (3).

13. Contra Costa County Board of Supervisors, acting as Board of Directors of Contra Costa County Water Agency, Summary of Basis of Concern Relative to the Physical Works Proposed in the Sacramento-San Joaquin Delta by the State of California, November 2, 1960, pp. 2, 8.

14. Bulletin No. 76, p. 33.

15. Ibid., pp. 32-35.

16. Ibid., pp. 36-39.

17. Ibid., pp. 40-43.

18. Ibid., p. 59.

19. Ibid.

20. Ibid.

21. Mel F. Nielsen, press release, August 22, 1961, in Information Supporting Objections to Water Development Planning Affecting the Offshore Water Supply, June 7, 1962.

22. Bulletin No. 76, p. 52.

23. Contra Costa County Water Agency to DWR, November 30, 1960, p. 3.

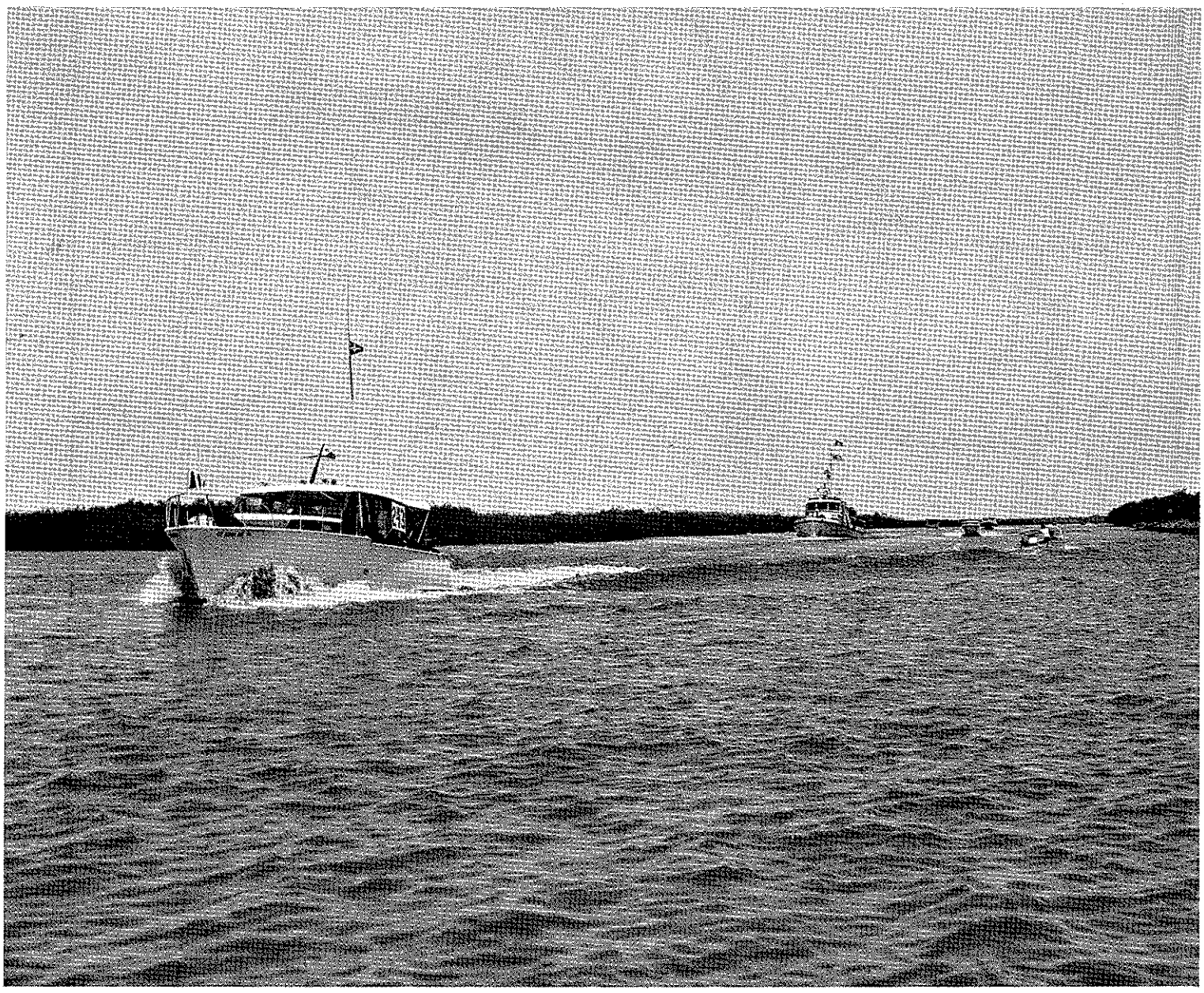
24. DWR, Economic Aspects, Appendix to Bulletin No. 76, December, 1961, p. 172.

25. Contra Costa County, Outline -- Comprehensive Statement with Respect to the Offshore Water Supply of the Western Delta, June, 1962, p. x-1.

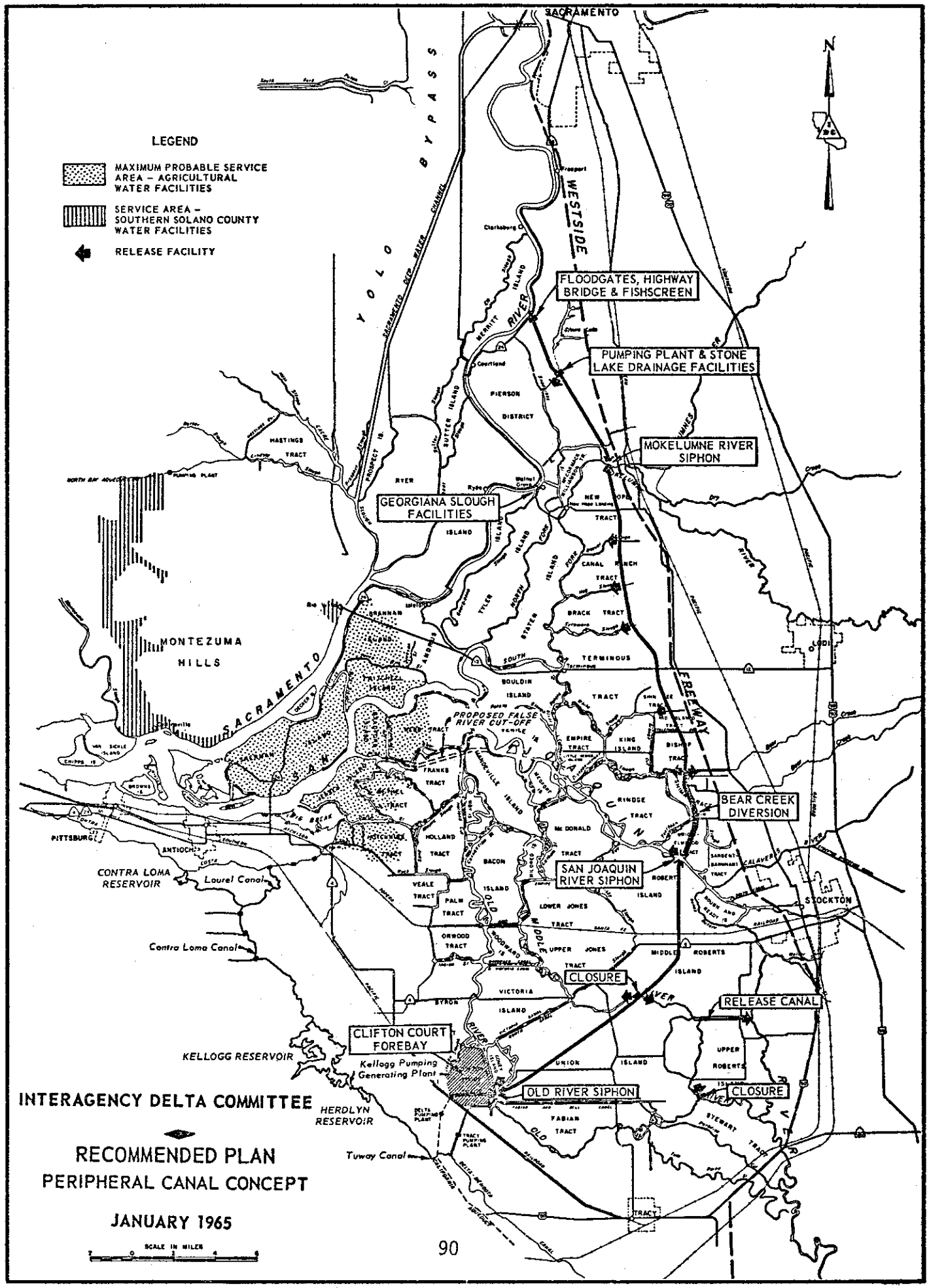
26. Ibid., p. x-2.

27. Minutes, Public Hearing held by California Water Commission and DWR, March 1, 1963, p. 25.

28. Ibid.



Pleasure boating in the Delta. With over 1,200 miles of waterways, the Delta is a favorite location for boaters. Yachting organizations opposed the State's Biemond Plan and its derivatives because of the impact channel closures and locks would have had on recreational navigation.


LEGEND
MAXIMUM PROBABLE SERVICE AREA – AGRICULTURAL WATER FACILITIES
SERVICE AREA – SOUTHERN SOLANO COUNTY WATER FACILITIES
RELEASE FACILITY
SACRAMENTO
YOLO BYPASS
WESTSIDE
FLOODGATES, HIGHWAY BRIDGE & FISHSCREEN
PUMPING PLANT & STONE LAKE DRAINAGE FACILITIES
MOKELUMNE RIVER SIPHON
GEORGIANA SLOUGH FACILITIES
MONTEZUMA HILLS
PROPOSED FALSE RIVER CUT-OFF
FREEWAY
BEAR CREEK DIVERSION
SAN JOAQUIN RIVER SIPHON
CLOSURE
RELEASE CANAL
CLIFTON COURT FOREBAY
OLD RIVER SIPHON
CLOSURE
CONTRA LOMA RESERVOIR
Laurel Canal
Contra Loma Canal
KELLOGG RESERVOIR
Kellogg Pumping Generating Plant
HERDLYN RESERVOIR
Tuway Canal
STOCKTON
TRACY
INTERAGENCY DELTA COMMITTEE
RECOMMENDED PLAN
PERIPHERAL CANAL CONCEPT
JANUARY 1965
SCALE IN MILES

IX. The Interagency Delta Committee

NEW APPROACHES IN PLANNING -- By 1960, comprehensive planning for the most efficient utilization of California's vast but poorly distributed water resources had reached a high degree of development, but coordinated planning among the agencies entrusted with construction and operation of water projects was virtually unknown. California's original State Water Plan had been surrendered to the Bureau of Reclamation, and subsequent attempts by the state to influence its design and construction had failed miserably. Along with the Central Valley Project the Bureau inherited responsibilities for the further development of the state's water resources, a task it willingly undertook. Its own long-range plan for the Central Valley Basin had been released in the late 1940's. From 1947 to 1957 the state carried on somewhat parallel but separate investigations that resulted in the California Water Plan. In scope, the state's second major attempt at comprehensive planning far outstripped earlier efforts, for it comtemplated the transfer of northern California water as far south as the Mexican border. In the formulation of these grand schemes, each agency worked in virtual isolation; liaison was sketchy and seldom adequate. The most glaring example of the pitfalls of independence was the Department of Water Resources' inaccurate assumption in 1957's Bulletin No. 60 regarding the volume of salinity control flows being released by the Bureau of Reclamation. In 1958, California Director of Water Resources Harvey O. Banks suggested that regular high-level meetings held during the 1940's between the Corps of Engineers, Bureau of Reclamation, and the state be reinstituted and expanded to include the U. S. Soil Conservation Service.[1] Meetings of the Federal-State Interagency Group began in 1958 and were held two or three times a year until at least 1963. The meetings and the supporting staff work introduced a pattern of coordination in overall planning and operation that was expanded during the recess in the State Water Rights Board's hearings in late 1959 and 1960. The result was the May 16, 1960, agreement between the Bureau of Reclamation and the Department of Water Resources on the apportionment of water between federal and state projects in years of subnormal water supply. In its Decision D-990, the Water Rights Board encouraged further cooperation among the agencies and interests in Delta development.

Additional prodding came from the California legislature in early 1961. It was already abundantly clear to the Assembly Interim Committee on Water that the Biemond Plan, in any form, was unacceptable to the Delta. Not only did the Department of Water Resources' planning seem to be of at least debatable value, but the planning process itself came under fire when the committee noted that testimony indicated "that the department's planning approach places too much emphasis upon presenting the department's solutions to problems rather than consulting with local interests to achieve mutual understanding and coordination of effort."[2] The committee therefore suggested that legislation be enacted to mandate cooperation between local and state planners and they recommended the establishment of a Delta Study Commission consisting of perhaps seven members to review the region's problems and to "analyze, compare and integrate prior studies and the work now being done"[3] on possible solutions. The legislators express particular interest in the possibility of expanding the Corps of Engineer's model of San Francisco Bay to include the Delta, and suggested that provision be made for federal participation in the work of the proposed Delta Study Commission. Emphasis, however, remained on quieting local fears that Delta interests would not be consulted in future planning rather than establishing a basis for federal-state cooperation.

The Department of Water Resources greeted the committee's suggestions without enthusiasm, citing the study commission proposal as a vehicle likely to perpetuate the endless wrangling that had so long plagued Delta planning and one that might intrude unnecessarily into departmental administrative affairs.[4] At the same time, the obvious distaste on the part of Delta interests for the Department's plans had been well known even before the publication of those plans in Bulletin No. 76, making imperative some alternative means of solving such Delta problems as flood control and seepage and providing a reliable system for water transfer. The Delta water problem was, in large part, one of accommodating State Water Project diversions in addition to present and future diversions by the Bureau of Reclamation. Not only would state pumps pull still more water from the Delta, but that water had to meet more stringent quality standards than the Central Valley Project observed because, rather than supplying primarily agricultural water, a substantial portion of the State Water Project's yield would serve municipal and industrial customers in southern California, the Bay Area, and on the coast. In the Department of Water Resources' prototype contract of November 4, 1960, with the Metropolitan Water District of Southern California maximum chloride levels were set at

110 ppm monthly average and 55 ppm for the 10-year average, with total dissolved solids held to averages of 440 ppm monthly and 220 ppm over 10 years.[5] The maintenance of high quality exports also became a matter of concern to the Bureau of Reclamation because of the joint use of San Luis Reservoir and a stretch of the California Aqueduct by the two agencies. Although the Bureau's cross-channel at Walnut Grove had been a satisfactory means of rerouting enough water through interior Delta channels to serve the original Central Valley Project units without undue strain, the contemplated future diversions were far more than it could handle. Without additional cross-Delta transfer facilities, increasingly substantial portions of the export supply would have to flow around Sherman Island and up the San Joaquin River, increasing the likelihood of degradation by salt water and requiring ever increasing volumes of outflow to prevent that from happening. Demands on Delta water supplies were expected to increase from 1.5 million acre-feet in 1960 to over 12 million acre-feet in 2020, if contemplated but not yet authorized projects such as the Bureau's East Side Canal were included. Stepped up diversions and the inevitable increases in upstream usage seemed likely to reduce potential outflow at the same time that more water would be required to maintain a hydraulic barrier. The Biemond-inspired Delta Water Project had been one solution to the problems posed by increasing exports; its rejection seemed to require redoubled efforts at developing a satisfactory plan for Delta facilities. Shunning the spotlight of public hearings that would certainly follow if the agency adopted the Delta Study Commission proposal, the Department of Water Resources began an unprecedented attempt to coordinate state planning activities with the operations of other agencies dealing with the Delta water problem.

The Department of Water Resources began conversations with the two major federal agencies involved, the Bureau of Reclamation and the Corps of Engineers, in early 1961. The Bureau had recently taken an interest in Delta planning and had established the Delta Counties Consulting Board to coordinate local and federal agencies. The Board consisted of representatives from the five Delta counties of Sacramento, Yolo, Solano, San Joaquin, and Contra Costa plus Stanislaus and Merced counties, and liaison members from other governmental agencies. In August, 1961, the Department promoted an organizational meeting for an Interagency Delta Study Committee. Reporting on the August 22 gathering, Langdon Owen, Supervisor of the Delta Studies Unit, told Carl Werner of the Department's Delta Branch that the Corps of Engineers "expressed considerable interest. I felt throughout the meeting that representatives from the Bureau were not responsive. This may be due to the possible conflicts of the proposed committee and the present U. S. Bureau of Reclamation's Delta Counties Consulting Board."[6] Premonitions of Bureau of Reclamation reluctance to join in the agency level planning discussions were well-founded. On September 6, 1961, the Acting Regional Director of the Bureau, E. F. Sullivan, wrote to William Warne, Director of the Department of Water Resources:

> *Your suggestion for an interagency study committee, we believe, would overlap the function of two existing interagency groups. It appears that consideration of policy matters related to the interagency programs in the Delta can adequately be handled by the existing interagency committee comprising the heads of the Division Office of the Corps, the State Office of the Soil Conservation Service and our offices. The combination of the Delta Counties Consulting Board and the liaison representatives of your Department, the Corps of Engineers, the Public Health Service, and the agencies of the Department of the Interior, appear to me to be adequate to accomplish the study functions of your suggested committee.*[7]

The Bureau of Reclamation was not alone in its reluctance to accept the concept of an interagency committee. Still unhappy over lack of consultation with local interests in the development of the Delta Water Project, the Contra Costa County Water Agency passed Resolution No. 373 on October 10, 1961, to voice its opposition to the new and publicly inaccessible organization then being formed. Noting that the Bureau of Reclamation, in its Delta Water Quality Investigation, was already giving representation to local spokesmen through the Delta Counties Consulting Board and that the Bureau's "Policy and Technical Committees" were actually a representative body, they resolved that "this Board opposes the formation of any interagency Delta committee unless representation of this Board and local interests in the Delta Counties be included."[8]

The Interagency Delta Study Committee, however, was already at work. In April, 1962, it issued a report by its Delta Functions Subcommittee on Functional Objectives of Delta that outlined the objectives and requirements of member agencies in the Delta region and established a basis for further work. Despite its activities, however, the Committee was still in jeopardy. In a June 22, 1962, letter relating primarily to other Delta matters,

Bureau of Reclamation Regional Director H. P. Dugan told William Warne that the interagency committee was unnecessary because local views were coming in through the Delta Counties Consulting Board.[9] This opinion, in view of the already functioning committee, created considerable consternation in the Department of Water Resources, and Assistant Director R. C. Price was dispatched to the Bureau's regional office to talk with Dugan regarding his statement. Price reminded Dugan that his approval had been obtained by telephone before the Committee had been formed and that the body was now actually functioning. Dugan admitted that the earlier conversation had slipped his mind, but the Bureau's reliance on the Delta Counties Consulting Board remained a bone of contention. The interagency group was, according to Price, handling some confidential material, such as the appendices to the Army's not yet released barrier studies, and that such material was unsuitable for review by a public body like the Consulting Board. Dugan, while promising to respect the confidentiality of the material used by the Committee still seemed, in Price's view, to be reluctant to share fully the Bureau's information. An agreement was finally reached between the two men to rewrite the offending paragraph in the letter of June 22, and continue Bureau participation in the Interagency Delta Committee, the word "Study" having been dropped at the request of the Bureau of Reclamation.[10]

THE PERIPHERAL CANAL IS BORN -- Fears that the Bureau's reluctance to join the Committee would limit their participation proved unfounded. Early in 1963, the Bureau introduced to the Committee the Peripheral Canal concept as an alternative system of water transfer and Delta enhancement. The main features of the proposed canal around the east end of the Delta had been designed during the 1940's as a hydraulically-isolated version of the Delta cross-channel. The plans, however, had proven too costly and the concept was abandoned in favor of the dredged cut at Walnut Grove and channel improvements that facilitated the transfer of water from the Sacramento River through the Delta waterways themselves. The Canal quickly won favor with the Committee even though it had not been studied to the same extent as the hydraulic or physical barriers or the Biemond Plan. In their report to the Interagency Delta Committee, the Coordination of Delta Planning Subcommittee wrote on May 31, 1963:

> *The recent review of the advantages and disadvantages of the several approaches to solution of the Delta problem had indicated the need for an alternative that will give more consideration to fish and wildlife, recreation, water quality and public health . . . Pursuant to this need the subcommittee is pulling together some of the recent proposals growing out of the U. S. Bureau of Reclamation's Delta water quality studies and presenting them as a fourth concept.*[11]

Reasons for the subcommittee's position deserve comment because they indicate that substantial consideration was being given to intangible benefits associated with the environmental and recreational aspects of water use. Previous water planning had attempted, so far as possible, to reduce all benefits and detriments to a dollars-and-cents balance. In the subcommittee's decision to make fish and wildlife, recreation and water quality features significant reasons for choosing between alternatives, an important new departure in planning was first introduced. The subcommittee concluded:

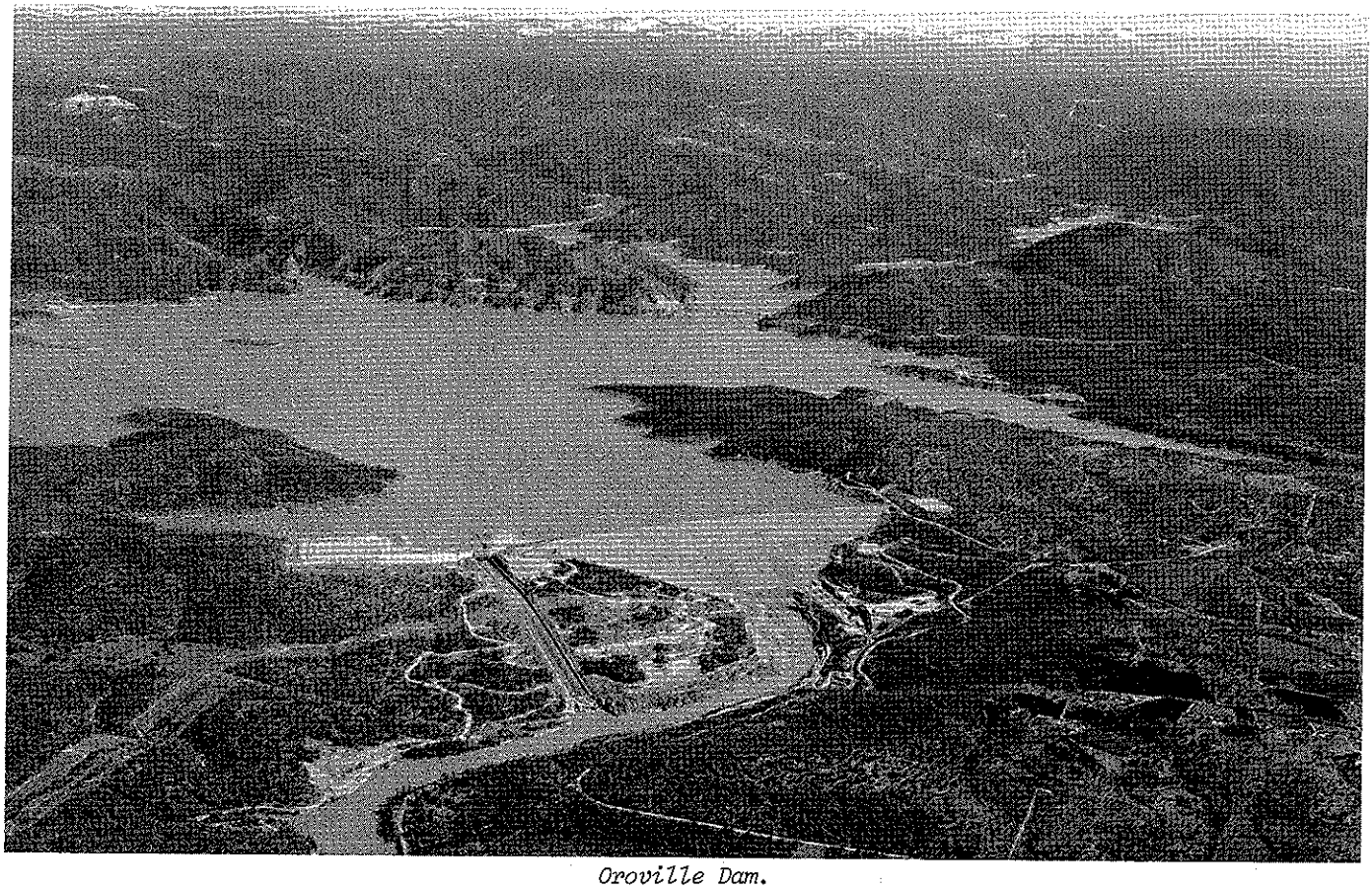
> *After review of the impact of each of the alternatives on the stated objectives the subcommittee is of the opinion that the peripheral canal offers the greatest opportunity for balanced growth of many Delta-oriented activities. The subcommittee recognizes that there are several problems associated with this plan but considers that these problems are legal or social in nature and can be resolved by appropriate agreements among the three representing agencies and the Delta interests.*[12]

Reaction to the subcommittee's stand within the Department of Water Resources was cautious. William Berry, Division Engineer of the Division of Resources Planning, noted that the subcommittee was expressing no more than an opinion because the Canal had not been studied in sufficient detail to warrant the praise heaped on it in the report.[13]

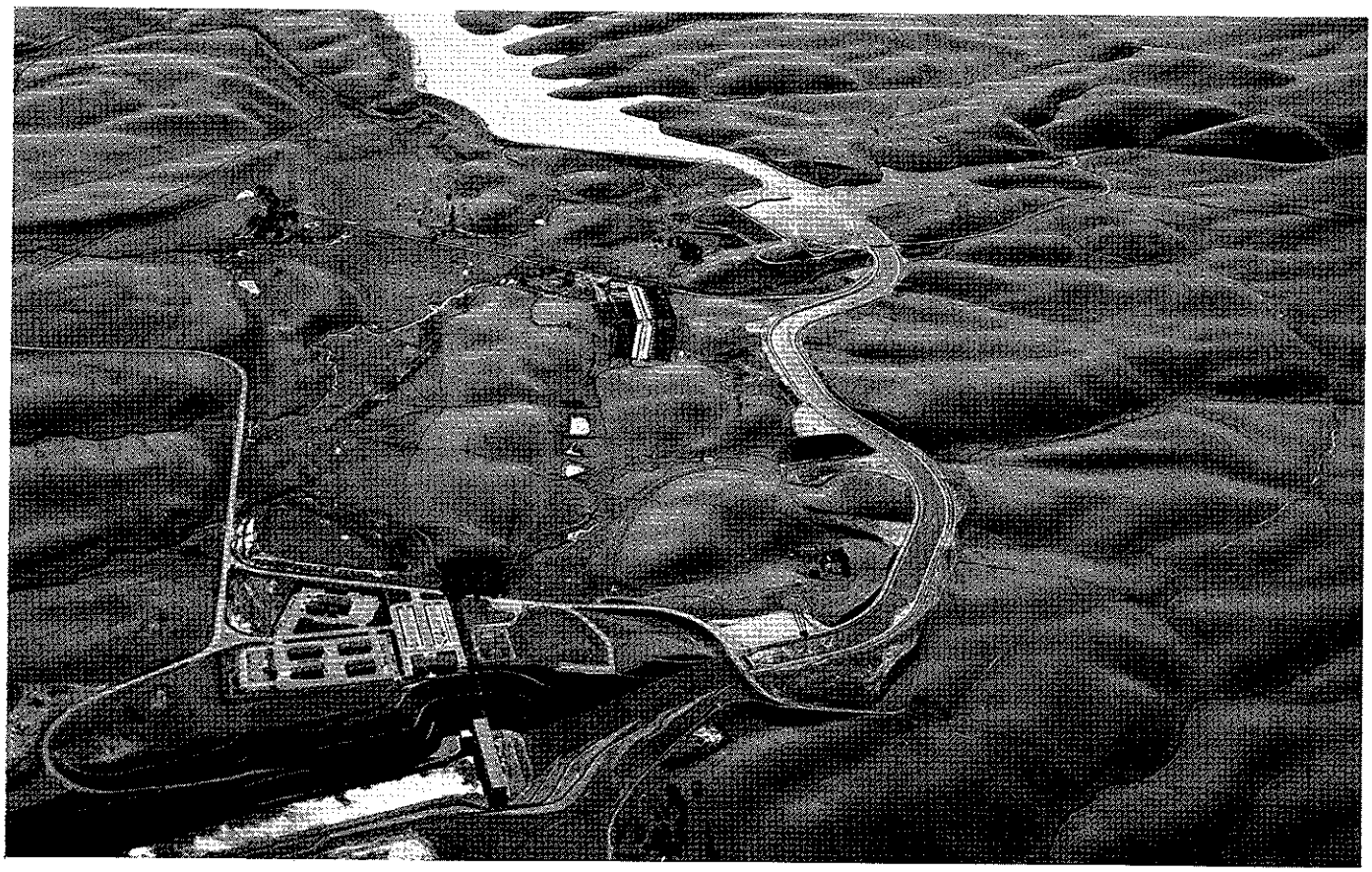
Objections to the Committee's very existence were still being heard. Mel Nielsen, chairman of the Delta Counties Consulting Board and a Contra Costa County supervisor, tried repeatedly to inject his group into the Interagency Delta Committee deliberations. In response to his persistent entreaties, the Committee agreed to consider any written suggestions or comments from local agencies but refused to open their meetings to the Consulting Board or any other private Delta interests.[14]

Man-made rivers in the San Joaquin Valley. The California Aqueduct flows southward near foothills of the Coast Range and Interstate 5. The Bureau of Reclamation's Delta-Mendota Canal is visible to the right of the picture.

Engineers planning the State Water Project were faced with the problem of getting water from the Feather River across the Delta to the pumping plant feeding the California Aqueduct without pulling salt water into the Delta and into the Aqueduct. A system of control structures and channel closures seemed to offer a solution, but local opposition forced a reconsideration of the concept. As a result of that reconsideration the Interagency Delta Committee adopted the Peripheral Canal as a facility that would serve both federal and state projects and protect the Delta environment. (DWR photos)



Oroville Dam.



Department of Water Resources' Delta Pumping Plant, showing the California aqueduct and Bethany Reservoir.

In the Report of Interagency Delta Committee for Delta Planning, dated August 28, 1963, the same endorsement of the Peripheral Canal concept found in the earlier subcommittee report was reiterated. In sketching out the proposal, the report envisioned a diversion from the Sacramento River at Walnut Grove carrying a capacity of 20,000 second-feet of water to the point where it intersected with State Highway 12. From that point 5,000 second-feet would be diverted to the Bureau of Reclamation's proposed East Side Canal, with the remaining 15,000 second-feet flowing to the pumps where the state would receive two-thirds of the total. The August report outlined the course of the Committee's investigations and established a tentative timetable for decision on the best of the four alternatives under consideration. Besides the Peripheral Canal, the Committee continued to examine the Chipps Island physical barrier, the hydraulic barrier, and a Delta Water Project similar to the Typical Alternative Delta Water Project described in Bulletin No. 76.[15]

The agencies taking part in the study were not all as enthusiastic about the Peripheral Canal as the subcommittee's frequently republished statement would suggest. The Corps of Engineers, for example, failed to join in the stampede in favor of the Peripheral Canal, neither endorsing nor opposing the proposal. In January, 1964, General Frye, Division Engineer of the South Pacific Division, went a step further when he told the Commonwealth Club that a barrier across Suisun Bay constituted "a better solution to the State's water problems than the channel or canal proposed by state and federal agencies."[16] General Frye's remarks took the other members of the Committee by surprise, since at the release of the Corp's barrier studies the previous summer he had remained noncommittal.

Meanwhile, the Delta Counties Consulting Board had not taken the Committee's rejection of their request to participate in Committee meetings in good humor. The Board submitted a statement to the California Water Commission on February 7, 1964, deploring the lack of consultation with local interests that, they felt, might lead to the same sort of unhappy results as Bulletin No. 76. They also expressed the opinion that the time schedule the Committee had established for itself was inadequate for proper planning. At the same time, the Contra Costa County Water District issued another statement, arguing that, based on review of the August 28th report,

> *. . . the present concepts for Delta planning do not properly consider the rights, entitlements and interests of Contra Costa County Water District or of the lands and water users bordering the Delta channels which derive a water supply therefrom or use the waste assimilation capacity thereof.*
>
> *There does not seem to be sufficient recognition of the fact that a determination of the entitlements of the Delta interests to an off-shore supply of good quality water is basic to the planning of any of the alternatives under consideration and the allocation of costs therefore. Such entitlements exist by virtue of rights, legislative enactments and historic usage of water diverted from the channels.*[17]

The water district could have its direct needs filled from the proposed Kellogg Reservoir, but it was felt that the additional cost of water delivered from that project should be borne by the agencies diverting the natural water supply.

As the summer of 1964 progressed, the trend toward an official endorsement of the Peripheral Canal accelerated. While the Corps of Engineers was still withholding approval of the Canal and even supporting the barrier concept, testimony before the Committee by the California Department of Fish and Game indicated that the Peripheral Canal would have a beneficial impact on fish and wildlife, while the barrier would be a serious detriment, especially for salmon and other anadronomous fish.[18] Mounting interest in fish and wildlife enhancement as a function of any proposed Delta project received further impetus when the San Francisco Tyee Club and Aquatic Resources Committee endorsed the Canal in a letter to the California Water Commission on July 6, 1964. Other groups of sportsmen also took a position in favor of the Peripheral Canal even before the Committee prepared its final report.

On September 11, 1964, the Interagency Delta Committee released its Proposed Report on Plan of Development, Sacramento-San Joaquin Delta, officially recommending construction of the Peripheral Canal. At the same time a longer, more technical, draft of a task force report on the Committee's recommendations was released. The Committee's plan was based on the construction of the 43-mile long Peripheral Canal, isolated from the Delta channels, equipped with a pumping plant near its intake, and siphoned under the Mokelumne, San Joaquin and Old rivers. The design of the 400-foot wide and 30-foot deep artificial river had been

refined and modified from the tentative proposals of the previous year. The point of diversion had been moved upstream to Hood, capacity had been increased to 21,800 second-feet, and the East Side Canal connection had been eliminated. In full operation, the Canal would supply 10,300 second-feet to the State Water Project and 8,000 second-feet to satisfy present and future demands of the Central Valley Project, while the remaining 3,500 second-feet was intended for release into Delta channels along the Canal route to satisfy half the maximum monthly demand of 7,000 second-feet for Delta use and outflow, with outflow estimated at 1,500 second-feet.[19] By manipulation of the eleven release facilities, Sacramento River water could be distributed throughout the Delta as required. Project designers admitted that the controlled Delta environment and minimal salinity repulsion releases envisioned for the future would result in worsening water quality conditions in the western Delta. To mitigate these damages, a series of water supply programs was made an integral part of the Peripheral Canal proposal. The Kellogg Project to augment and improve the water available in the Contra Costa Canal was already under study and was considered necessary if the proposed reduction in outflows were to be achieved. To supply the islands of the western Delta, overland agricultural water facilities were proposed that would bring water from less saline interior channels or from the Peripheral Canal. Southern Solano County would receive water from two projects; a diversion from Lindsay Slough to serve the Rio Vista vicinity, and a Collinsville Aqueduct serving the Denverton-Collinsville area from either the state's North Bay Aqueduct or the Bureau's Putah South Canal from Lake Berryessa. Improvements in levees and in the Stockton ship channel were also endorsed and the development of a management plan for Suisun Marsh was proposed.

Throughout its consideration, the Peripheral Canal had been promoted partially on the basis of its potential intangible benefits to the environment. The physical separation of cross-Delta transfers from natural waterways would eliminate channel scouring by fast flowing water moving across the Delta and curb the loss of striped bass at project pumps. In the early 1960's an estimated 15-30 percent of the bass eggs were lost annually at Central Valley Project pumps, and the figure was expected to climb to 50-80 percent if planned increases in diversions occurred without the construction of an isolated cross-Delta conveyance system to separate bass nursery areas from the influence of the pumps.[20] Control of Canal intake and release operations could further protect the fishery, beginning in the early spring when increased releases in the southern Delta would help achieve salinity levels favorable for striped bass spawning. Later, the Canal pumps could be shut down to allow striped bass larvae spawned in the Sacramento River upstream from the city of Sacramento to float safely downriver past the intake. In the fall, releases of Sacramento River water into the south Delta would be limited to insure a predominance of "homestream" water from the San Joaquin River system in the area to guide migrating San Joaquin River salmon to the streams of their birth. The release of water into dead-end sloughs from Canal gates was also expected to flush out those backwaters, raise dissolved oxygen levels, and generally improve the resident fish habitant. Precise patterns of operation were not defined but the flexibility of the controlled distribution system was thought to be adaptable to solving a wide variety of the Delta's problems.[21] The reports proposing nearly $300 million worth of Delta improvements were presented to the California Water Commission, which agreed to hold hearings on the plan on November 6, 1964, to receive public comments.

While the public was commenting at the Water Commission's hearing, the report was also being scrutinized by the State of California. The Resources Agency, of which the Department of Water Resources is a part, formed its own Delta Review Task Force to review the Interagency Delta Committee's findings. Members of that panel included the Chief Engineer of the Department of Water Resources, A. R. Golzé and representatives of wildlife, soil conservation, recreation, water rights, water quality, and reclamation interests. Meanwhile, the Department, whose contributions to the Committee's work had been limited to the Delta Branch, undertook its own review of the Peripheral Canal recommendation. In a report made in October, 1964, the Department's reviewers were critical of the interagency report and in general remained unconvinced of the clear merits of the Peripheral Canal. The bulk of the review report was technical in nature, dealing with objections in engineering concepts employed by the Committee, but the recommendations serve to sum up the Department's attitude toward the results of the interagency effort.

> *. . . the report does not demonstrate the clear economic advantages of the Peripheral Canal on the basis of tangible benefits, nor does it demonstrate that the greater cost of the intangible benefits is justified. Those who must make the decision between alternatives should have a better basis for decision than now exists.*[22]

The report was sent to the Director's office for review and William Warne replied to Golzé regarding the internal report that

> *. . . although the report does not clearly demonstrate the economic superiority of the Peripheral Canal Plan on the basis of tangible economic benefits, the significant intangible benefits that would be generated by such a project, together with its distinct advantages in ease of operation, more effective control, increased reliability, minimization of water rights problems, relative hydraulic simplicity, and ease of construction, are sufficient to warrant the adoption of the Peripheral Canal Concept as the framework within which development should proceed.*[23]

Warne said substantially the same thing in the Department's "Review Comments" submitted to the Interagency Delta Committee, while warning that cost estimates for the Canal might be too low. Once again, it was apparently the intangible benefits that played a major role in the adoption of the Peripheral Canal scheme. The importance of fish and wildlife as recipients of the intangible benefits was underscored when Warne wrote: "We concur that significant intangible benefits related to fisheries would be realized through the more favorable pattern of flow in the Delta channels. We recognize fisheries as a prime consideration in the formulation of a comprehensive plan of development for the Delta."[24] Matters involving environmental quality were no longer merely being quantified in monetary terms in an effort to determine the most economically feasible project; rather, maintenance and improvement of the environment came to have an intrinsic value. Though the argument was not made that the Canal was approved by the interagency panel and by Warne only because of the hoped-for enhancement of the Delta environment, the intangible benefits seem to have tipped the scales in favor of the Peripheral Canal. The Resources Agency Task Force studying the proposed plan also endorsed it, largely on the basis of its intangible benefits.

The hearing held by the California Water Commission on November 6, 1964, seemed to bear out the confidence that had been placed on the value of its subsidiary benefits. Only the Contra Costa County Water Agency spoke in opposition to the proposed report. The County Board of Supervisors, acting as ex officio Board of the Agency, attacked the "clandestine" procedures of the Committee and proceeded to turn their fire on the implied Committee definition of the word "development" with the searing charge that use of that term to describe an already settled area constituted a "transparent exercise in Madison Avenue semantics"[25] on the part of the Committee. They charged that the Committee's "basic and overriding objective is the exportation of water . . . This objective is apparent throughout both reports and is pursued with the cynical attitude that the aim must be accomplished at all costs, even if it means destroying the Delta . . ."[26]

In its outspoken opposition to the Peripheral Canal Plan, the Contra Costa County Water Agency stood alone. Other groups, both governmental and voluntary, gave the proposal either a conditional endorsement or praised it in enthusiastic terms. Southern California and San Joaquin Valley purchasers of state water worried over the cost of any works that might increase their own costs. The Contra Costa County Water District argued for a definition of offshore entitlements and the provision of equivalent water at no additional cost to Contra Costa water users. Likewise, the Farm Bureau expressed a guarded acceptance of the scheme, and other affected agencies were often similarly cautious. The most unstinting praise for the Canal came from the recreational organizations, particularly those interested in fishing. From the Associated Sportsmen of California through the Yolo Sportsmen Association, the sport fishermen led the chorus of approval on the basis of the expectation that controlled releases from the Canal into the Delta would eliminate the harmful reversals of flow in some channels resulting from pump operations. As the chairman of the California Water Commission reported:

> *An interesting aspect of the hearing was that, for the first time in our memory, large groups of fish and wildlife and recreation interests supported, almost without qualifications, a proposed water project. In fact, the entire San Francisco Bay fishing fleet declared a holiday so that the skippers and their families could be present at the hearing.*[27]

When the final version of the Plan of Development, Sacramento-San Joaquin Delta was released in January, 1965, it carried the endorsements of the Bureau of Reclamation and the Department of Water Resources, while the third partner in the interagency deliberations, the Corps of Engineers, withheld its approval of the Canal, though it raised no objection to its construction. Discussions then turned to the more mundane matters of choosing a construction

agency and closing down the official Interagency Delta Committee, which had in the space of four years reached agreement on a plan for Delta development that, more than any previous suggestion, enjoyed wide public approval. At the same time, the Committee had broken fresh ground in bringing together federal and state agencies that had previously worked separately even while working on the same or similar problems of water management. With the backing of fish, wildlife, and recreation organizations and the consent of major economic interests, except Contra Costa County, the statement of William Warne on September 23, 1964, that " . . . I am sanguine indeed that we are on the verge of achieving a solution to the complex water problems of the Delta"[28] seemed to be coming true. Appearances, however, were very misleading.

NOTES

1. Harvey O. Banks to B. P. Bellport, Regional Director, USBR, July 31, 1958.
2. Assembly Interim Committee on Water, The Delta, January 2, 1961, p. 12.
3. Ibid., p. 17.
4. James F. Wright to B. Abbott Goldberg, January 20, 1961, in DWR Files. All additional correspondence cited in this chapter is found in DWR Files.
5. DWR, Salinity Incursion and Water Resources, Appendix to Bulletin No. 76, April, 1962, p. 155.
6. Langdon W. Owen to Carl Werner, August 25, 1961.
7. E. F. Sullivan to William Warne, September 6, 1961.
8. Contra Costa County Board of Supervisors, acting as Board of Directors of the Contra Costa County Water Agency, Resolution No. 373, October 10, 1961, in DWR Files.
9. H. P. Dugan to Warne, June 22, 1962.
10. R. C. Price to Warne, July 11, 1962.
11. Coordination of Delta Planning Subcommittee, Coordination of Delta Planning, May 31, 1963, p. 29.
12. Ibid., p. 35.
13. Comments by William L. Berry, August 19, 1963, in DWR Files.
14. Minutes, Interagency Delta Committee, January 28, 1964, in DWR Files. This Committee cited hereafter as "IDC."
15. IDC, Report of Interagency Delta Committee for Delta Planning, August 28, 1963.
16. San Francisco Chronicle, January 25, 1964.
17. Contra Costa County Water District, Statement to California Water Commission, February 7, 1964.
18. J. W. Keysor to Division Engineer, Division of Design and Construction, July 3, 1964.
19. IDC, Draft of a Task Force Report to the Interagency Delta Committee on a Coordinated Plan for the Sacramento-San Joaquin Delta, September, 1964, pp. III-53-56.

20. Department of Fish and Game, Ecological Studies of the Sacramento-San Joaquin Estuary, A Decennial Report, 1961-1971, June, 1972, p. 40.

21. IDC, Coordinated Plan, pp. III-79-80.

22. DWR, Report on Review of Interagency Delta Committee Task Force Report, p. 33.

23. Warne to A. R. Golzé, October 22, 1964.

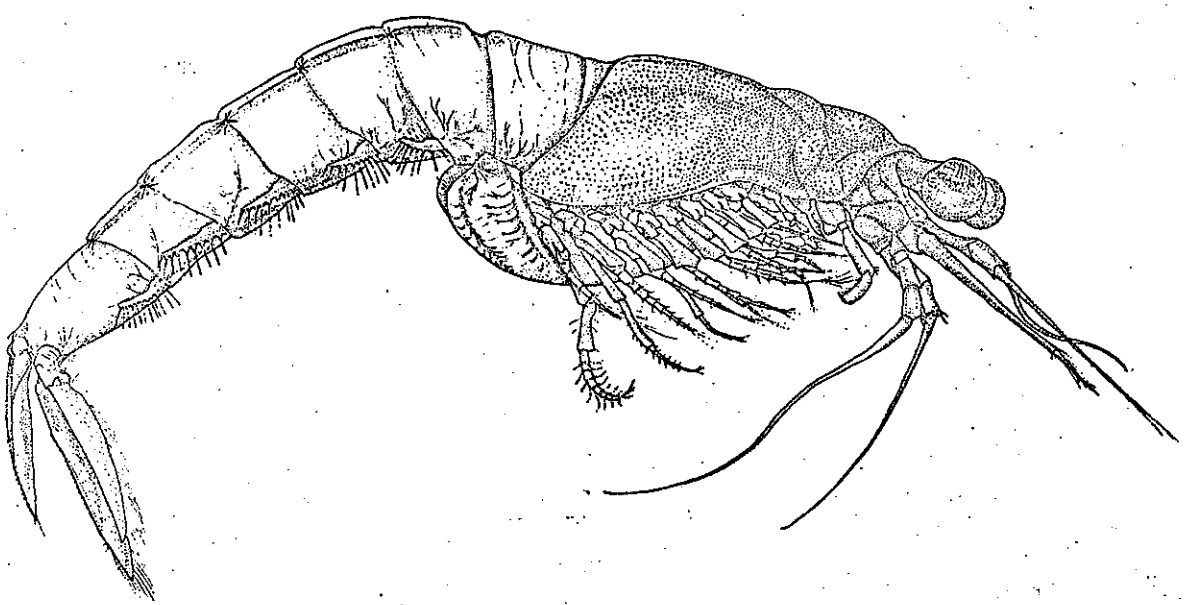
24. IDC, Plan of Development, Sacramento-San Joaquin Delta, January, 1965, p. 28.

25. Contra Costa County Board of Supervisors, ex officio Governing Board of the Contra Costa County Water Agency, Statement before California Water Commission, November 6, 1964, in IDC, Appendix, Review Comments and Statements on Plan of Development, Sacramento-San Joaquin Delta, March, 1965, p. 25.

26. Ibid., p. 29.

27. Ibid., p. 31.

28. Warne to Price, September 23, 1964.



Opossum shrimp, Neomysis mercedis. These little animals average only 10 millimeters in length and are the favorite food of juvenile striped bass. The shrimp are sensitive to salinity, temperature, light penetration and tidal currents. Because of their value as a food source, the State Water Resources Control Board has adopted regulations designed to insure their survival. (Illustration by Bruce Stewart, UCD)

X. The Establishment of Water Quality Standards

THE NOVEMBER 19TH CRITERIA -- Unlike most of semi-arid California, the dilemma of Delta water management lies in the quality of water rather than the quantity. Availability in an estuary is virtually unlimited, but quality can deteriorate to the point that water, even though plentiful, becomes unusable. The determination of water rights under those circumstances must, therefore, be a definition of the minimum quality levels to which water users are entitled, levels that differ widely according to location and season. Three basic approaches have been applied to the protection of Delta water rights. Litigation was the first response to the deterioration in water quality that became apparent in 1920, but the Antioch Case proved unsuccessful for Delta plaintiffs. The reluctance to pursue a strictly judicial approach stems in part from the complexity inherent in dealing with essentially all water rights and uses in the Central Valley, and in part on the chance that, as in the Antioch Case, the outcome may not be favorable. Subsequently, such resorts to judicial proceedings as a general remedy for salinity intrusion was replaced by the reliance on a physical solution to water management problems. The decision to control salinity by upstream releases of fresh water made the protection of Delta entitlements dependent in part on operations of the Central Valley Project, and later, the State Water Project. Guarantees that the projects would be operated to protect the Delta could be obtained through contracts negotiated between Delta interests and the project agencies, or could be established by regulatory boards vested with authority to manage water development. The administrative determination of water quality standards has in recent years become the predominant means of guarding Delta water rights, while not eliminating the need for negotiation or the threat, ultimately, of litigation.

The first water quality standard for the Delta was suggested by the Division of Water Resources in 1931. It had been assumed that a chloride content of over 1,000 ppm made water unsuitable for irrigation, leading state engineers to recommend maintenance of that concentration at Antioch, the western edge of the agricultural Delta. The proposal was incorporated into the State Water Plan, but federal construction and operation of the Central Valley Project effectively eliminated that initial agricultural criteria, although in fact the project did stabilize salinity conditions. The State Water Project, even before its approval by the voters, was committed to salinity control as one of its functions, though no definite standards were established. On April 11, 1965, the Resources Agency adopted Agency Order No. 18, announcing interim water quality criteria to govern state operations in the San Francisco Bay-Delta region, but in the Order, Administrator Hugo Fisher wrote that:

> *Because negotiations are currently under way between Federal, State, and local interests concerning salinity control and important water rights considerations in many parts of the Delta, I will defer setting interim objectives for mineral constituents, salinity and total dissolved solids (TDS) in those areas.*[1]

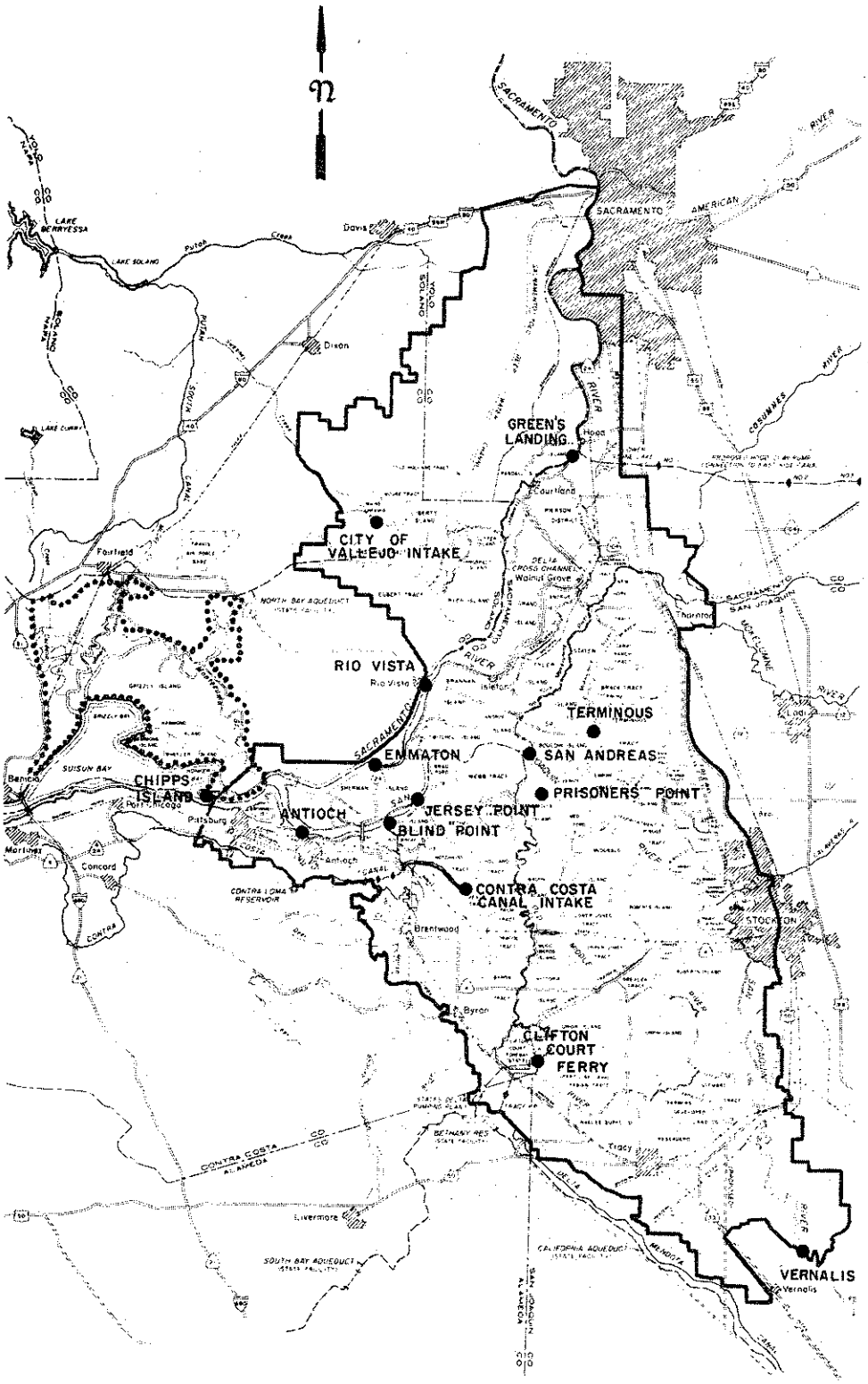
With the completion of repayment contracts between the Bureau of Reclamation and Sacramento River diverters in 1964, the Bureau's attention shifted to negotiations with Delta water users. The Bureau and the Sacramento River and Delta Water Association, representing primarily Sacramento, Solano, and Yolo county interests, began discussions in mid-1964 on Delta water entitlements. The negotiations gained momentum in 1965 with the participation of the Department of Water Resources and the Delta Water Users Association, acting as the San Joaquin Water Rights Committee and representing San Joaquin and part of Contra Costa counties. The initial basis of discussion had been a proposal that the Bureau and the Department regulate releases to maintain a specified minimum outflow in order to meet definite quality criteria for certain locations in the Delta. However, because the inclusion of both outflow standards and quality requirements posed the possibility of confusion, the participants decided to concentrate on the definition of acceptable water quality criteria. The talks reached a successful conclusion on November 19, 1965, when an agreement was signed setting minimum quality limits designed to protect Delta agriculture without requiring excessive outflows. The agreement was not binding on the signatories but was advanced as a basis for future negotiations. Water quality requirements in the agreement were conditioned on the classification of any year as normal, below normal, dry, or critical as defined by Shasta inflow. The criteria agreed to were based on maximum chloride levels at Emmaton on the Sacramento River and Jersey Point on the San Joaquin of 1,000 ppm, except that in critical

years the concentration could rise to 1,400 ppm between August 1 and December 31. A flushing flow was required in the spring of all but dry and critical years sufficient to lower chloride concentrations at Emmaton and Jersey Point to 200 ppm for ten consecutive days sometime between April 1 and May 31. Irrigation in the interior Delta was protected from salinity by control stations at Terminous, Rio Vista, San Andreas Landing, Clifton Court Ferry, and, after the initial operation of the Peripheral Canal, the bifurcation of Middle and Old rivers. At those locations, total dissolved solids were restricted to a daily average of 700 ppm, monthly averages of 500 ppm, and annual concentrations not to exceed 450 ppm. In the event of a dry or critical year, the standards for total dissolved solids could be increased to 800, 600 and 500 ppm for daily, monthly and annual levels, respectively, after April 1. If the year were only below normal, the criteria would be allowed to change to the dry year levels after August 1, extending to December 31. Additional variation was allowed whenever the salinity level at Green's Landing on the Sacramento River near Hood exceeded a mean 10-day or mean monthly average of 150 ppm TDS. At that point, the criteria for the interior Delta stations could be modified by adding one and one-half times the amount by which Green's Landing exceeded 150 ppm TDS to the normally applicable standards. After 1980 the chloride control points at Jersey Point and Emmaton could be moved upriver as far as Threemile Slough if the original standards were creating "undue hardship to the operators of the State and Federal projects"[2] but only if substitute water supply facilities were first constructed to serve the areas affected by the move. In case the Delta water users suffered undue hardship they could request amendment of any of the criteria. Finally, if the New Melones Dam proposed for the Stanislaus River was operated for water quality control purposes, the San Joaquin River at Vernalis would be limited to 500 ppm TDS average mean daily value over a 30-day period, provided that not over 70,000 acre-feet per year could be released specifically to meet that requirement.

The November 19th criteria, as these standards became known, did not protect inchannel water quality throughout the entire Delta, rather they represented approximately the minimum degree of protection associated with operation of the Central Valley Project's export facilities. It was estimated that the 1,500 second-foot minimum outflow projected for Peripheral Canal operation and defined by the Bureau of Reclamation as its minimum carriage water requirement would maintain salinity at the November 19th levels, although it would be the responsibility of project operators to provide whatever outflow proved necessary.[3] For the portion of the Delta unprotected by the November 19th criteria, overland facilities, as proposed in the Peripheral Canal plan and elsewhere, were deemed the most economical means of water supply.

ANOTHER KIND OF STANDARDS -- The negotiations that culminated in the November 19th criteria were the last successful negotiations on water quality in the agricultural Delta. Thanks to the Federal Water Pollution Control Act of 1965 and a growing national interest in combatting air and water pollution, the history of Delta water quality standards was just beginning. Water pollution control laws had long been on the books to restrict and control the dispersion of human, agricultural, and industrial wastes into natural waterways, but the apparently limited success of these laws, as seen in the deteriorating quality of many streams and lakes, prompted a renewed concern over pollution abatement that embodied a broader perception of the problem. Traditionally, water pollution control had involved little more than the regulation of waste discharges, but a new emphasis on water "quality," a more inclusive term, seemed to indicate a change in the basic philosophy to one of total management of water resources to insure the protection of all beneficial uses. The federal legislation of 1965 did much to implement that new philosophy for under its terms states were required to draft water quality standards for all interstate and coastal waters and submit them to the Secretary of the Interior for approval by June 30, 1967. If a state failed to promulgate adequate standards, the Secretary, with the advice of the Federal Water Pollution Control Administration, would do so unilaterally.

The new law's impact on the Delta depended on two things; whether the Delta estuary was within the definition of coastal water, and whether natural saline pollution was covered by the legislation. The State Water Quality Control Board, the California agency responsible for compliance with the federal statute, argued that the Delta, far removed geographically from the ocean, should not be subject to the requirements of the Act. A redefinition of the term "coastal" to include all water influenced by the ebb and flow of the tide drew protests from California, but nonetheless forced the state to formulate and adopt water quality standards for the Delta.[4] In the Delta, salt was the most serious water quality hazard, but



● WATER QUALITY CONTROL STATION

•••• SUISUN MARSH BOUNDARY

—— LEGAL DELTA BOUNDARY

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

SACRAMENTO-SAN JOAQUIN DELTA

PLATE I

NOTE:
BASE MAP BY THE BUREAU OF RECLAMATION

it could be argued that the law was intended by Congress to prevent man-caused pollution rather than control the extent of naturally occurring saline intrusion. However, the Department of Water Resources apparently assumed at the outset that salinity fell under the control requirements of the new statute. In its annual report on the State Water Project for 1966, the Department observed that,

> *. . . It is not possible to clearly estimate the impact the Water Quality Control Act of 1965 will have upon the State Water Project. It appears possible that the Federal Government could fund those costs of project facilities allocated to the purpose of water quality control, insofar as interstate streams are affected, such as the cost of augmenting salinity control releases in the specific case of the Delta facilities.*[5]

The Department later changed its position, arguing vehemently that the law did not require California to establish limits on saline intrusion. On the other hand, officials in the San Francisco office of the Federal Water Pollution Control Administration warned that although the Department of the Interior had not yet definitely decided that salinity control should be included, if the state failed to include salinity criteria in its water quality control plan, it ran the risk of having the federal government write the standards later.[6]

Under California's system of water pollution control, regional water quality control boards operated under the general authority of the State Water Quality Control Board, but that Board delegated responsibility for drafting the water quality standards required under federal law to the relevant regional bodies. By the spring of 1967 the Central Valley Regional Water Quality Control Board had its recommendations ready to submit to its parent board, and they included a number of salinity control criteria.

16. Total dissolved solids (TDS) concentrations of Delta waters shall be maintained below these limits:

A. Old River at Clifton Court Ferry:

Calendar year, Annual average	*450 mg/l**
Calendar month, Average	*600 mg/l*
Daily, Average	*800 mg/l*
5-year, Average	*400 mg/l*

B. Cache Slough at City of Vallejo Intake — *250 mg/l*

C. The mean tidal cycle Total Dissolved Solids content in the Sacramento River upstream from Threemile Slough and in the San Joaquin and False Rivers from Jersey Point to Venice Island;

a. 350 mg/l from 1 April until the water temperature at these locations reaches 60° F, and
b. 180 mg/l for at least 5 weeks after the temperature, as identified in (a), reaches 60° F.

D. Rock Slough at Contra Costa Canal Intake;

a. 750 mg/l, mean tidal cycle, and
b. 380 mg/l, mean tidal cycle, for at least 65% of any year.

E. San Joaquin River near Vernalis; 500 mg/l mean average concentration over any consecutive 30-day period.

F. Eastern Delta Channels: 700 mg/l mean monthly concentration.

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* Milligrams per liter (mg/l) is an expression of concentrations in solution exactly equal to parts per million (ppm), and the two notations are used interchangably.

17. Chloride concentration shall be maintained below these limits:

A. Rock Slough at Contra Costa Canal Intake;

a. 250 mg/l, mean tidal cycle value, and
b. 100 mg/l, mean tidal cycle value, for at least 65% of any year.

B. San Joaquin River at the City of Antioch water intake,
a. 100 mg/l, as measure 1 1/2 hours after high tide, at least 50% of any year, and
b. 250 mg/l, as measured 1 1/2 hours after high tide, at least 60% of any year.

C. Cache Slough at City of Vallejo Intake; 100 mg/l.

D. San Joaquin River at Jersey Point, 250 mg/l, as measured 1 1/2 hours after high tide, at least 79% of any year.[7]

The most controversial standards recommended by the regional board were those designed to protect striped bass spawning (16C), municipal and industrial uses in the western Delta (17B) and agriculture (17D). The Department of Fish and Game had once advised the limitation of total dissolved solids to 150 mg/l from March 1 to May 31 in "San Joaquin River, the reach from Antioch to the confluence of Little Connection Slough, False River, and the Sacramento River, the reach from Collinsville to Sacramento"[8] for the protection of spawning bass. At the urging of the Department of Water Resources, the Department of Fish and Game revised its recommendation to the level described in standard 16C. Both 17B and 17D were based on the number of days that chloride concentrations had, on the average, been at or lower than the specified level. The Department of Water Resources warned that it could not meet the restrictive salinity standards in a dry year. Nevertheless, on April 28, 1967, the regional board approved the Delta water quality control plan as drafted, subject only to review by June 30, 1972. The policy was then forwarded to the State Water Quality Control Board for further action.[9]

The San Francisco Bay regional board was also involved in the establishment of standards and, because its jurisdiction included a small portion of the western Delta, it too became enmeshed in the Delta salinity control controversy. That board proposed standards for the westerly end of Chipps Island, or approximately Mallard Slough, based on the average water quality historically available, though unlike the Central Valley board's proposal the criteria would be lifted when overland facilities were constructed. The San Francisco board's proposal order that:

> *Mean chloride concentration shall not exceed 150 mg/l for a 21-year moving average of 150 days, a 5-year moving average of 127 days nor to exceed a minimum of 74 days during the period between November 1 and June 30 of each year.*
>
> *Note C*
> *This objective shall be maintained until the domestic, industrial, and agricultural water supplied are provided by alternate means to the satisfaction of the Regional Board.*[10]

Although the Department of Water Resources indicated its approval of Note C, it still felt that additional language should have been included to relax the standards during years of below average runoff.[11]

While the Department protested that salinity requirements adopted by the Central Valley regional board had gone too far, Contra Costa County was arguing that they had not gone far enough. After re-evaluating their county's position, the Board of Supervisors approved a policy statement on June 21, 1966, calling for, as a minimum, a chloride concentration of not over 1,000 ppm at Antioch and 100 ppm at Jersey Point at all times, with salinities of under 100 ppm chloride to be maintained at Mallard Slough for 150 days between November 1 and June 30.[12] Comparison with standards suggested in 1959 indicates that Contra Costa's position had altered somewhat, increasing the 150-day Mallard Slough quality from 150 ppm chloride to 100 ppm, while at the same time relaxing the recommended Antioch standards from 350 ppm chloride to 1,000 ppm.

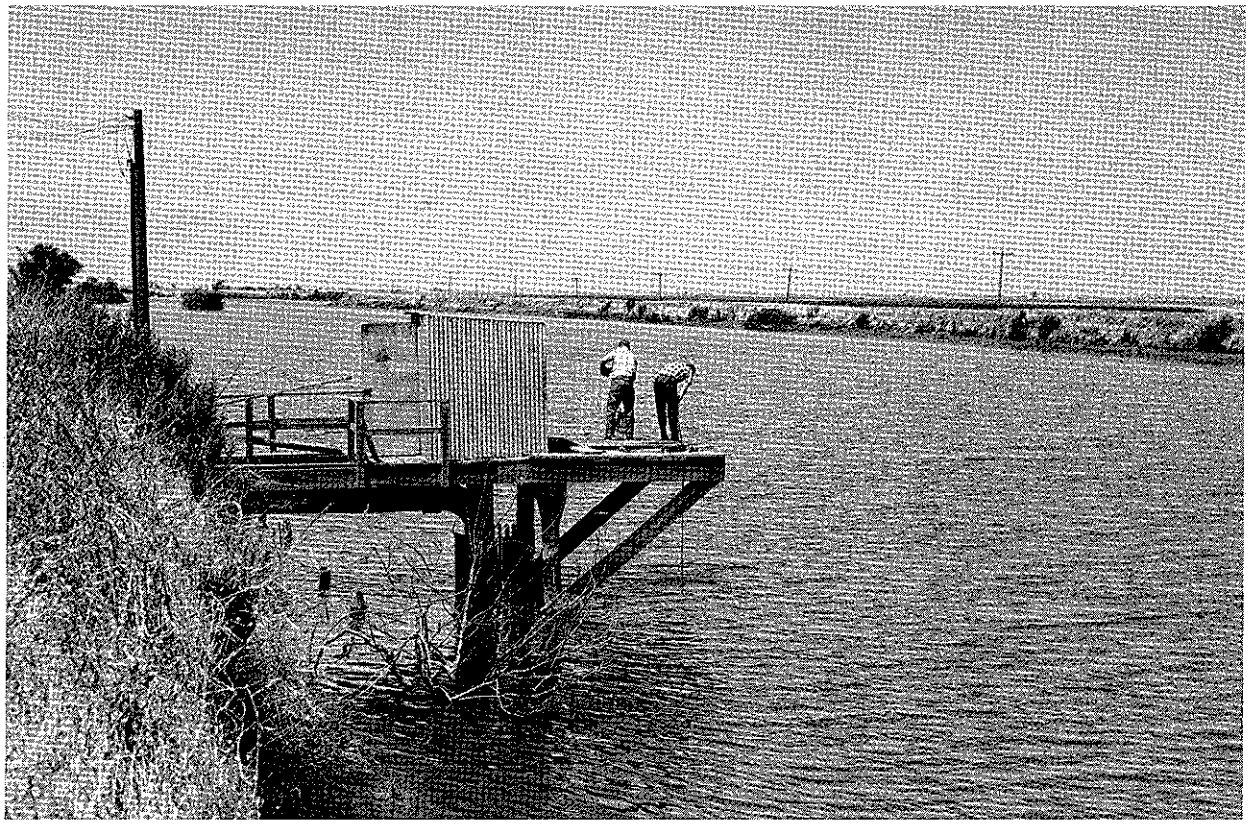
Having failed to convince the Central Valley board, the Department of Water Resources took its case to the State Water Quality Control Board, urging it to delete criteria 16C, 17B and 17D as proposed by the regional board. The Department argued that natural salinity control criteria were not required under federal law and that the standards as written would entail a considerably higher, and more wasteful, outflow than had been expected. In a presentation to the State Board on June 14, 1967, John Teerink, Deputy Director of the Department, pointed out that striped bass spawning areas in the interior Delta, rather than the zone protected by criteria 16C, were to be maintained following construction of the Peripheral Canal, while criteria 17B and 17D were historical averages that obviously did not occur every year. For example, since 1920, criteria 17B had not been met in 11 of the 23 years before Shasta Dam went into operation, and had not been achieved in 10 of the 24 years since the Bureau of Reclamation had partially controlled the Sacramento River. If a dry cycle similar to the 1928-1934 period occurred, the recommended standards would require release of an estimated 2.7 million acre-feet of water a year, valued at about $30 million, over and above the outflow needed to maintain the November 19th criteria. The release of additional water was not only considered wasteful, but it might restrict the State Water Project's ability to meet other commitments. At the hearing, Teerink was able to refer to the recently concluded contract with the Contra Costa County Water District promising compensation for inchannel depletions resulting from State Water Project operations as evidence that negotiations could eliminate the need to maintain offshore salinity at levels proposed by the regional board.[13] The State Board found the Department's arguments persuasive, and on June 14, 1967, adopted the water quality control plan as recommended by the regional unit, but only after deleting criteria 16C, 17B and 17D. On June 23, 1967, the Board forwarded those policies to the Secretary of the Interior for his approval as required by the 1965 federal law.

WATER RIGHTS AND WATER QUALITY -- At the same time that the State Water Quality Board was setting standards for Delta water quality, the State Water Rights Board was wrestling with the same problem. In its Decision 990 in 1961, granting appropriation permits to the Bureau of Reclamation, the Board had reserved jurisdiction on the water quality requirements to be attached to the permits until more information was available on which to base criteria. When the Department of Water Resources came before the Board requesting the permits necessary for operation of the State Water Project, the regulatory board was once again confronted with the question of how the permits should be conditioned to protect water rights in the Delta. Although the Board still believed that sufficient information to establish permanent quality criteria was lacking, it did find that interim water quality standards could be adopted. Testimony before the Board indicated that agricultural water needs in the Delta could be protected by maintaining a chloride concentration of not more than 250 ppm at Blind Point on the San Joaquin River from April 1 through June 30, while the enforcement of the November 19th criteria would guarantee adequate water quality from July 1 to November 30 of each year.[14] The Board therefore, in Decision 1275, on May 31, 1967, ordered that:

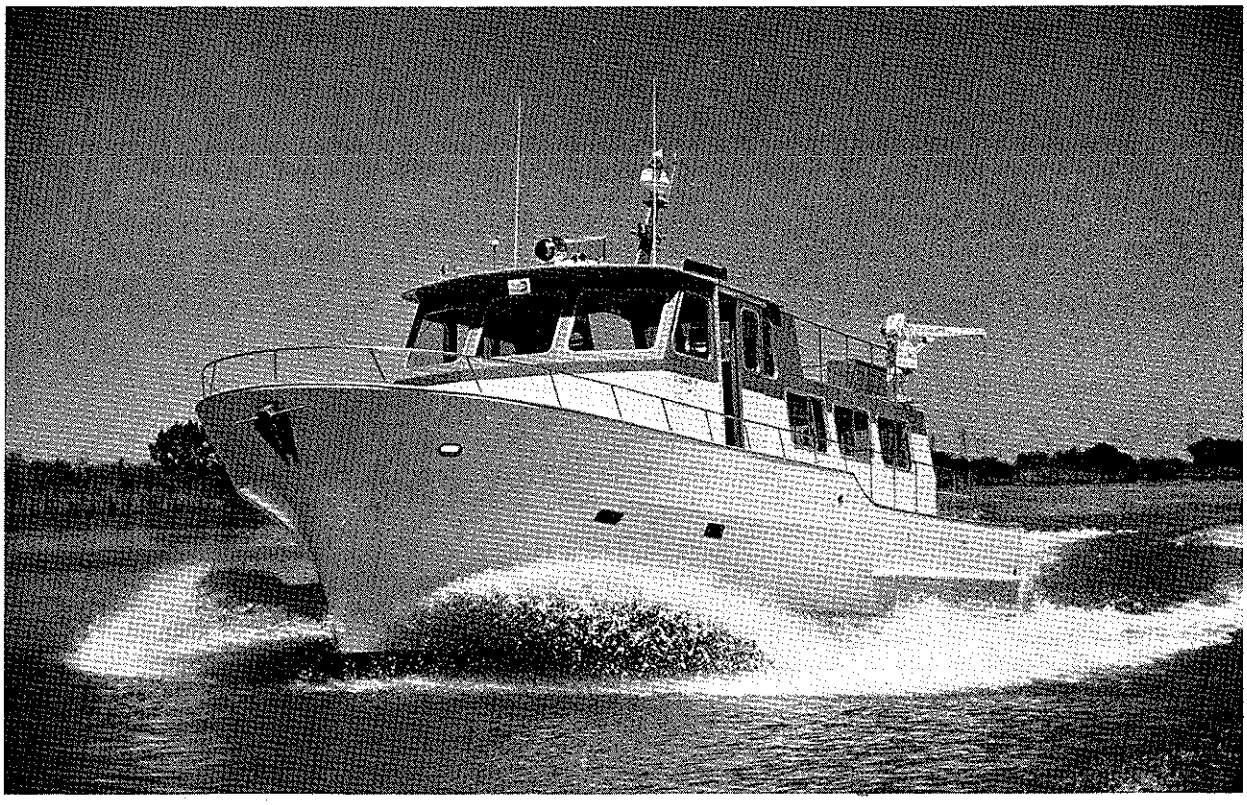
> *15. Until further order of the Board, permittee shall make no diversions (except under permits issued pursuant to Applications 5629 and 14444) and shall not collect water to storage during the period from April 1 through June 30 at any time the maximum surface zone chloride ion (content) of the San Joaquin River at Blind Point exceeds 250 parts per million. If Blind Point is not used as a monitoring station, permittee shall establish a correlation with some other station satisfactory to the Board to provide the necessary data on quality at Blind Point.*[15]

Additionally, the project was to be operated to meet the November 19th criteria.[16]

The Department of Water Resources petitioned the Water Rights Board on June 29, 1967, to reconsider its decision on several points, including Condition 15 that would adversely affect the State Water Project and ought to be eliminated, or at least modified by the inclusion of dry year relaxations of the criteria. As in the case of the water quality control plan, the Department asserted that it was more economical to provide substitute water than maintain outflows high enough to protect all Delta water entitlements. If significant volumes of water were released as outflow rather than used to meet contractual commitments for water deliveries, the Department would be faced with either imposing deficiencies on water contractors or developing additional storage capacity. The Contra Costa County Water Agency and the Central Valley Regional Water Quality Control Board also submitted protests, the Contra Costa interests objecting to the implied endorsement of the November 19th criteria, and the regional board requesting that its standards be substituted



Water quality research in the Sacramento-San Joaquin Delta. A number of water quality monitoring stations are maintained in the Delta, such as this one operated by the Bureau of Reclamation. The Department of Water Resources uses the water quality work boat San Carlos as a floating laboratory for water quality investigations throughout the Delta.



for those included in the Department's permits. On July 19, 1967, the State Water Rights Board agreed to reconsider some of the issues raised by the Department's petition and denied reconsideration to the other petitioners.[17] Although Condition 15 was not among the items reviewed by the Board, Decision 1291 on November 30, 1967, clarified the requirement, making it clear that it prohibited only the diversion of natural Delta inflow when salinity standards were violated and not the rediversion of stored water released from Oroville for export purposes.[18] On December 29, 1967, the Contra Costa County Water Agency and Jersey Island Reclamation District No. 830 took the State Water Resources Control Board, newly created by the amalgamation of the State Water Rights Board and the State Water Quality Control Board, to court in Contra Costa County to force amendment of Decisions 1275 and 1291, but the suit remained dormant despite efforts to reactivate it in 1972.

The elimination by the State Water Quality Control Board of criteria requiring the control of tidal salinity was not well received by the Federal Water Pollution Control Administration. An Interior Department task force was set up to review Delta water quality standards and make further recommendations to the Secretary of the Interior. They found that although the beneficial uses of water had been adequately described by the state and regional boards, the adopted criteria were inadequate to protect them. The task force recommended additional standards for the control of salinity, reflecting largely the November 19th criteria supplemented by standards relating to striped bass spawning and municipal and industrial uses at Antioch. The task force criteria that went beyond the November 19th standards were:

> *B.2 Above Three Mile Slough in Sacramento Rover and between Jersey Point and Venice Island in San Joaquin and False Rivers except in below normal, dry and critical years there shall be maintained a daily mean total dissolved solids concentration of:*
>
> *a. 350 milligrams per liter or less from April 1 until the water temperature at these locations reaches 60° F,*
>
> *b. 180 milligrams per liter or less thereafter for five weeks.*
>
> *This provision shall continue in effect until the initial operation of the Peripheral Canal at which time modification to enhance striped bass spawning in interior Delta channels shall be considered.*
>
> *B.5 Within the normal operation capability of local, state and Federal water projects there shall be maintained at Antioch in the San Joaquin River until September 30, 1972, a mean total dissolved solids concentration of 450 milligrams per liter when measured on the basis of the average of the mean daily values for any 10 consecutive days throughout a period of at least 150 days each water year, except that the period is reduced to 120 days during dry years and 100 days during critical years; provided that the criteria contained in this paragraph shall not apply when contractual arrangements regarding substitute supplies have been completed between the water users in the Delta and the State and the Federal governments.*[20]

Criteria B2, recommended by the Bureau of Sport Fisheries and Wildlife, was virtually identical with the Central Valley regional board's criteria 16C, although the federal version provided for relaxation when the Peripheral Canal went into operation. Likewise, criteria B5 was intended to duplicate average pre-Shasta conditions, but the task force recognized that:

> *Continued maintenance of this high quality would seriously hamper long range water resources development plans for the Central Valley . . . Therefore, protection is extended for a period (5 years) sufficient to make arrangements for overland supply to all diverters in the western Delta without causing any interference with Central Valley water resources development plans.*[21]

On July 19, 1968, over a year after the state had adopted its water quality control plans, the Secretary of the Interior returned the standards to the State Water Resources Control Board with the request that the Board consider the adoption of the supplemental standards suggested by the Interior Department task force. The staff of the State Board, however, had reservations regarding the implementation of additional salinity criteria requiring the restriction and control of upstream storage, reservoir releases, and Delta diversions. A staff report in 1968 argued that water quality control policies were inadequate enforcement mechanisms, and that satisfactory control could "be achieved only within the framework of water rights adminstration at the state level and, hopefully, by negotiation

and agreement between federal, state, and local agencies."[22] More specifically, the staff expressed their concern that adoption of the B2 striped bass criteria could interfere with agreements that might be negotiated between the Department of Fish and Game and the project agencies.[23] The impact of criteria B5 on the State Water Project also worried the staff because it "may or may not seriously cripple the ability of the department to deliver this water, but there was not submitted adequate detailed information for the Board to evaluate these conflicting contentions."[24] After holding hearings on September 5 and October 3, 1968, the Board adopted Resolution No. 68-17 on October 24, 1968, adding the November 19th criteria to the standards approved in 1967 while rejecting, on the advice of the staff, inclusion of the B2 and B5 criteria. The Board noted its continuing jurisdiction over water rights permits granted to the Bureau of Reclamation and Department of Water Resources and stated its intention to reopen hearings on the interrelated problems of water project operation and Delta salinity control during 1969. In light of its activities in regulating appropriation permits, the Board resolved that "Adoption of salinity objectives should be coordinated with the terms of water rights permits . . . and only those objectives which are consistent with said permit terms should be adopted at this time."[25] The supplemental criteria were forwarded to the Secretary of the Interior on November 21, 1968. At the October 24, 1968, meeting, the Board also adopted Resolution No. 68-16, a nondegradation policy providing that if existing water quality was better than standards adopted by the Board no deterioration of quality was to be permitted unless it was consistent with the maximum benefit to the state as a whole.

Secretary of the Interior Stewart Udall informed Governor Reagan on January 9, 1969, that he had approved California's water quality standards with certain exceptions. The Secretary weighed California's failure to accept standards protecting striped bass and western Delta consumptive uses, and the State Board's intention to consider additional criteria in 1969, in conditionally endorsing the state's salinity control standards. The Secretary concluded:

> *In reliance upon your State Board's commitment and, of course, reserving the position of the United States as a participant in such hearings as the holder of water rights for the Central Valley Project, I have approved the Delta salinity standards as submitted as far as they go. In addition, the Bureau of Reclamation has analyzed prospective operating conditions for the Central Valley Project and related water projects that affect Delta supplies, and it has concluded that the Central Valley Project and related projects can be operated during the interim period indicated by the Interior task force (until September 30, 1972) to conform to the recommendations of the task force, including paragraphs B2 and B5.*[26]

Although the Bureau would maintain all federally-adopted salinity criteria in the short run, Secretary Udall also specifically reserved to the federal government freedom of action in the operation of the Central Valley Project.

While the state and federal governments haggled over the regulation of water quality in the Delta, an independent report covering the entire Bay-Delta estuary was being prepared. In June, 1969, the long-awaited final report of the Kaiser Engineers on a comprehensive regional water quality control program was released after three years of work in response to a legislative concern over the future of San Francisco Bay. The results of the study had been widely anticipated, but once it was issued the report, recommending a regional waste-water collection and treatment system, was largely relegated to library shelves. It is interesting to note, however, the conclusions drawn concerning salinity control in the Delta. Kaiser Engineers estimated that substantially higher outflows would be required to meet the November 19th criteria than had been thought, ranging from 3,000 second-feet in the summer to 5,000 second-feet during the winter, with somewhat lower releases permissible during dry years.[27] The only additional criteria recommended by the report was the B2 standard to protect striped bass spawning, while the engineering firm believed that the favorite food of the juvenile bass, the Neomysis shrimp, would be guaranteed the necessary 4,000 mg/l chloride concentration at Chipps Island by the November 19th criteria.

THE DELTA DECISION: 1971 -- The State Water Resources Control Board opened hearings on Delta water quality for the purpose of imposing conditions on appropriation permits involving the Central Valley Project and State Water Project on July 22, 1969. The hearings turned into a marathon affair, generating thousands of pages of testimony explaining and reemphasizing the complexity of defining Delta water entitlements and the operational standards necessary to protect them. Further complicating matters was the increased importance attached to noneconomic, nonconsumptive uses of water involving the maintenance of an acceptable habitat for a variety of organisms in Delta waters. The Board had envisioned reaching a decision on revised criteria in 1970, but the problem proved so complicated and the conflicting information so extensive that a decision was delayed until July 28, 1971. At that time the Board announced its Decision 1379, the Delta Decision, that became a landmark in the establishment of Delta standards by administrative action. Once again, the Board refrained from setting permanent criteria, imposing interim standards instead, subject to review no later than July 1, 1978.

For the protection of agricultural uses in the Delta, the Board adopted a complex series of standards.

A. *Standards for Protection of Agricultural Uses*

1. Station	Cl^- & TDS Criteria	Type of Year	Months AMJJ	Months ASOND
Blind Point*	Running Average of mean daily for any 14 consecutive days: (TDS) EC maximum millimhos	non-critical	2	3.6
	(Cl^-) maximum, mg/l	non-critical	350	1,000
	(TDS) EC Maximum millimhos	critical	3	3.6
	(Cl^-) maximum, mg/l	critical	1,000	1,000
Jersey & Emmaton	Average of mean daily Cl^- content for at least 10 consecutive days between April 1 and May 31 maximum 200 mg/l	normal and below normal		

**Jersey and Emmaton will be substituted for Blind Point when an overland supply is provided to existing irrigation uses on Sherman and Jersey Islands and Hotchkiss Tract.*[29]

[Cl^- is chloride]

Comparison with earlier standards was complicated by the use of electrical conductivity (EC) as a measure of the mineral content of Delta water rather than the traditional total dissolved solids. Retired University of California soils specialist Warren Schoonover, water quality consultant to the Department of Water Resources, dismissed TDS as a "very poor measure of water quality"[30] because it revealed only the weight of dissolved salts without providing any clues to their chemical composition. Electrical conductivity was a more accurate indicator of total salt characteristics and a reasonably reliable guide to a water's impact on plant growth. For that reason, EC was substituted for TDS in the new State Delta Standards for agricultural water quality. Blind Point, at the western edge of Jersey Island, was protected by criteria that were less stringent than the interim standard applied in D-1275, but higher than the November 19th criteria adopted by the State Board in Resolution No. 68-17. It had been estimated that 1,000 ppm chloride, the maximum concentration in a noncritical year at Jersey Point in the November 19th criteria, would equal 3.6 millimhos EC at that location.[31] Blind Point, downstream from Jersey Point and thus slightly more susceptible to saline intrusion, would not, under the new standards, rise above 2 millimhos in a normal year until August and even then the 1,000 ppm chloride line would be maintained west of Jersey Point. In a critical year, water quality in the western Delta would be considerably improved over the November 19th criteria that would have allowed chloride concentrations at Emmaton and Jersey Point to reach 1,400 ppm. Improvements in the level of protection afforded Delta agriculture were limited to the western stations, since the standards adopted for Rio Vista, Terminous, San Andreas Landing, and Clifton Court Ferry were the same as the November 19th criteria for interior Delta stations, though reexpressed in EC rather than TDS, and based on 14-day averages rather than 10. The Green's Landing adjustment and dry year averaging for interior locations contained in Resolution No. 68-17 were also included in the new agricultural standards.

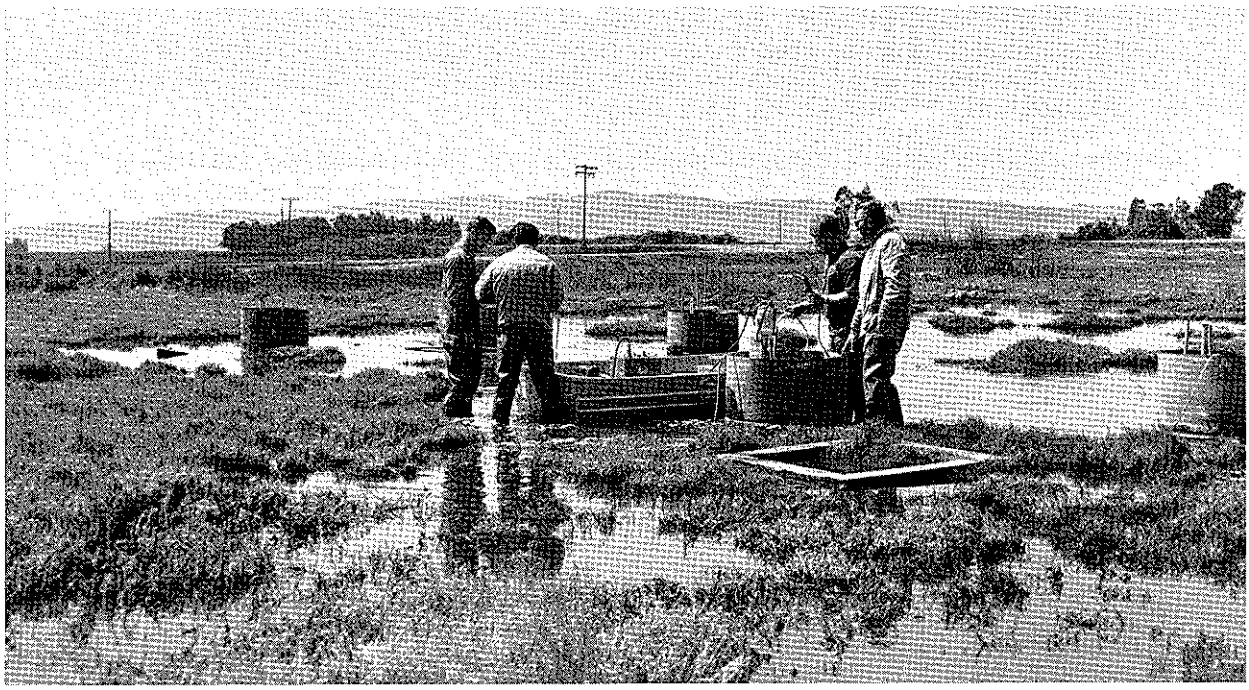
The municipal and industrial criteria adopted by the Board were intended to safeguard consumptive uses in the western Delta for an interim period by the adoption of the B5 criteria as proposed by the Secretary of the Interior. The Board ordered that until overland supply facilities were constructed the average of the mean daily TDS concentrations for any 14 consecutive days at Antioch could not exceed 450 mg/l for 150 days in a normal or below normal year, or 120 or 100 days in dry and critical years, respectively. The chloride criteria for Rock Slough at the Contra Costa Canal Intake remained unchanged from the 1967 water quality control plan, though supplementary EC standards were now included as well.[32]

The Delta Decision marked a notable departure not only because of the relatively high standards for the protection of agricultural and municipal and industrial consumptive uses, but in the protection it afforded fish and wildlife as well. Previously, water rights decisions had not specifically included criteria designed to preserve the Delta's complex ecology, but the danger of mismanagement in a controlled environment and the publicity that made the environment and its advocates a factor to be reckoned with in decision-making compelled the Board to define acceptable water quality for inchannel as well as consumptive uses. In writing the new standards, the Board relied heavily on advice from the California Department of Fish and Game. Rather than recommend the B2 criteria for striped bass, that Department had suggested the adoption of guidelines described in a March 10, 1969, memorandum of understanding between the Departments of Water Resources and Fish and Game and the federal Bureaus of Reclamation and Sport Fisheries and Wildlife. The water quality standards contained in that memorandum, and accepted by the Board, reflected operational experience that indicated that bass spawning in the San Joaquin River was less dependent on salinity conditions that had been assumed. Accordingly, the criteria called for the maintenance of 1.5 millimhos EC at Antioch and 0.55 millimhos at Prisoners Point on Venice Island for five weeks after the water temperature at Antioch reached 60° F.[33] Those EC levels corresponded to 1,000 ppm and 350 ppm TDS at Antioch and Prisoners Point respectively as compared to a maximum of 180 ppm TDS for the five-week period required under the B2 standards. Although they noted that Kaiser Engineers had assumed that the maintenance of agricultural water quality standards would insure protection for Neomysis, the Board still specifically ordered that the chloride concentration at Chipps Island should not exceed 4,000 ppm. Salmon also received protection for the first time in D-1379, even though they had no particular salinity requirements. Salmon were guided back up the rivers to the streams of their birth by the direction of the flow and the presence of water from their homestreams. The Board's decision called for positive downstream flows in all Delta channels and a sufficient supply of San Joaquin River water in the southern and eastern portions of the Delta from September 1 through November 30 to avoid confusion to migrating San Joaquin River salmon. Not only was the preservation and enhancement of aquatic life within the Delta recognized as a beneficial use of water, but wildlife dependent on Delta outflows were also considered. Suisun Marsh was an important haven for waterfowl but if it was to remain productive and able to support large bird populations, water and soil salinities would have to be kept in check to assure an abundance of preferred food plants. Salinity in the top 12 inches of the soil was therefore limited by the Board to 9,000 mg/l TDS from April 15 to June 1, requiring a suitable water supply to be available by February 1. Plans called for the construction of alternative water supply facilities for the Marsh but until they were in place water in the surrounding channels was to be at or under 18,000 mg/l TDS.

Despite the fact that a great deal had been learned about the Delta environment much more knowledge was needed to accurately regulate project operations to insure the protection of beneficial uses, while at the same time preventing any excessive or unnecessary use of water. The permittees were, therefore, required by the Board to conduct additional investigations of Delta conditions and their interrelationships and to monitor a wide variety of water quality parameters at 32 locations from San Pablo Bay to Green's Landing and the mouth of the Stanislaus River. It was hoped that a continuing program of research would provide sufficient insights into the mechanisms influencing the Delta environment to allow the establishment of permanent water quality conditions to govern the appropriation permits.

Decision 1379, widely hailed as a victory for environmentalists and western Delta water users, signaled a serious setback to water project operators and their customers. Using arguments reminiscent of those that defeated the Central Valley regional board's 1967 recommendations for salinity control, the Bureau and the Department estimated that increased outflows needed to meet the D-1379 criteria rather than the November 19th criteria would reduce dependable water yields of the state and federal projects by a total of 1.8 million acre-feet annually in a dry year, impairing their ability to fulfill water delivery commitments.[34] Although the project agencies requested reconsideration of the decision, the Board refused to do more than clarify its standards and issue corrections of some of its numerical criteria.

Suisun Marsh. In recent years, the waterfowl habitat north of Suisun Bay has received increasing attention in the establishment of water quality standards for the Delta. The ability of the marsh to support large waterfowl populations depends on the survival of plants used for food by the birds, and that in turn depends on the degree, timing and duration of salinity in the marsh. Investigations have been made and are continuing into the fresh water requirements of the marsh.



When administrative appeals were exhausted, the Delta Decision was challenged in court. On October 12, 1971, the Central Valley East Side Project Association, an organization of interests hoping to receive water from the Central Valley Project's proposed East Side Unit, and in general representing federal water contractors in the San Joaquin Valley, sued the State Water Resources Control Board in Sacramento County Superior Court for a writ of mandate to set aside D-1379 (Central Valley East Side Project Association v. SWRCB). State Water Project contractors took similar legal action in the same court on October 15, 1971 (Kern County Water Agency v. SWRCB). The petitioning agencies argued that the State Delta Standards would require the release of stored water to maintain water quality levels higher than those existing naturally, without demanding repayment for benefits. The use of water from project reservoirs would impair delivery of water to the customers of both projects, and because more reservoirs would become necessary to meet both the Delta standards and the contracted delivery requirements, the cost of those facilities would increase the price of water to project contractors. Judge William Gallagher issued a temporary restraining order against the Board when the first of the suits was filed in October, 1971, and handed down a preliminary injunction suspending implementation of D-1379 in January, 1972.[35]

Several agencies sought to intervene in the proceedings and in April, 1972, one intervenor, the Contra Costa County Water Agency, filed a cross-complaint against both the Bureau and the Department asking the court to rule that the Bureau was subject to the jurisdiction of the State Water Resources Control Board and that salinity control was a nonreimbursable purpose of both federal and state projects. At this point a broader legal issue was raised, that of state regulatory control over federal water projects. According to the 1902 Newland's Act that established the federal reclamation program, the Bureau was required to secure water rights for its projects from the states where they would be operated. The Bureau had long insisted, however, that rights granted to the federal government were essentially unconditional, and that its operations could not be bound by regulatory terms attached by state authorities. The Board and its predecessor, the State Water Rights Board, disagreed with the Bureau's contention, and in D-990 they declared their belief that the Bureau was generally subject to state regulation and specifically responsible for Delta salinity control. Since no specific criteria were attached to Central Valley Project permits by D-990 the controversy seemed more potential than actual, but the situation changed in the early 1970's with the announcement of a series of decisions conditioning permits to protect largely recreational and environmental water uses to the potential detriment of project operations. The Delta Decision requiring reservoir releases for purposes other than irrigation or export to municipal and industrial users was only the beginning. In 1972, the Board conditioned the Bureau's Auburn Dam permits to require an additional 747,000 acre-feet of releases annually into the American River for recreational and fish and wildlife purposes. When the Bureau was granted permits for New Melones Dam in 1973, the Board ordered that the reservoir not be filled beyond approximately half of its ultimate capacity to preserve a white-water recreational area until the full yield of the project was clearly required. In each case, deliveries to federal contractors were threatened by the limitations imposed by the Board.[36] In response to litigation surrounding New Melones, Assistant Secretary of the Interior James R. Smith issued a statement of federal policy rejecting the Board's assertion that it had authority to regulate federal projects. The Department of the Interior, with the support of the Justice Department, argued that the Central Valley Project must be operated in accordance with the terms of congressional authorizations, and that nothing in those laws allowed the Bureau to allocate water to quality control purposes if to do so would interfere with performance of authorized project functions.[37] Whatever the merits of the D-1379 standards, they had become part of a larger issue of federal-state relationships.

The legal actions against the Delta Decision were consolidated, and in September, 1972, removed to the Federal District Court in Sacramento, despite attempts by the Contra Costa County Water Agency to have the case returned to state jurisdiction. In reply to the Interior Department's claim that it could not be bound by regulations imposed by the state, the State Water Resources Control Board filed a cross-complaint against the Bureau of Reclamation and the United States in March, 1973, asking the court to determine that the Bureau had to submit to the Board's regulation of its appropriation permits. In June, 1973, the California Attorney General filed suit against Secretary of the Interior Rogers C. B. Morton and Commissioner of Reclamation Gilbert Stamm to compel the federal government to comply with four water rights decisions; D-1379, D-1400 (American River), D-1407 (Hidden Reservoir) and D-1422 (New Melones). The suit also requested a declaratory judgment requiring the Bureau of Reclamation to seek water rights permits from the Board for operation of the Central Valley Project and authorize the Board to attach reasonable conditions, binding on the Bureau, to such permits. The federal government responded to the suit with a denial and a claim of sovereign immunity, and on October 15, 1973, sued the State of California seeking a declaratory

judgment that Bureau of Reclamation water rights were not subject to regulation by the State Water Resources Control Board and that specific portions of D-1422 should be voided. The various actions relating to California's competence to regulate federal facilities, including Kern County Water Agency v. SWRCB, Central Valley East Side Project Association v. SWRCB, California v. Morton, and San Joaquin County Flood Control and Water Conservation District, et. al. v. SWRCB, involving D-1400, were stayed on July 8, 1974, pending a decision on U.S. v. California. Arguments in the case were heard in the Federal District Court in Sacramento in 1974 and 1975 with the Department of Water Resources filing a friend-of-the-court brief during 1975 in support of the state's position. Although the Department had favored salinity standards less restrictive than those adopted in D-1379, it feared that exemption of the Bureau from state regulation could transfer the entire burden of maintaining Delta water quality onto the State Water Project, a move that could seriously threaten its ability to meet contract commitments and undermine its financial integrity. On October 9, 1975, Federal District Court Judge Thomas J. MacBride ruled in favor of the United States in regard to D-1422. According to Judge MacBride's opinion, the federal government could appropriate any unappropriated waters for reclamation projects, applying to state authority only as a matter of comity for a determination that unappropriated water did in fact exist. If such water was available, the ruling stipulated that the state could not reject the federal application for water rights and could not attach conditions to such water rights.[38] Predictably, the state appealed the ruling to the Ninth Circuit Court of Appeals, but on April 1, 1977, Judge MacBride's decision was sustained. Further appeal is possible, as is congressional action to break the federal-state impasse.

THE BASIN PLANS -- Water rights management was, of course, distinct from water quality control standards adopted by the state and federal governments. In 1969, California moved to strengthen its water quality laws by passage of the Porter-Cologne Act requiring the preparation of regional water quality control plans. At about the same time the Environmental Protection Agency (EPA), successor to the Federal Water Pollution Control Administration, ordered the states to prepare water quality control programs for each drainage basin as a prerequisite for wastewater treatment grants, a policy also required under the 1972 amendments to the Federal Water Pollution Control Act. The Delta was designated Basin 5-B for planning purposes, one of 16 basins in California. While the State Water Resources Control Board had the final authority, subject to EPA approval, for the adoption and coordination of basin plans, the nine regional water quality control boards were responsible for the preparation of particular quality standards. The federal government required the completion of final basin plans by July 1, 1973, but to enable construction grants contingent on the plans to proceed, allowance was made for interim plans published by July 1, 1971.[39] In accordance with these federal regulations and the parallel requirements of the Porter-Cologne Act, the State Board adopted an interim water quality control plan for the Delta basin in June, 1971. The interim basin plan approved criteria that, unlike those attached to water rights permits by the same board at almost the same time, broke no new ground. They consisted only of the standards adopted in 1967, as supplemented by the November 19th criteria in Resolution No. 68-17. The only change appears to have been a minor modification in the language regarding standards for below normal, dry, and critical years at interior Delta monitoring stations. Before its adoption by the regional board, the interim plan met with some local opposition from the Delta Water Agency, the San Joaquin County Counsel, and the Contra Costa County Water Agency. The Delta Water Agency asked that the regional board refrain from approving any plan pending a contract between water users and project operators, while San Joaquin County urged delay until the State Board had made a final determination on water rights conditions. Contra Costa County once again insisted that the November 19th criteria were inadequate.[40]

Despite the relatively limited nature of the interim plan of June, 1971, the Board did intend to honor its commitment made in Resolution No. 68-17 to consider higher Delta standards, and proposed making D-1379 the basis for water quality control policies submitted to the EPA. At a public hearing on October 14, 1971, the Department of Water Resources objected to the use of D-1379 standards for water quality plans on grounds that the federal government lacked authority over natural salinity and that approval of D-1379 standards by the federal government might limit the flexibility of their administration.[41] With the Delta Decision soon enmeshed in legal uncertainty, the Board did not move rapidly in adopting supplemental salinity control standards, but in the interim a slower than anticipated buildup in demand for Central Valley Project water supplies allowed the Regional Director of the Bureau of Reclamation to order the federal project to continue to meet the B2 and B5 standards after the September 30, 1972, expiration date provided in Secretary Udall's letter of January 9, 1969.[42] At the behest of the EPA, the Board once again considered supplementary

criteria in late 1972, followed by the adoption of Resolution No. 73-16 on April 19, 1973. That resolution amended the water quality control plan adopted in 1967 and supplemented in Resolution No. 68-17 to include the B-5 criteria for Antioch municipal and industrial uses as proposed by the Secretary of the Inerior, and striped bass spawning standards identical to those contained in D-1379. The EPA approved the Board's action on June 20, 1973, but the Contra Costa County Water Agency emphatically did not. In a lengthy memorandum to the EPA, the Agency argued that historic and existing water quality levels in the western Delta were materially better than those provided for by the adopted standards and should be maintained at approximately historic post-Shasta conditions. Instead of the criteria used in Resolution No. 73-16, the Agency recommended a limit of 1,000 ppm chloride at Antioch for the protection of agriculture, with Mallard Slough maintained at not over 400 mg/l for 150 days during a normal year. Striped bass would be provided 150 mg/l TDS at Antioch for spawning and a minimum outflow of 8,000 second-feet in June and July.[43] These pleas for higher salinity control standards were not enough to halt federal approval of California's Delta criteria.

In 1973 work was already underway on the final basin plans mandated by the Porter-Cologne Act and the federal government. In March, 1972, Bay-Valley Consultants, a consortium of four engineering-planning firms, was retained by the State Water Resources Control Board to draft a comprehensive plan for Basins 5-A, B, and C, the Sacramento Valley, Delta, and San Joaquin Valley respectively. In a long report in July, 1974, the consultants reviewed the beneficial uses of Central Valley waters and the water quality problems threatening them. Various alternatives were evaluated and a final program of water quality standards was developed. The report defined criteria that, while not including fish and wildlife standards, generally reflected some improvement in the interim standards. The Delta water quality objectives finally published by the regional board, and adopted by the State Board on August 21, 1975, more closely followed the standards developed in D-1379 and previously approved Board policies. Specifically, the Basin 5 plan called for the following standards to be observed.

Beneficial Use Protected and Location	*Parameter*	*Description*	*Shasta Inflow Water Year Type*	*Value*
Municipal and Industrial				
Antioch on San Joaquin R. (These objectives shall not apply when the State Bd. determines that adequate substitute supplies are available to all M&I users in the Antioch and Pittsburg areas.)	*TDS*	*Maximum 14-day running average of mean daily TDS for:*		
		150 days	*Normal and below normal*	*450 mg/l*
		120 days	*Dry*	*450 mg/l*
		100 days	*Critical*	*450 mg/l*
Rock Slough at Contra Costa Canal Intake	*TDS*	*Maximum mean tidal cycle*	*All*	*750 mg/l*
	TDS	*Maximum mean tidal cycle, 65% of the year*	*All*	*380 mg/l*
	Chloride	*Maximum mean tidal cycle*	*All*	*250 mg/l*
	Chloride	*Maximum mean tidal cycle 65% of the year*	*All*	*100 mg/l*
Cache Slough	*Chloride*	*Maximum (instantaneous)*	*All*	*100 mg/l*
	TDS	*Maximum (instantaneous)*	*All*	*250 mg/l*

Beneficial Use Protected and Location	Parameter	Description	Shasta Inflow Water Year Type	Value		
				AMJJ	ASOND[1]	
Agriculture						
Blind Point on the San Joaquin R.	EC	Maximum 14-day running average of mean daily EC in mmhos	Non-crit.	2.2	3.1	
			Critical	3.6	3.6	
Jersey Point on San Joaquin R. and Emmaton on the Sacramento R.	Chloride	Maximum 14-day running average of mean daily chloride	Non-crit.	1,000 mg/l Jan/July 1,000 mg/l Aug/Dec		
			Critical	1,400 mg/l		
	Chloride	Average mean daily concentration for a period of at least 10 consecutive days	Non-dry or or critical	Sometime between April 1 to May 31, 200 mg/l		
				JFM	AMJJ	ASOND[1]
Terminous, Rio Vista, San Andreas Landing, Clifton Court Ferry, and, with the Peripheral Canal, Bifurcation of Old and Middle Rivers	TDS	Maximum 14-day running average of mean daily TDS in mg/l	Normal or above	700	700	700
			Below normal	700	700	800*
			Dry or crit.	700	800*	800*
		Average of mean daily TDS in mg/l for any calendar month, not to exceed	Normal or above	500	500	500
			Below normal	500	500	600*
			Dry or crit.	500	600*	600*
	TDS	Average of mean daily TDS in mg/l for any calendar year not to exceed	Normal or above	450	450	450
			Below normal	450	450	500*
			Dry or crit.	450	500*	500*
Green's Landing on the Sacramento River	TDS	Whenever maximum 14-day running average or mean monthly water quality at this station exceeds 150 mg/l TDS the objectives at the above (interior Delta) stations are changed by adding to those values the product of 1 1/2 times the amount by which the recorded TDS at Green's Landing exceeds 150 mg/l	All	150 mg/l		
San Joaquin R. at Vernalis	TDS	Maximum 30-day average	All	500 mg/l		
Eastern Delta Channels	TDS	Maximum mean monthly	All	700 mg/l		
Fish and Wildlife						
Antioch Water Works Intake on San Joaquin R.	EC	Maximum 14-day running average of mean daily EC	All	1,500 umhos when water temperature has increased to 60° F.		
Prisoners Point on the San Joaquin R.	EC	Maximum 14-day running average of mean daily EC	All	550 umhos, when water temperature has increased to 60° F.		

1/ October-December based on Shasta Inflow water year type for previous water year.

* *The TDS value at any of these five stations may reach but not exceed the asterisked values, provided the average of the TDS value at all five stations does not exceed the adjacent non-asterisked value.* [44]

Because the Basin Plan dealt with water quality rather than river regulation the salmon standards in D-1379 were not applicable. The EPA approved the Delta policies on December 24, 1975.

The San Francisco regional water quality board was responsible for some western Delta standards, and they also intended to mirror D-1379 criteria for the protection of Neomysis and of the Suisun Marsh, but the Region 2 Basin Plan turned out to have certain technical differences. The plan provided for salinity measurements at a different location on Chipps Island than had been used in D-1379, and sampling for Suisun Marsh at high tide rather than measurement over all tidal cycles. The San Francisco Board modified its Basin Plan on May 4, 1976, in order to bring it into agreement with D-1379, and the changes were subsequently approved by the State Board.[45]

Though water quality criteria had been adopted and approved for the protection of Delta water uses, the controversy was far from over. The legal challenge to the State Water Resources Control Board's authority to condition appropriation permits was not yet settled and drought conditions in 1976 and 1977 complicated the reanalysis of Delta water quality criteria required by 1978 under provisions of D-1379. Despite the difficulties yet to be solved, the establishment of Delta standards by administrative action had, within ten years, had a major impact on the way water resources in California were managed and on the future of the Delta.

NOTES

CHAPTER X - THE ESTABLISHMENT OF WATER QUALITY STANDARDS

1. DWR, The Delta and the State Water Project, memorandum report, June, 1969, Appendix E, p. 1.

2. USBR, DWR, Sacramento River and Delta Water Association, Delta Water Users Association, "Delta Water Quality Criteria," November 19, 1965, p. 5.

3. The Delta and the State Water Project, p. 25.

4. Natural Resources and Power Subcommittee, U. S. House Committee on Government Operations, 90th Congress, 1st Session, Hearing on Water Pollution -- Central and Northern California, May 19, 1967, pp. 35, 38-53.

5. DWR, Bulletin No. 132-66, The California State Water Project in 1966, June, 1966, p. 8. The Bulletin 132 series is issued annually in June and will hereafter be cited as "Bulletin No. 132-__."

6. Hearing on Water Pollution, May 19, 1967, p. 60.

7. Central Valley Regional Water Quality Control Board, State Water Quality Control Board, Water Control Policy for Sacramento-San Joaquin Delta, 1967, p. G-2.

8. Department of Fish and Game, 1967, quoted in Contra Costa County Water Agency, Before the U. S. Environmental Protection Agency in the Matter of Proposed Water Quality Standards for the Sacramento-San Joaquin Delta, June 28, 1973, p. 18.

9. Water Control Policy for . . . Delta, 1967, p. V-14.

10. The Delta and the State Water Project, Appendix E., p. 2.

11. Ibid.

12. Ibid., Appendix E, p. 3-4.

13. John R. Teerink, "Statement of Department of Water Resources to State Water Quality Control Board on Water Quality Control Policy, Sacramento-San Joaquin Delta," June 14, 1967, p. 7.

14. State Water Resources Control Board, Decision 1275, May 31, 1967, p. 19. The State Water Resources Control Board will hereafter be cited as "SWRCB."

15. Ibid., pp. 40-41.

16. Ibid., p. 41.

17. SWRCB, "Order Granting for Limited Purposes Petition of the Department of Water Resources and Denying Petitions of Central Valley Regional Water Quality Control Board and Contra Costa County Water Agency for Reconsideration of D-1275."

18. SWRCB, Decision 1291, November 30, 1967.

19. DWR, Bulletin No. 132-68, p. 64. For further discussion, see DWR, Bulletin No. 132-73, p. 11.

20. Environmental Protection Agency, Water Quality for the Sacramento-San Joaquin Delta: A Recommended Position, Task Force Report, March 31, 1971, p. 40.

21. Ibid., p. 41.

22. Ibid.

23. Ibid., p. 42.

24. Ibid.

25. SWRCB, Resolution No. 68-17, October 28, 1968.

26. Stewart Udall to Ronald Reagan, January 9, 1969.

27. Kaiser Engineers, San Francisco Bay-Delta Water Quality Control Program: Final Report to the State of California, June, 1969, pp. XVIII-7-14.

28. Ibid., p. XII-21.

29. SWRCB, Decision 1379, July 28, 1971, pp. 53-54 (as corrected).

30. Warren R. Schoonover, A Study of Delta Water Quality in Relation to Delta Agriculture, July, 1974, p. III-12.

31. Ibid., Appendix G.

32. Decision 1379, p. 54.

33. Ibid., pp. 32-33.

34. Association of State Water Project Agencies, Sacramento-San Joaquin Delta -- Summary of Facts, July, 1976, p. 9-6. The above document will hereafter be cited as "ASWPA, Summary of Facts."

35. DWR, Bulletin No. 132-72, p. 17.

36. ASWPA, Summary of Facts, 9-7, 9-10.

37. DWR, Bulletin No. 132-73, p. 19.

38. For the general history of the litigation see the DWR, Bulletin 132 series, 1972-1976, and ASWPA, Summary of Facts, 10-5, 10-6.

39. SWRCB, Interim Water Quality Control Plan for Central Valley Region, Basins 5A, 5B, June, 1971, p. 1, and ASWPA, Summary of Facts, 5-24, 5-25.

40. SWRCB, Interim . . . Plan, June, 1971, Appendix B.

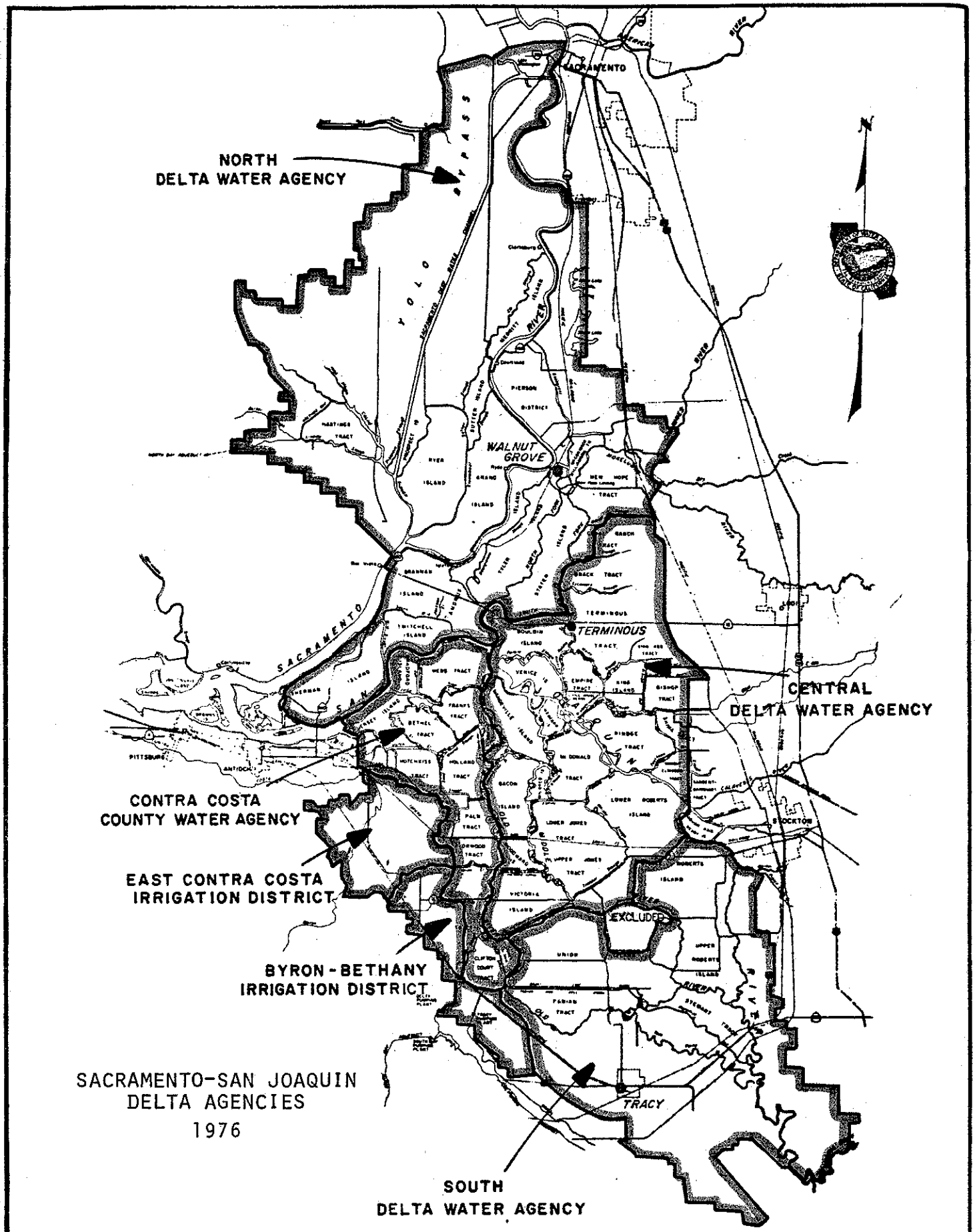
41. DWR, Bulletin No. 132-72, pp. 17-18.

42. ASWPA, Summary of Facts, p. 5-14.

43. Contra Costa County Water Agency, Before the U. S. Environmental Protection Agency . . ., June 28, 1973, pp. 34-36.

44. Excerpted from SWRCB, Interim Water Quality Control Plan for 1977 -- Sacramento-San Joaquin Delta and Suisun Marsh, February, 1977, pp. 17-22.

45. ASWPA, Summary of Facts, pp. 5-20, 5-21.


NORTH
DELTA WATER AGENCY
CENTRAL
DELTA WATER AGENCY
CONTRA COSTA
COUNTY WATER AGENCY
EAST CONTRA COSTA
IRRIGATION DISTRICT
BYRON-BETHANY
IRRIGATION DISTRICT
SOUTH
DELTA WATER AGENCY
SACRAMENTO
WALNUT GROVE
TERMINOUS
TRACY
STOCKTON
EXCLUDED
SACRAMENTO-SAN JOAQUIN
DELTA AGENCIES
1976

DWR

XI. The Matter of Repayment: Continued and Complicated

THE RISE OF THE DELTA WATER AGENCY -- Negotiations with Delta water users on repayment were first considered when the Central Valley Project was still in the initial stages of planning and construction. The State Water Plan of 1931 assumed, as had the federal reclamation officials who took responsibility for the project, that the Delta would benefit from operations that controlled salinity intrusions into the agricultural Delta. For these benefits, compensation, in the form of repayment of a portion of overall project costs, was expected from Delta irrigators. The Central Valley Project Studies in the mid-1940's prepared an analysis of project benefits that recommended Delta water users be assessed a total of $200,000 annually for crop losses prevented by Bureau of Reclamation salinity control. This was a minimal estimate for the total potential benefits might soar to $1,600,000 if a five-percent greater crop yield could be realized due to a general increase in water quality. Establishing a dollar basis for compensation turned out to be easy when compared with the task of collecting it. In a sense, the reluctance of the Delta farmers to sign repayment agreements was entirely understandable. Benefits from the Central Valley Project were, of course, unevenly distributed, with the most significant benefits going to the western portion of the agricultural Delta. On the other hand, the southern Delta experienced some water quality problems associated with the deterioration of San Joaquin River quality attributable in part to Central Valley Project operations. Serious saline intrusion had to be prevented to permit export pumping at Tracy and Rock Slough, regardless of repayment, and that inescapable fact combined with the variable benefits, the uncertainties surrounding Delta water rights, and the continuing argument over the Bureau of Reclamation's obligation to provide nonreimbursable salinity control tended to discourage the negotiation of repayment contracts. In the meantime, the costs allocated to Delta water users were being charged to other project customers as an irrigation expense.

In 1962, the Bureau, which had also failed to secure repayment from farmers along the Sacramento River taking advantage of additional water provided by Shasta Dam, demanded that upland Delta and Sacramento River diverters sign contracts or face legal action. Because of its unique situation the Delta was separated from the Sacramento River diverters, and negotiations continued on water rights upstream from Sacramento. The successful completion of those discussions and the execution of contracts defining water rights and supplemental supplies provided by the Central Valley Project came in 1964. At that time, the Bureau shifted its attention to the Delta, though still talking with the same group, the Sacramento River and Delta Water Association (SRDWA) that had been active in the Sacramento River negotiations. In 1965, SRDWA and the Bureau were joined by the Department of Water Resources and the Delta Water Users Association (DWUA), acting in the negotiations as the San Joaquin Water Rights Committee to represent San Joaquin County and part of Contra Costa County, and the talks proceeded briskly to a conclusion in November, 1965. The suddenness of the success seems remarkable in light of the long history of delay, but perhaps the necessity of guaranteeing usable water in the agricultural Delta in the face of proposed outflow reductions encouraged conclusion of an agreement. The document signed on November 19, 1965, provided a basic water quality criteria assumed to equal the limits of intrusion maintained by the Central Valley Project and comparable to the salinity control proposed in connection with Peripheral Canal operations. Outflow levels, long the basis of argument, were not specified, rather the criteria established quality standards in terms of chloride and TDS concentrations for various Delta locations. The signatories assumed that a 1,500 second-foot outflow would be sufficient to maintain those standards, though it was further assumed that whatever standards were contained in a Delta contract, adequate water would be released to meet them.

The voluntary associations that had signed the November 19th agreement represented about 95 percent of the agricultural Delta, but they could not bind their members nor could they levy assessments to pay for the water quality controls provided for in the pact.[1] In order to obtain a contract a special district endowed with appropriate legal powers was required. Further negotiations established $200,000 as a reasonable annual compensation for maintenance of the November 19th criteria, and on December 15, 1967, SRDWA and DWUA entered into a memorandum of understanding that proposed immediate creation of a Delta Water Agency able to execute a contract and assure repayment. The two groups agreed to provide a draft of the necessary legislation to their members by February 1, 1968, and to the legislature one month later. Provisions in the legislation would prohibit the Agency from signing a contract for less than the November 19th criteria, or for more than $200,000 in annual

payments. Exemption from the 160-acre limitation imposed on irrigators receiving water from the Bureau of Reclamation was also required, though only Congress could actually grant that exemption.[2] In the spring of 1968, the legislation was proposed with the blessings of the Bureau of Reclamation, the Department of Water Resources, and even the Metropolitan Water District of Southern California, prime customer of the State Water Project. Bureau Regional Director Robert J. Pafford wrote to John Luther of SRDWA on April 8, 1968, that:

> *We believe the Delta has benefitted from the operation of the Central Valley Project. Consummation of a contract containing the foregoing provisions as to diversions and quality would insure the continuance of these benefits. In our opinion an annual payment by the Delta Water Agency of $200,000 would be equitable when considered in relation to the payments made by the Sacramento River diverters.*[3]

Although the formation of the Agency was endorsed by most Delta interests as well as project operators, the proposed legislation was still controversial. Contra Costa County had always considered the November 19th criteria inadequate and, because the Delta Water Agency proposal was a product of those negotiations, and was expected to execute a contract based on that agreement, the County attempted to prevent the formation of the Agency. Contra Costa Senator George Miller, Jr. proposed an amendment to allow the county to exclude itself from the Agency, while the Contra Costa County Water Agency (CCCWA) suggested a battery of amendments. Among the changes suggested by CCCWA were provisions that would require the Boards of Supervisors of all counties included in the Agency to approve it, would substitute a limit of 1,000 ppm chloride at Antioch for the November 19th criteria, would give the western Delta more weight in voting, and would alter Agency boundaries to include the industrial area west of Antioch. All the amendments aimed at effectively crippling the Agency at birth were rejected in committee.[4] There was no doubt that the November 19th criteria were agricultural rather than industrial standards, and sponsors doubted that agricultural water users could afford to pay for water quality sufficient to protect nonagricultural uses. Despite the charges levelled at the prospective agency, it received legislative approval by June, 1968, and was set to take effect in January, 1969. As defined in the act, the Agency's purposes were:

> *. . . to negotiate, enter into, execute, amend, administer, perform and enforce one or more agreements with the United States and with the State of California, or with either, which have for their general purposes the following:*
>
> *(a) To protect the water supply of the lands within the agency against intrusion of ocean salinity; and*
>
> *(b) To assure the lands within the agency a dependable supply of water of suitable quality sufficient to meet present and future needs.*[5]

Once a contract had been negotiated, approval by a majority of Delta users was necessary, and if no contract were signed by December 31, 1973, the organization would automatically terminate. The Agency was governed by an eleven-member Board of Directors elected by district, though the initial Board was nominated by supervisors in the respective counties. Votes were assigned on the basis of land values, a landowner having one vote for each dollar's worth of land. Originally, taxation to support the Agency and any contract was to have been based on acreage but difficulties with that scheme led to the passage of amendments allowing a change to an assessed valuation system.[6]

The organizational meeting of the Delta Water Agency was held in Sacramento, January 23, 1969. At that time, Jack Port of the CCCWA appeared to announce his agency's on-going opposition to the existence of the Delta Water Agency based on its connection to the November 19th criteria.[7] The next month a legal action was filed by Nomellini Farms, Salyer Properties, and Victoria, Inc. contending that the Agency was illegial and unconstitutional and without the right to levy taxes or bind landowners. It further argued that the November 19th criteria, the Peripheral Canal, and the 160-acre limitation were all contrary to the best interests of the Delta. The suit failed, but at the August 20, 1969, meeting of the Board of Directors, a resolution opposing the Peripheral Canal until negotiations were completed was approved by the Board.[8]

No negotiations had actually taken place by the summer of 1969, prompting Rio Vista Director Albert Jongeneel to express some dissatisfaction at the slow pace of activity, indicating at the same time that the northern portion of the Agency was eager to complete a settlement. Directors from the southern Delta, however, pointed out that they had less experience in matters of negotiation than some of their northern counterparts and argued that it would be unfair to force a hasty and inadequate agreement on the entire area.[9] Before negotiation could take place, some basic position regarding Agency objectives had to be defined. At the October 1, 1969, meeting a modification of the November 19th criteria calling for more interior Delta sampling stations, increased spring-time flushing, and overland distribution systems providing water under 350 ppm chloride to Jersey and Sherman islands and the Hotchkiss Tract was submitted by W. R. Darsie of Walnut Grove on behalf of directors representing Yolo, Solano, and Sacramento counties.[10] No immediate action on Darsie's proposed criteria was taken, but on December 8, 1969, Dr. Gerald T. Orlob, president of Water Resources Engineers, Inc., and consultant to the Agency, recommended tentative water quality standards for Delta agriculture. His values for the interior Delta remained unchanged from the November 19th criteria, but suggested salinities at Jersey Point and Emmaton were superior to those of the November 19th standards.

Month	April		May		June		July		Aug-Dec	
Station	JP*	E**	JP	E	JP	E	JP	E	JP	E
Critical year	300	400	450	600	600	1,000	950	1,300	1,100	1,300
Dry year	250	300	350	400	450	500	650	800	800	800
Other	200	200	250	300	350	400	450	600	600	600

*JP - Jersey Point **E - Emmaton [11]

At the December 8, meeting, however, the adoption of Orlob's criteria was defeated in a vote that showed a marked sectional division, with northern directors voting in favor of the proposal and southern directors voting in opposition.[12] A week later, on the motion of Director Alfred Zuckerman of Stockton, the Board voted 6 to 4 to reject the general provisions of the November 19th criteria as the basis for negotiation.[13] In a brief presented in 1971 to the State Water Resources Control Board, the Agency stressed that in order to maintain soil salinities under 1,000 ppm chloride on peat and muck soils, water applied between April and September should not exceed 70 ppm chloride. The November 19th criteria would allow, according to the Agency, water of 189 ppm chloride at McDonalds Island in the central Delta, resulting in a soil salinity on the island of 2,000 ppm chloride by the end of the irrigation season, or approximately double the maximum advisable level.[14] As in the case of the Orlob criteria, the vote on the November 19th criteria was on strictly sectional lines, foretelling a serious split in the Agency. However, the Department of Water Resources and others persisted in citing the November 19th agreement as the basis for their own operational plans, resulting in an unanimous vote in May, 1970, to reaffirm the rejection of the criteria, although one absent director later went on the record in opposition to the motion.[15] The Agency did recommend an interim level of 250 ppm chloride at Blind Point to the State Water Resources Control Board during the hearings on Delta water rights.

THE DEMISE OF THE DELTA WATER AGENCY -- The Department of Water Resources reported that discussions with the Delta Water Agency proceeded slowly in 1969 and reached a standstill in 1970, while awaiting the outcome of the Delta water rights hearing. Meetings were held in 1970, including two general sessions with the Department and the Bureau of Reclamation, and several technical meetings with staff members, but progress was indeed negligible and the negotiations were suspended after the August 17, 1970, meeting. Meanwhile, the Agency concerned itself with the thankless task of establishing criteria acceptable to all interests. Some basic agreement was demonstrated on another issue when the Board voted on December 16, 1970, to unequivocally oppose the Peripheral Canal; a position scarcely likely to find favor with the project operators.[16]

In February, 1971, Dr. Orlob again submitted draft criteria for the protection of Delta agriculture, and this time the Board endorsed the use of the proposed standards in negotiation with the water project agencies. As published in the Delta Water Agency's annual report, the criteria included:

	Oct-Apr	M	J	J	A	S	Annual Average	4-Year Average
Sacramento River, Emmaton	150 mg/l*	150	250	750	750	400	240	200
Three-Mile Slough, Sacramento River	70	70	70	100	100	70	100	70
San Joaquin River, Jersey Point	140	140	200	600	600	200	180	140
Secondary Stations:								
Rio Vista	70	70	70	70	70	70	70	70
Rock Slough Intake	100	100	100	150	150	100	120	100

*All values are in chloride.

17

One meeting was held in 1971 following release of the State Water Resources Control Board's Decision 1379, but neither the new State Delta Standards nor the Orlob criteria proved sufficient to break the stalemate that had developed.

The problem of finding a physical means to provide high quality water to the Delta, and especially the south Delta, in lieu of the Peripheral Canal, prompted the Directors to order a study of the possibility of using the Bureau of Reclamation's proposed Folson-South Canal to improve Delta water quality. The annual report, dated October, 1971, summarized the alternatives in cross-Delta water transfer that included the modified Folsom-South plan and an alteration of the Peripheral Canal concept to emphasize the redistribution of water within the Delta rather than export. Under the Agency's proposal, the Folsom-South Canal leading from the American River to San Joaquin County would be augmented by water diverted from the Sacramento River through the Hood-Clay interchange and some 2,270 to 4,270 second-feet would be released into the Mokelumne, Calaveras, and Stanislaus rivers.[18] Exports would continue to be drawn through Delta channels but would be limited to a maximum rate of no more than 6,500 second-feet according to the Department of Water Resources or 9,850 second-feet by the Agency's estimate, compared to an anticipated ultimate rate of 18,000 second-feet of diversion. In late 1971, the Department and the Bureau rejected the modified Folsom-South plan because of its limited transfer potential and its inability to correct flow reversals while adding to the problems faced by migrating salmon with the release of large quantities of Sacramento River water into the San Joaquin Delta.[19]

By this time, the obstacles to negotiation were clearly substantial. The rejection of the November 19th criteria and adoption of more restrictive quality standards would, without other action, have caused serious difficulties for state and federal conferees, but the firm rejection of the Peripheral Canal and development of an alternative manifestly unsuitable to project operators was sure to make progress even more difficult to achieve. Unfortunately, lack of unanimity within the Agency compounded the other dilemmas. When the CCCWA filed a cross-complaint against the Bureau of Reclamation in litigation growing out of the Delta Decision, the Board endorsed the Contra Costa action "unequivocally" in a split vote that once again saw northern directors in a minority position.[20] In July, 1972, matters began to come to a head as staff discussions with the representatives of the Bureau and the Department were suspended and southern and central Delta interests questioned the adequacy of the Orlob criteria.[21] On June 21, 1972, the Board approved amendments to the criteria that added Blind Point as a sampling station. The maximum permissible chloride concentrations at that location would be 100 mg/l October through May, 250 mg/l in June, 800 mg/l in July and August, and 450 mg/l in September, all computed as 14-day means. The annual maximum was to be 230 mg/l and the four-year average 200 mg/l, with adjustments for dry years.[22] Dr. Orlob insisted that his criteria reflected post-Shasta conditions with provision for reasonable improvements, but argument over the sufficiency of the standards continued with the Contra Costa County Water Agency leading the opposition.

The tone of the debates deteriorated markedly as the sectional battlelines became more sharply defined. At the October 18, 1972, meeting, for example, veiled threats that those interests unhappy with the proposed criteria might seek legal redress against the Agency, prompted the following exchange:

> *CHAIRMAN SOUZA: Wait a minute, Tom. We are not going to stand for any threats. If you want to sue us, go ahead and sue. We have the opinion of our attorneys and we are going to abide by that, and that's what it is going to be. We are not going to be intimidated by you or Cressey [Nakagawa of CCCWA] or anybody else to sue us. We have been sued before. So, go ahead and sue . . .*

MR. TOM ZUCKERMAN: I think you are slapping five directors of this Agency in the face.

CHAIRMAN SOUZA: There have been five other directors slapped in the face for three to five years, too.[23]

Warfare within the Agency over the adequacy of the proposed criteria had by late 1972 effectively paralyzed the organization.

Another major problem, long lurking in the background, was the question of what assurances or legal remedies would be available to guarantee performance, if one was signed. Concern was expressed that if project operators failed to meet the standards, legal action against them might secure some monetary compensation but no water. In late 1972, it was proposed to table the discussion of criteria and concentrate on securing reasonable assurances of performance. The controversy over criteria, however, was too intense to disappear and on December 20, 1972, attorney Dante Nomellini urged the executive committee to consider an amendment to the Delta Water Agency Act splitting the Agency into three separate zones.[24] The necessity of such action was deemed obvious in light of the steadfast opposition by south Delta representatives to the Orlob criteria, and the different problems experienced in the southern area. Nomellini wrote to the executive committee again on January 15, 1973, calling the Orlob criteria "unacceptable to me and to the landowners which I represent,"[25] and recommending an even more stringent set of standards. For example, Nomellini proposed maintaining normal year chloride levels at Emmaton at 30 mg/l from November through April, rising to a peak of 160 mg/l only in July and August. Even in dry years, no reading would exceed 160 mg/l at Emmaton.[26] On January 15, 1973, the executive committee met in Stockton where resolutions were proposed calling for the removal of the Agency's two attorneys, Martin McDonough representing the northern section of the Delta and John Wilson representing the southern. McDonough was accused of a conflict of interest and Wilson was charged with no longer reflecting the interests of the "San Joaquin group" he represented. Although in a split vote the executive committee did not approve the resolutions, their introduction did indicate the presence of a deep and bitter schism in the Agency.[27]

The handwriting was plainly on the wall by early 1973, as fruitless discussions of criteria and contractual assurances continued amid talk of allowing those areas that favored the Orlob criteria to proceed with negotiations covering only their districts. By March, the main topic of discussion was on how to best, and most painlessly, put the Agency to death. Within a month, action had been taken by the northern interests to secure legislation creating a separate North Delta Water Agency and central Delta water users were not far behind. At the April 18, 1973, meeting of the directors, a resolution was passed ending all doubt as to the fate of the Delta Water Agency. By a vote of 9-0 it was resolved that "this Board does not urge the extension of the existence of this Agency as it presently exists and encourages those portions of the Delta with common interests to form such local agencies as may appear appropriate."[28] A final meeting with the Department of Water Resources and the Bureau of Reclamation in June, 1973, indicated that of the eleven districts, eight had agreed basically on the criteria, while two of the remaining three districts wanted considerably higher water quality standards.[29] On the last day of December, 1973, the Delta Water Agency expired, ending a brief and divisive career.

THE BALKANIZED DELTA -- In 1973 the legislature created three new Delta water agencies and let another three existing in the western Delta assume or reassume negotiation responsibilities. The North, Central and South Delta Water Agencies along with the CCCWA, the Byron-Bethany Irrigation District and the East Contra Costa Irrigation District became the successors to the divided and dissolved Delta Water Agency. Like the authorizing act for the earlier Delta organization, the enabling legislation was conditioned to require that if no contracts were negotiated by January 1, 1978, the new agencies would automatically go the way of the old. In dividing up the Delta, part of Union Island was excluded from the jurisdiction of any of the agencies at the request of trustee Walter Gleason, who was also an attorney for the CCCWA. Negotiations with the East Contra Costa Irrigation District began at the District's request, even before the Delta Water Agency was officially buried.[30] Talks with the small district were soon suspended, however, pending the completion of an agreement with one of the three major negotiating entities.

The northern agency, covering approximately the area once represented by SRDWA, had indicated prior to the dissolution of the Delta Water Agency that it was willing to discuss a contract having less stringent quality standards than south Delta interest had been demanding. Soon after the North Delta Water Agency was officially established, the Bureau

of Reclamation and the Department of Water Resources submitted an operation study drafted by the Department showing the water supply requirements necessary to meet a range of water quality standards.[31] The Bureau and the Department suggested that the Agency should pay for water delivered to the Delta in excess of the amount that would have been available if the projects had not been built. Based on the large quantities of water required to maintain desirable criteria, the high cost of a contract on the basis proposed might have made acceptance by Delta landowners questionable, so the Agency submitted its own suggestions in February, 1975, based on terms similar to those found in the 1964 contracts with Sacramento River diverters and quality criteria similar to the 1971 Delta Decision standards. Along the Sacramento River riparian and appropriative water rights had been defined through a complex series of legal studies. Under the contracts negotiated between water users and the Bureau of Reclamation water diverted in excess of established rights had to be paid for at the rate of $2.00 per acre-foot. The determination of Delta riparian rights had been a more complicated process although they had eventually been defined by the Bureau, but in March, 1975, the Bureau rejected a water rights settlement in the Delta. One of the reasons for the rejection may have been the legally undefined status of Delta outflow needed to maintain salinity control. No firm basis existed for classifying such outflow as a riparian or appropriative right, or if appropriative, its legal priority in relation to other water rights. Another probable reason for the Bureau's reluctance to pursue the water rights approach was the unfavorable response to the Bureau's Sacramento River contracts from the watchdog General Accounting Office over handling of the 160-acre limitation in those agreements. The Bureau preferred to define Delta water requirements on the basis of projected outflow deficiencies. These deficiencies were based on the estimated water supplies that would be available, and were compared with the estimated outflows that would occur in the absence of the federal and state projects. Water needed to meet quality requirements that would not have been available without the projects was supplementary, and subject to repayment requirements. For supplemental water provided by the Central Valley Project to correct future deficiencies and maintain adequate water quality the price would be $3.50 per acre-foot rather than the $2.00 per acre-foot charged to upstream Sacramento River diverters. Despite the increased price of water delivered by the Bureau, federal water was far cheaper than the State Water Project's $10.00 per acre-foot rate, and the North Delta Water Agency would have preferred to contract exclusively with the Bureau of Reclamation. An agreement reached in 1975, however, proposed that the Bureau supply 75 percent of the water needed to meet the November 19th criteria, with the remainder provided by the Department of Water Resources. Additional water to meet still higher quality requirements would be provided equally by the Department and the Bureau. In 1976, the Bureau definitely rejected the concept of contracting without the participation of the Department.

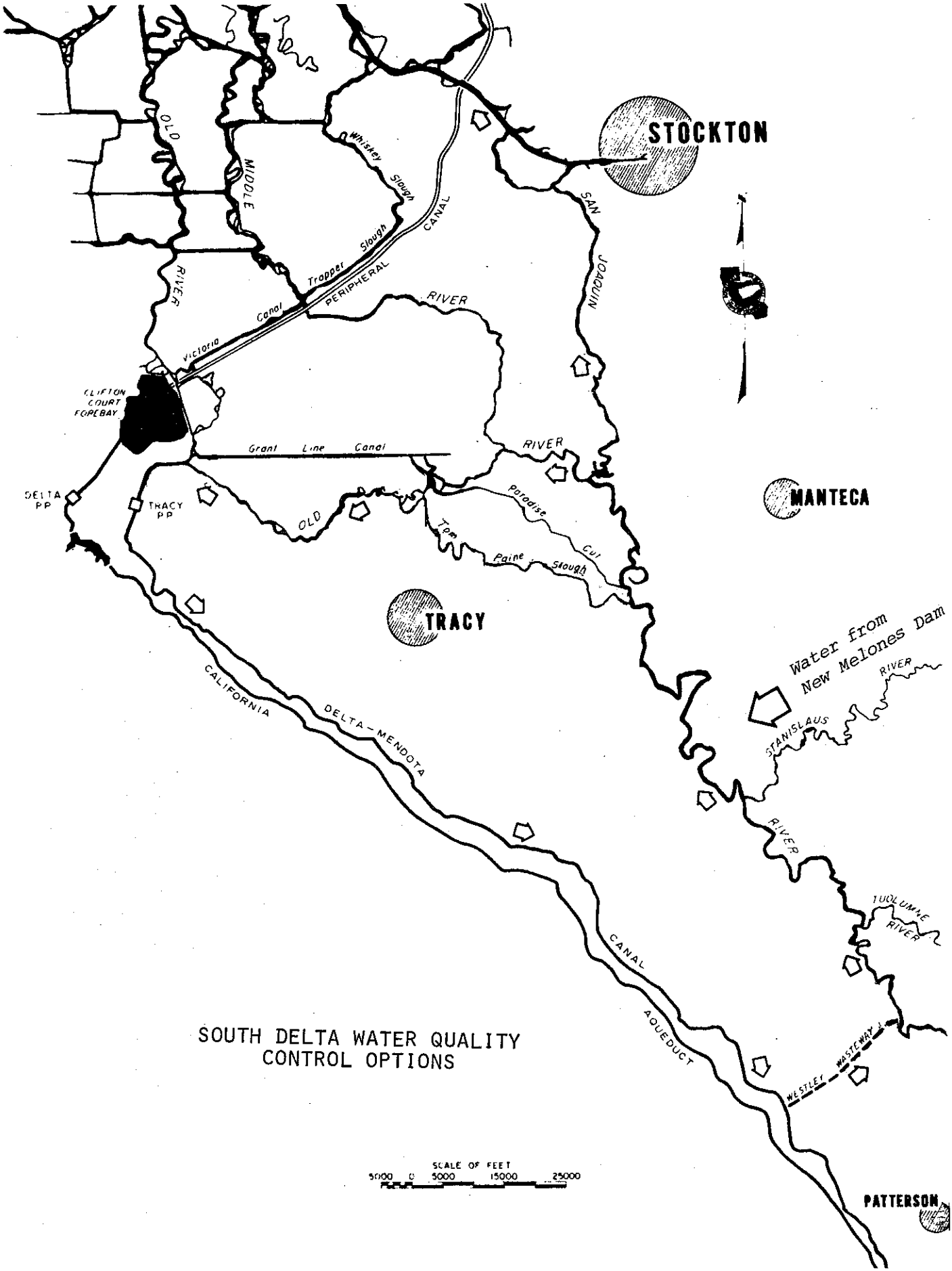
The Bureau's counterproposal of May, 1975, indicated the complexity of the negotiating process when, in addition to examining methods of determining the quantity of additional water to be provided, it designated four other issues that could not escape scrutiny in a proposed contract including the Peripheral Canal, and coordination of any agreement with other Delta negotiations, the Sacramento River contracts, and the Department of Water Resources' obligations to meet water quality criteria. Negotiations began again in June, 1975, on a technical level, with agreement reached in December, 1975, on methods of allocating deficiencies in Delta water supplies among water users, including the share of costs chargeable to the North Delta Water Agency. The Agency approved the hydrology recommended by the technical committee but desired further negotiations on matters of cost. The cost as computed from the December, 1975, hydrology proposal would have been about 99 cents per acre. For that rate, which was uniform throughout the Delta, the project operators would supply minor deficiencies in consumptive needs as well as the necessary outflow, with some of the costs of the outflows allocated to other than Delta irrigators for repayment. Other contractual provisions desired by local agencies would have to be paid for in addition to the basic Delta-wide charge. Errors were discovered in the basic hydrology, however, and the Bureau of Reclamation readjusted its computations. The reanalysis of supplemental water requirements, allocations, and costs resulted in a new figure of $1.84 per acre, but further work revealed yet another error that brought the cost back down to about 97 cents per acre. Still the major problem facing North Delta Water Agency negotiators has been attainment of satisfactory quality levels at a price water users are willing to pay.

In its negotiations, the Agency has based its criteria on the Basin Plan, or essentially D-1379 standards, with relaxation to the November 19th criteria when appropriate replacement facilities are constructed on Sherman Island. Opposition to the Peripheral Canal has been a basic Agency position, but only until a binding contract is concluded with both state and federal water agencies to guarantee proper operation of the facility. With the likelihood that the North Delta Water Agency can achieve its ends by January, 1978, diminishing, legislation has been proposed granting a one-year extension of its life.

The 148,000 acre South Delta Water Agency occupied an unenviable position in terms of water quality and availability.[32] The area's primary source of fresh water is the San Joaquin River but that stream has become too polluted with saline agricultural drainage and depleted by upstream development to provide a fully satisfactory water supply for the southern Delta. Even the quantity of water available is sometimes inadequate when low river flows, low tides, and the local effects of the export pumps drop water levels below the efficient reach of irrigation pumps. The South Delta Water Agency has estimated that between 400,000 and 500,000 acre-feet of water are used in the Agency each year and even more is required as carriage water to flush San Joaquin River salts and drainage from Delta farm lands out of the channels, though at times the flow is too low to accomplish that task and low quality water becomes trapped in the southern Delta.

Discussions with the Department of Water Resources and the Bureau of Reclamation began as soon as the Agency was legally established. In the spring of 1974 the Agency recommended a mean daily salinity of no more than 450 mg/l TDS throughout the area, with a 14-day average of 400 mg/l, annual average of 350 mg/l, and a four-year average of 310 mg/l. In dry years a 10 percent relaxation in those standards would be allowed.[33] The Agency submitted a contract in 1974 that was deemed unacceptable by the project operators, but the active negotiations continued and another proposal was readied by 1975. In January, 1977, the Bureau and the Department responded with a proposal of their own based on the hydrology developed in cooperation with the North Delta Water Agency. Basically, the additional water needed to meet South Delta quality and quantity requirements could be provided from two sources; the New Melones Dam on the Stanislaus River, or the Delta-Mendota Canal through the Westley Wasteway to the San Joaquin River. Because the canal carried water already partially fouled by its passage through the southern Delta to the pumps, releases through the Westley Wasteway would have to be four times the volume of the New Melones releases necessary to accomplish the same result. However, with a Peripheral Canal to guarantee better quality in the Delta-Mendota Canal the proportion would change to only one and one-half times as much canal water as Stanislaus River discharges. New Melones Dam, when completed, was authorized to release up to 70,000 acre-feet annually to maintain a monthly average of 500 mg/l TDS at Vernalis. In the project operators' proposal of January, 1977, a phased contract was suggested, the first section running until New Melones Dam becomes operational for fish and wildlife and initial water quality releases, the second until the dam is fully operational, the third phase until additional physical facilities to control water in the south Delta are in place, with the final phase following the completion of those facilities. It was anticipated that during the first three phases up to 900 second-feet would be released from the Delta-Mendota Canal, augmented by New Melones releases during the second and third phases of 98,000 acre-feet for fish and wildlife (69,000 acre-feet in a critical year) and 70,000 acre-feet for water quality control. In the third phase an additional 35,000 acre-feet of water from New Melones might be allocated to enhance Delta water quality. During the first three phases, a 30-day average electrical conductivity of 70 millimhos, or approximately 450 mg/l TDS, would be maintained at Vernalis except in critical years, with phase four standards to be negotiated at a later date. To insure adequate quantities of water, the proposed contract called for a mean 10-day flow at Vernalis of not under 30 percent of estimated channel depletions in the Agency plus 300 second-feet during the first three phases. The costs of such a contract would exceed the basic supplemental charge totalling $1.84 per acre (before the most recent correction) or about $272,000 annually, because of the power and conveyance costs of wheeling Central Valley Project water through the California Aqueduct when the Delta-Mendota Canal was carrying water for release at the Westley Wasteway. The South Delta Water Agency had desired higher objectives as to both quality (450 mg/l TDS throughout all channels on a 30-day average) and quantity (full channel depletion plus 900 second-feet) but the Bureau and the Department estimated that to meet Agency criteria for Phase I would entail an average of $1,287,000 at 1977 cost levels compared to $790,000 for the federal and state proposal. Further comparison indicated that while the cost of a contract under Agency criteria would remain stable throughout the three predictable phases, the project operator's proposal would diminish in cost as New Melones releases were substituted for Delta-Mendota Canal deliveries.[34] In January, 1977, the South Delta Water Agency rejected the proposed agreement and soon thereafter sent a proposal of their own to the project agencies containing minor changes relating to dry year operations, but indicating little fundamental shift in negotiating positions. Although the proposal of January, 1977, was quickly declared unacceptable as to both quality and quantity, it does serve to illustrate the problems encountered in satisfying south Delta water requirements and some of the water management alternatives under consideration for that purpose.

The Central Delta Water Agency has been far less active than the other two major Delta agencies.[35] The Agency has met rather sporadically with the Bureau of Reclamation and requested that the Department of Water Resources not join talks that the Agency indicated



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CONTROL OPTIONS

were on matters of primarily federal concern. In early 1977, the Agency did meet with state representatives and the Cooperative Extension Service of the University of California in order to establish a study program to define water quality requirements for agriculture on Agency lands.

The remaining agencies have taken little part in the negotiations since the collapse of the Delta Water Agency, though it is thought that the East Contra Costa Irrigation District might follow the terms of a settlement with the North Delta Water Agency when one is reached. Major issues remain to be settled in the negotiations involving the water needs of half a dozen agencies and two major water projects, not the least of which is coordination. The interrelated system of Delta waterways makes it virtually impossible to maintain a different criteria for each area, requiring a mutually agreeable basic criteria for use throughout the entire Delta. Another problem, as yet unsolved, concerns the priority of Delta water entitlements. Delta interests have long insisted that satisfaction of Delta water needs should rank above the needs of other contractors, while project operators have generally held the opinion that deficiencies in dry years should be spread evenly among all customers. Despite efforts over more than ten years, these and other problems remain thorns in the side of Delta water management.

MUNICIPAL AND INDUSTRIAL WATER ENTITLEMENTS -- Talks with the Negotiating Committee on Contra Costa's Water Requirements were begun in 1964 by the Department and the Bureau but because the fifty-member committee headed by former Water Resources Director Harvey O. Banks represented all the water interests in the county, the negotiations eventually collapsed from lack of internal cohesion.[36] At the western edge of the Delta, water project operators had long intended to provide overland water supplies in lieu of large salinity control releases. In northern Contra Costa County an alternative system, the Contra Costa Canal, already existed, though increased reliance on it would entail higher costs and eventually require additional facilities to meet the larger demand. Following the failure of county-wide discussions, the Department of Water Resources negotiated with individual municipal and industrial water users in Contra Costa County to work out a means by which to reimburse them for the deterioration of offshore water quality that would necessitate larger purchases from the canal, to the extent that the State Water Project was responsible for such degradation. Talks with the Contra Costa County Water District (CCCWD), the Contra Costa Canal water contractor and a major municipal supplier, reached a successful conclusion on April 21, 1967, when a contract was signed to compensate the District when it had to purchase extra water from the Bureau of Reclamation. It had been calculated that from 1926 through 1959 the District was able to divert river water with no more than 100 ppm chloride, as measured at mean tidal cycle, on an average of 142 days between January 15 and June 6 at the Mallard Slough pumping plant. As increased upstream and export diversions depleted Delta outflow in the future, the District was expected to buy canal water to cover the deficiency. The Department of Water Resources accepted responsibility for one-third of the costs of additional canal deliveries as a reflection of the extent to which the State Water Project contributed to reduced fresh water availability. It was assumed by the state than an additional third of the responsibility rested with the federal Central Valley Project, while the final portion was charged to all other water users upstream from the Delta. If offshore quality during an October 1 to September 30 water year were worse than the average; that is, at or under 100 ppm chloride for less than 142 days, the state would pay the District one-third the added cost of water delivered through the Contra Costa Canal. If water quality were better than normal the number of days in excess of the historic average would be credited to the state to offset losses in future dry years.[37] It was estimated that maximum payments in a dry year would be about $86,000.[38] A year later, the other municipal water supplier in the western Delta, the city of Antioch, signed a similar contract with the Department of Water Resources. The April 11, 1968, agreement provided for an historic annual availability of 208 days of 250 ppm chloride or better water at the city's intake as measured at higher high tide. Once again, the state would repay the city for its share, one-third, of the cost of substitute water obtained from the Contra Costa Canal.[39]

The only payment made by the fall of 1975 was one of $6,188.34 to the CCCWD in 1968.[40] Since that time enough water of suitable quality was available offshore to offset deficiencies in the 1971-72 water year, and gave the District a credit of 237 days and the city a credit of 539 days by the end of the 1974-75 water season.[41] Payment, however, was only useful if substitute water was available, and more upstream development coupled with increasing demands made a means of augmenting the Contra Costa Canal's overland supply imperative. The Bureau of Reclamation had proposed the Kellogg Project to improve canal quality by pumping from the Delta-Mendota Canal rather than Rock Slough, and the project had been included in the Peripheral Canal plan. Failure to win speedy approval of the project led the CCCWD to

NOTES

CHAPTER XI - THE MATTER OF REPAYMENT: CONTINUED AND COMPLICATED

1. DWR, Bulletin No. 132-68, p. 64.
2. Memorandum of Understanding, SRDWA and DWUA, December 15, 1967.
3. Robert J. Pafford to John Luther, April 8, 1968.
4. Miscellaneous material in Delta Water Agency files, County Clerk's Office, Stockton, California.
5. Delta Water Agency Act of 1968, Sec. 4.1.
6. Delta Water Agency, Annual Report, 1970-71, November 17, 1971, p. 2. This agency will hereafter be cited as "DWA."
7. Minutes, DWA, Organizational Meeting, pp. 5-6.
8. A copy of the legal complaint appears in the DWA files, and a reference to it can be found in the Minutes, June 18, 1969. The Peripheral Canal motion is found in Minutes, August 20, 1969.
9. Minutes, DWA, September 17, 1969.
10. Minutes, DWA, October 1, 1969.
11. G. T. Orlob, "Tentative Water Quality Criteria for Protection of Delta Agriculture," December 8, 1969.
12. Minutes, DWA, December 8, 1969.
13. Minutes, DWA, December 15, 1969.
14. Martin McDonough and John Wilson, Opening Brief on Behalf of Delta Water Agency, before the SWRCB, March 4, 1971.
15. Minutes, DWA, May 20, 1970 and June 25, 1970.
16. Minutes, DWA, December 16, 1970.
17. DWA, Annual Report, 1970-71, Table 1.
18. Ibid., p. 10.
19. DWR, Bulletin No. 132-72, pp. 18-19.
20. Minutes, DWA, May 17, 1972.
21. Dante Nomellini to Alfred Souza, Chairman, DWA, July 18, 1972.
22. G. T. Orlob, "Comparison of Water Quality and Water Level Control Criteria as per Resolution No. 53, adopted 17 February and as Proposed for Adoption to supersede Resolution No. 53 on 21 June 1972."
23. DWA, Transcript of Board Meeting, October 18, 1972, p. 103.
24. Dante Nomellini to members of the Executive Committee, DWA, December 20, 1972.
25. Dante Nomellini to members of the Executive Committee, DWA, January 15, 1973.
26. Ibid.

27. Minutes, Executive Committee, DWA, June 15, 1973.

28. Minutes, DWA, April 18, 1973.

29. DWR, Bulletin No. 132-74, p. 20.

30. Ibid.

31. Information on the North Delta Water Agency was derived from Bulletin 132 series, a letter from Gleason L. Renoud, Manager, to Alan M. Paterson, January 13, 1977, and conversations with Gleason L. Renoud, John Budd of the Bureau of Reclamation, and Walt Fisher and Ben Vanberg of the Department of Water Resources.

32. Information on the South Delta Water Agency was derived from Bulletin 132 series, a letter from Robert Ferguson, Chairman, to Alan M. Paterson, March 4, 1977, and conversations between Alan M. Paterson and John Wilson, attorney for the Agency, John Budd of the Bureau of Reclamation, and Walt Fisher and Ben Vanberg of the Department of Water Resources. Mr. Wilson provided an "Introduction" to the SDWA presentation to the SWRCB, Phase I hearing, November, 1976, that provided additional information.

33. South Delta Water Agency, Water Requirements for the Southern Delta, 1974, p. 28.

34. USBR, DWR, "Proposed Major Provisions for a Contract Among United States of America, State of California and the South Delta Water Agency," January, 1977.

35. Information on the Central Delta Water Agency was derived from the Bulletin 132 series, and conversations between Alan M. Paterson and John Budd of the Bureau of Reclamation, and Walt Fisher and Ben Vanberg of the Department of Water Resources.

36. DWR, The Delta and the State Water Project, memorandum report, June 1969, p. 36.

37. Ibid., Appendix B, pp. 1-4.

38. DWR, Bulletin No. 132-69, p. 18.

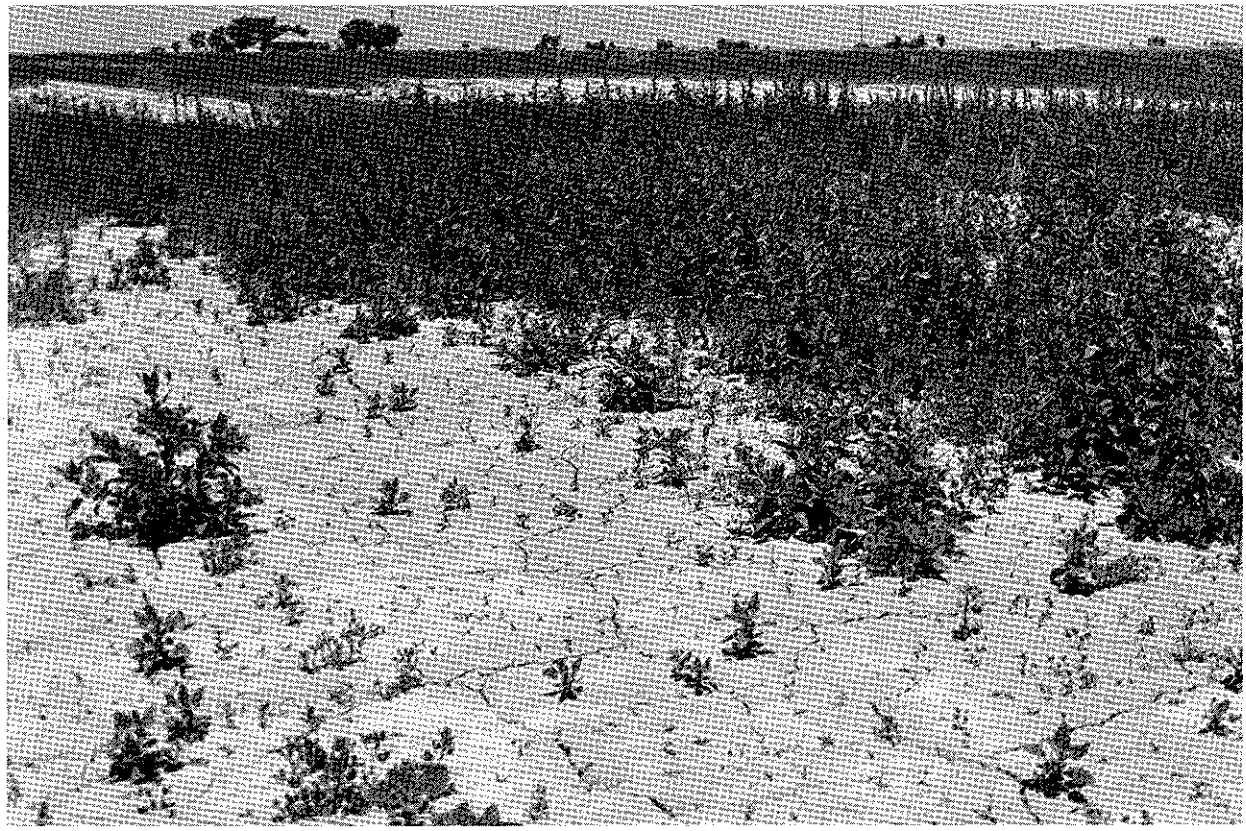
39. The Delta and the State Water Project, Appendix B, pp. 5-8.

40. Bulletin No. 132-69, p. 18.

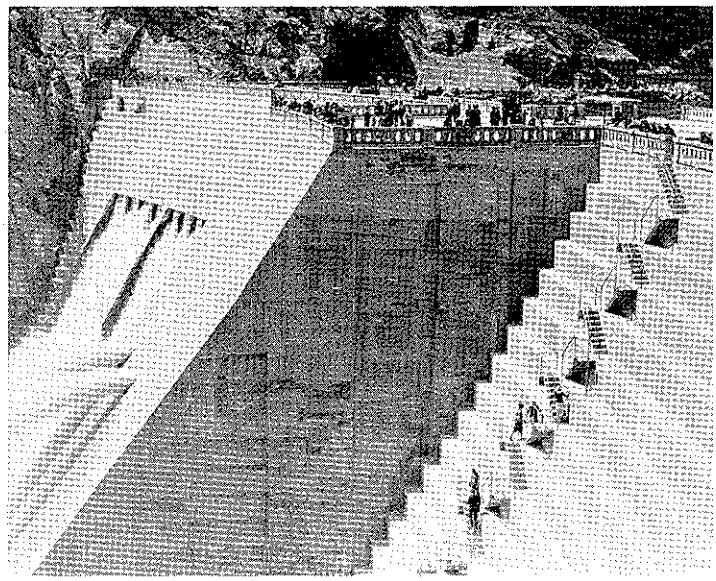
41. Bulletin No. 132-76, p. 19.

42. Bulletin No. 132-70, p. 18, and Bulletin No. 132-72, p. 19.

43. The Delta and the State Water Project, pp. 41-42.



Salt damage in an alfalfa field. The detrimental effects of excessive salinity near the soil surface are dramatically illustrated in this spotty stand of alfalfa. To prevent salt buildup additional water must be applied to flush salt below the root zone. Unfortunately, the salts must eventually be disposed of, and the application of supplemental irrigation water can lead to drainage problems. (DWR photo)



O'Shaugnessy Dam impounds the City of San Francisco's Hetch Hetchy water supply reservoir in the High Sierras. Hetch Hetchy, on the Tuolumne River, is just one of many diversions from the San Joaquin River and its tributaries that has contributed to a reduction in water quality in that stream. (Photo from Water Resources Center Archives)

XII. The Great San Joaquin Drainage Problem

-OR-

"WHAT'S BAD WATER LIKE YOU DOING IN A NICE VALLEY LIKE THIS"

SALT MANAGEMENT -- Despite the emphasis on protecting the Delta from the influx of tidal salinity, another source of salt water pollution threatens parts of the Delta: the San Joaquin River. At the root of the problem are some fundamental facts about irrigated agriculture in arid and semi-arid regions, and more specifically, the problems of salt management. Salts occur naturally in all waters, and in small quantities are considered beneficial, but can become dangerously concentrated by irrigation. If water is collected for later use, the evaporation of pure water from reservoir and canal surfaces increases the concentration of salts in the remaining supply, but even if the water is pumped directly from underground, some salts will be applied to growing crops. Since plants use only pure water for transpiration, the processes of evaporation and transpiration tend to leave behind salts in the soil. Ideally, a farmer would apply only enough water to replace the amount of moisture lost through evapotranspiration, but to do so would continue to trap additional salts near the soil surface where their presence would soon reduce the land's fertility because although plants vary in their sensitivity to salts, most crops cannot tolerate excessive salinities. To overcome this difficulty the farmer must leach away the unwanted salts; that is, flush them below the root zone by applying more water than is actually needed by the crop. In California, the average leaching requirement is about 20 percent, meaning that one-fifth of the water applied by irrigation is used to maintain reasonable soil salinities. Obviously, the better the quality of water used for irrigation the fewer salts are deposited and the lower the leaching requirement. Conversely, fairly saline water can be used on crops if enough extra is provided to accomplish the necessary leaching. Proper irrigation management takes into consideration water quality and the required leaching to maintain a satisfactory salt balance that either establishes a steady state condition balancing incoming salt and salt being leached beyond the root zone, or else actually reduces the soil's salt level. If the balance is unfavorable the salt level will eventually increase, forcing the abandonment of agriculture in the area, a process that may have destroyed the fertility of the "cradle of civilization" in the Tigris and Euphrates river valleys.[1]

Applying more water to crops to prevent the buildup of soil salinities can in turn create additional problems of water management. The water, carrying salts with it, has to go somewhere, meaning that drainage must be considered as well. Water can collect underground until the water table is elevated sufficiently to damage crops by waterlogging or it can flow through the soil to emerge elsewhere. It has been estimated that without drainage San Joaquin Valley water tables rise to the danger level some 10 to 20 years after the initial application of irrigation water, necessitating some sort of corrective action. Drainage ditches can carry off some of the excess water but subsurface systems are often a more efficient means of lowering the water table beneath a field and permanently removing salts. Underground drains are usually constructed of tile "pipes" buried in lines perhaps eight or ten feet deep at intervals determined by soil structure. Drainage, whether collected in underground tile drains, by surface ditches or drainage wells, or naturally seeping through porous soil layers, must be disposed of and unless a regional collection facility is in operation, the excess water will find its way eventually to a river or some other outlet. South of the Delta the San Joaquin River is the ultimate drainage ditch for its basin, washing saline water into the southern Delta where it has become an increasingly serious water quality problem.

Taken overall, the San Joaquin River basin itself has a favorable salt balance, in that at the projected 1990 level of development 1.5 million tons of salt would be added to the basin annually, but an estimated 2.3 million acre-feet of drainage water would carry 2.4 million tons of salt out of the valley. If these salts and drainage flows continued to reach the San Joaquin River, the quality of water available to farmers dependent on the river for irrigation might be severely impaired. At the south end of the Central Valley is the Tulare Basin, hydrologically distinct from the San Joaquin River and without any natural outlet for drainage. By 1990 some 1.6 million tons of salt could be added to the closed basin every year, posing a serious threat to the continued development of agriculture in that region.[2]

Water quality investigations in the San Joaquin Valley began at the request of irrigators on the valley's West Side drawing water from the San Joaquin River just south of the Delta. A cooperative investigation was undertaken by the Department of Water Resources, the Banta Carbona Irrigation District, the West Stanislaus Irrigation District, and the Patterson Water Company in 1955 when those districts became alarmed at the apparent decline in the quality of the San Joaquin River. Even before water project development, degradation of the river in that area occurred as a result of natural brines and West Side tributaries that, though low in volume, were high in salt content. Ground water from Tracy to Firebaugh on the West Side averaged 871 ppm TDS, with 114 ppm chloride, certainly not high quality water.[3] More interesting, however, were the tables prepared as a result of the joint study showing average quality levels in the San Joaquin River, and how they had been affected by the operation of the Central Valley Project after the Delta-Mendota Canal went into operation in 1951, and other developments that reduced outflows from tributary streams. Improvements in quality north of Fremont Ford can be attributed to inflows from higher quality east side streams.

	Pre-1951		*1951-1954*	
San Joaquin River	*TDS*	*Cl*	*TDS*	*Cl*
source	*37*	*3.4*	*31*	*2.8*
Mendota	*44*	*3.4*	*100*	*27*
Fremont Ford	*434*	*123*	*597*	*190*
Hills Ferry	*356*	*83*	*549*	*121*
Grayson	*399*	*104*	*534*	*107*
Maze Rd.	*294*	*82*	*416*	*103*
mouth	*297*	*76*	*317*	*78*

(All values are ppm; Cl is chloride)[4]

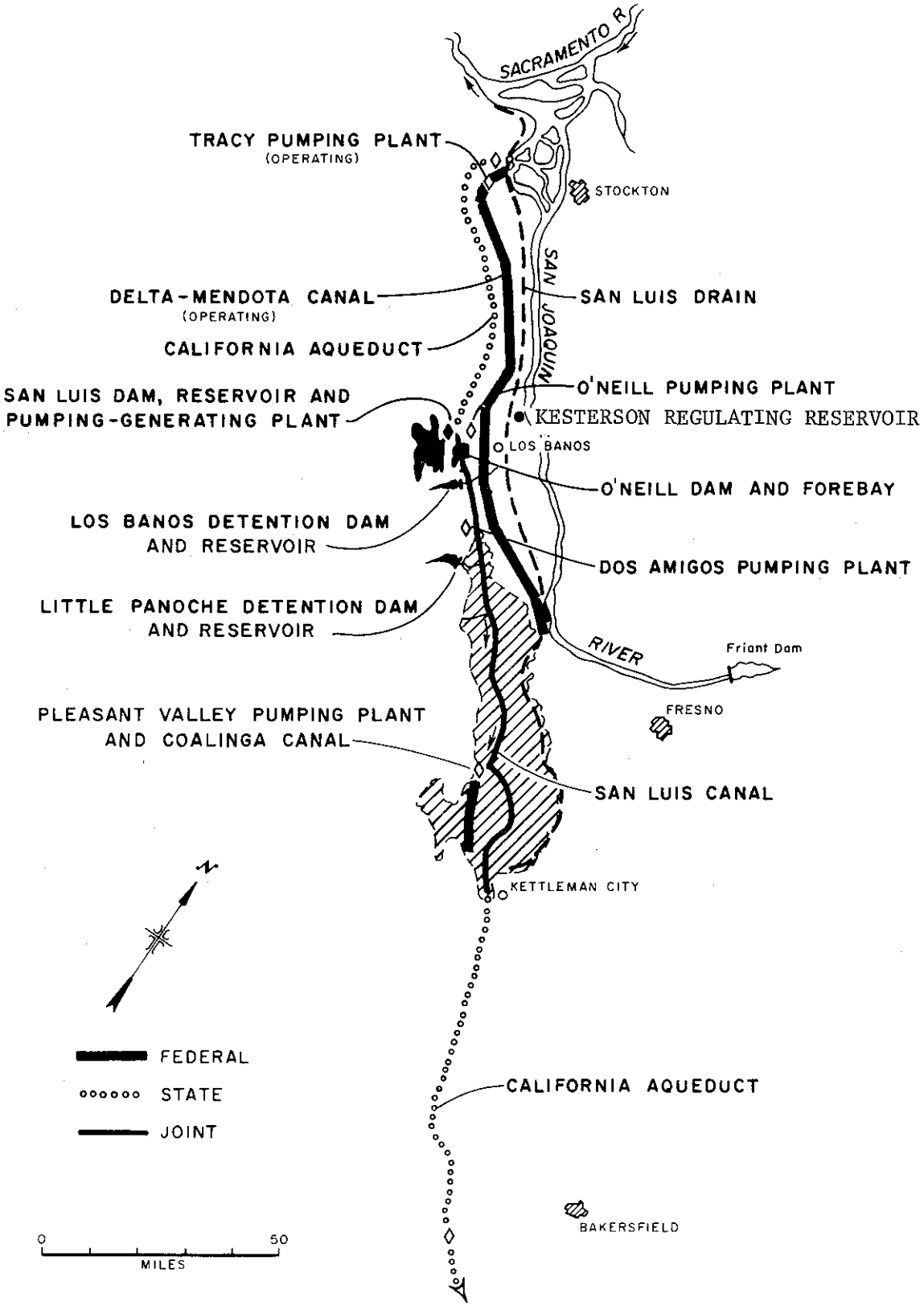
	1955-1959	
Station	*TDS*	*Cl (ppm)*
Near Friant	*35*	*3.2*
At Mendota	*291*	*65*
At Fremont Ford	*691*	*232*
Near Newman (Hills Ferry Bridge)	*622*	*169*
Near Grayson	*520*	*142*
At Maze Road Bridge	*435*	*119*
Near Vernalis (Durham Ferry Bridge)	*332*	*100*
At Mossdale	*461*	*112* [5]

The Central Valley Project had dammed the San Joaquin River at Friant where it leaves the foothills of the Sierra Nevada and diverted it through the Friant-Kern and Madera canals to serve irrigation districts on the east side of the San Joaquin Valley. With little water remaining in the river it was necessary to import Sacramento River water in exchange for the upstream diversions. The Delta-Mendota Canal was designed to empty into the Mendota Pool on the San Joaquin River after serving farms on the West Side, and releases from the pool have been made to maintain a minimum level of river flow. In fact, river management and imported water meant that more water was available in the San Joaquin River than would have been present had users continued to exploit the limited natural supply. Despite the stabilization and enhancement of water quantity, the Central Valley Project had a negative effect on water quality. The deleterious effect of the Delta-Mendota Canal on San Joaquin River quality was anticipated before it went into operation. Consulting engineer Thomas H. Means wrote to the manager of the Hetch Hetchy water system on February 27, 1947, that:

> *The effect of this canal will be to increase the return seepage into the San Joaquin River from the lands on the west side. This water will come from the canal and lateral percolation from new areas irrigated . . . the deep percolation from irrigated lands and unlined lateral canals is apt to be a potent source of future trouble.*[6]

Recognition that drainage and river modification had created a water quality problem in the river, and by extension on the West Side as a whole, prompted research into the matter. The Department of Water Resources initiated a comprehensive San Joaquin Valley Drainage Investigation in 1957 in the wake of hearings on drainage and water quality by the Joint

SAN LUIS UNIT
AND RELATED FEATURES



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San Luis Dam and the O'Neill Forebay are part of both the Central Valley Project and the State Water Project. San Luis Reservoir stores water diverted from the Delta during the winter when irrigation demand is low. Water is then released later in the year to serve water contractors in the Central Valley and southern California. In addition to the reservoir, a portion of the California Aqueduct known as the San Luis Canal is jointly operated to serve both the Central Valley Project's San Luis service area and the State Water Project customers further south. (DWR photo)

Legislative Committee on Water Problems established to examine the California Water Plan. As a result of the Department's studies and the increasing magnitude of the problem, the Burns-Porter Act authorizing construction of the State Water Project specifically allowed the Department ot build "facilities for removal of drainage water from the San Joaquin Valley."[7]

At the same time the Bureau of Reclamation was contemplating expansion of its West Side service areas through construction of San Luis Reservoir. The San Luis Unit, first proposed in 1955, received congressional authroization for construction as a joint-use facility with the State Water Project in 1960. Included in the authorization was the requirement that construction of the unit could not begin until provision had been made for a drain from the San Luis service area to the Delta, or until the Secretary of the Interior had received assurances that the state would construct its contemplated master drainage facility and make it available to the federal irrigation project. The necessity of drainage was thus recognized, but instead of allowing drainage water to further pollute the San Joaquin River, Congress stipulated that the river was to be bypassed in favor of an outfall at the western edge of the Delta.[8]

Meanwhile, water quality in the San Joaquin River deteriorated to the point that irrigation with river water became hazardous for some crops. The salinity problem that had first been noticed in irrigation districts on the West Side of the river in the early 1950's had resulted in salinities occasionally approaching 500 ppm TDS, but the dry years of the early 1960's that increased reliance on irrigation and reduced dilution flows sent quality plummeting to near the 1,000 ppm TDS level in the Banta-Carbona and West Stanislaus irrigation districts and the Patterson Water Company. For water users, the increased salinity meant that water management would have to be monitored more closely, often including expensive laboratory tests, and more water would have to be applied to provide adequate leaching. In an effort to dilute available low quality water, some districts purchased water from the Bureau's Delta-Mendota Canal to mix with the more saline San Joaquin supplies, though doing so increased costs appreciably. In 1961, the Banta-Carbona Irrigation District bought 35 percent of its water from the Bureau, and the West Stanislaus district also made heavy purchases, while the Patterson Water Company was prevented from using much canal water by the design of its delivery system. Increased costs for orchardists on the West Side from the mouth of the Merced River north to the Durham Ferry Bridge were estimated by consultant Warren Schoonover to be from $5.00 to $15.00 per acre, while alfalfa and row crop growers escaped heavy additional expenses by virtue of the high volumes of water usually appied to those crops that automatically provided ample leaching.[9]

A FEDERAL DRAIN OR A STATE DRAIN? -- The necessity of providing drainage for the valley having been established beyond a reasonable doubt, the question remained of what to do with the agricultural effluents. Two principal alternatives existed to the continued use of the San Joaquin River as a drainage channel. The first of these envisioned the creation of one or more salt sinks in the valley where drainage could be collected, in a manner similar to the Salton Sea, an accidental lake in the southern California desert maintained by inflows of agricultural drainage from the Imperial Valley. The utility of sinks or evaporation ponds as a solution to the drainage problem was limited by the enormous acreages required and the problem of disposing of the concentrated brines that resulted. The other potential answer to the drainage riddle was to convey it out of the valley in a gravity canal to the natural and ultimate salt sink: the ocean. It was the latter alternative that Congress had adopted in the San Luis authorization, and the plan favored by the Department of Water Resources for its own proposed master drain. In 1961, the Department was forced to admit that its own planning efforts were not sufficiently advanced to guarantee that facilities would be ready to receive drainage from the San Luis Unit as soon as those services might be required. In a letter to the Bureau of Reclamation on June 21, 1961, the state advised the federal agency to proceed alone with the planning and construction of a drain to serve only the San Luis area.[10] The Bureau did begin planning but it failed to move fast enough to satisfy a group of landowners and irrigation and drainage districts on the West Side. On December 20, 1962, they filed suit in federal district court seeking injunctions against construction of San Luis Dam on grounds that irrigation of the project's service area without assurances of adequate drainage could injure their lands. The Bureau responded in January, 1963, that it was in the process of analyzing alignments for the drain, while the Department of Water Resources filed a friend-of-the-court brief in favor of the Bureau's position. Immediate relief was denied by Judge M. D. Crocker of Fresno on July 15, 1963, but he informed the plaintiffs that if no drain were constructed, and they were threatened with injury by unregulated drainage from the San Luis Unit, they could once again bring the matter to the attention of the court.[11]

During 1963, the Bureau was able to announce that construction of the promised drainage facility would begin in 1966 with completion to the Delta scheduled for 1968. The Department of Water Resources, meanwhile, had continued its own attempts to meet drainage needs throughout the San Joaquin Valley, but engineering a physical system proved far less difficult than establishing the necessary institutional basis to assure repayment of state expenses. The cost of the drain, as in all state water developments, was to be repaid by the project's beneficiaries. Because to finance it entirely by user charges might make it uneconomical for the individual farmer, it was decided to consider the creation of special tax districts in the San Joaquin Valley because even the valley's urban areas depended on the maintenance of agricultural productivity.[12] The Bureau of Reclamation avoided a similar problem in the San Luis Unit because it was also the water supplier, and could simply attach a charge, estimated at 50 cents per acre-foot, on water delivered to offset the additional cost of drainage. San Joaquin Valley legislators were critical of the Department's area-wide financial program, but notwithstanding legislative skepticism, the Department felt that by late 1963 it was once again ready to discuss cooperation with the Bureau. In March, 1964, the Department announced publicly that a 290-mile long drainage canal stretching from Bakersfield to the Antioch Bridge and costing $75 million, would solve the drainage problem of the entire San Joaquin Valley.[13] William Warne, Director of Water Resources, discussed California's plans with federal officials in Washington, D. C. and found them receptive to the idea that the Department and the Bureau should cooperate on a drainage program. On April 3, 1964, the Department indicated that it was now in a position to offer assurances that a state facility would be available to drain the San Luis Unit, followed on June 22, 1964, by a formal statement to the Secretary of the Interior guaranteeing that drainage from the new federal service area could be accommodated in the master drain scheduled for first stage completion from Kettleman City to the Delta by July 1, 1970. With these assurances, the Bureau could avoid construction of its own smaller capacity drain.[14]

Assurances of early construction by any agency soon proved to be illusory. Contra Costa County, where the drain would empty into the western Delta, objected strenuously to the addition of saline drainage flows full of nitrogen from fertilizers and perhaps residues from pesticides to its fresh water supplies. As a result of vigorous opposition to the drain, a meeting was held in Washington, D. C. on March 4, 1964, presided over by Assistant Secretary of the Interior Kenneth Holum and attended by the congressmen from Contra Costa County and the San Joaquin Valley, Senators Engle and Kuchel, Water Resources Director William Warne and Bureau of Reclamation Regional Director Robert Pafford. Of the problems discussed at the conference, the matter of joint or separate drains for federal and state agencies was most easily resolved in favor of a single master drain. However, a mutually acceptable solution of what to do with the water after it had been collected remained elusive.[15] At the request of Assistant Secretary Holum, the Bureau released a summary of alternatives to the Antioch outfall, including two so-called dilution plans. The first of these required a conduit from the drain to Sack Dam on the San Joaquin River with a reservoir nearby to allow the drainage to be released into the river either continuously or intermittently for periodic flushing. The second alternative, known as the Salt Slough dilution plan, would have stored drainage for 11 months in a 7,000 acre-foot reservoir for release when high river flows would provide maximum flushing and dilution. In addition to these plans, evaporation ponds could still be provided either in the grasslands, a marshy, saline wildfowl habitat north of Los Banos, or in local evaporation ponds located near the areas in need of drainage. Bureau officials were unenthusiastic about any of these alternatives while San Joaquin Valley interests pronounced all of them unacceptable because they either failed to completely remove salt from the valley or continued to use the San Joaquin River as a drain.[16]

The Contra Costa County Water Agency remained vocally opposed to any drainage discharge in the Bay-Delta system capable of contaminating the county's offshore water supplies, although unregulated drainage was already entering the Delta from the San Joaquin River. On April 27, 1964, the Agency issued an "emergency report" warning that the fresh waters of the Delta were "gravely threatened"[17] by the drains proposed by the Department of Water Resources and the Bureau of Reclamation. Supervisor Edmund Linscheid, chairman of the county Board of Supervisors and ex officio head of the Water Agency, stated that, "These waste drainage waters are unfit for irrigation, and they are a potential menace to public health, wildlife, and recreation resources throughout the entire Central Valley-San Francisco Bay drainage basin."[18] The report argued that farm drainage should be carried to tidal waters, "as far westward from the Delta as possible."[19]

The year 1964 witnessed a flurry of interest in the master drain and its potential effects, summarized in a report to the legislature in January, 1965, by the state Senate Permanent Fact-Finding Committee on Water Resources, chaired by Senator James Cobey of Merced.

Contra Costa County had continued to attack the project, with supervisor Mel Nielson calling it "the greatest present threat to the beneficial use of tidal waters east of Port Chicago."[20] Also in opposition was the Association of Bay Area Governments and the U. S. Public Health Service, because they feared that inorganic nitrogen wastes from the drain might combine with population growth, reductions in Delta outflow and further filling of San Francisco Bay to lower the Bay's capacity to assimilate additional sewage and industrial wastes. In defense of the project, the Department and the Bureau pointed out that while initial drainage salinities might be approximately 6,500 ppm TDS, the leaching of accumulated salts would eventually reduce the concentration to 2,500 ppm TDS. Because the drain would be built in stages, with the first section extending only to Kettleman City and carrying a maximum flow of 400 second-feet, it would be many years before the ultimate capacity of 900 second-feet was reached, and the opportunity existed to modify the system if early operations proved it advisable.[21] The California Department of Fish and Game took an essentially neutral viewpoint characterized by Deputy Director Harry Anderson as "cautious optimism" tempered by concern over the future of wildfowl habitats in the Central Valley being maintained by existing brackish drainage flows.

After reviewing the controversy and testimony it had heard the committee, with the exception of Senator George Miller, Jr., of Contra Costa County, concluded:

> *The evidence before this committee indicates that the discharge of the proposed joint drain into the bay area will probably, at the worst, be a relatively minor addition to the bay area's pollution and, at best, a negligible one. Furthermore, the bay area is presently receiving about two-thirds of the agricultural waste water from the Central Valley, and the initial discharge of the drain in quantity does not equal that of one oil refinery in the Richmond district.*
>
> *At the moment no more than mere possibilities of significant damage to the quality of the receiving waters appear to exist, and even at full capacity 20 years hence the discharge of the drain cannot be considered as a probable major cause of pollution in the bay area.*[23]

Opponents had argued, with the support of the Public Health Service, that the threat of pollution from a drain dumping into the Bay system at Antioch was real enough to justify a five-year delay to provide time for a comprehensive study of Bay Area water pollution in general. They felt that the study would prove that at least the drain should be redesigned to discharge in the vicinity of Port Chicago and perhaps ought to be removed from the Bay altogether. Rather than choosing exclusively between construction and further study, the committee decided to compromise.

> *In view of these circumstances and in view of the urgent and critical need for drainage facilities in certain areas of the San Joaquin Valley now and upon completion of the federal San Luis Project, in the committee's opinion, the wisest and soundest course for both state and federal governments would be to press forward with all possible speed in the immediate construction of the joint drain with appropriate safeguards for the delta receiving waters and also with the immediate initiation of comprehensive studies of the total bay-delta pollution problem.*[24]

The committee made two other observations of interest. They noted that although the controversy over the drain had grown bitter, the debate had kindled interest in a regional approach to the pressing problems of water pollution, from whatever source derived, and in 1965 the legislature responded to those concerns by directing that a comprehensive study of pollution in the Bay-Delta estuary be undertaken and a master water quality control plan formulated. The task was subsequently entrusted to the Kaiser Engineers under the guidance of the State Water Resources Control Board. The committee also speculated that the possibility of federal funding for 60 percent of first stage construction could permit deferring the creation of special assessment districts to repay state expenditures. The federal share and user charges could total 75 percent of the initial cost, with water project bonds available to meet the remaining 25 percent. Local taxation would become necessary to pay for the second stage of the drain, or in the event that the drain terminous had to be relocated downstream from Antioch. The committee warned that many citizens of the San Joaquin Valley who would be asked to help pay for the drain did not yet understand the necessity for the expense, so that unless a public education campaign preceded special district formation, the proposed agencies might meet formidable local opposition.[25]

Bay Area congressmen failed to appreciate the sense of urgency that motivated the committee to endorse the master drain and the new year of 1965 found five of them introducing a bill in the House of Representatives to restrain the Bureau from starting construction on its drain until investigations of its pollution potential were completed.[26] An editorial in the San Francisco Chronicle on January 8, 1965, endorsed the attempt to delay federal construction or participation in any drainage scheme, and noted that a similar bill in the past session had gone to its death in the House Rules Committee. To keep the Bay from becoming a "cesspool for valley pollutants"[27] the paper urged that the new bill be more seriously considered. In case the House Rules Committee did attempt to repeat the previous year's action, the five congressmen also asked President Johnson to drop the San Luis Drain from the federal budget. The President complied with their request in January, 1965, while at the same time asking for a $300,000 appropriation to enable the U. S. Public Health Service to examine the environmental effects of the drain.[28] The drain, whether state or federal, had met its first major setback.

Regardless of the President's budgetary decision, the drain project was still very much under consideration. The California Water Commission, for example, heard consultant Warren Schoonover tell them that drainage was going to enter the Bay in any event, the question was whether "It will come down to the bay in a disorderly, dangerous fashion in the creeks and streams, or it will come down in an orderly fashion through the drain."[29] The Water Commission was convinced by these and similar arguments and recommended that the drain not be delayed while concurrent studies of its impact were undertaken. However, they warned that the studies should not become a "vehicle for delay."[30] The Bureau of Reclamation, too, disliked the prospects of delay and requested a supplemental appropriation to begin construction. The battlefield moved temporarily to Washington, D. C., where a delegation of Contra Costa County representatives appeared to plead before the House and Senate appropriation committees for postponement of any funding for the drain.[31] They were met by California Resources Secretary Hugo Fisher, speaking in favor of the project, and urging the legislators not to be swayed by the claims of conservationists and Bay Area interests. The members of the Senate's Subcommittee on Air and Water Pollution took an attitude similar to that of the California legislative committee that favored simultaneous study and construction. As subcommittee chairman Senator Edmund Muskie said, "It seems to me that we can do both things -- proceed with the building and go ahead with the studies."[32] On the other side of the Capitol, the House Appropriations Committee voted to provide $2 million for work on the San Luis Drain, though construction to Antioch was prohibited until the completion of environmental studies.[33] The Bureau could construct facilities south of Los Banos in the interim period, using a holding reservoir to collect drainage until a means of final disposal was approved, although the small appropriation was insufficient to make any real progress in construction.

The investigation of the drain's effect on the Bay-Delta system had been entrusted to the Federal Water Pollution Control Administration, with work beginning in 1965 and culminating in a comprehensive report released in January, 1967. In its report, the Administration discussed the impact of a federal-state San Joaquin master drain as then planned; a facility capable of discharging a maximum of 900 second-feet of drainage, or up to 500,000 acre-feet per year by the year 2000. The study's conclusions seemed to conditionally endorse the project.

> *1. The planned discharge of the joint State-Federal San Joaquin Master Drain to the Delta near the City of Antioch would not have significant adverse effects on the quality of waters of the San Francisco-Bay Delta system if adequate pollution control measures are employed. Without such measures, economic losses would become significant by 1980 and possibly as early as 1974 when the Peripheral Canal is scheduled to go into operation.*
>
> *2. The nitrogen content of the Master Drain waters would, if discharged untreated at Antioch, stimulate the growth of large quantities of planktonic algae and other aquatic plants in the receiving waters. The presence of these plants in great density would have significant adverse effects upon the fishery of the Bay-Delta system. Their presence would also significantly reduce the recreation and aesthetic value of these waters and increase costs associated with their use for boating, navigation, industrial cooling, and other purposes. The monetary value of those detrimental effects for which costs can be estimated is placed at $11 million annually.*

3. Augmentation of Delta outflow would be relatively ineffective in reducing losses attributable to the nitrogen content of drain waters.

4. The detrimental effects due to nitrogen in the drain waters could be prevented by treatment which would keep the nitrogen content of the receiving waters from exceeding 2 mg/l.[34]

Fertilizer-derived nitrogen thus emerged as the most dangerous pollutant, while dissolved salts leached from valley soils would have consequences that varied with the net Delta outflow. If the 1,500 second-foot level deemed sufficient by the Bureau of Reclamation were maintained, the receiving waters would actually be more saline than incoming drainage, so that San Joaquin Valley effluents might even improve water quality in the Antioch area. The Administration assumed, however, that despite Bureau estimates to the contrary, 3,000 rather than 1,500 second-feet would be required to meet the November 19th criteria for water quality. At that outflow the drain would increase the salt concentration of western Delta agricultural water supplies and cause an estimated $1 million worth of damage annually.[35] The frequently expressed fears that the drain would dump large quantities of pesticide residues into the estuary proved to be groundless, because the proposed master drain would collect only sub-surface tile drainage, where pesticide levels were reportedly no higher than in the Delta receiving waters. While surface runoff from irrigated fields could be relatively contaminated by hazardous chemicals, water collected from drainage tiles had been effectively filtered by the soil where residues remained trapped. If the drain's terminous were relocated westward in the Bay system, the detrimental effects of its salt content would be virtually eliminated but only marginal mitigation of nitrogen impacts could be expected. While studies were underway on the treatment and removal of nitrogen, the federal report advised partial construction of the drain, to a point where it could be directed toward the Delta or the ocean depending on the outcome of the investigations. The anticipated slow buildup of drainage demand would allow for storage of the brackish effluent until a final decision could be reached.

STILL NO SOLUTION -- Not long after the Federal Water Pollution Control Administration report's cautious approval of the drain, the Department of Water Resources came to the conclusion that it would be unable to proceed with the project. Originally, it had been assumed that in line with the Governor's principles for repayment, 75 percent of the drain's capital cost would have to be covered by contracts before construction could begin. With total costs estimated at $24.00 per acre-foot of drainage, contracts would have been for $18.00 per acre-foot, a figure that found no acceptance in the San Joaquin Valley. However, if the federal government assumed responsibility for 50 percent of the total capital costs the water users would have to contract for only $6.00 per acre-foot. The response to an offer by the Department for drainage services at that rate elicited an enthusiastically affirmative response. Unfortunately when the incoming Reagan administration examined the financial status of the State Water Project, it was found that the available bonds were insufficient to cover even 25 percent of the capital costs of drainage.[36] Accordingly, the Department informed the Bureau on March 10, 1967, that it was withdrawing the assurances offered in 1964 that a state facility would be available to handle drainage from the San Luis Unit.[37] The Department formed a San Joaquin Valley Drainage Advisory Group in early 1967, made up of valley agencies, to review the now-stalled master drain plan and develop repayment methods acceptable to local interests. The advisory group made its final report in 1969, finding that the most efficient means of disposal was still by canal to the Delta; unfortunately, their repayment plan was less definitive, recommending "some combination of toll charges, taxes, and government funds."[38] The Department of Water Resources phased out its drainage investigations in 1969 and 1970, except for cooperation with the Bureau of Reclamation and the Environmental Protection Agency in wastewater treatment studies being conducted at the Firebaugh research station.

In February, 1967, the interests that had sued the Bureau in 1962-63 over the failure to provide drainage facilities returned to court charging that with water deliveries in the San Luis Unit ready to begin no drain had yet been constructed. In a trial held before Judge Crocker in December, 1967, and January, 1968, the Bureau reaffirmed its intent to build a drain, while arguing that only 1,500 acres outside the San Luis Unit would be damaged by drainage from the unit. The new suit was dismissed in May, 1973.[39]

The seesaw course of federal-state cooperation had now tossed responsibility for compliance with the San Luis authorizing legislation back into the Bureau's lap. They had, of course, already put considerable effort into planning a San Luis Interceptor Drain as well as participating in cooperative investigations with the Department of Water Resources.

Following the state's abandonment of plans for early construction of its own facility, Bureau Regional Director Robert Pafford described the drain as a canal initially running north from Tranquility 55 miles to Kesterson Reservoir, a holding lake to be located near Salt Slough east of Gustine. The first stage was to be completed in 1969, with expansion southward to Kettleman City by the end of 1970. It was estimated that no discharges into the Delta would be necessary before 1971, with interim drainage stored at the 14,000 acre-foot Kesterson facility.[40] The buildup of demand for drainage collection and removal was predicated on the installation of on-farm tile drains, and that in turn depended on the pace of construction of water distribution systems in the San Luis Unit and economic decisions made by individual growers. As events developed, the Bureau's 1967 schedule assumed a far more rapid buildup of demand than actually occurred. By 1974, the San Luis Drain was about 77 percent complete from Kesterson to Kettleman City, and a revised timetable called for construction to Kettleman City beginning about 1977, and from Kesterson to the Delta about 1981, though that schedule too could be subject to delay.[41]

In a report on the status of the drainage program in December, 1974, that marked a resurgence of state interest in the problem, the Department of Water Resources once again reviewed the alternatives to discharge into the Delta. Salt sinks could be created in the valley itself or in the Carrizo Plain southwest of the San Joaquin Valley or the Panoche Valley in the Coast Ranges west of Fresno, but each of the plans designed to evaporate drainage water had limited capacity, involved substantial pumping costs, and would result in the accumulation of concentrated brines. Ocean disposal at Cayucos on the central coast or at Monterey Bay had been examined and rejected because of the high costs entailed in conveying water across the mountains, leaving gravity drainage to the Delta as the most feasible plan although the price had risen to a total of about $250 million. Objections to disposal at the Antioch site were being met, at least partially, by continued research. The Federal Water Pollution Control Administration report had indicated that drainage salinity might not be a major problem and the Kaiser Report two years later concluded that:

> *In general, the effects of the San Joaquin Agricultural Drain on the western Delta range from slightly beneficial at low net Delta outflows of say 3,500 cfs or less, to a condition of essentially negligible effect at higher flows. . . . In terms of TDS and chlorides, the results of this investigation support the acceptability of the Drain discharge location at Antioch.*[42]

The earlier federal report had determined that nitrogen rather than salt could be the major hazard associated with a drainage discharge, but the Kaiser Engineers found that nitrogen was already abundant enough in the Delta to allow algae blooms if some other limiting factor, such as light availability, did not inhibit growth. Following the release of the Federal Water Pollution Control Administration report in 1967, the Administration (later part of the Environmental Protection Agency), the Bureau of Reclamation and the Department of Water Resources initiated a cooperative research program at Firebaugh to develop methods of nitrogen removal and desalination. Nitrogen removal experiments utilizing several different methods have proven successful, but implementation of any of them must await proof that the expense of treatment is actually justified. Experimental desalination has also been successfully achieved at Firebaugh with up to 90 percent recovery of fresh water, but application of the techniques to drainage water remains uneconomical.

In 1975, another effort at federal-state cooperation, the San Joaquin Valley Interagency Drainage Program, was inaugurated in hopes of finding "the most environmentally sound, politically acceptable, cost effective, and lasting solution to San Joaquin Valley agricultural drainage water management problems."[43] The program will continue to study, and even emphasize, alternatives to Delta disposal, including the recycling of agricultural drainage to produce more water for the chronically dry San Joaquin Valley, though no satisfactory means of disposing of the unwanted brines has yet been suggested. In the summer of 1976, the Bureau of Reclamation signed an agreement with Pacific Gas and Electric to consider the use of drainage water in nuclear power plant cooling, based on an estimated supply of 50,000 acre-feet of drainage per year by 1990; a quantity sufficient to cool a single 1,000 megawatt nuclear plant.[44] The usefulness of drainage water in cooling applications will depend on plant siting, the degree of pretreatment necessary for the water to be successfully used, and the costs of handling the brines that will collect as water is evaporated. There are, in other words, uses for the water derived from drainage, but no use for the salt carried off with it.

By early 1977, the Bureau of Reclamation had not yet collected any drainage from the San Luis Unit, although a substantial portion of the drain was in place and some 1,300 acres of the eventual 4,700 acres at the Kesterson site had been prepared. The slower than anticipated buildup in demand for drainage could be traced primarily to the retarded development of distribution systems to bring project water to farms in the service area. Until collector drains are connected to the main drain, Kesterson will continue to be operated as a waterfowl habitat by the U. S. Fish and Wildlife Service part of the year and drainage from the unit will be recycled until unusable and eventually find its way into the San Joaquin River.[45] Many of the subsurface tile drainage systems presently installed in the San Joaquin Valley are north of the San Luis Unit near Dos Palos and Mendota, where drain water is delivered to the Grasslands Water District for use on grazing lands and duck ponds. Other drainage in the San Joaquin Basin as far north as the Delta is routed into the river, while in the Tulare Basin, the Tulare Lake Drainage District has built a small evaporative disposal system and has plans for another. The ultimate solution to the San Joaquin Valley drainage problem seems to remain as elusive as ever, but until a plan that is acceptable to all the diverse interests in the valley and Bay Area can be evolved, the southern Delta will continue to be the recipient of salts carried downstream by its source of "fresh" water.

NOTES

1. A convenient source of basic information is the U. C. Cooperative Extension Service pamphlet, Salt Management: California's Most Complex Water Quality Problem, June, 1974.
2. DWR, Bulletin No. 127-74, Status of San Joaquin Valley Drainage Problems, December, 1974, p. 9.
3. DWR, Interim Report, Lower San Joaquin Valley Water Quality Investigation, October, 1956, p. 53.
4. Ibid., p. 55.
5. DWR, Bulletin No. 89, Lower San Joaquin Valley Water Quality Investigation, December, 1960, pp. 116-117.
6. Ibid., p. 73.
7. Burns-Porter Act, 1959, cited in Bulletin No. 127-74, p. 3.
8. San Luis Authorizing Act, (P. L. 86-488), cited in Bulletin No. 127-74, p. 3.
9. Warren R. Schoonover, Quality of Water, Central Valley Project, California, A Report on Water Quality in Lower San Joaquin River as Related to Agriculture, USBR, October, 1963.
10. Bulletin 127-74, p. 3.
11. California Senate Permanent Fact-Finding Committee on Water Resources, Progress Report of the Legislature, 1965 Regular Session, The San Joaquin Valley Drain, pp. 17-18.
12. San Francisco Chronicle, February 15, 1963.
13. San Francisco Chronicle, March 9, 1964.
14. Bulletin 127-74, pp. 3-4.
15. Progress Report to the Legislature, 1965, pp. 15-16.

16. Ibid., pp. 16, 21, and USBR, Alternative Solutions for Drainage, San Luis Unit, CVP, February, 1964.

17. San Francisco Chronicle, April 28, 1964.

18. Ibid.

19. Ibid.

20. Progress Report to the Legislature, 1965, p. 27.

21. Ibid., pp. 18-20.

22. Ibid., p. 26.

23. Ibid., p. 8.

24. Ibid., p. 9.

25. Ibid., pp. 9-10.

26. San Francisco Chronicle, January 5, 1965.

27. San Francisco Chronicle, January 6, 1965.

28. San Francisco Chronicle, January 26, 1965.

29. San Francisco Chronicle, March 6, 1965.

30. San Francisco Chronicle, April 3, 1965.

31. San Francisco Chronicle, May 18, 1965.

32. San Francisco Chronicle, June 16, 1965.

33. San Francisco Chronicle, June 18, 1965.

34. Federal Water Pollution Control Administration, San Joaquin Master Drain: Effects on Water Quality of San Francisco Bay and Delta, January 1967, p. 5.

35. Ibid., p. 6.

36. Telephone conversation, Louis Beck, Director, San Joaquin Valley Interagency Drainage Program, and Alan M. Paterson, February 28, 1977.

37. Bulletin 127-74, p. 4.

38. Ibid., p. 38.

39. Ed Price, USBR, memorandum, April 11, 1977.

40. Robert Pafford, "The San Luis Drain," before Bay Counties Water Problems Committee, April 28, 1967.

41. Bulletin 127-74, p. 7.

42. Kaiser Engineers, San Francisco Bay-Delta Water Quality Control Program: Final Report to the State of California, June, 1969, p. XVIII-13.

43. San Joaquin Valley Interagency Drainage Program, Program Review Report, March, 1976, p. 1.

44. Stanislaus County Farm Bureau News, October 20, 1976.

45. Telephone conversation, Ed Price, USBR, with Alan M. Paterson, February 24, 1977.

XIII. The Peripheral Canal and the Environment

THE DAWNING OF THE AGE OF ECOLOGY -- In early 1965, the Peripheral Canal was well on its way to becoming the Cinderella story of the Delta. Its rapid emergency and nearly universal acceptance gave project engineers the feeling that at long last a satisfactory solution had been found to the problems inherent in cross-Delta water transfers and large-scale diversions. The warm glow of apparent success was, however, destined to fade and, as Cinderella's carriage turned into a pumpkin and the horses into mice, the Peripheral Canal would turn into one of the bitterest points of contention in the long and contentious history of Delta water development.

The two water project agencies, the Department of Water Resources and the Bureau of Reclamation, wasted no time in implementing the Interagency Delta Committee's recommendations. A little over a year after the January, 1965, report endorsing the Canal plan had been released, state and federal conferees had reached tentative agreement on cost-sharing provisions and had concluded that the project should be ready for operation by 1974. In early 1966, the Department and the Bureau sponsored five public hearings in the project area to gather local suggestions on the canal alignments then under consideration by a joint work group.[1] Despite day-to-day teamwork and undeniably amicable intentions, there were some potentially serious cracks in the facade of interagency harmony. California, for example, was willing to see the Bureau design and construct the Peripheral Canal, but insisted that the state's Department of Water Resources should operate the facility so that it could be incorporated into the computer system being designed to control the California Aqueduct. Although the precedent for federal construction and state operation had been established at the joint-use San Luis Project, the Bureau of Reclamation, with more water in storage and greater delivery commitments than the State Water Project, seemed reluctant to envision state control of a Delta facility.[2] The Department of Water Resources was, however, in a somewhat better position than its federal counterpart, because it was at least legally empowered to build a canal around the Delta. The Department took the position that the Peripheral Canal could become the Delta facility authorized, but not defined, in the 1959 Burns-Porter Act and on May 16, 1966, it issued Project Order No. 12 officially adopting the Canal as a part of the State Water Project. For the Bureau of Reclamation to participate in the scheme in any way would require direct congressional authorization.

While it was cooperating to the limits of its legal ability in planning the Canal, the Bureau had set in motion the administrative machinery of federal authorization by producing a preliminary, but never publically released, feasibility report by the spring of 1966. At the same time, California officials were doing their utmost to supplement Bureau initiatives and secure congressional permission for the agency to become a full partner with the state in the project. In June, 1966, the Director of Water Resources, William Warne, met with a number of California congressmen in Washington, D. C. to urge early federal action on the Delta facility, and late in that congressional session, Congressman John McFall of San Joaquin County introduced legislation authorizing participation on terms similar to those applied to the San Luis Project.[3] No action was taken before adjournment, but it was reported that the staff of the House Interior Committee was preparing a similar bill for introduction at the next session. During December, 1966, the Department sponsored briefings for California congressmen in Los Angeles and Sacramento to emphasize the importance of federal action on the Delta program.[4] The next actual attempt at authorization came in May, 1967, when Representative Craig Hosmer of Long Beach proposed a bill to approve both the Peripheral Canal and the Kellogg Project, but that effort ended in failure as did an attempt almost a year later by Senators Murphy and Kuchel to authorize only the Peripheral Canal. Because Canal backers were unable to secure the necessary congressional mandate, William Gianelli, the new Director of the Department of Water Resources, announced on July 7, 1967, that preliminary design work on the project would be deferred to obtain still more time to seek federal participation.[5]

Even though the Bureau of Reclamation still could not share in the project, the Department of Water Resources was working to secure right-of-way for the proposed Canal. The Interagency Delta Committee had pointed out that since much of the Canal route would parallel the planned Interstate 5 freeway in San Joaquin and Sacramento counties, dirt excavated from the Canal could be used as freeway fill, reducing costs to both projects. In January, 1968, the state Departments of Water Resources and Public Works executed an

agreement whereby the transportation agency would advance $2 million for the purchase of Canal right-of-way in San Joaquin County to be repaid by the Department of Water Resources when construction on the Canal began, or no later than January 1, 1976. A $5 million saving was anticipated as a result of the cooperative pact, and in September, 1968, a similar agreement extended the same provisions to sites in Sacramento County. In the event that Canal construction lagged more than three years behind dirt removal for the highway project, the Department of Fish and Game would stock and maintain the borrow pits as a warmwater fishery until work on the Canal was ready to begin. The Department of Water Resources, however, still hoped to avoid long delays and planned to meet the 1974 completion schedule.[6]

Opposition to building the Canal still emanated primarily from Contra Costa County, where congressional inaction had done nothing to temper local anxieties. The County viewed the hydraulically-isolated Canal as an all-too-efficient means of capturing fresh water for export to southern California, and one that would relieve the operating agencies of any necessity of maintaining high quality water in Delta channels. The estimated minimum outflow with the Canal in operation would be only 1,500 second-feet; enough to meet the November 19th agricultural water quality criteria but not enough to protect industrial water users in the western Delta. On that point, of course, state engineers were in complete agreement, but they insisted that it would be far cheaper, and more efficient in terms of water use, to provide a substitute overland supply to areas deprived of salinity protection. The Department's reports in the early 1960's on the waterway control plan as well as the Interagency Delta Committee's recommendations had all favored alternative water supply programs, like the Kellogg Project, western Delta agricultural facilities, and Solano County aqueducts. They argued that to increase outflow sufficiently to maintain no more than 1,000 ppm chloride at Antioch, six miles down stream from the November 19th control point at Emmaton, would require and additional 1,500 second-feet of flow supplied from half-a-billion dollars worth of new upstream storage at an annual cost of $25 million. By comparison, the estimated annual cost of overland facilities and industrial cooling system modifications to permit the use of more saline water was between one and one-and-one-half million dollars, depending on the extent of the agricultural water supply system.[7] Contra Costa County vigorously asserted that such mitigation measures would be inadequate, imposing an intolerable curb on economic growth through higher costs and restricted water supplies. The threats perceived to the present and future well-being of the county from the more closely controlled management of Delta outflows and accelerated export diversions that could be accommodated by the Peripheral Canal prompted a maximum effort to stop construction of the proposed facility.

What the Department of Water Resources and the Bureau of Reclamation on the one hand, and Contra Costa interest on the other, were arguing over were essentially competing economic uses of water. In the simplest terms, water could either be committed to enhance or protect Contra Costa's offshore supply or it could augment southern California's existing and potentially inadequate water resources and irrigate portions of the San Joaquin Valley, but not enough existed to fully satisfy all the ultimate demands of both uses. Although only about 2.5 million acre-feet of the 8.5 million acre-feet that might be ultimately exported from the Delta was destined for delivery south of the Tehachapis, Contra Costans, like District Attorney John Nejedly, charged that their own area was being sacrificed to overdevelop southern California.

> *'There has been a ruthless and brutal disregard of the effect of these tremendous exports on the existing economy of the Delta and Bay region. The tremendous havoc that will be visited upon the Delta is being carried forward simply for the bland and selfish purpose of Southern California land development. It seems inconceivable that the people of California will stand by and permit the ruin of an existing fruitful economy to make possible desert real estate profits south of the Techachapis.'*[8]

Seen in those terms the matter was really no more than an extension of the ongoing debate over the most beneficial use of a scarce resource, carried on, as it always had been, in primarily economic terms. But whereas competing and mutually exclusive consumptive uses had once been all that was at issue, the emergence in the late 1960's of a widespread interest in the environment compelled the recognition and protection of noneconomic and nonconsumptive uses of fresh water in the estuary to maintain a satisfactory natural setting. It was assumed by environmentalists that major reductions in outflow would upset the delicate balance of the estuarine life zone, and because the Peripheral Canal was designed as a diversion facility potentially capable of redirecting large quantities of water away from the Delta, they came to regard the plan as environmentally unsound or at best, suspect.

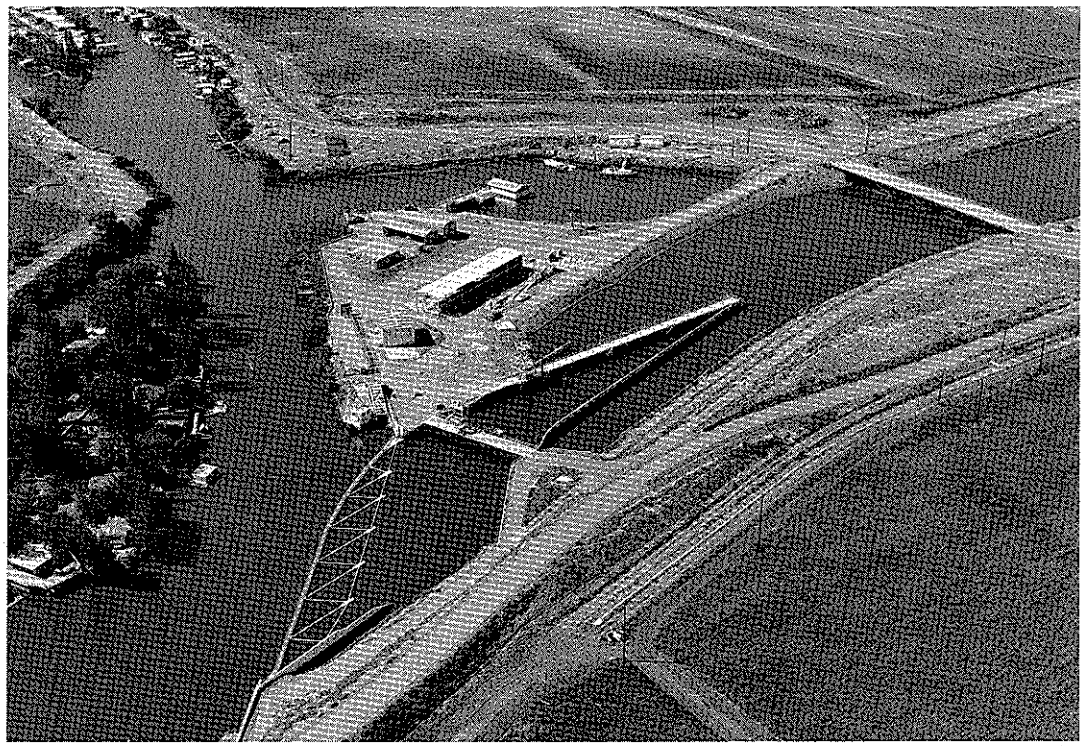
Lodging such arguments against the Peripheral Canal was not without its irony since it had been adopted at least partly on the basis of its "intangible" benefits, among them the project's capability of protecting the Delta fishery. More than any water development program that came before it, the Canal seemed to embody environmental considerations, and yet it was to bear the brunt of attacks on water management policies in the Sacramento-San Joaquin Delta.

Despite the slowly building crescendo of criticism, the California Department of Fish and Game remained loyal to the Peripheral Canal concept as the most reasonable means of accommodating water transfers to the needs of the fishery. Writing in the July/August, 1968, issue of Outdoor California, George Warner, chief of the Delta Fish and Wildlife Protection Study, reiterated the Department's position.

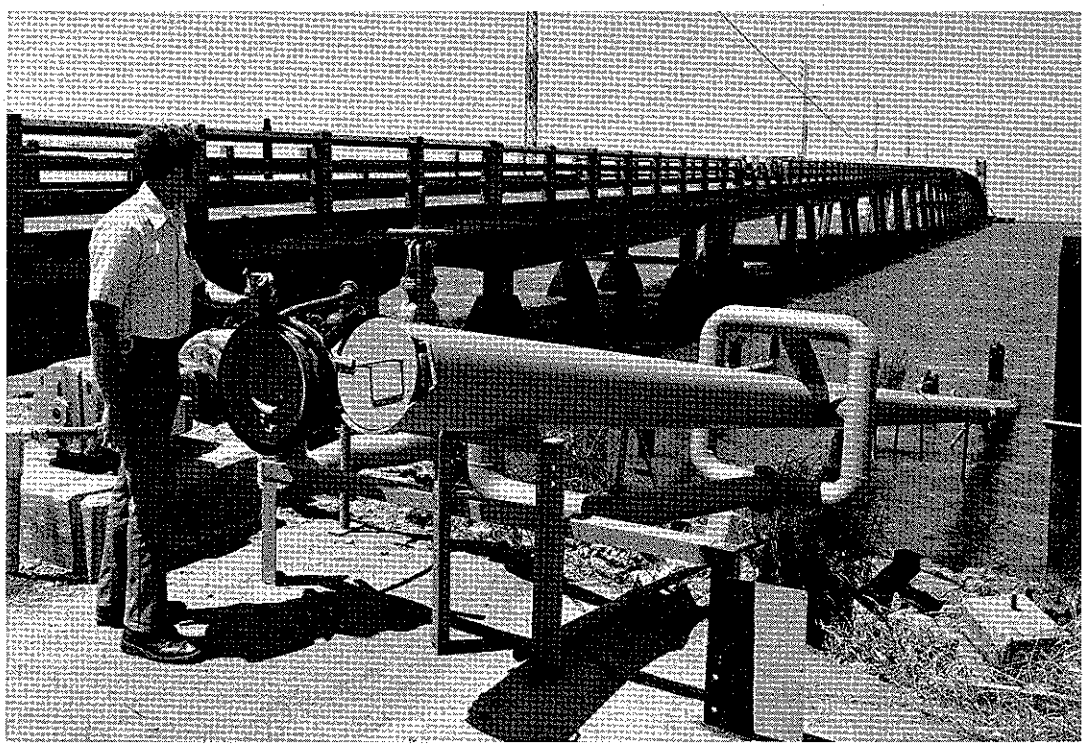
> *The momentum generated by overwhelming public support for the Peripheral Canal Plan at the Water Commission hearing has diminished largely because of the delay in obtaining authorization and funding for federal participation in the project. The Vietnam situation and resultant cutbacks in federal spending for water projects has not provided a favorable climate for a Peripheral Canal bill.*
>
> *Many of the groups which supported the Peripheral Canal Plan are concerned over the delay in project implementation and over conflicting reports regarding the ability of the project to meet delta water requirements and to protect fish and wildlife resources. They are asking such questions as: 'Does the Department of Fish and Game still recommend the Peripheral Canal Plan?' or 'Are earlier statements that the Peripheral Canal can be designed and operated to protect the delta fishery still valid?'*
>
> *. . . Although interim fish protection measures are being implemented, the only real solution to these problems is the construction of the Peripheral Canal project.*[9]

Assurances from the Department of Fish and Game failed to convince Canal opponents that the Canal might not have unforeseem effects as bad or worse than the detriments it was supposed to correct. The Canal could, according to its antagonists, degrade the Delta environment, and they could point to a federal study on the impact of the proposed San Joaquin Valley drain to support their case. Although the Federal Water Pollution Control Administration report of January, 1967, had neither condemned nor defended the Peripheral Canal, it did observe that when the Canal was completed, San Joaquin River flows laden with nitrogen from agricultural drainage would no longer be picked up by project pumps and recirculated back to the valley. Instead, the water, and the nitrogen, would remain in the Delta, where it might encourage algae blooms that were as harmful to fish life as they were aesthetically obnoxious.[10] Citing evidence of possibly harmful effects, and basically suspicious of any large-scale alteration of the existing scene, the environmentalists joined Contra Costa County in opposition to the Peripheral Canal. The coalition was, at first glance, improbable in view of Contra Costa's long tradition of dedication to a developmental philosophy, but in fact, the similarities in demands for the maintenance of high outflows, whether for industry or wildlife, made the marriage of convenience a logical one. It was an association that the Contra Costa County Water Agency did much to encourage through the recruitment of expert witnesses able to identify the dangers involved in increased diversions and the Peripheral Canal. Oceanographer Joel Hedgpeth of Oregon State University, zoologist Charles Goldman and engineer Ray Krone of the University of California, Davis, fishery expert Fred Tarp of Contra Costa Community College, and hydrological consultant Bernard Smith were all part of a team assembled by the Agency to testify before the State Water Resources Control Board when it held hearings beginning in July, 1969, into the imposition of water quality conditions on appropriation permits granted to the Department of Water Resources and the Bureau of Reclamation.[11] Although the Peripheral Canal was not specifically under consideration, the experts from Contra Costa County were on hand to define the kind of water quality they felt was needed and protest any detrimental alterations.

At the Sacramento hearings as well as in newsletters and press releases, official testimony and impromptu arguments, an environmental critique of the Peripheral Canal emerged emphasizing that more study would be needed before the full impact of flow modifications could be reliably predicted. There was, however, already enough knowledge available for the critics to warn of the dangers that could conceivably result from further tampering with the Delta environment. Outflow reductions were certain to result in increased salt water intrusion that might severely limit Neomysis abundance or inhibit striped bass spawning in



Tracy Fish Collecting Facilities, Central Valley Project. Fish screens prevent as many fish as possible from being drawn into the Tracy Pumping Plant. The fish are collected and transported by tank truck to near the mouth of the San Joaquin River at the Antioch Bridge where they are returned to the river. The design of fish screens for the proposed Peripheral Canal has proven difficult because of the greater volume of water involved and the intention to screen smaller fish and larvae. Environmentalists fear screening at the Canal will prove inadequate, while project engineers feel that it may prove more efficient than present facilities. (USBR photos)



the San Joaquin River. The Canal might not, according to its enemies, even save the fish it was intended to protect, because it relied on fish screens of untested design and size for the intake, as well as the curtailment of Canal pumping when the striped bass larvae floated down the Sacramento River in the spring. Although salmon would find positive downstream flows in all channels, it was claimed that some Sacramento River salmon might be guided by their olefactory senses to the Canal outlets releasing water from the Sacramento into the central or southern Delta. Even the hoped-for purification of dead-end sloughs by Canal releases could backfire by altering the environment to the detriment of resident fish species. Even more subtle, but perhaps more serious, problems could result from diverting a major portion of the Sacramento River into an isolated man-made channel. It was assumed that silt being transported by the river would be diverted in the same proportion as the water that carried it, thereby reducing the silt load and turbidity of Delta channels. Although cleaner looking water might seem appealing, the greater transparency would allow light to penetrate deeper and increase the euphotic zone, the level where phytoplankton or algae growth can take place. As a result of these changes, and the much lower velocities in interior channels no longer needed to convey water to the pumps, algae blooms might become more likely. Not only could blooms be unpleasant to humans but sudden population explosions of algae could be matched by equally rapid die-offs, with decomposition demanding so much of the available dissolved oxygen that fish could be suffocated. Aside from the possible stimulation of algae growth, researchers worried that increased transparency might deprive some species of the protective gloom that shielded them from predators, and the depletion of fresh water flow might deprive diatoms, the most abundant species of algae in the Delta, of the silica necessary for their survival, and so permit other forms of phytoplankton to increase in relative abundance.[12] As portrayed by its opponents, the Peripheral Canal was a potentially awesome instrument of environmental mayhem, but the project agencies worked to refute the skeptics and despite the onslaught maintained their faith in the Canal as a useful and flexible tool for preserving the Delta in the face of increasing demands on its water resources.

At about the same time that environmentalist opposition to the Peripheral Canal was growing more strident, the project received new endorsements from federal and state officials. In May, 1969, the Bureau of Reclamation released a feasibility report on the Canal, based on the Regional Director's report of September, 1968, and including his recommendation that the Canal be approved by Congress. Capacity of the Canal's initial reach, from the Sacramento River to the Canal pumps, was increased to 26,800 second-feet to accommodate a 5,000 second-foot diversion to the proposed East Side Canal via the Hood-Clay Connection. Delta releases and basic operational criteria were essentially unchanged from earlier projections, although in his letter of transmittal to the Secretary of the Interior, Commissioner of Reclamation Floyd E. Dominy amended the Regional Director's report to reflect recalculations that set 1,800 second-feet as the minimum outflow required to meet the November 19th criteria. The Bureau agreed with the Department of Water Resources that it was more efficient to supply the western edge of the Delta through overland systems rather than guarantee outflows high enough to permit direct diversion from the channels. The Federal Water Pollution Control Administration had already indicated that it had no particular objection to the Peripheral Canal but warned that the resulting modification of Delta hydrology could affect compliance with adopted Delta standards. In order to insure that the facility would be operated to protect beneficial water uses in the Delta as defined in federally-approved water quality criteria, the Administration recommended that specific operational water quality objectives be included in the congressional authorization of the Canal. To comply with that request, Commissioner Dominy stated his intention to withhold the feasibility report from Congress until the criteria had been reviewed following joint studies by the Bureau and the Administration.[13]

After revising the figures supplied by the Regional Director, the Commissioner listed total annual benefits of Peripheral Canal operation at $16,855,000, with construction costs estimated at $208,922,000. When the costs were computed on an annual equivalent basis they totalled $10,743,000, giving a benefit-cost ratio of 1.38 to 1. Over $6 million of irrigation benefits were estimated from the elimination of 490,000 tons of salts that would otherwise be delivered to San Joaquin Valley farmers each year. The reduction in salinity content would permit more recycling of agricultural runoff and lessen the demand for master drainage facilities. Municipal and industrial water users supplied from the California Aqueduct and Bureau canals would receive an estimated $3 million in annual benefits stemming from less saline water. Recreational benefits were expected to exceed $2 million a year, even with some potential sites along the Canal left undeveloped. The resident fishery benefits were valued at $3 million, while anadromous species would receive up to $1.7 million worth of annual enhancement if releases from San Joaquin Valley storage reservoirs were properly

managed.[14] In a report appended to the feasibility study, the U. S. Fish and Wildlife Service admitted the Canal by itself could not restore the San Joaquin anadromous fishery, but it was a prerequisite to the success of any such plans. In endorsing the Canal, the Service assumed that an efficient fish screen could be developed and it recommended that at least 1,500 second-feet of flow be maintained in the Sacramento River below Hood, though it considered the previously suggested net outflow of 1,500 second-feet adequate.[15] On the whole, the feasibility report reflected the general, if at times conditional, approval, of the Peripheral Canal by federal administrative agencies.

Following publication of the report, the Commissioner of Reclamation requested the views and recommendations of the State of California on the document. To no one's surprise, the Department of Water Resources concurred in the basic conclusions of the favorable Bureau of Reclamation report. Testifying before a joint meeting of the Senate and Assembly water committees on September 17 and 18, 1969, Department Director William Gianelli announced that the Bureau's benefit figures were too low because they failed to take into consideraton the money saved by not building dams needed to provide outflow in lieu of a Canal. Gianelli estimated those additional water conservation benefits to be worth an annual equivalent of at least $15 million that boosted the total benefit-cost ratio to 2.6 to 1.[16] Another endorsement of the Canal had been included in the Kaiser Engineers' June, 1969, report on Bay-Delta water quality, though their estimates of flows necessary in the Sacramento River below Hood and net Delta outflow were considerably higher than those used by the Bureau and the Department.[17]

In the fall of 1969, the legislative committees made their reports on the Peripheral Canal as proposed by the Bureau's feasibility study. The Assembly Committee concluded that:

> *After evaluating the facts before us, it is the judgment of this Committee that the Peripheral Canal, properly operated, will not only enable the State of California and the Bureau of Reclamation to deliver high quality water to their respective service areas on a continuing basis, but will make possible the protection and enlargement of the Delta's valuable fishery resources, the maintenance of high quality water in the Delta including higher water quality in numerous Delta channels, and the protection of the Delta environment.*[18]

An equally positive endorsement came from the Senate Committee on Water Resources.

> *. . . While some might disagree that the issue of inclusion of the canal is resolved, it must be apparent to all that it is essential, and the only real issue before this Committee was whether it is desirable to have federal assistance for a joint federal-state facility to serve both the needs of the Central Valley Project and the State Water Project, while assuring adequate protection for present and future water and environmental conditions in the Delta area . . .* [19]

Both committees urged that authorizing legislation should order the Bureau to observe whatever water quality criteria the State Water Resources Control Board chose to adopt, because as the Assembly report noted, the Bureau lacked authority under existing law to release stored water to meet quality standards unless a contract for that purpose had been signed with a local agency. The legislators also felt that the problems of Suisun Marsh had not received enough attention in the feasibility report, though that area would need some sort of mitigation as Suisun Bay salinity increased.

Testimony from those opposed to the Canal had also been heard by the legislative committees but "few but vocal opponents"[20] had failed to convince the members that "irreparable harm"[21] would result from Canal operation. Opposition once again came almost exclusively form Contra Costa County, an area that, as the committee reports noted, had always opposed any water transfer plans. Contra Costa Senator John Nejedly filed a minority report congratulating the Senate committee for its good intentions, but expressing considerable doubt that the Canal would actually be operated in the way the legislators hoped. He called, as had other Contra Costa representatives, for more study of the Delta and the Canal before allowing its construction.[22]

CHICKEN LITTLE AND OTHER STORIES -- Warnings of algae and fish kills in the Delta as a result of the Peripheral Canal was really only the tip of the environmentalist iceberg, for underlying them was a philosophy at odds with the fundamental premises that had guided water development in California and elsewhere. The environmental movement possessed an iconoclastic attitude toward the traditional virtues of progress and technology that seemed to involve the ever more complete control or alteration of the environment. In the words of Assemblyman George Milias, "We have everything to lose from blind progress"[23] and to some environmentalists water development must have seemed one of the blindest forms of progress. Applying the principles of biological ecology to water planning, the critics stressed that all development was interconnected; that a canal in the Delta might profoundly influence the north coast, the south coast, and the entire Bay Area as well as the immediately affected region. Assertions that the basic economic, social, and political justifications for water development may have been defective in their inability to judge the cumulative effects of the projects on the natural and human environments drew a barbed response from Director of Water Resources William Gianelli. In a speech to the Irrigation Districts Association on December 4, 1969, he warned that Californians must not "fall into the quagmire trap of Chicken Little emotionalists" who he claimed "are trying to fabricate and promote the idea that the Project [SWP] is bad for the environment."[24] While defending water projects as bestowing great benefits, the Director admitted that the environment was in need of some protection. "We have created one disaster," he warned, "Let us not create another by swinging the pendulum of our demands too far in the opposite direction."[25] Although he did not specifically name Contra Costa County, he castigated critics who insisted the Peripheral Canal would lead to the degradation of San Francisco Bay and charged that they were "lying to the public by trading on public emotions for selfish profit."[26] Contra Costa Senator John Nejedly was quick to respond to Gianelli's "Chicken Little" speech by urging Governor Reagan to fire the Director of Water Resources, but the Governor's aides rejected the idea and reaffirmed the administration's faith in Gianelli.[27]

Of course, not all opposition to large-scale water development could be traced strictly to a concern for California's environmental health. Contra Costa County, for example, sought to defeat the State Water Project in 1960 largely out of fear that its own development might be jeopardized. That attitude carried over into opposition to the Peripheral Canal, for in the words of Congressman Jerome R. Waldie, "The Peripheral Canal is the key to, and the heart of, the whole program. Without that facility, the entire water diversion flounders, and properly so."[28] In late 1969, Waldie and others formed a new group, the Save the Delta Association, consisting of public officials, businessmen, and sportsmen "drawn together by a common love of the Delta region and concern for its future."[29] The organization had pretensions to permanence but its foremost goal, and perhaps reason for existence, was opposition to "the potential devastation of the Delta environment by the proposed Peripheral Canal."[30] Congressman Waldie, the Canal's most vocal critic, was named honorary co-chairman along with San Joaquin County Supervisor Gary Wiler, while Stockton attorney Tom Zuckerman became acting chairman. The group seemed to reflect Contra Costa County's long-standing objections to water transfers in general, for at a meeting of the new association on January 2, 1970, Waldie told the sympathetic gathering that the Canal would place the Delta "faucet" in the hands of the Metropolitan Water District of Southern California and by extension under control of southern California's electoral majority and its representatives. "The issue," the congressman told them, "is political -- not engineering."[31]

The onset of an election year made the issue even more blatantly political. Formerly Assembly Speaker and candidate for the Democratic gubernatorial nomination Jess Unruh might have been expected to endorse the State Water Project, including the Peripheral Canal, as a boon to his southern California constituents and a legacy from a previous Democratic administration. Instead, Unruh aligned himself with the environmentalists against the Canal, perhaps hoping to ride the rising tide of enthusiasm for the "ecology." In a speech in Richmond toward the end of 1969, he declared:

> *Despite all of its rhetoric about the need to put conservation first, this State Administration today is very close to giving its formal approval to the much-debated Peripheral Canal, the vast water diversion project that would pump fresh water from the Sacramento River and deprive Bay Area farms, industries and sportsmen of the priceless resource.*
>
> *. . . As far as residents of Contra Costa and other counties surrounding the delta are converned, it may well mean the creation of a salt water wasteland stretching from the Carquinez Straits to Stockton on the east and Rio Vista on the north.*[32]

While Waldie had recruited several of his colleagues in the California congressional delegation to oppose the Peripheral Canal, making favorable federal action unlikely, Unruh teamed with Republican Senator John Nejedly in an attempt to block the Canal in the California legislature. In January, 1970, Nejedly introduced SB 187, a bill to prohibit the Department of Water Resources from spending any money on the Canal unless specifically approved by the legislature, but the preponderance of southern California votes made passage unlikely.

The environmentalist attack on the Peripheral and the entire State Water Project took a bizarre turn on February 2, 1970, when San Francisco dressmaker Alvin Duskin placed a full-page advertisement in the San Francisco Chronicle, the Examiner, and the Los Angeles Times entitled "Alcatraz, the Bay, Water and the Imminent Death of California." Using similar tactics, Duskin had helped halt the sale of the former federal prison on Alcatraz Island but when he wanted to turn "The Rock" into a bird refuge, worries that the birds might be deprived of an adequate food supply by the stagnation of San Francisco Bay, led him into a crusade against the California Water Plan. The ecological activist charged that after diversions to southern California were extracted, Sacramento River outflow would drop to a mere two million acre-feet annually, and that in a dry cycle "the plan might well lead to the drying up of the Bay."[33] Just as important to Duskin as the direct environmental perils of the project was the encouragement its water supplies gave to growth in a state already plagued by too many people and choking on its own air pollution. Coupons addressed to Governor Reagan, candidate Unruh, Congressman Waldie, Water Director Gianelli and Duskin himself were included in the ad, to be sent by readers as evidence of widespread opposition to the water project. The one directed to the Governor, for instance, urged that he not support the Peripheral Canal or the California Water Plan but instead to investigate a "stabilized"[34] California economy to avoid developing a copy of the "gigantic East Coast industrial mess which so many Californians came here to avoid."[35] The coupons began appearing on the addressees' desks a couple of days after the advertisement appeared, and Jess Unruh, noting that 2,000 of the clippings had already arrived, took advantage of the occasion to once again condemn the Peripheral Canal.[36] Unruh's attacks and the generally accelerated campaign against the State Water Project prompted another Democrat, former Governor Edmund G. Brown, to defend the Canal as a necessary unit in the water project he had been instrumental in launching. At a news conference, Brown expressed his concern over the "campaign of selfish property owners in Contra Costa County who are trying to block the Canal."[37] However, it was obvious that anti-Canal sentiment had spread beyond Contra Costa County. A week after his plea appeared in the newspapers Alvin Duskin reported the receipt of over 24,000 coupons and he estimated that the Governor had received over 30,000.[38] As it turned out, Reagan's staff was not adding up what Executive Secretary Edwin Meese III called the "silly coupons."[39]

Before the Governor could arrive at a decision on the Peripheral Canal in response to the Bureau's feasibility study, two major conservationist organizations took positions opposing further water development. Friends of the Earth led by activist David Brower, called for a moratorium on all construction and referred to the California Water Plan as a "conceptual and environmental catastrophe" that would "degrade the north to desecrate southern California"[40] by encouraging pollution-causing growth. The evolution of a policy by the Sierra Club had been more cautious, and as late as April, 1969, a technical subcommittee had endorsed the Canal if it was guaranteed that the facility would be operated in a manner that would protect the environment.[41] However, in December, 1969, the Club urged Governor Reagan to reject the feasibility report before him until comprehensive studies could be undertaken on the effects of the project. Although the Sierra Club had not categorically opposed the Canal, its February, 1970, report on the California Water Plan left no room for doubt that it was philosophically opposed to the developmental ends the Canal was meant to serve.

> *California Water Plan. The Sierra Club has long questioned the wisdom of constructing great water transfer systems that are founded on a narrow concept of land and water use. Nearly all such systems have arisen from the application of a simplistic formula: to provide for massive collection, storage, and distant transfer of water for its 'proper' use, subject only to conventional tests of engineering and economic feasibility, and geared and designed to long range projection of uses that in a narrow sense are proper.*
>
> *Such systems are devised with inadequate understanding of their overall consequences and with little regard for the emerging land-use ethic, which recognizes that man must, for his own survival, place himself in better balance with his total environment. They constitute, by virtue of their*

massive manipulation of the most vital of all resources, a dominating force that blindly governs the pattern of land use and population, and that tends irresistably to fulfill its own projections of population and 'proper' use. . . .

We contend that the California Water Plan, the State Water Project, and the Central Valley Project (federal) are such water systems; that they are narrowly conceived and unresponsive to new goals and values society is fast adopting to insure its own survival. We believe they will hasten the deterioration of the state's natural environment, irretrievably destroy the remaining natural North Coast water courses, threaten the integrity of the Bay-Delta estuarine system, and force upon the land patterns of use that are unwise and irremediable. We believe further that these systems as conceived will aggravate the grave problem already confronting major population centers by needlessly stimulating their growth.[42]

Some observers had expected Governor Reagan to delay either endorsing or rejecting the Bureau's report until after the November, 1970, elections, although the Governor had indicated informally that he favored the Canal in November, 1969.[43] The state's formal response to the feasibility study was contained in a letter from Norman Livermore, head of the Resources Agency, to Interior Secretary Walter Hickel, dated April 28, 1970, that reaffirmed California's official commitment to the Peripheral Canal.

Federal authorization of the Peripheral Canal Project is critically needed for both the conservation of the Delta's fishery resources and environment, and to firm up authorized export water supplies of the federal Central Valley Project and the California State Water Project. The state strongly urges early authorization and construction of this project. . . [44]

In an effort to placate opposition from Contra Costa and other Delta interests, Livermore promised that the Delta would receive first priority in years of deficient supplies.

. . . if there is not adequate water in the Delta to meet any water quality criteria which will be established by the Water Resources Control Board and to meet any requirements under an agreement which would be reached with the Delta interests and the Department of Water Resources and the Bureau of Reclamation, then the federal and state export projects would be required to assume any such shortage of supply, and the Delta area would have a prior right.[45]

If the Canal were not built, the Resources Secretary predicted a decline in the Delta fishery as the inevitable result of increasingly severe flow reversals, pump losses, and higher velocities in some channels. Because construction of the isolated transfer system seemed so imperative, Livermore recommended that the Commissioner of Reclamation reconsider his decision to withhold the report from Congress pending completion of water quality studies. Interim criteria had already been adopted by the State Water Resources Control Board and approved by the federal government, and the time required for authorization, design and construction would provide ample opportunity to complete the necessary research and establish initial operational criteria. Livermore wrote:

The final criteria for this purpose can only be set on the basis of experience gained during a trial operation period. Flexibility must be retained so that conditions in anticipated agreements with the Delta water users and governmental fishery agencies, and in water rights permits, can all be met.[46]

California's response emphasized that the congressional authorization should be conditioned on the requirement that the Delta have first priority on available water supplies and that releases from the Canal would be made to satisfy water quality objectives and Delta contracts. Furthermore, the Bureau of Reclamation should be made subject to State Water Resources Control Board regulation and directed to negotiate with western Delta interests in recognition of its obligation to participate in guaranteeing alternative water supplies. Finally, Livermore advised that continuously updated fish and wildlife information be used to guide operation, and that Delta lands should be exempted from the provisions of the federal 160-acre limitation.

In a statement on April 29, 1970, Governor Reagan added his endorsement to the Canal program, stressing that proper operation of the facility would be ensured by the State Water Resources Control Board. The Governor had recognized, as had the two legislative committees, that if not properly operated, the Peripheral Canal had the potential to damage the Delta environmentally and economically. His approval of the project, like theirs, was predicated on the belief that Canal operation would conform to guidelines established to protect reasonable water requirements in the area.[47] As might have been expected, Jerome Waldie lashed out at Reagan's action, charging the Governor with having made "an absolute political payoff to the people of Los Angeles and the Metropolitan Water District, which will take half the water."[48]

Any encouragement that Canal backers received from the state's official support of the Peripheral Canal project was soon offset by another controversy. In May, 1970, the Menlo Park office of the U. S. Geological Survey released a report on San Francisco water circulation patterns that indicated drastic reductions in Delta outflow might have a deleterious effect on water quality in San Francisco Bay, and particularly in the southern portion. It was theorized that if the south bay were allowed to become stagnant, nutrients derived from urban wastewater could produce algae blooms. Although the report was preliminary in nature, environmentalists quickly seized on it as further evidence of the destructive potential of the Peripheral Canal. The San Francisco Board of Supervisors asked that no construction on the Canal be undertaken until it was certain that its ability to reduce outflow would not harm the Bay, and Congressman Waldie, now joined by south Bay Representative Paul McCloskey, called again for a reanalysis of the State Water Project and the Canal that could, in Waldie's opinion, turn San Francisco Bay into a "dead lake as putrescent and foul smelling as Lake Erie.[49] This was not the first time the issue of Bay quality had been raised and in previous instances the Department of Water Resources had countered fears of stagnation and pollution by arguing that the ebb and flow of the tide was by far the most effective factor in keeping the Bay clean, while the greatest threat was the continued use of the Bay as a disposal site for wastes of all sorts.[50] The Department advised San Francisco to follow the example of San Diego, where a badly contaminated bay without any appreciable inflow had been restored through improved wastewater treatment facilities. In addition, state officials contended that the Geological Survey report was based on conditions during the winter of a wet year, and that river flows dropped off every summer, with or without water project operations.[51] Despite these disclaimers, environmental interests made the possibility that the Canal could contribute to the demise of San Francisco Bay part of their arsenal of arguments against the Delta project.

Environmentalists could do more than testify and protest, they could also sue. The first of the environmental lawsuits to hit the State Water Project was sponsored in part by Alvin Duskin, who declared that "The California Water Project is illegal."[52] The complaint filed on June 16, 1970, by four small farmers from Central Valley Project service areas on the east side of the San Joaquin Valley against the Secretary of the Interior was somewhat less sweeping than Duskin's assertions (Bowker v. Morton). They asked the Federal District Court to declare that the 160-acre limitation on federal reclamation water be extended to the State Water Project because of federal participation in San Luis Reservoir. Damage to California's environment was also charged, and that aspect of the case drew the intervention of the Sierra Club, the North Coast Rivers Association, and a Trinity River landowner, demanding not only imposition of the 160-acre rule but also environmental impact statements covering the Trinity River and San Luis divisions of the Central Valley Project. Following the filing of an amended complaint in April, 1974, the aspects of the case dealing with the impact statement requirements of the National Environmental Protection Act of 1969 were dismissed. An October, 1974, decision that the State Water Project is not subject to reclamation law has been appealed.[53]

Purported violations of the 1899 Rivers and Harbors Act, the Fish and Wildlife Coordination Act, and the National Environmental Protection Act formed the basis of another suit against the Secretary of the Interior and other federal and state officials, filed by the Sierra Club, Friends of the Earth, and three individuals on March 16, 1971 (Sierra Club v. Morton). The plaintiffs charged that the Delta diversion pumps were in violation of requirements that all facilities affecting navigation have permits from the Corps of Engineers, and that the Peripheral Canal, San Luis Drain, and East Side project would also need permits. Judge Charles Renfrew agreed, and on July 28, 1975, he ruled that the two pumping plants and the Peripheral Canal could affect navigation making necessary Corps of Engineers approval. In obtaining the permits, the project operators were further ordered to prepare environmental impact statements for the consideration of the Corps in the

evaluation process. No injunction on current operations was issued and the defendants have appealed, although the Department of Water Resources has also filed permit applications for its pumping facilities in case the appeal fails.[54]

In another development in 1971, the Environmental Defense Fund sued the Secretary of the Interior to force the publication of an environmental impact statement before a proposed coordination agreement could be signed between the Bureau of Reclamation and the Department of Water Resources for the joint operation of their water projects (Environmental Defense Fund v. Morton). The Bureau agreed to draft the necessary document and the case is dormant until the study is ready. In the meantime, less formal annual operating agreements have been exchanged by the two agencies.[55] These and other cases had been aimed at slowing or stopping water resources development, or forcing the projects to comply with a variety of environmental requirements, but regardless of the ultimate outcome environmental litigation has had a marked effect on the evolution of water policy as well as on the pace of construction.

December, 1970, saw two organizations that had previously taken equivocal, though basically hostile, positions on the Canal, pronounce themselves categorically opposed to its construction. The Sierra Club rejected the project completely when they saw no evidence that the water development agencies would be ready to release the minimum 4,600 second-foot outflow the Club had recommended a year earlier.[56] The Delta Water Agency also joined the ranks of the totally opposed, presumably because the best assurance that Delta water quality would be maintained was the use of at least some open Delta channels to convey water to the pumps.

Environmentalist arguments that the State Water Project was as unnecessary as it was unwise seemed to be at least partially confirmed in early 1971, when the Department of Water Resources admitted that population projections of rapid growth in southern California, with a resulting rise in water demand, had been in error. The lower growth rate did not, however, mean a halt in construction of initial units of the project, including the Peripheral Canal, but it was expected to provide a breathing space before additional water developments were needed to augment the yield of Oroville Reservoir. Conservationists expressed dismay at the intention to continue first-stage construction, but did expect that the interim lag would allow the time to develop alternative means of water supply including the desalination of sea water.[57]

Since the release of the feasibility report in 1969, the Bureau of Reclamation had escaped much of the adverse publicity surrounding William Gianelli and the as yet uncompleted State Water Project. Although the Department of Water Resources had been the Peripheral Canal's most conspicuous defender, the Bureau came under fire again in January, 1971. A year earlier, President Nixon had signed the landmark National Environmental Protection Act, a law requiring that before any major federally-supported project was undertaken, an environmental impact statement had to be prepared as part of a process of environmental protection by public scrutiny. The Regional Office of the Bureau prepared a draft environmental impact statement in 1970 and gave it limited circulation within the federal government for comments and suggestions, but did not release it publicly. Congressman Waldie obtained, and released, documents showing that the Bureau's statement had been labelled "generally inadequate"[58] by David Dominick, head of the Environmental Protection Agency's Water Quality Office, successor to the Federal Water Pollution Control Administration. In its statement, the Bureau had complained that misinformation about the proposed project had been widespread and that it would not, despite statements to the contrary, divert any more water than would have been diverted without the Canal. It was, the Bureau wrote, "Strictly a conveyance feature for water which has already been authorized for export."[59] Dominick, however, criticized the Bureau's failure to consider possible alternatives, and was unsure that the Canal could in fact eliminate the adverse impacts of water transfer. Shortly after Waldie's disclosures, Environmental Protection Agency Administrator William D. Ruckelshaus admitted that he too was "seriously concerned"[60] over the effect the Canal might have in reducing Delta outflow. Capitalizing on federal interest in environmental protection in the Delta, the Contra Costa County Water Agency dispatched a 150-page report on the Canal, predictably uncomplimentary, to the President's Council on Environmental Quality.[61]

The local office of the Environmental Protection Agency, wishing to have comments on a Bureau of Reclamation environmental impact statement ready should one be submitted to them for evaluation, prepared a task force report in early 1971 on the Delta and the Peripheral

Canal. It was a strictly preliminary document authored by a four-man team of scientific specialists. The report never moved beyond its original, preliminary stage, and lay unknown until accidentally discovered in 1973 by a student preparing a research paper who turned it over to the Friends of the Earth.[62] The task force report included an outright condemnation of the Peripheral Canal.

> *10. All further water resources development under the State Water Project should be halted until the plan has been thoroughly reevaluated.*
>
> . . .
>
> *24. The Peripheral Canal, as it is now conceived, should not be constructed.*
>
> *25. North coast water development for export should not be allowed. This should apply in particular to efforts to mitigate the adverse environmental effects of the CVP and the SWP, or to supplement their water supply in the Delta.*[63]

The authors cited doubts similar to those voiced by environmental organizations about the Canal's ability to prevent ecological damage as one of the principal reasons for their opposition, while the insufficiency of legal guarantees that satisfactory operational standards would be observed was another. The task force, however, indicated that their frame of reference was vastly different from traditional approaches to water quality problems in the Delta. Under "Other Recommendations" they included:

> *45. The entire Delta island area, encompassing 886 islands, should be acquired on a fee simple basis by the Federal Government, perferably to be administered by the Bureau of Outdoor Recreation, National Park Service or the Fish and Wildlife Service primarily as a recreation, open space and fish and wildlife management area, with limited recreational and agricultural management of some islands and parts of others. It is believed that taking a stand in favor of a development like this will not only fulfill a major future demand by the public for some of the amenities which make life worth living, but also will put the Federal Government in a superior position to regulate land and water use, and to control water quality in the Delta . . .* [64]

How seriously the task force, or their superiors, considered this and other proposals has remained a mystery, but the unpublished report taking an activist position on protection of the Delta was made all the more interesting by the fact that it came from within a federal agency. The environmentalists were no longer exclusively outsiders in the process of policy formation.

Another somewhat unusual critic active in early 1971 was the Right Reverend C. Kilmer Myers, Episcopal Bishop of California. Identifying stewardship of the environment as an important Christian position, the bishop spoke out against the State Water Project and the Peripheral Canal as potentially destructive, using arguments drawn largely from Contra Costa County and various environmentalist groups. Fellow Episcopalian William Gianelli met with Bishop Myers, resulting in a moderation of the churchman's opposition, though it did not eliminate it. Myers still favored a postponement of Canal construction, until doubts about its impact could be resolved and it was truly needed to serve southern California water needs.[65]

That the Canal had been, and would be, delayed was an inescapable fact. Gianelli admitted that at best construction was unlikely before 1974, and with the project stalled, other means of transferring water from the Sacramento River were being explored. Although the start of construction was somewhere in the future, the state had already invested $1.5 million in Canal right-of-way and was prepared to spend another $1.25 million on that purpose in 1973, in addition to the sums spent on designing the controversial waterway. With no progress having been made toward securing a federal authorization, some consideration was being given to a state-only canal, or perhaps a stub canal reaching part way around the Delta.[66] The Canal had not been abandoned by its sponsors, but the environmentalists along with strong political opposition from Contra Costa County had managed to enmesh it in lengthy controversy and tarnish the Cinderella gleam that the project had once enjoyed.

WATER RIGHTS IN AN ENVIRONMENTAL ERA -- On July 22, 1969, the State Water Resources Control Board opened hearings on the salinity and fish and wildlife protection standards to be attached to water appropriation permits previously granted to the State Water Project and the Central Valley Project. When the permits, including those covered by D-990, D-1275 and D-1291, had originally been approved, information on Delta water quality requirements had been insufficient to determine what permanent conditions should be imposed, compelling the Board to reserve jurisdiction until a later date. During 90 days of hearings extending intermittently until October, 1970, and in some 11,000 pages of testimony, the Board heard not only the usual assertions concerning water rights and beneficial economic uses protected by Delta outflows, but for the first time heard from environmental advocates urging that water rights be qualified to require the protection of noneconomic uses of water in the Delta. In reaching its decision, the Board acknowledged a responsibility to protect the public interest as defined in legislative actions reflecting gradually changing public priorities. The California Water Code had been amended in 1957 and 1959 to permit, and then require, the Board and its predecessors to consider the preservation of fish and wildlife and the needs of recreation when acting on water rights applications. In 1959, the enhancement, as well as preservation, of fish and wildlife was made a beneficial use of water, while the Davis-Dolwig Act of 1961 specifically made those activities a purpose of the State Water Project. The advent of water quality control plans required the coordination of appropriation permits with the adopted standards, and finally, the California Environmental Quality Act of 1970, a companion to the national act of the previous year, established environmental protection as a guiding principle in the establishment of all state policy.[67]

Despite the extensive testimony, the Board once again determined that not enough was known about the complex Delta ecosystem to assign permanent conditions to the permits in question. The Board, therefore, in Decision 1379, issued on July 28, 1971, attached interim water quality requirements to state and federal permits, subject to review by July 1, 1978. Decision 1379, the Delta Decision, was a landmark in the history of water management in California in part because the Board observed that "The construction of major water diversion and delivery facilities has been the cornerstone of the prosperity that has been achieved. This prosperity has not been without its side effects and it is necessary to have a balanced program for water enhancement and protection."[68] The "balanced program" adopted by the Board entailed some limitation on water development in favor of environmental considerations, among them the spawning of striped bass and the protection of Neomysis shrimp. In order to protect fish and wildlife and to safeguard western Delta consumptive uses until the completion of overland facilities, the Board set standards requiring a substantially higher outflow than the 1,800 second-foot minimum contemplated by state and federal planners. These outflows were computed by the Board based on the period of time that requirements for a specific use would be the governing criteria.

Municipal and Industrial	*150 days at 4500 cfs*	=	*1,350,000 acre-feet*
Fish and Wildlife	*35 days at 4400 cfs*	=	*308,000 acre-feet*
Agricultural (Blind Point)	*55 days at 2500 cfs*	=	*275,000 acre-feet*
Agricultural (Resolution 68-17)	*125 days at 1800 cfs*	=	*450,000 acre-feet*
	Total		*2,383,000 acre-feet*[69]

By maintaining larger Delta outflows, the Board not only ordered the State Water Project and the Central Valley Project to refrain from reducing flows as drastically as had been planned, but they required releases from storage reservoirs to maintain the specified quality levels. The Department of Water Resources had estimated that an outflow of 1,800 second-feet was sufficient to meet the criteria adopted in Resolution 68-17, using approximately 1.3 million acre-feet annually, but the beneficial uses protected by the Board's decision were expected to require an estimated 2.4 million acre-feet of annual outflow. Though some of the additional water would come from unregulated runoff, such flows were expected to diminish with increasing upstream development. It was predicted that reservoir releases of approximately twice the 100,000 acre-feet annually required to meet Resolution 68-17 standards would be necessary in the immediate future, but under the projected 1990 level of development 400,000 acre-feet of impounded water would be needed in a normal year to achieve the outflow levels ordered by the Delta Decision. For critical years, the Board was unable to determine how much water would be needed to meet the D-1379 criteria, but it was probable that releases twice as great as a normal year would be required.[70]

Although substantial flows were earmarked for municipal and industrial protection by the Board, it continued to insist that an overland supply would be a more economical and reasonable method of water supply than large Delta outflows. The Delta region was senior in

rights to the holders of the appropriation permits, but those rights extended only to the quality and quantity that would have been available without the water projects. However, the matter of vested rights in Delta outflow, so often debated, was not at issue in the present instance.

> *In view of the Board's determination expressed later in this decision that beneficial uses of water in the Delta must be protected in the public interest without regard to whether or not the users have prior vested rights, the legal basis upon which such rights depend is of significance only to indicate to what extent compensation is required for benefits to those rights by virtue of the subject projects.*[71]

To an extent, then, water users were incidental beneficaries of environmental protection in the Delta.

On the Peripheral Canal, the Board took a noncommittal position.

> *The Board takes no position concerning the Peripheral Canal. It believes however that if project deliveries are not to be curtailed in the future, it will be necessary to have either a cross-Delta transfer facility or that arrangements must be made for additional water to augment the combined project yields.*[72]

However, the Board also ordered that "There shall be a positive downstream flow in all principal channels of the Sacramento-San Joaquin Delta including the Sacramento below the proposed Peripheral Canal Intake and the San Joaquin River from the head of Old River to Antioch."[73] If those conditions were to be met either a Peripheral Canal would be needed to separate cross-Delta flows from the natural channels or the pumps that were responsible for the flow reversal problem would have to cease operation.

Reaction to the Delta Decision ranged from stunned disbelief by water service agencies supplied by the projects to jubilation on the part of the environmental interests who sensed a victory in their battle against pell mell development of water resources without consideration of the environmental consequences. Eight petitions were filed asking the Board to reconsider its decision, including those of the Department of Water Resources, the Bureau of Reclamation and the Metropolitan Water District of Southern California. If the Board's decision was not modified the water project operators and their customers claimed the integrity of both the Central Valley Project and the State Water Project would be jeopardized, because less water would be available for delivery than had been anticipated. As a result the projects would either be unable to meet contracted water supply commitments or the construction of new water storage reservoirs would be necessary to augment Delta outflow and prevent project deficiencies. The Board, however, decided to stand by its original interim decision, and on September 16, 1971, agreed to make only technical clarifications. Among them was the admission that until the Peripheral Canal was built the elimination of flow reversals was impossible.[74] The Delta Decision, once appeal to the Board itself had failed, was challenged in court by contractors of the state and federal projects, and the Board was subsequently enjoined from enforcing the conditions in the important ruling.

The imposition of stringent new outflow standards only indirectly affected the Peripheral Canal. Operational guidelines would now have to be modified to comply with the Decision and a pall of uncertainty was cast over federal-state cooperation by the Bureau of Reclamation's insistence that it did not have to submit to regulation by the Board. The Decision, in other words, substantially revised the context of Delta water management.

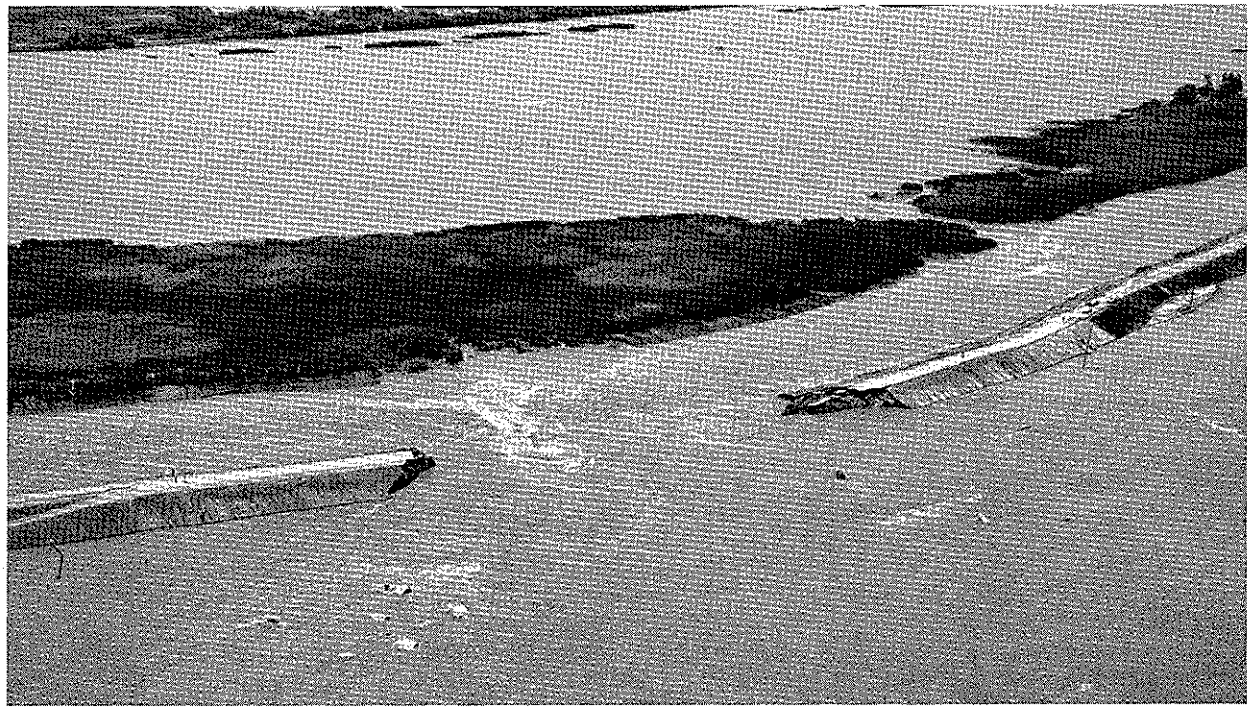
While controversy still boiled around the Delta Decision in October, 1971, the 80,000 horsepower pumps of the A. D. Edmonston Pumping Plant went into operation, boosting the first northern California water over the Tehachapi Mountains. The Sierra Club held a "water wake" to mark their defeat in the battle against the California Water Plan, but they may have had trouble suppressing a smile when the newly-opened California Aqueduct broke near Lancaster, providing an impromptu irrigation for some 1,500 acres.[75] While participants in the struggles over water development faced one another in court over the Delta Decision or watched water flow over the Tehachapis, work continued to define more precisely the water requirements conductive to protection of the Delta environment. The Department of Fish and Game, in cooperation with the Department of Water Resources, planned a program to test striped bass survival under maximum diversion and controlled outflow conditions from mid-May through July, 1972. On April 21, 1972, the Secretary of the Interior terminated the B2 water quality criteria, and outflow was restricted to 4,000 second-feet.

Unfortunately, the experiment ended much more abruptly, and dramatically, than had been anticipated. Early in the morning of June 21, 1972, two sheriff's deputies discovered that the levee separating Andrus Island from the San Joaquin River was crumbling. By 8:00 A.M. water was rushing through a 300-foot wide gap onto the depressed island surface, flooding agricultural land and threatening the town of Isleton on adjacent Brannan Island. The battle to save Isleton by construction of emergency levees failed within 36 hours but the disaster was only beginning to unfold. The rush of water into the islands produced a giant suction drawing sea water into the Delta. State and federal pumps were shut down as soon as the levee broke, effectively doubling outflow, while releases were increased from Shasta, Oroville, and Folsom reservoirs. Three days after the breach, the two islands had been flooded and higher outflows had stabilized the situation in the western Delta, where chloride concentrations at Blind Point had risen from 460 ppm before the break to 2,070 ppm on June 24. By June 29, Delta outflow had risen from 4,500 second-feet to 12,000 second-feet. Although the additional releases did push the salt water back in the Sacramento River, the Delta cross-channel and connecting sloughs were unable to carry sufficient flows to purge the southern Delta. As conditions in that isolated section worsened, the pumps were put back into service on June 30 to remove the salt trapped in the Delta in the only way possible; by exporting it southward.[76] For the Contra Costa County Water District the saline trap posed especially serious problems. Prior to the levee break, chloride levels in Rock Slough had been between 80 and 90 ppm, reaching 150 ppm the day after the break. The U. S. Public Health Service recommended standard for drinking water, 250 ppm chloride, was reached on June 28, and by July 3 the level was at 370 ppm. On July 3, workmen completed modifications to one of the East Bay Municipal Utility District's Mokelumne River Aqueduct pipelines near Antioch to allow 40 million gallons per day of fresh water to pass into the Contra Costa Canal to dilute the highly saline water pumped from the Delta.[77] Finally, on July 4, 1972, salinity peaked in Rock Slough at 440 ppm chloride and then gradually returned to normal. Some 300,000 acre-feet of stored water had been released to battle the unexpected salinity intrusion, and 53,000 tons of additional salts were pulled from the Delta into project canals.[78]

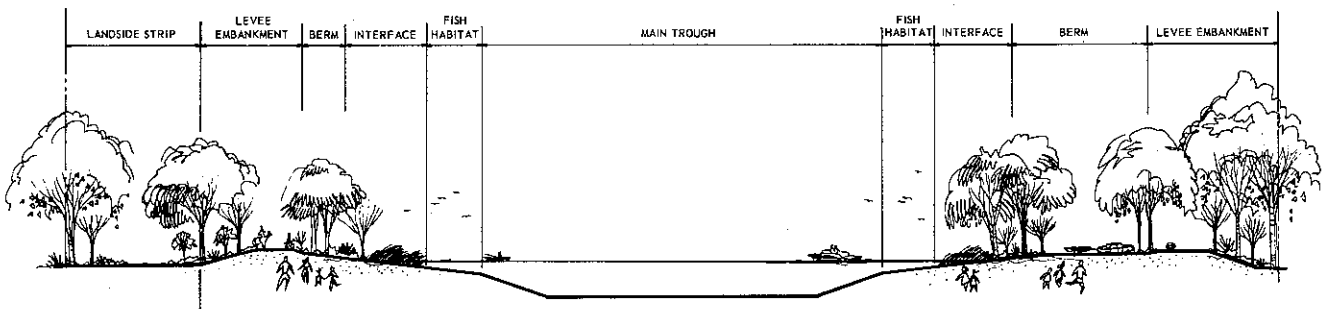
Levees had broken before in the Delta, though usually during winter floods, and some islands, like Franks Tract, had not been reclaimed. While the cause of the Brannan-Andrus disaster was unknown, the fact that other levees were in similar peril made the impact of future levee failures a topic of particular interest. In testimony concerning the break before a state senate committee in September, 1972, Director of Water Resources William Gianelli not only discussed the jurisdictional and economic problems of levee maintenance, but was able to claim that the Peripheral Canal would have been a useful tool for meeting the recent emergency. If it had been in operation when the Andrus Island levee failed, Canal releases could have helped hold back the saline invasion and, because flow distribution could be adjusted, prevent the entrapment of salt water in the southern Delta. Gianelli estimated that the job of cleaning out the Delta that took two months in 1972 could have been accomplished in three weeks with the Canal, and without the necessity of sending unwanted salt to project customers in the process.[79]

During the summer of 1972, Fresno Congressman B. F. Sisk introduced legislation that would have authorized both the East Side Project and the Peripheral Canal, but like other such attempts, Sisk's initiative failed. Since the federal government had proven unable or willing to participate in the Canal, the only alternative was for the state to undertake construction of its own, and hope the Bureau of Reclamation would join in its use and operation at a later date. The possibility of unilateral state action had been discussed from time to time, but in November, 1972, William Gianelli told the Assembly Committee on Water that the state was finally ready to go it alone.

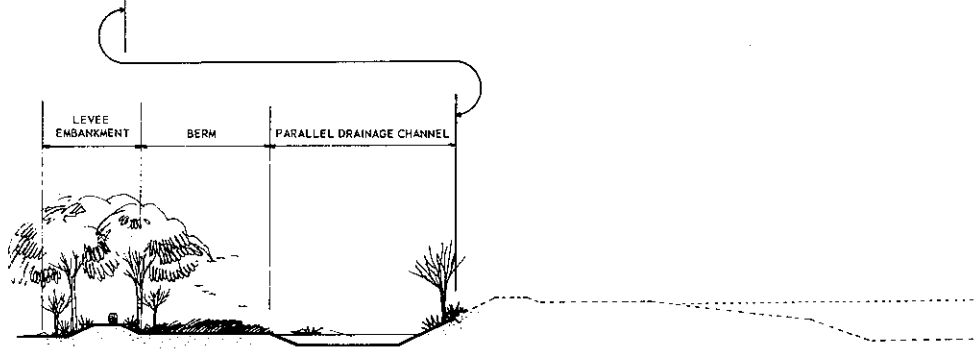
> *'It is our current estimate that the Peripheral Canal will be needed in 1980 to protect the water supply and quality functions of the State Water Project and the federal Central Valley Project aqueducts to the south and west of the Delta. . . .*
>
> *'If federal participation is not forthcoming within the required time schedule, the State must proceed with construction of a water conveyance facility in the Delta to meet the needs of the State Water Project. This facility should be a Peripheral Canal, since studies over the past ten years have shown that any other alternative would be unacceptably disruptive to the Delta environment. . . .*
>
> *'If the State proceeds without federal participation, the Canal should be conceptually developed as a "staged joint facility", which would be readily adaptable to meet the joint needs of the state and federal projects. A*



Levee break at Andrus Island in the summer of 1972. The collapse of the levee on the San Joaquin River flooded Andrus and Brannan islands and pulled salt water into the Delta. Upstream reservoir releases pushed the salinity back in the Sacramento River but the only way to remove salt water trapped in the San Joaquin Delta was to pump it into the export canals and send it southward. (DWR photo)



TYPICAL CANAL CROSS SECTION



DRAINAGE AND RELEASE CANAL CROSS SECTION

Typical Peripheral Canal cross section, Recreation and Wildlife Plan (DWR illustration)

feasible state course of action would be to construct a full-sized, full-length, gravity canal from the Sacramento River at Hood to Clifton Court Forebay with full size channel release facilities. With the later addition of a pumping plant and other deferred features, the capacity of the first stage facility could be increased to meet the combined needs of the State Water Project, the Delta, and the federal Central Valley Project. With this approach, federal participation would be feasible at any time, making it possible to derive full benefits from the Peripheral Canal.

'Proceeding on this basis would present two basic, but not insurmountable, problems. First, financing of the first stage would probably require advancing funds that would exceed the State's 50 percent share of the joint canal. Second, it would be necessary to negotiate an agreement with the United States for adding the second-stage features and wheeling Central Valley Project water through the Canal.'[80]

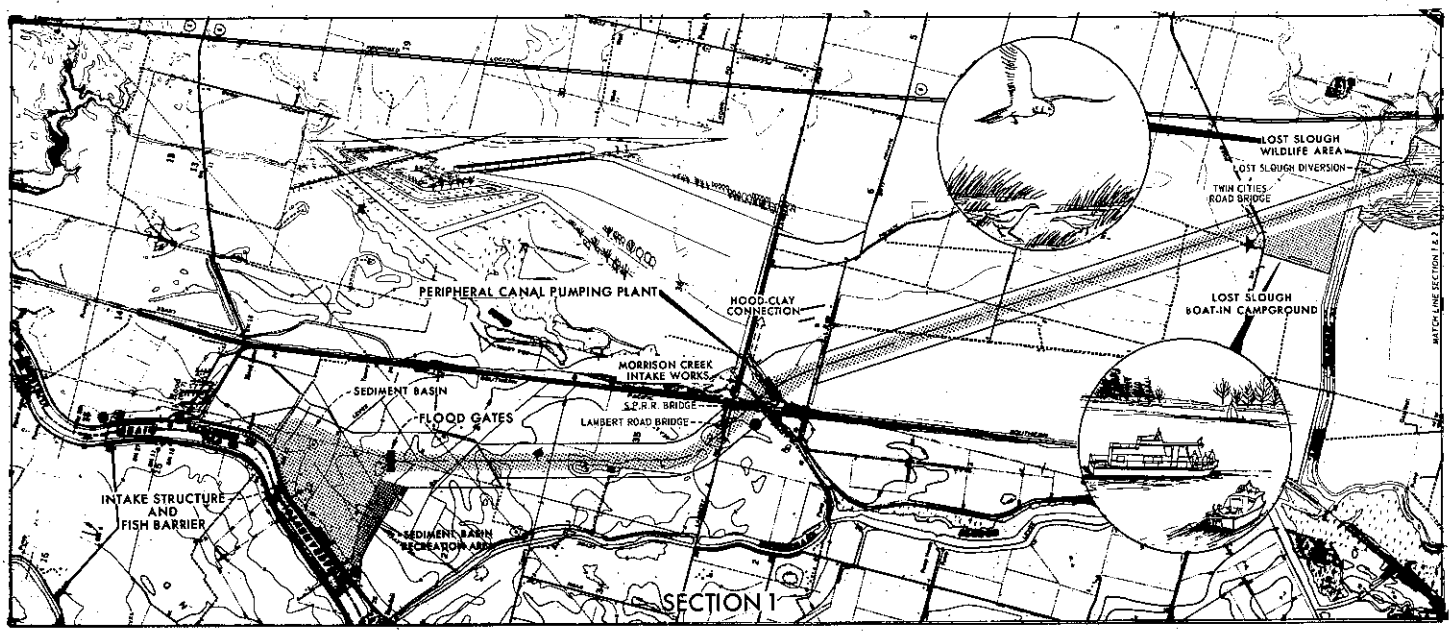
In order to have the facility ready for operation in 1980 the decision to proceed with construction would have to be made by 1975.

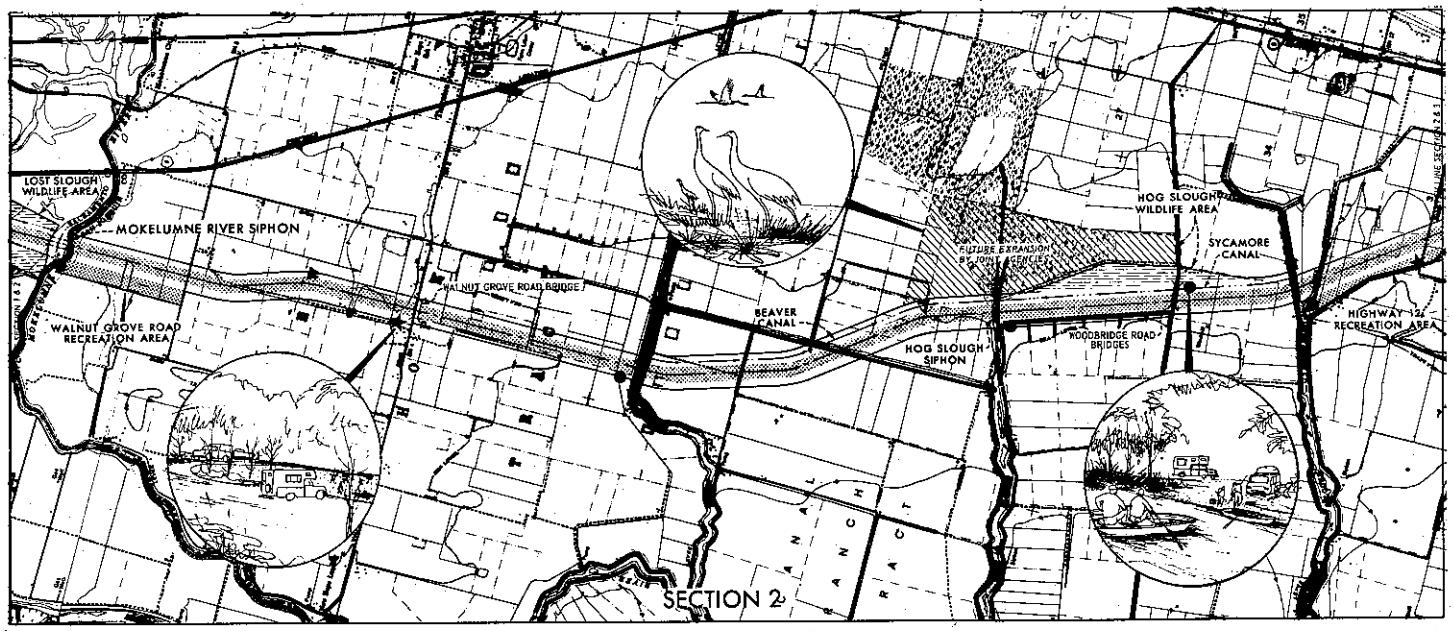
An unofficial beginning on the controversial ditch was, however, in the more immediate future as the start of construction on Interstate 5 grew nearer. Foes of the Peripheral Canal understood that projects once underway take on an additional momentum, and that removal of dirt from the Canal site for use as freeway embankment would mark the de facto beginning of Canal construction. To prevent use of what they conceived to be a backdoor approach to the water project, opponents prepared to entangle the freeway in the same web of delay that had so far stymied the Canal. It was not until November, 1973, that the imminence of highway construction prompted the Friends of the Earth to file suit in Washington, D. C. against the U. S. Secretary of Transportation on grounds that the Interstate 5 environmental impact statement was inadequate in its discussion of the borrow pits. In the complicated legal maneuvering that followed, the environmental advocates did at least succeed in postponing any action. Dismissed without prejudice from the District of Columbia and refiled in San Francisco, the complaint was accompanied by one entered against the State of California in Superior Court. In May, 1974, the Federal District Court in San Francisco ruled that the connection between the freeway and the Canal was too tenuous to require the highway impact statement to treat the Canal as well. The Ninth Circuit Court of Appeals confirmed the District Court's decision in March, 1975, effectively resolving the issues in the parallel state court suit at the same time and allowing the highway program to move forward.[81]

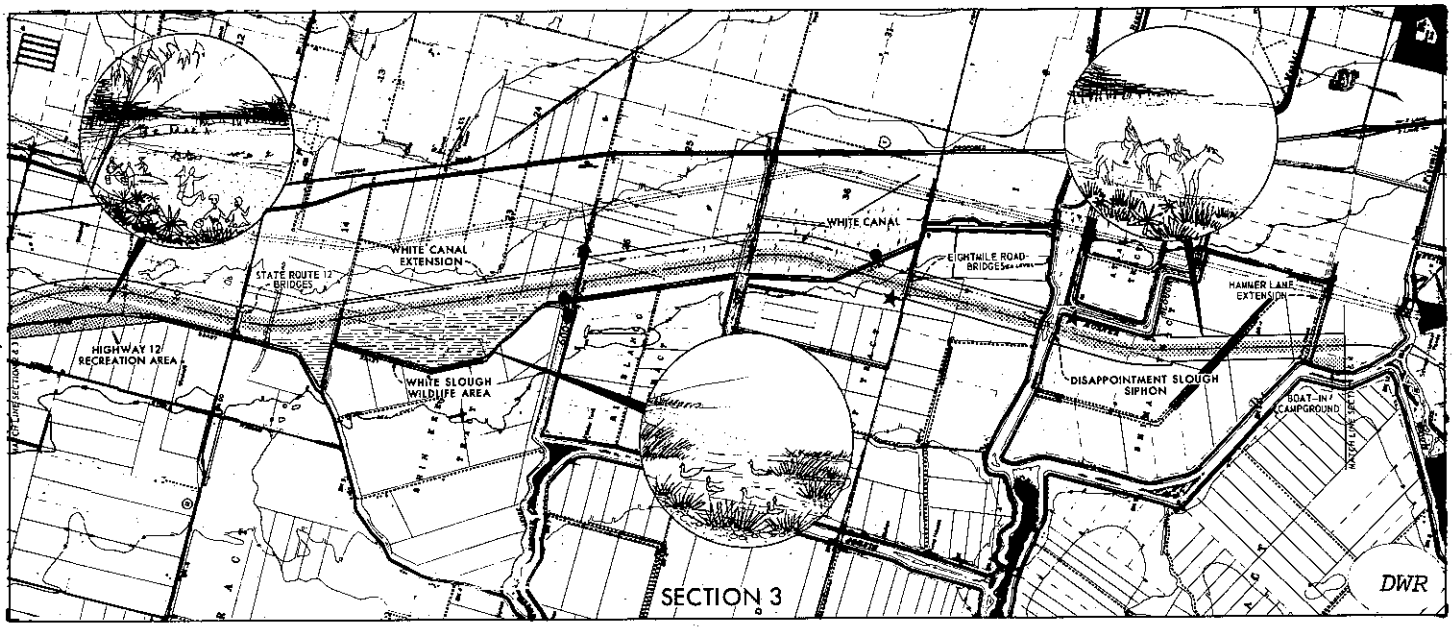
THE DRAFT ENVIRONMENTAL IMPACT REPORT -- The Bureau of Reclamation had not abandoned its attempts to produce an environmental impact statement on the Canal following criticism of the 1971 draft report. The regional office of the Bureau, in a team effort with the Department of Water Resources, had a draft statement ready for consideration by Washington in late January, 1972. The document, dated February, 1972, was never publicly released, apparently the victim of conflicting politcal pressures and questions of timing that were resolved by continued delay.[82]

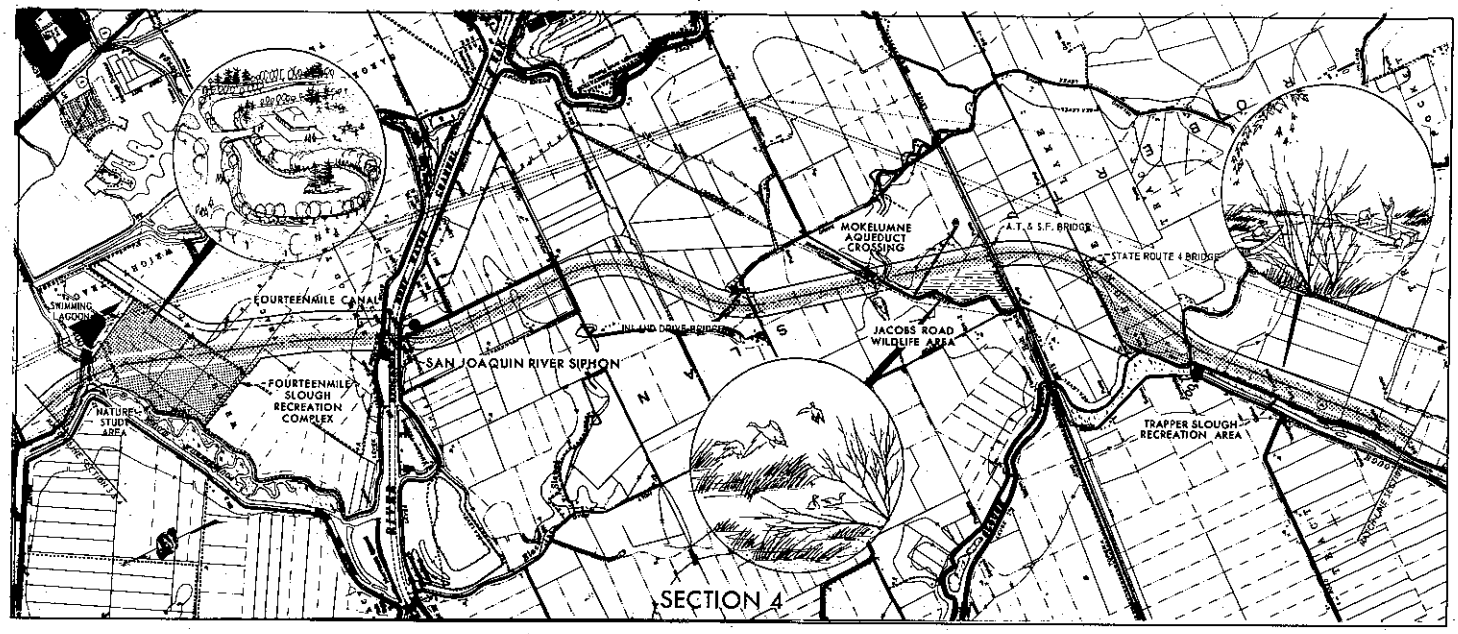
In preparing suggestions for a Central Valley Basin water quality control plan, Bay-Valley Consultants assumed that the Peripheral Canal would eventually be constructed. They examined the impact of the Canal and decided that it could improve exported water supplies by 70 percent and effect a five percent improvement in the quality of the San Joaquin River because project canals would bring fewer salts into the basin. On the other hand, flow reduction would increase water retention time in Delta channels, encouraging algae growth and reducing dissolved oxygen concentrations. They decided that the increased algae populations might present a problem but it was hoped that Canal releases could be managed so as to mitigate some of the potentially ill effects. They recommended that the Canal be constructed since the benefits were thought to outweigh any disadvantages.[83]

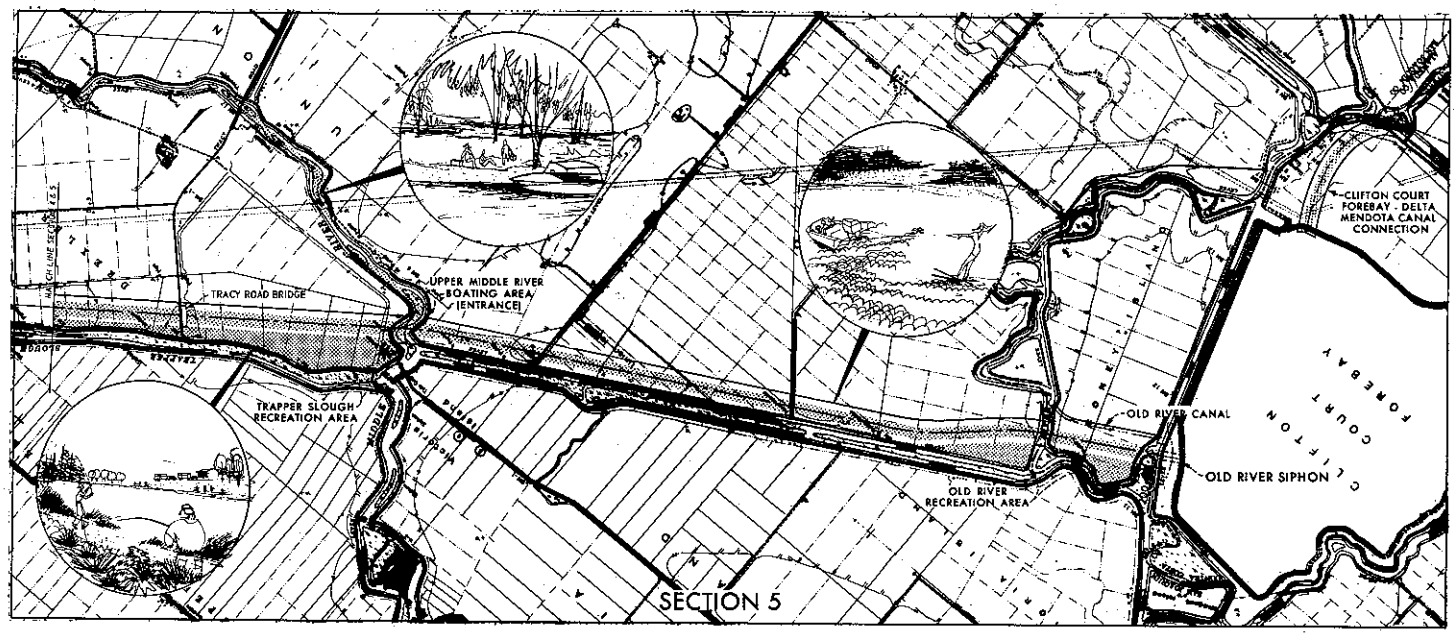
The Department of Water Resources was eager to fulfill the assumption that there would be a Peripheral Canal. Under the California Environmental Quality Act of 1970, environmental impact reports were required on all major state projects similar to the statements required on all federal plans by the National Environmental Protection Act. The Department, still adhering to its 1980 completion target, published a 600-page draft impact report in August, 1974. The physical proposal was more or less the familiar one, though capacity in the initial reach had been reduced in line with a smaller diversion through the Hood-Clay Connection, a new siphon had been added at Disappointment Slough, and the number of release points had been raised to twelve. The cost, too, had changed, with an estimate of $285


LOST SLOUGH WILDLIFE AREA
LOST SLOUGH DIVERSION
TWIN CITIES ROAD BRIDGE
PERIPHERAL CANAL PUMPING PLANT
HOOD-CLAY CONNECTION
LOST SLOUGH BOAT-IN CAMPGROUND
MORRISON CREEK INTAKE WORKS
SEDIMENT BASIN
FLOOD GATES
S.P.R.R. BRIDGE
LAMBERT ROAD BRIDGE
INTAKE STRUCTURE AND FISH BARRIER
SEDIMENT BASIN RECREATION AREA
SECTION 1


LOST SLOUGH WILDLIFE AREA
MOKELUMNE RIVER SIPHON
WALNUT GROVE ROAD BRIDGE
WALNUT GROVE ROAD RECREATION AREA
BEAVER CANAL
HOG SLOUGH WILDLIFE AREA
SYCAMORE CANAL
FUTURE EXPANSION BY OTHER AGENCIES
WOODBRIDGE ROAD BRIDGES
HOG SLOUGH SIPHON
HIGHWAY 12 RECREATION AREA
SECTION 2


WHITE CANAL
WHITE CANAL EXTENSION
STATE ROUTE 12 BRIDGES
EIGHTMILE ROAD BRIDGE
HAMMER LANE EXTENSION
HIGHWAY 12 RECREATION AREA
WHITE SLOUGH WILDLIFE AREA
DISAPPOINTMENT SLOUGH SIPHON
BOAT-IN CAMPGROUND
SECTION 3
DWR





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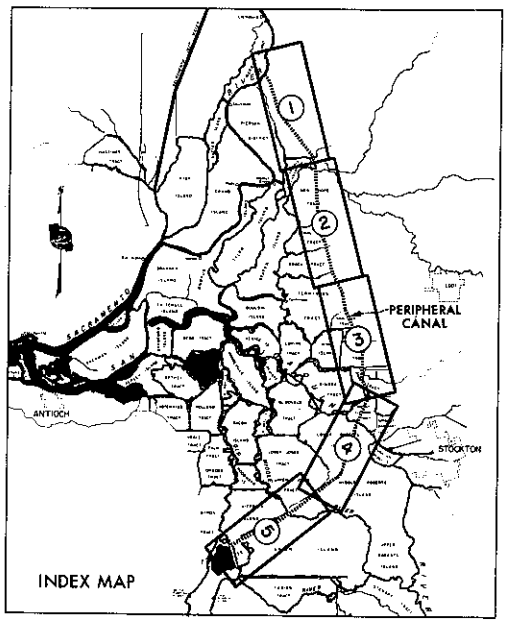


LEGEND

- MAJOR RECREATION AREA
- MAJOR WILDLIFE AREA
- AUTO-AQUATIC PARK
- FISHING ACCESS SITE
- 600 RELEASE FACILITY (CFS)
- WATER SURFACE AREA

FIGURE III-2

DETAIL MAP
PERIPHERAL CANAL ALIGNMENT
AND MAJOR FEATURES

SCALE OF MILES

9—86463

million replacing the Bureau's 1969 figure of $209 million. Despite the ever-increasing expense, the Department intended to proceed with construction following the staged, joint-use plan outlined in November, 1974, even if federal cooperation was unobtainable. As required by law, alternatives to the proposal were also evaluated, including both physical and hydraulic barriers, the waterway control plan, a state-only gravity canal, and a modified Folsom-South Canal plan. The Department concluded that the Peripheral Canal remained the best choice.

> *The Peripheral Canal is not perfect in all respects and each of the alternatives is possibly superior in some respects. However, it is concluded that the Peripheral Canal does have the greatest potential for obtaining desired environmental conditions in the Delta and the least interference with established and projected activities in the Delta, while meeting the water needs in the export service areas of SWP and CVP. It would reduce the amount of future additional northern California surface water needed at the Delta by about 1.9 million acre-feet per year during a critical period and delay the time such supplies would be needed from 1980 to 1990 or later. If instead, alternative sources south or west of the Delta were developed, the canal would reduce the amount needed by from 800,000 to 1,000,000 acre-feet per year and provide more time to develop technology. Taken as a whole, it comes closest to meeting the most important environmental needs at this time.*[84]

One of the most significant aspects of the draft report in light of the Delta Decision was the discussion of how the Canal would be operated to maintain Delta water quality standards. The Department assumed, as had the State Water Resources Control Board, that overland facilities would one day eliminate the necessity for municipal and industrial criteria in the western Delta. However, the planners went on to assume that the criteria for fish and wildlife protection would be relaxed in dry and critically dry years to the point that only minimum agricultural standards need be observed. Decision 1379 had not committed the Board to make such modifications, although the order denying reconsideraton of the Decision indicated that dry year criteria might subsequently be adopted, and in December, 1973, the Board stated a definite intention to consider lower fishery maintenance standards for dry and critical years.[85] The Department of Water Resources made a series of assumptions as to what the relaxations would be and computed the outflows associated with reductions in the level of protection.

Striped Bass Spawning	*1,000 ppm TDS at Antioch*	*6,700 cfs*
Neomysis (fish food organism)	*4,000 ppm Cl^- at Chipps Island*	*4,500 cfs*
Western Delta Agriculture		
April through July	*350 ppm Cl^- at Emmaton*	*4,000 cfs*
August through December	*1,000 ppm Cl^- at Emmaton*	*2,500 cfs*
Critical Year	*1,000 ppm Cl^- at Emmaton*	*2,500 cfs.*

Note: TDS = Total Dissolved Solids; ppm = parts per million; Cl^- = Chlorides[86]

Estimated Minimum Delta Outflow a/
In cubic feet per second

Month	*Critical Year d/*	*Dry Year d/*	*Other Years*
October	*b/*	*b/*	*b/*
November	*b/*	*b/*	*b/*
December	*b/*	*b/*	*b/*
January	*b/*	*b/*	*b/*
February	*b/*	*b/*	*b/*
March	*b/*	*b/*	*b/*
April	*2,500*	*4,000*	*5,100 c/*
May	*2,500*	*4,000*	*6,700*

Month	*Critical Year d/*	*Dry Year d/*	*Other Years*
June	*2,500*	*4,000*	*4,500*
July	*2,500*	*4,000*	*4,500*
August	*2,500*	*2,500*	*4,500*
September	*2,500*	*2,500*	*4,500*

a/ Delta outflows are not allowed to decrease below these values but often exceed them
b/ 2,500 cfs if previous year was dry or critical, otherwise 4,500 cfs.
c/ 5,100 cfs represents 3 weeks at 4,500 cfs and 1 week at 6,700 cfs.
d/ See Table III - 4 for definition (not given here)[87]

If outflows were adjusted according to the Department's proposal, the Peripheral Canal could meet minimum Delta requirements during dry periods without imposing undue deficiencies or export deliveries.

If the Department's conclusion that the Canal was basically desirable from environmental, engineering, and economic viewpoints came as no surprise, environmentalists assertions that the report did not adequately prove the Department's point should have been equally predictable. The Friends of the Earth, for example, took issue with at least three major premises of the document, including the official contention that outflow reductions would not adversely affect San Francisco Bay. The conservationist group contended that private conversations with the Geological Survey confirmed, and perhaps even strengthened, the 1970 conclusions on the necessity of adequate outflow to flush the south Bay; conclusions they felt the draft report had not adequately refuted. Direct detrimental effects on northern California were matched, according to the critics, by indirect effects on southern California.

> *There is no discussion of the impact of what the water is for: 9 million more people in the already polluted Southern California air basin.*
>
> *We could find no discussion of the air pollution impact of providing water to enable this huge population increase in Southern California. . . .*
>
> *We know that the Department considers the transfer of massive amounts of water from one basin to another primarily a problem of engineering. However, communities are beginning to try to regulate their rate of growth through limiting water connections. And EAP has a policy that no sewage treatment funds are granted for projects intended to increase capacity in critical air basins.*[88]

Finally, Friends of the Earth doubted that the project, if built by the state alone, would be financed entirely by water users, as the Department had claimed, citing alternatives in tidelands oil revenues and nonreimbursable allocations to fish and wildlife and to recreation.

It is a tribute to the environmental critique and a reflection of the complexity of the issues that other critics were able to castigate the draft report without merely repeating the points raised by Friends of the Earth. In a joint response to the document, California Trout and the California Committee of Two Million attacked the assumption, at the very heart of the report, that the federal government would join in the use and eventually in the repayment and operation of the Peripheral Canal. Although the critics in this instance overstated their case by claiming that the report presumed "full participation of the federal Central Valley Project in construction and operation."[89] of the Canal despite the Department's insistence that it could build the first, gravity operation, stage by itself, the fact remained that the Bureau had no congressional authorization to participate in any way in the project. Furthermore, the two organizations charged that if the Canal were ever to transport the maximum volume proposed, more water supplies would have to be developed, presumably on the north coast, where the major streams were protected by wild rivers legislation. The discussion of energy requirements for the Canal and the State Water Project as a whole was considered inadequate, as was the treatment of alternatives, and the evaluation of fish screen effectiveness. In closing the groups charged:

> *We reject this report as being an incomplete, hurried, and cursory treatment of a vastly complex proposal never before attempted by civilized man. The report is brim full of guesses, conjectures, uncertainties, and unfounded conclusions and therefore must, by definition, be erroneous and must, by definition, fail to fully disclose the impact of the proposed action.*[90]

Comments received from federal and state agencies were nearly as critical as some of the conservationist responses. The Environmental Protection Agency found that the draft report contained "serious inadequacies,"[91] beginning with the fundamental assumptions of complete coordination between state and federal water projects, particularly since the Bureau of Reclamation was challenging the legal basis of some of that coordination in court. Besides other criticisms involving the presentation of alternatives and the assumed modifications of dry year quality criteria, the Agency expressed concerns over the Canal's impact on southern California noticeably similar to those voiced by Friends of the Earth.

> *This expanded analysis becomes most important in view of the serious air pollution problems in certain areas of California. The State Water Resources Control Board has, as a matter of State policy, adopted regulations to allocate State and federal wastewater treatment grants to be consistent with the State's air pollution control strategy. The California Department of Transportation is developing regional transportation plans which will, as a matter of State law and Federal law, authorize the construction of only those transportation projects which are consistent with the State's Air Implementation Plan. The Department of Water Resources should consider and discuss in the EIR the feasibility of constructing and operating the Peripheral Canal to be mutually supportive of the State and Federal policies and laws intended to insure clean air for the citizens of California.*[92]

The State Water Resources Control Board shared many of the Environmental Protection Agency's reservations about the draft document. It indicated that the Department should have based its operational projections on unmodified water quality standards because it had been the Board's intent that the Delta should have first priority in years of subnormal runoff rather than sharing general project deficiencies. The regulatory Board was also worried about the problems inherent in the joint operation of a project not authorized for Bureau participation, and advised delay until those problems could be solved.

> *We believe the need for resolving the legal issues relating to joint state-federal operation, and the need to establish comprehensive operating criteria are matters which will require additional time. We realize that if a series of dry or critical years should occur, the Peripheral Canal would make it possible to meet contractual commitments to a greater degree while protecting Delta interests, but without the resolution of some of the important considerations relating to federal participation in the project, the conficts over diversion of water, and responsibility for Delta protection could be extremely serious.*[93]

The Senate Committee on Natural Resources and Wildlife, chaired by Senator Nejedly, agreed that the uncertainties of federal participation as well as unanswered questions about the Canal's impact on the Delta made construction at an early date "premature."[94]

At the end of 1974, it had been ten years since the Peripheral Canal plan had been adopted by the Interagency Delta Committee with every hope of speedy construction. The intervening years had witnessed a growth of opposition due largely to the new environmental movement, though never without the presence of Contra Costa's arguments in support of its own water demands. The response to the draft environmental impact report of 1974 had been so negative that additional time would certainly be needed to prepare an acceptable final environmental report. In early 1975, Water Resources Director John Teerink announced a one-year delay in the construction program that was to have been inaugurated that summer, leaving the Canal once again mired in controversy.

NOTES

CHAPTER XIII - THE PERIPHERAL CANAL AND THE ENVIRONMENT

1. Carl Werner, DWR, "Implementation of the Peripheral Canal," presented before Statewide Conference on Delta Water Problems, May 13, 1966, pp. 6-7.

2. Ibid., pp. 7-8, and remarks by John Teerink, Assistant Chief Engineer, DWR, and Archie Hanson, Chief of Delta Branch, USBR, in Testimony -- Sacramento-San Joaquin Delta -- Peripheral Canal, before a special Contra Costa panel, February 17, 1967, pp. 162-166, 195-197.

3. DWR, Bulletin No. 132-67, p. 19.

4. Alfred R. Golzé, Chief Engineer, DWR, "A Federal-State Peripheral Canal," presented to members of the California Congressional Delegation, December 15, 16, 1966, pp. 1, 4.

5. DWR, Bulletin No. 132-68, p. 35.

6. Ibid., pp. 34-35, and Bulletin No. 132-69, p. 6.

7. DWR, The Delta and the State Water Project, memorandum report, June, 1969, pp. 49, 59.

8. San Francisco Chronicle, January 4, 1968.

9. George Warner, "The Peripheral Canal: Boon or Disaster to Delta Fishlife?" Outdoor California, July/August 1968, p. 5.

10. Federal Water Pollution Control Administration, San Joaquin Master Drain, Effects on Water Quality of San Francisco Bay and Delta, January, 1967, p. 65.

11. Arthur Miller, "Delta Water Controversy Stalls Construction of the Peripheral Canal, Last Major Link in State Water Project," California Journal, January, 1973, p. 11.

12. For a discussion of some of these effects see: Senate Select Committee on Salinity Intrusion in Agricultural Soils, San Francisco Bay-Delta Fact Finding Hearing, Transcript, Vol. 2, November 19, 1970, containing the testimony of Dr. Charles Goldman, pp. 2-21. For a general background on the Delta environment see: Department of Fish and Game, Ecological Studies of the Sacramento-San Joaquin Estuary, A Decennial Report, 1961-71, June, 1972, and annual reports by the Interagency Ecological Study Program.

13. Floyd E. Dominy, to the Secretary of the Interior, May 6, 1969.

14. Ibid., and USBR, Peripheral Canal Unit, Central Valley Project, California, A Report on the Feasibility of Water Transfer in the Sacramento-San Joaquin Delta, 1969, p. 94.

15. John D. Findley, Acting Regional Director, Bureau of Sport Fisheries and Wildlife to USBR Regional Director, August 27, 1965, pp. 10-11, 19-20.

16. William Gianelli, "The Peripheral Canal as it relates to the Operation of the State Water Project," presented to the Senate Committee on Water Resources and the Assembly Water Committee, September 17-18, 1969, p. 8.

17. Kaiser Engineers, San Francisco Bay-Delta Water Quality Control Program: Final Report to the State of California, June 1969, p. XVIII-16.

18. Assembly Committee on Water to Norman Livermore, October 14, 1969.

19. Senate Committee on Water Resources to Norman Livermore, November 7, 1969.

20. Assembly Committee on Water to Livermore, October 14, 1969.

21. Ibid.

81. A general summary of the litigation can be found in the annual reports of the State Water Project in the DWR, Bulletin 132 series.

82. Regional Director, USBR, to Commissioner of Reclamation, April 6, 1972; Regional Planning Officer to Regional Director, January 8, 1973; Commissioner of Reclamation to Regional Director, July 9, 1973.

83. Bay-Valley Consultants, Recommended Water Quality Management Plan, Tentative Report, July, 1974, pp. 4-79-83.

84. DWR, Draft Environmental Impact Report -- Peripheral Canal Project, August, 1974, "Summary," p. 38.

85. Ibid., p. III-48.

86. Ibid., p. III-49.

87. Ibid., p. III-50.

88. "Statement of Connie Parrish, California Representative of Friends of the Earth, on the Draft Environmental Impact Report on the Proposed Peripheral Canal," October 3, 1974, p. 2.

89. Richard H. May, President, California Trout, and Chairman, California Committee of Two Million, to John Teerink, Director, DWR, November 29, 1974.

90. Ibid.

91. Paul DeFalco, Jr., Regional Administrator, EPA, to John Teerink, December 4, 1974.

92. Environment Protection Agency, "Comments on Draft Environmental Impact Report -- Peripheral Canal Project, dated August, 1974," December, 1974, p. 7.

93. State Water Resources Control Board, "Comments on Draft Environmental Impact Report for the Peripheral Canal," presented by W. W. Adams, Chairman, to Senate Committee on Natural Resources and Wildlife, December 11, 1974, p. 6.

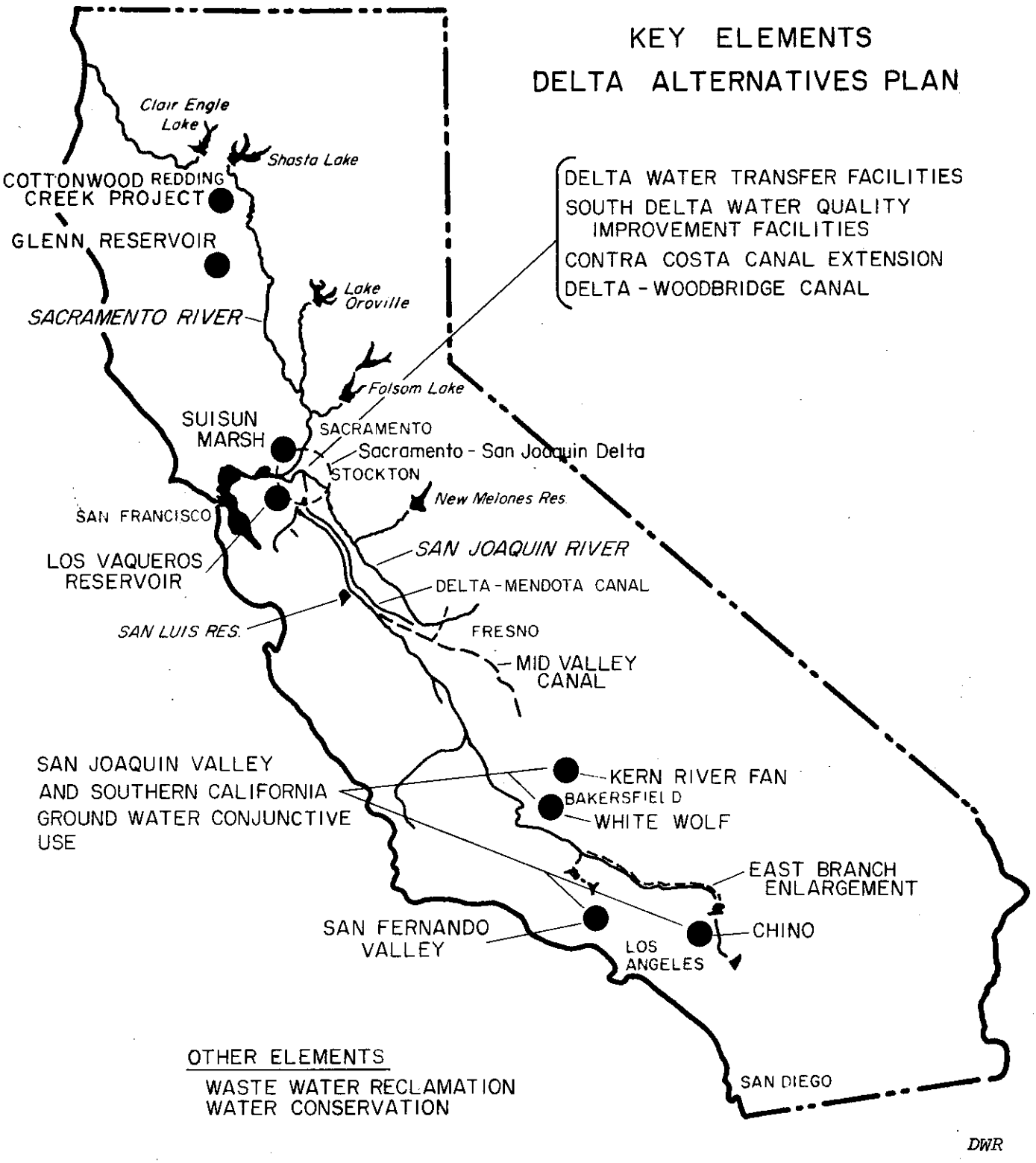
94. Senate Committee on Natural Resourses and Wildlife, The Peripheral Canal Project, A Report to the Legislature, January, 1975.

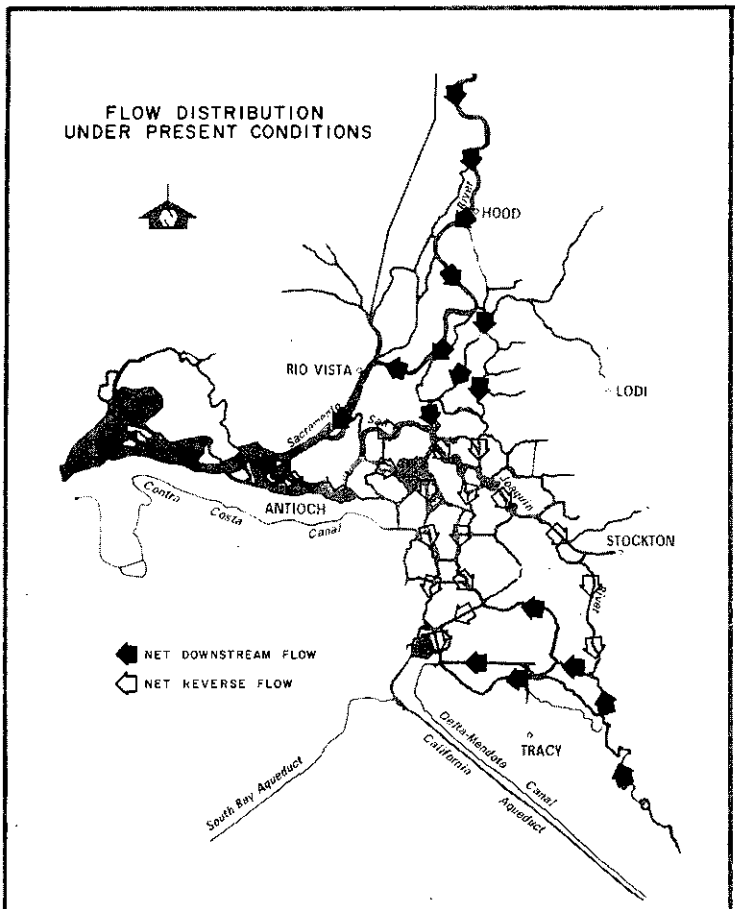
XIV. Lowered Expectations

PERIPHERAL CANAL ALTERNATIVES -- While the Department of Water Resources' Peripheral Canal Draft Environmental Impact Report was drawing the wrath of environmental defenders in the latter part of 1974, the political climate of water development in California shifted noticeably. The State Water Project had enjoyed the official backing of state administrations since its inception but the election in November, 1974, of Governor Edmund G. Brown, Jr. was accompanied by indications that the alliance between California government and water development interests might be cracking. Brown took no stand on the Peripheral Canal during his campaign, but he did endorse the initiative proposition aimed at halting work on the Crops of Engineers' New Melones Dam in the interest of preserving white-water recreational areas on the Stanislaus River. More than any specific policy pronouncements, Brown's questioning, iconoclastic, ecologically-oriented manner was disturbing to developers, and the new Governor's assertions that an era of limits had been reached was profoundly out of step with traditional attitudes that revolved around the upward spiral of both water demand and supply. Brown's appointments to key administrative posts reflected his rhetoric. To head the Resources Agency, and oversee water policy formation, Brown chose Clare Dedrick of the Sierra Club, who had once voiced the opinion that the Peripheral Canal "ought to be killed, dead."[1] That statement was later tempered to the extent that it reflected a personal, and not an official feeling. Working under the Resources Secretary was the Director of the Department of Water Resources and, here again, the new Governor broke with tradition by selecting Ronald B. Robie to take charge of the state water development system. The Department and the State Water Resources Control Board had maintained a somewhat adversary relationship in the past, especially over Delta water quality standards, so the appointment of Robie, former vice-chairman of the Board, to head the Department was a notable departure and a strong indication that the Board's environmentalist sympathies would be expressed more directly in the operation of the State Water Project. Reinforcing that impression was the naming of Gerald Meral, a staff scientist for the Environmental Defense Fund, as Robie's assistant and later a Deputy Director of the Department. The changes in personnel and in the priorities they represented were dramatic, but the question remained as to how those new tendencies would actually be expressed by the Department of Water Resources.[2]

Perhaps the most significant problem still to be resolved was what sort of facility, if any, was to be built in the Delta. The Peripheral Canal had already been delayed after the unfriendly reception that greeted the draft of the environmental impact report, but in April, 1975, Director Robie announced the beginning of a new and more searching reappraisal of the Canal and other Delta alternatives. Previously, the Canal had been considered largely in a Delta context as a conveyance and conservation facility necessary for the successful operation of present and undefined future units of the state and federal water projects. At the outset, the new study was designed to consider all aspects of water management relating to the Delta including means of reducing the demand on Delta water supplies as well as the projects still required to insure adequate water at the Delta for the year 2000. Guiding assumptions included the use of alternatives to more storage reservoirs wherever possible and an abandonment of the "go-it-alone" policy that would have had California proceed without federal participation. From now on, Department planning was aimed at meeting the needs of the coordinated operation of both the Central Valley Project and the State Water Project. The first phase of the reexamination was completed in October, 1975, when various general actions were suggested. Public hearings were held and in March, 1976, a Phase II report was released outlining a number of schemes for Delta water transfer facilities including such exotic alternatives as shifting all export diversions to a point west of Antioch, building a west Delta canal, or constructing a reservoir in the Montezuma Hills of Solano County. The Department staff then selected the most promising plans and prepared a basic summary of water management alternatives by October, 1976.[3]

As proposed in the Department's study, a total federal and state export demand by the year 2000 could be approximately 8.4 million acre-feet, though the conservation of fresh water supplies and the reclamation of wastewater could reduce the figure to 7.8 million acre-feet. In order to allow additional reductions in dry and critical years, when available water would be needed to meet Delta quality standards, it was proposed to recharge dewatered goundwater basins in southern California during wet and normal years and draw on them when necessary. Firm project yield could be increased by some 400,000 acre-feet, replacing 200,000 acre-feet of Delta diversion in dry years and 600,000 acre-feet in critical years.


KEY ELEMENTS
DELTA ALTERNATIVES PLAN
DELTA WATER TRANSFER FACILITIES
SOUTH DELTA WATER QUALITY IMPROVEMENT FACILITIES
CONTRA COSTA CANAL EXTENSION
DELTA - WOODBRIDGE CANAL
Clair Engle Lake
Shasta Lake
COTTONWOOD REDDING CREEK PROJECT
GLENN RESERVOIR
SACRAMENTO RIVER
Lake Oroville
Folsom Lake
SUISUN MARSH
SACRAMENTO
Sacramento - San Joaquin Delta
STOCKTON
New Melones Res.
SAN FRANCISCO
SAN JOAQUIN RIVER
LOS VAQUEROS RESERVOIR
DELTA - MENDOTA CANAL
SAN LUIS RES.
FRESNO
MID VALLEY CANAL
SAN JOAQUIN VALLEY AND SOUTHERN CALIFORNIA GROUND WATER CONJUNCTIVE USE
KERN RIVER FAN
BAKERSFIELD
WHITE WOLF
EAST BRANCH ENLARGEMENT
SAN FERNANDO VALLEY
CHINO
LOS ANGELES
SAN DIEGO
OTHER ELEMENTS
WASTE WATER RECLAMATION
WATER CONSERVATION
DWR


FLOW DISTRIBUTION
UNDER PRESENT CONDITIONS
HOOD
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TRACY
Sacramento
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Delta-Mendota
California
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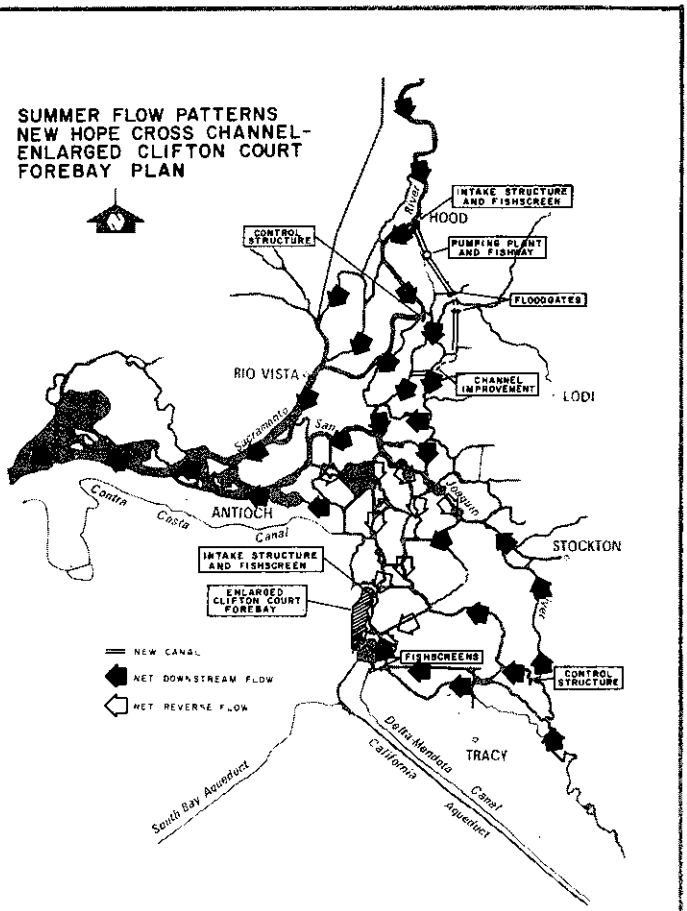
SUMMER FLOW PATTERNS
NEW HOPE CROSS CHANNEL-
ENLARGED CLIFTON COURT
FOREBAY PLAN
INTAKE STRUCTURE AND FISHSCREEN
CONTROL STRUCTURE
PUMPING PLANT AND FISHWAY
FLOODGATES
CHANNEL IMPROVEMENT
INTAKE STRUCTURE AND FISHSCREEN
ENLARGED CLIFTON COURT FOREBAY
FISHSCREENS
CONTROL STRUCTURE
NEW CANAL
NET DOWNSTREAM FLOW
NET REVERSE FLOW
HOOD
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ANTIOCH
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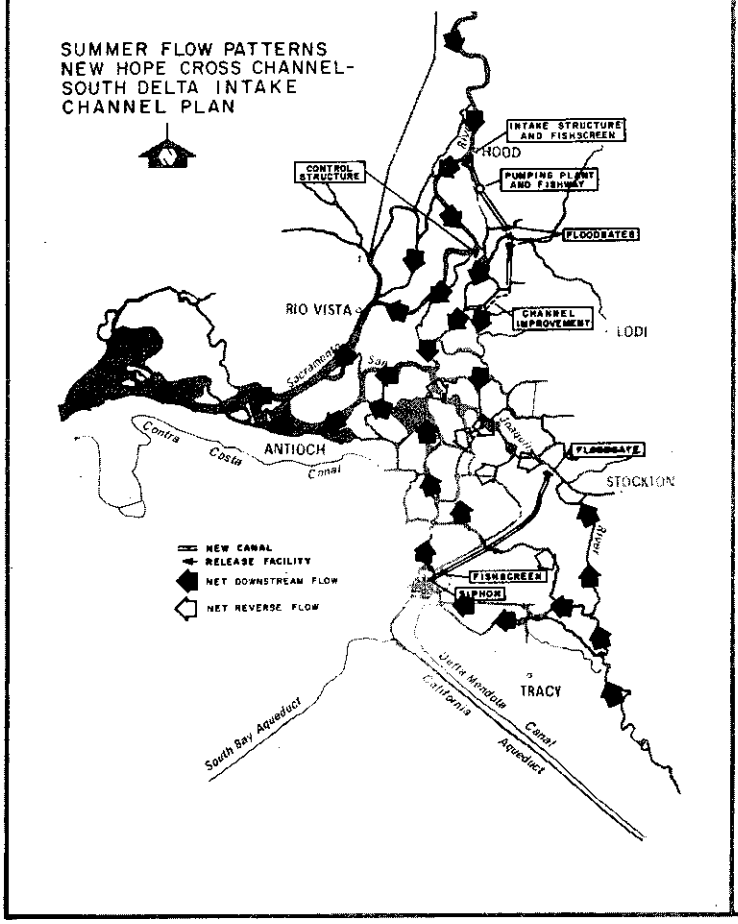
South Bay Aqueduct


SUMMER FLOW PATTERNS
NEW HOPE CROSS CHANNEL-
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CHANNEL PLAN
INTAKE STRUCTURE AND FISHSCREEN
CONTROL STRUCTURE
PUMPING PLANT AND FISHWAY
FLOODGATES
CHANNEL IMPROVEMENT
FLOODGATE
FISHSCREEN
SIPHON
NEW CANAL
RELEASE FACILITY
NET DOWNSTREAM FLOW
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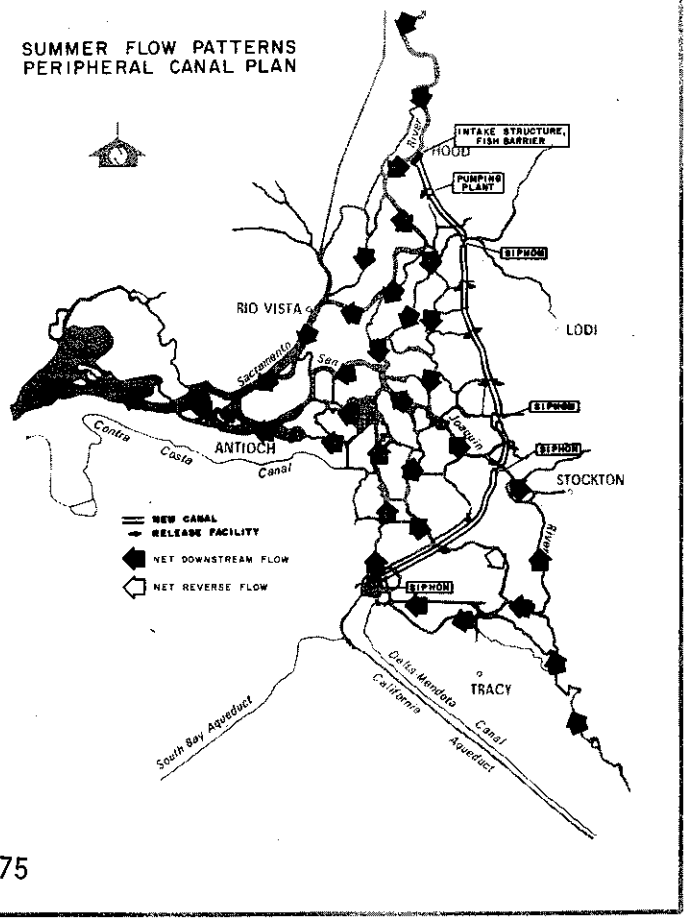
SUMMER FLOW PATTERNS
PERIPHERAL CANAL PLAN
INTAKE STRUCTURE, FISH BARRIER
PUMPING PLANT
SIPHON
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NEW CANAL
RELEASE FACILITY
NET DOWNSTREAM FLOW
NET REVERSE FLOW
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Of course, more water would have to be diverted in years of adequate or plentiful supply to restock the underground storage reservoirs. Almost full groundwater basins in the Sacramento Valley were another possible source of supply, where drilling 150 wells could yield 200,000 acre-feet a year. Even with the conjunctive use of groundwater, wastewater reclamation and conservation, more water would have to be provided if the two projects were to meet the anticipated demands. It was assumed that the federal Auburn and New Melones dams would be completed and that the offstream Los Vaqueros Reservoir would be built in Contra Costa County. Two Army Corps of Engineers dams, Cottonwood Creek and the Marysville Reservoir in the Sacramento Basin, were included in the program with the large offstream Glenn Reservoir proposed for construction as a joint-use facility near the year 2000. The approximate yield of the four new projects would be 1.6 million acre-feet, or enough water in combination with other aspects of the plan to meet delivery commitments without necessitating the construction of dams on the North Coast.[4] The California Wild and Scenic Rivers Act of 1972 had legislatively protected the Klamath, Trinity, Smith and Eel rivers from further development though the Eel would continue to be the subject of investigations with reconsideration of its status due in 1984. The elimination of dam sites on the North Coast from the Department's proposals might remove the objection often voiced by environmentalists that the Peripheral Canal was really only plumbing for the later exploitation of the wild rivers.

The combination of groundwater, reservoirs, and demand reductions was sufficient to satisfy water requirements in both state and federal service areas until at least the end of the twentieth century but only if a Delta facility was constructed. The alternatives suggested by the Department included construction of one or more parts of the Peripheral Canal or the whole canal. The northern section, dubbed the "New Hope Cross-Channel" would extend 12 miles from Hood to Beaver Slough, a tributary of the South Fork of the Mokelumne River, and would include a one-and-a-half mile long channel across Staten Island to connect the Mokelumne's forks. The New Hope Cross-Channel would route water through the interior Delta that would otherwise have to round the end of Sherman Island, creating reverse flow problems in the San Joaquin. Two alternatives existed in the south Delta for implementation along with the northern facility; an enlargement of the Clifton Court Forebay to double its present capacity, or the construction of a South Delta Intake Canal roughly paralleling the course of the proposed Peripheral Canal from the San Joaquin River near Stockton to the project pumps. Enlarging Clifton Court Forebay would allow more water to be pumped at high tide, but aside from relieving low water problems and some channel scour in the southern Delta, it would have little beneficial effect. The South Delta Intake Canal would serve the same purpose but could also provide positive downstream flows in Old and Middle rivers for fishery enhancement. Of course, the entire Peripheral Canal could also be built; leaving three primary Delta alternatives; the Peripheral Canal, the New Hope Cross-Channel with enlarged Clifton Court Forebay, or the New Hope Cross-Channel and South Delta Intake Canal. Any combination could salvage half-a-million acre-feet of water otherwise lost while still maintaining Basin Plan water quality standards, and if dry year modifications of fishery protection criteria were agreed to, a total of almost a million acre-feet of additional yield might be realized. The Department estimated that whatever Delta facility was chosen should be in operation by 1984. It was also recommended that the intake of the Contra Costa Canal be moved to Clifton Court Forebay to improve water quality and eliminate the necessity of maintaining fresh water in Rock Slough.[5]

The engineering alternatives were viable only if certain institutional conditions were met, conditions that related largely to coordination with the Bureau of Reclamation. The issue of whether or not the State Water Resources Control Board could order the federal agency to release water for purposes not contained in congressional authorizations was still before the courts. A resolution of outstanding legal questions was necessary before the Department's program calling for close cooperation with the Bureau could be implemented. In addition to federal authorization for Central Valley Project participation in Delta alternatives, joint-use storage systems, and water quality control, the Bureau was also expected to join in contracts with Delta water agencies and in the proposed Four-Agency Fish Agreement with the Departments of Water Resources and Fish and Game and the U. S. Fish and Wildlife Service. Protection of Delta water users under the state's plan would be afforded by legal water supply contracts and language in the authorizing legislation requiring the maintenance of acceptable water quality conditions. The crossing of these institutional hurdles promised to be no less difficult than the development of a consensus on the best physical plan.

In October and November, 1976, the Department sponsored public hearings in Stockton, Bakersfield, Sacramento, Los Angeles, Oakland, Antioch, and Chico while simultaneously making private presentations to affected agencies. From the responses gathered at these meetings no real agreement seemed apparent, with water contractors in the San Joaquin Valley and

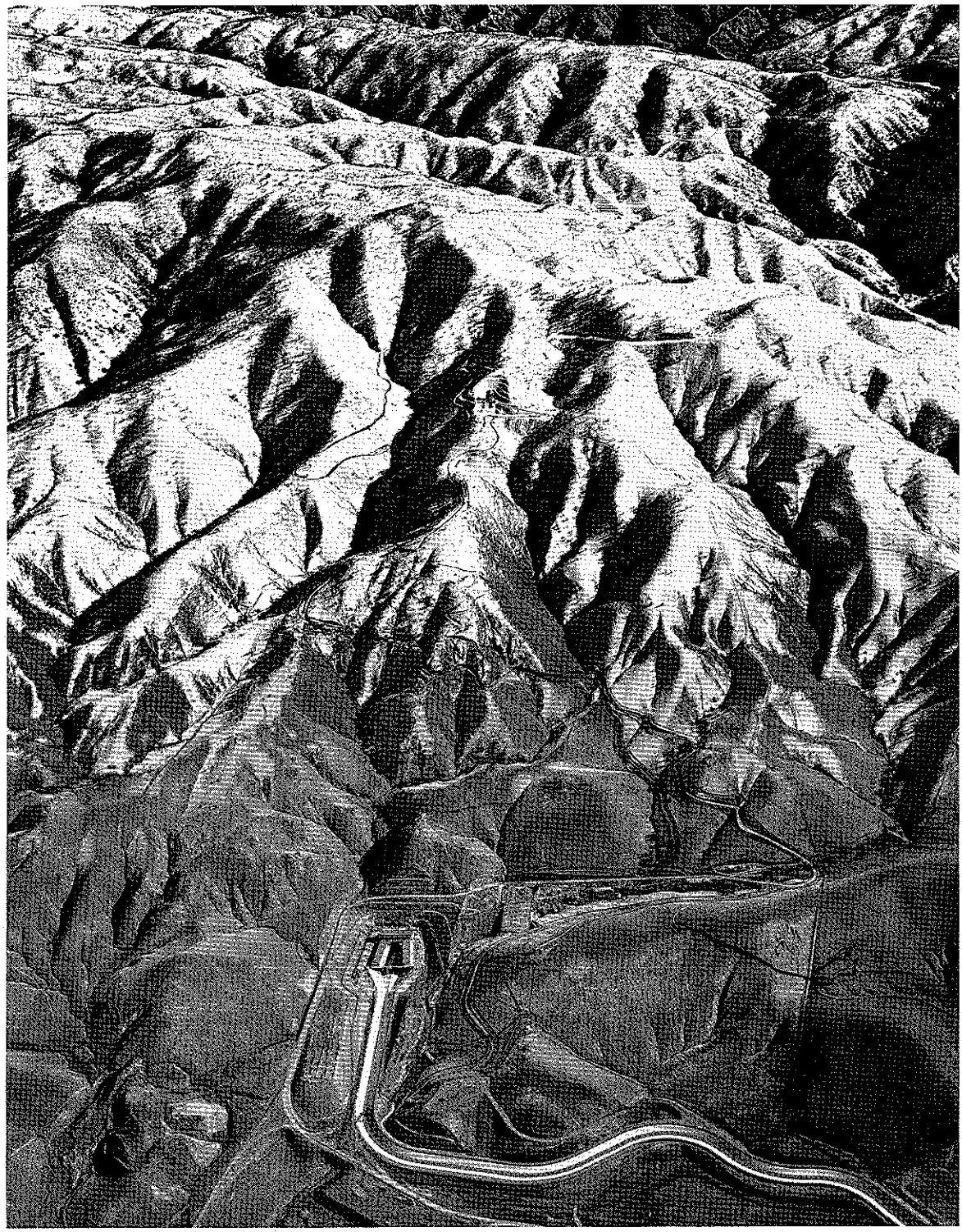
southern California expressing a preference for the Peripheral Canal because of the improvements in project water quality obtainable only through a closed conveyance system, and Delta interests taking the opposite view that any alternative but the Peripheral Canal was most desirable. Institutional guarantees, particularly contracts and federal legislation requiring Bureau of Reclamation cooperation in maintaining water quality standards were important to Delta water users but some felt that no amount of legislation could absolutely insure their fresh water supply.[6] Tom Zuckerman of the Central Delta Water Agency summarized that organization's case against the Peripheral Canal when he said, "We don't think that you can write enough laws to overcome the political power that can be exercised by the San Joaquin Valley interests in conjunction with the metropolitan water districts of Southern California . . . "[7] Contra Costa Assemblyman Dan Boatwright wrote that the public should dismiss

> *. . . the myth that this 18-month study is providing us with real alternatives to the Peripheral Canal . . . If we accept the DWR report, which I am amazed to see is concurred in by the Department of Fish and Game, we will either have the Peripheral Canal now, or later. It will either be constructed as a unit, or in stages.*
>
> *. . . I want to assure everyone concerned that I, for one, am not going to sit idly by and watch Contra Costa County farms and industries become the unwanted step-children of the warring family of competing water interests.*[8]

Environmental spokesmen also emphasized the legal and legislative prerequisites to any construction program but generally supported the full Peripheral Canal rather than one of the partial alternatives. Their views were shared by the California Department of Fish and Game, which based its conclusions on the assumption that the Four-Agency Fish Agreement would be executed and the Bureau of Reclamation would be authorized to operate the Central Valley Project for fish and wildlife purposes. One additional physical constraint was the development of an adequate fish screen for use at the Hood diversion point to either a Peripheral Canal or New Hope Cross-Channel. Ever since the Peripheral Canal had first been approved by the Interagency Delta Committee, studies of fish screening and recovery processes had been conducted but because of the size of the diversion, no device had been certified as being fully satisfactory even though the engineers and biologists remained confident that a solution could be developed. In evaluating the proposed alternatives, the Department of Fish and Game analyzed only the Delta fishery since other factors relating to saline intrusion would be the same in any of the proposals because each alternative involved identical outflows. The fishery experts measured Delta facility impacts against both historic, or pre-project, and present conditions. Striped bass, for example, were already less numerous than they had been, and if no Delta project were built to offset increased diversions, bass abundance could drop to 50 percent of the 1968-1975 mean figures. Either the enlarged Clifton Court Forebay or the South Delta Intake Canal by themselves would be slightly worse than the "no project" alternative. The New Hope Cross-Channel combined with the enlarged forebay would lead to an estimated 10 percent reduction in current populations, while the northern channel operated in conjunction with the South Delta Intake Canal could lead to a 10 percent increase in striped bass abundance. The Peripheral Canal, if operated properly, would eliminate exports from striped bass nursery areas and result in a 50 percent increase in bass abundance, to equal pre-project historic levels.[9] The exact relations between alternatives varied from species to species but in every case the Peripheral Canal was considered the most favorable alternative. The case of the San Joaquin salmon was particularly dramatic because any alternative but the Canal could lead to substantial reductions of the already depleted population, although reestablishment of the salmon fishery would require upstream releases as well as improved water transfer facilities in the Delta.[10] The Department of Fish and Game therefore concluded that:

1. *as soon as the recommended institutional actions are completed, as Delta water facility should be constructed to mitigate CVP-SWP impacts on fish and wildlife.*
2. *that facility should be the Peripheral Canal.*[11]

Since the whole basis of the Department of Water Resources' program was close cooperation and joint operation with the Bureau of Reclamation, the Bureau's response to the suggested alternatives was of more than casual interest. Regional Director Billy E. Martin responded that while the Bureau preferred the isolated Peripheral Canal because it would provide the most benefits for the money while protecting the environment, the agency was "not adverse to consideration of a conveyance system other than the Peripheral Canal. However, we would look for certain attributes that an alternative would have in common with a Peripheral



The Tehachapi crossing, State Water Project. At the southern end of the San Joaquin Valley, huge pumps force water over the Tehachapi Mountains to southern California. Ultimately, about half the yield of the state project will be delivered to coastal and desert areas in the southern portion of the state. The Department of Water Resources' Delta Alternative Study had to consider not only conditions in the Delta but the water supply and water requirements of the entire state in making their analysis. (DWR photo)

Canal."[12] Among the attributes involved were protection for the Central Valley Project's water supply, financial integrity, and operational flexibility. The Bureau estimated that within ten years, depending on rainfall patterns and the impact of the State Water Project, the Bureau might begin to encounter difficulty in meeting its upstream commitments while still maintaining contractual water quality levels at the Delta, making early consideration of a Delta facility an important priority. For the time being, the Bureau continued its preparation of a Peripheral Canal Environmental Impact Statement on the assumption that the isolated channel would be selected by the Department of Water Resources as its final recommended program.[13]

By February, 1977, the Department's staff had refined its alternatives somewhat, increasing the combined conservation and wastewater reclamation savings from 500,000 acre-feet per year to 700,000 acre-feet per year. The conjunctive use of the 900,000 acre-foot Los Vaqueros Reservoir and 3,250,000 acre-feet of groundwater storage capacity adjacent to the California Aqueduct was expected to yield 560,000 acre-feet a year and allow Delta diversions to be reduced by 400,000 acre-feet in a dry year and a million acre-feet in a critical year. The Sacramento Valley groundwater extraction program was dropped from the Delta alternatives study as was the Marysville Reservoir on advice that the facility, mainly useful for the generation of hydroelectric power, would be too costly from a water supply point of view. The Mid-Valley Canal to alleviate groundwater overdrafts on the east side of the San Joaquin Valley was advanced in the construction schedule and a Delta-Woodbridge Canal was added to the program to serve areas east of the Delta, thereby relaxing demand on the Folsom-South Canal and allowing greater releases on the American River for recreational purposes.[14] Hard on the heels of the revision came fresh, and largely unexpected, complications from federal decisions to reevaluate both Auburn and New Melones dams, both integral parts of the Delta alternatives plan.

The state also prepared a draft legislative package for state and federal consideration to meet some of the institutional requirements identified by the Delta alternatives study. The most significant proposal was for a reauthorization of the Central Valley Project to add fish and wildlife preservation and enhancement, recreation, water quality maintenance and salinity control to the list of project purposes. The cost of preservation of wildlife or water quality was to be repaid by water and power customers, while any enhancement costs were to be made nonreimbursable. The Bureau of Reclamation would be required to adhere to all water quality criteria established by the State Water Resources Control Board as well as the terms of the Four-Agency Fish Agreement designed to restore fishery resources to their historic levels by 1985. The federal government would also add portions of the American River, and the North Coast streams already protected under California law, to the national wild rivers system. The old dispute over which agency would be responsible for construction and operation of the Peripheral Canal would be settled because the Department of the Interior would be "directed to contract for the construction, operation, and maintenance by DWR of the Sacramento-San Joaquin Delta transfer facilities,"[15] and the federal government would cooperate with the Department and the Contra Costa County Water District in relocating the Contra Costa Canal intake. The Interior Department was to be authorized to construct facilities to preserve Suisun Marsh and employ Central Valley Project water for that purpose. The Mid-Valley Canal would be constructed by the Bureau, although it was to be used only to combat the groundwater depletion problem rather than bring any new irrigated land into use, and the Los Vaqueros unit could be built by the state alone or in cooperation with the Bureau.[16] The Department's draft bill was discussed with federal officials in early 1977 and thus far has not been formally introduced in Congress, nor has it received extensive public comment or even a precise definition of its impact on the Central Valley Project. Should the legislation become law, it would mark a major departure in water development history and reflect changing priorities not only in environmental protection but in federal-state relationships as well.

On the state level, the Department recommended four bills, including longer lives for the Delta water agencies, requirements that all Delta diversions over two second-feet have fish screens at the owners' expense, and provisions for financing recreation features at Los Vaqueros and the Delta facilities. But more important than these three was a proposal to specifically authorize the Delta transfer facilities and other new State Water Project units despite earlier contentions that they were already covered under the Burns-Porter Act. The Department would also be required to meet water quality control plans and would be specifically authorized to release stored water to do so. As in the case of the federal legislation, no action has been taken on these suggestions.[17]

On May 10, 1977, the Department of Water Resources staff assigned to the re-evaluation of Delta facilities made its recommendations to the Director, and once again it was the Peripheral Canal that was named the best available alternative.

> *This conclusion is based on the simple fact that with isolated conveyance, the needs of both the Delta fishery and Delta agriculture can be met; while with either of the non-isolated alternatives many of the fishery requirements could not be met even though Delta quality might be better assured.*[18]

A staged construction program was proposed to bring the portion of the Canal from Hood to the Shima Tract into operation by 1984. The staff recommended that first stage release facilities be increased from a capacity of 2,100 second-feet to 6,000 second-feet to provide additional water in the central Delta. However, in the first two years of operation the staff suggested limiting the Canal to about one-quarter of its capacity in order to evaluate fish screen designs and central Delta operational requirements. The second stage of construction, preconsolidation work from the San Joaquin River to Clifton Court, would be carried on concurrently with the first, followed by the final stage completing the Canal from Shima Tract to the project pumps. If construction proceeded on schedule and the institutional prerequisites were satisfied, the full Canal could be in operation by 1988.[19] In summarizing their deliberations, the Department's staff indicated that project customers favored the isolated Peripheral Canal, while environmental and recreational interests endorsed it only if its proper operation were guaranteed. Delta water users, on the other hand, generally distrusted the isolated channel proposal, preferring to keep project water flowing through at least some natural waterways. Reflecting the Delta viewpoint, three Contra Costa County legislators, Assemblymen Dan Boatwright and John Knox and Senator John Nejedly, were quick to label the staff recommendations "premature, totally lacking in common sense and reflective of poor judgement."[20] Their response meant that although the Canal has passed another obstacle to its construction, its history of controversy was far from over.

Distinct from the evolution of the state's Delta alternatives was consideration by the Army Corps of Engineers of a modified salt water barrier concept as part of a navigation improvement project for the John F. Baldwin and Stockton ship channels. The deepening of the channels and realignment in the False River area would increase saline intrusion, and although the draft environmental impact statement on the project issued in May, 1976, claimed the salinity increase would be insignificant, it nonetheless suggested that measures to mitigate the effects of additional intrusion be included. An alternative to increased releases in the form of a partial barrier, or submerged sill, in the Carquinez Straits was proposed by the Sacramento District of the Corps. The sill would be a rock barrier with a crest 50 feet below mean lower low tide to avoid any interference with navigation. Preliminary tests on the Bay-Delta hydraulic model indicated that the sill might impede the upstream movement of heavier salt water enough to cancel out the effect of the deeper navigation channel. Tests were continued and new configurations of submerged barriers developed in late 1976 with the prospect that, perhaps at long last, a barrier of sorts might after all be constructed in the Carquinez Straits.[21]

THE DROUGHT OF 1976 -- The consideration of a Delta alternative was complicated by a serious lack of rainfall that began in November, 1975, when a high-pressure system entrenched itself west of California and shielded the state from its normal winter storms, forcing them north into Oregon and Washington. Storms trying to break through the atmospheric ridge were weakened as them moved south, resulting in more normal precipitation totals in the north than in the central portions of the state. By April 1, 1976, the snowpack, main source of water for the state's reservoirs, was below normal in all areas, with one-third of the snow courses reporting the lowest pack in history. Sacramento Basin reservoirs received inflows that reflected the exaggerated north-south precipitation pattern with Shasta getting 66 percent of normal compared to 43 percent at Oroville and 31 percent at Folsom. On the San Joaquin River, Friant Dam collected only 38 percent of its normal runoff during the October 1, 1975, to September 30, 1976 rainfall year.[22]

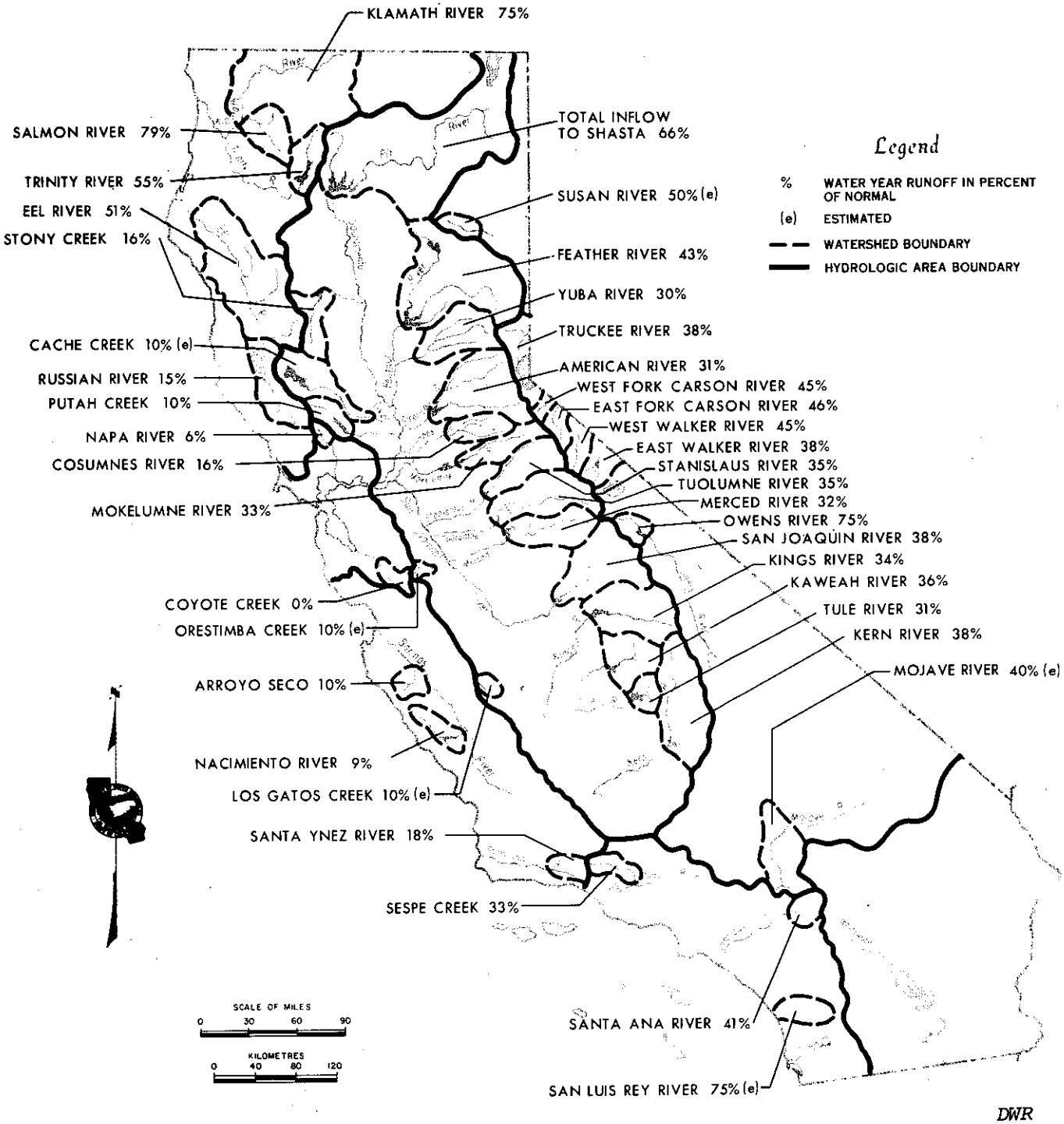
At the end of the 1975 water year, reservoirs were at normal carryover levels. As the situation worsened month by month, operational strategies were reviewed and revised by project managers to insure that contractual commitments were met, that water quality requirements were observed and that sufficient carryover would remain to continue operations should the following year be dry as well. Except for the Central Valley Project's Friant

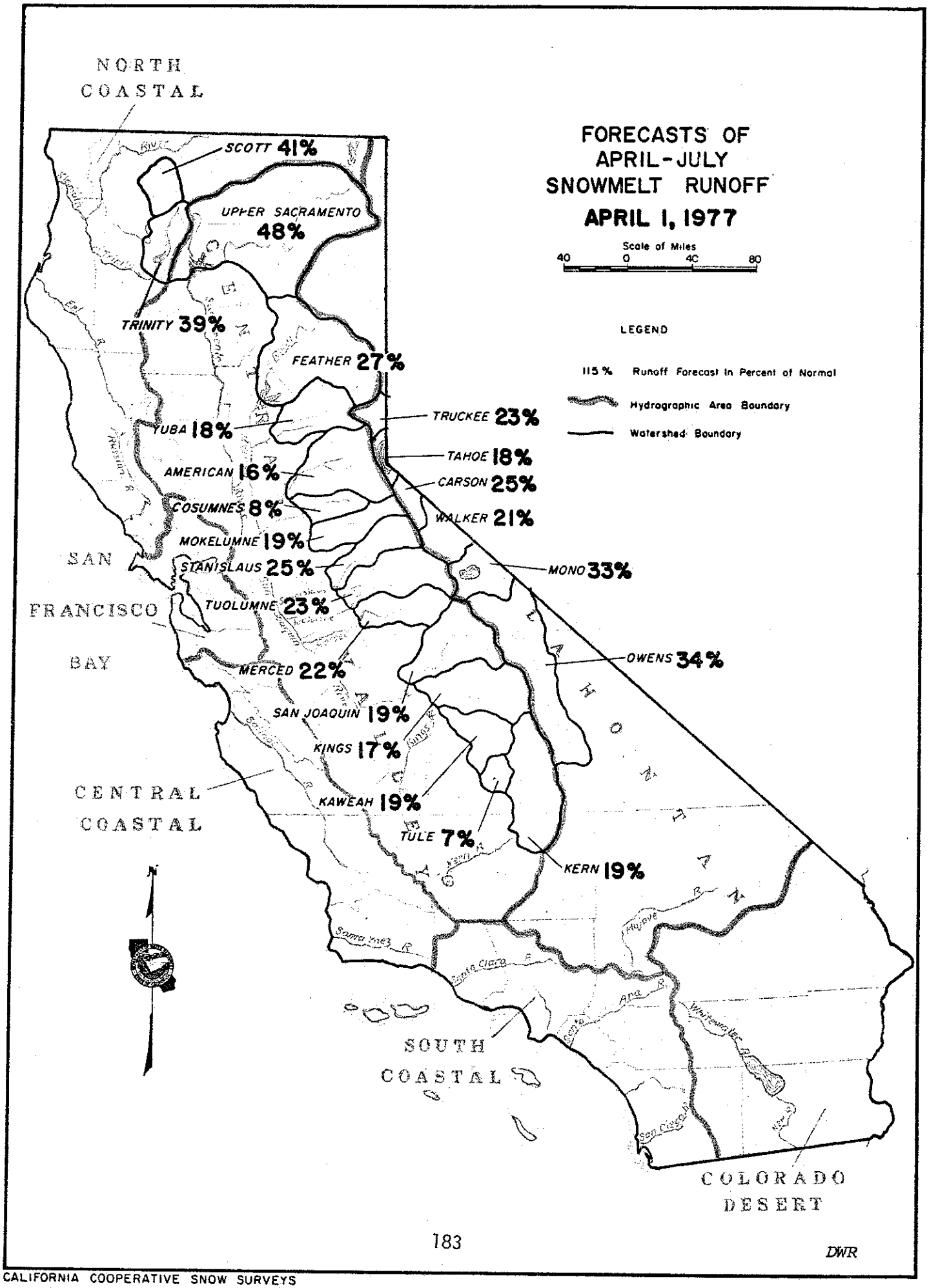
Division that operated independently and without carryover storage, the federal and state projects were able to allocate sufficient water to meet firm commitments. The State Water Project delivered a record 2.1 million acre-feet in 1976, some 21 percent above the previous high, while the Central Valley Project marketed over six million acre-feet. With an inflow of 3.6 million acre-feet at Shasta Reservoir, the Central Valley Project had no surplus water and the availability of interim water (firm supplies not yet under contract) was reduced to one million acre-feet. The Bureau decided to release 800,000 acre-feet of its interim supply to block the intrusion of ocean salinity, and assigned the remaining 200,000 acre-feet to the Westlands Water District in the San Luis Unit. On the Friant Division the 38 percent of normal runoff was raised to 46 percent of normal inflow into Millerton Lake by hydroelectric releases from upstream dams operated by Pacific Gas and Electric and Southern California Edison. The inflow was enough to meet 75 percent of Class I, or dependable, water contracts with the deficiency being made up by pumping from the already depleted underground water supply.[23]

Delta operations were a particularly difficult aspect of dry year water management, in part because the Department of Water Resources and the Bureau of Reclamation felt obligated to meet differing levels of Delta protection, with the state abiding by the Basin Plan and the Bureau planning to meet the November 19th criteria and the Rock Slough objectives for the Contra Costa Canal. Problems began early in the spring when on March 28 the water temperature at Antioch reached 60°F. and electrical conductivity exceeded the Basin Plan's striped bass spawning criteria of 1.5 millimhos EC or approximately 1,000 mg/l TDS at the same time. The state promptly reduced its Delta exports and increased Oroville releases in an effort to meet the standard, but the limited capacity of Georgiana Slough and the cross-channel to transfer the releases to the San Joaquin River thwarted the Department's initial attempts at meeting the Basin Plan objectives. The criteria were not met until April 12 and the 14-day running average was exceeded until April 21. An additional constraint to State Water Project operations was found in the conditions attached to Department water rights granted in D-1275. Decision 1379 had been intended to supersede the D-1275 interim criteria, but the court orders that stayed implementation of the Delta Decision in effect continued the applicability of D-1275. Under those standards the State Water Project was prohibited from storing additional water at Oroville or diverting natural inflows at the Delta between April 1 and June 30 when the chloride concentration at Blind Point exceeded 250 mg/l. The limit was reached first on April 15 but the salinity level dropped, rising to top the criteria on April 28 and remaining in excess through the end of the control period. As a result, some water was lost that otherwise could have been captured. The state's pumps were still able to operate as long as stored water rather than natural inflow was being released at Oroville, but in April pumping had been curtailed in an effort to meet striped bass criteria. In previous years, agreements with the Department of Fish and Game had called for limitations on exports for a five-week period each spring usually in April, but in 1976 Fish and Game requested that the curtailment take place in June. The state therefore planned to pump only enough water to satisfy demands on the South Bay Aqueduct and North San Joaquin Aqueduct between May 27 and June 30. The actual reduction in State Water Project exports began on May 22 because of a shortage of available water and extended much longer to allow time to repair a leak in the Aqueduct near Gustine that had developed in late June. With the California Aqueduct idled until August 15, State Water Project delivery schedules were met by releases from San Luis and the wheeling of 140,000 acre-feet of state water through Bureau of Reclamation facilities.[24]

During the striped bass spawning season, the Bureau had cooperated with the state in providing the necessary outflow, and at the end of that period the agencies agreed to maintain a new outflow of 4,000 second-feet in May. The Bureau had sufficient water to supply its share, three-quarters, of an outflow of that size for the rest of the season, and it was believed that if the Rock Slough criteria were met, the Exchange Contract, the November 19th criteria and most of the standards in Resolutions 68-17 and 73-16 would be fulfilled as well.[25] Although the State Water Resources Control Board slightly modified the Neomysis standard to allow a 14-day average rather than daily limits, higher outflows were required to meet the Basin Plan objectives, but because the Bureau claimed that it was not obligated nor authorized to meet Basin Plan criteria at the expense of other purposes, federal outflow releases remained at the previously agreed upon level. In a statement issued in mid-July, Director of Water Resources Ronald Robie explained that approximately 5,200 second-feet of outflow were needed to achieve adopted water quality standards and he charged that because the Bureau was refusing to release its share of the required outflow, the Department of Water Resources would have to release more of its own stored water. During a 10-day period in July, the Department released 18,000 acre-feet more than had been anticipated and predicted that if no aid was forthcoming from the Bureau some 127,400 acre-feet of state project water would have

NATURAL RUNOFF, 1975-1976
WATER YEAR OCTOBER 1 – SEPTEMBER 30




NORTH COASTAL
SCOTT 41%
UPPER SACRAMENTO 48%
TRINITY 39%
FEATHER 27%
TRUCKEE 23%
YUBA 18%
TAHOE 18%
AMERICAN 16%
CARSON 25%
COSUMNES 8%
WALKER 21%
MOKELUMNE 19%
SAN
STANISLAUS 25%
MONO 33%
FRANCISCO
TUOLUMNE 23%
BAY
OWENS 34%
MERCED 22%
SAN JOAQUIN 19%
KINGS 17%
CENTRAL COASTAL
KAWEAH 19%
TULE 7%
KERN 19%
SOUTH COASTAL
COLORADO DESERT
FORECASTS OF APRIL-JULY SNOWMELT RUNOFF
APRIL 1, 1977
Scale of Miles
40 0 40 80
LEGEND
115 % Runoff Forecast In Percent of Normal
Hydrographic Area Boundary
Watershed Boundary
DWR

to be released to combat salinity intrusion.[26] Because of water demands at the Delta, Director Robie had announced in early July that 115,264 acre-feet of previously projected surplus water would be unavailable for delivery to San Joaquin Valley users. The lion's share of that water, some 99,000 acre-feet, had been destined for the Kern County Water Agency and that organization was soon demanding a restoration of those supplies. The Water Association of Kern County contended that if the Delta salinity were allowed to move upstream only two or three miles, the full surplus water delivery program could be continued. Robie replied that "What the Kern County people said was, 'If you only violate the standards by this amount you can take care of us.' What I say is I can't violate them at all and take the law into my own hands."[27] Two State Water Project contractors, the Tulare Lake Basin Water Storage District and the Dudley Ridge Water Storage District, sued the state for its alleged failure to honor contractual obligations to deliver water and for violations of the constitutional requirement that water be put to reasonable beneficial use as well as violation of the court injunction against D-1379. A similar suit by the Berrenda Mesa Water Storage District was decided in favor of the Department in February, 1977, but that plaintiff was not a state contractor, and the other actions are still before the courts.[28] Cool August and September weather eased other project demands and about 20,000 acre-feet of the deleted 115,000 acre-feet was restored to the delivery schedules.

The Bureau of Reclamation, meanwhile, achieved its basic water quality standards because the November 19th criteria and the Exchange Contract were not violated and Rock Slough was held below 250 mg/l chloride. In fact, despite warnings from the Contra Costa County Water District in early July that the Bureau was placing "agricultural needs over the needs of people and industry"[29] by diverting too much water through its Tracy Pumping Plant and not allowing sufficient outflow, quality at the Contra Costa Canal Intake did not exceed 160 ppm at any time during the season. The Bureau also contracted with the South Delta Water Agency to release 1,600 acre-feet from the Delta-Mendota Canal to the San Joaquin River via the Westley Wasteway. As a result of the releases made between August 12 and 16, and a mid-August storm, south Delta water quality was improved.[30]

With salt water on the edge of the Delta in the summer of 1976, the Department of Water Resources sought a means to expedite the transfer of water from the Sacramento River by way of interior channels. In order to force more water into the main Sacramento River channel to increase the effectiveness of the Delta cross-channel and Georgiana Slough, the Department proposed in July to install a temporary rock dam in Sutter Slough about a miles southwest of Courtland. The $130,000 dam would be notched for fish passage and was expected to add about 2,000 second-feet to Sacramento River flows. Although the dam would result in water levels about one foot below normal at the confluence of Miner and Sutter sloughs, the Department planned to provide portable pumps as needed to protect local water users and hoped to secure contracts with these agricultural interests in late July. Farmers dependent on the slough proved to be unanimously opposed to the Department's scheme, delaying the dam until the state Reclamation Board could consider it on August 13.[31] The Board approved the temporary barrier following an agreement between the Department and the North Delta Water Agency that no changes in the available quality or quantity would be made and that the dam would be removed by December 20 or whenever necessary because of high river flows.[32] The barrier was completed on August 31 and saved an estimated 50,000 to 100,000 acre-feet by altering Delta flow patterns.[33] With the construction of the Sutter Slough dam the efforts to combat the 1976 drought were nearing an end. As the autumn, and the end of the water year, approached, project operators along with the rest of the state crossed their fingers and awaited the rains.

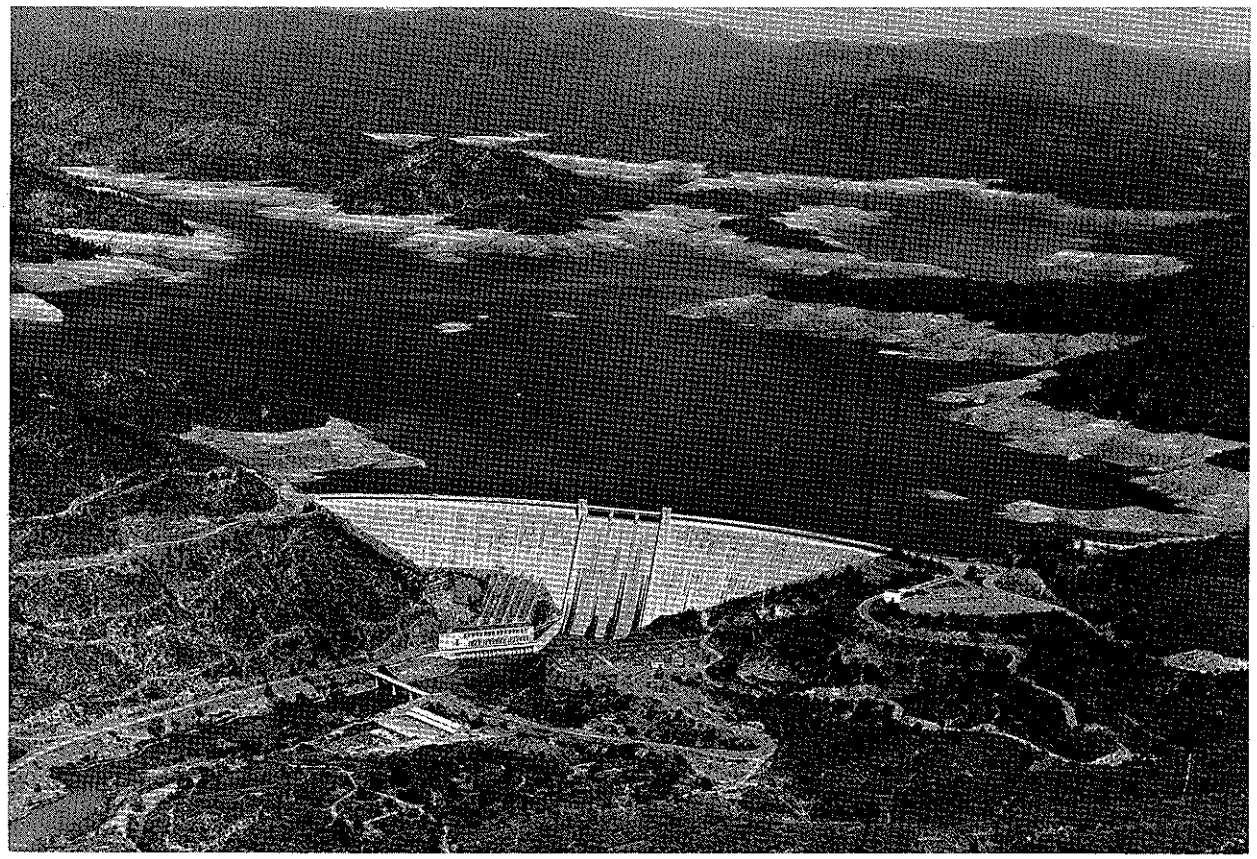
NO END IN SIGHT -- On January 20, 1977, Director of Water Resources Ronald Robie told the State Water Resources Control Board's dry year hearing that "prior to six weeks ago I don't think anyone in their right mind would have predicted that we would be saying that 1976 wasn't so bad after all."[34] Water supply conditions in California had continued to worsen in the latter part of 1976. The late summer rains temporarily eased agricultural water demands, but in October the persistent high pressure returned to the Pacific coast to once again push the storm track away from California, and this time from the Pacific Northwest as well. The beginning of the 1977 water year on October 1, 1976, found reservoirs throughout the Central Valley Basin far below normal seasonal levels. The Central Valley Project had only 3.65 million acre-feet in storage behind its main Sacramento, Trinity, and American river dams, compared to 6.2 million acre-feet under normal conditions.[35] The State Water Project ended its first critically dry year with 1.8 million acre-feet in Oroville Reservoir, also far below normal. The continued shortage of runoff meant that to meet Delta water requirements, water accumulated in previous years had to be released from storage reservoirs in increasing quantities. Project releases were trimmed following the irrigation season to

provide a 2,500 second-foot outflow into Suisun Bay, but with outflow almost totally dependent on stored rather than current supplies, the reduced releases proved inadequate to meet water quality objectives. The minimum controlled outflow was maintained from September 10 to November 10, 1976, when increased releases were begun that brought net Delta outflows to 8,000 second-feet by December 17. Throughout the month of December outflows averaged 6,100 second-feet, dropping to an average of 4,700 second-feet in January and early February, 1977. At first the additional water came exclusively from Oroville, but in early December the Bureau of Reclamation joined in augmenting Delta outflows in order to meet the water quality requirements of the Exchange Contract. As a result of the higher than usual releases to the Delta, reservoirs were drained even lower at a time of year when they should have been filling, with storage at Oroville dropping over 200,000 acre-feet by early 1977. Despite the efforts to meet water quality standards, some of the objectives were still exceeded. Because water years were classified according to Shasta inflows that in 1976 had been more nearly normal than in most of the Central Valley Basin, 1976, including the first months of the new water year, was not officially designated as critical. Basin Plan agricultural criteria for non-critical years called for salinities of not more than 1,000 mg/l chloride at Emmaton and not over 3.1 millimhos EC at Blind Point from August through December. The Blind Point objective was exceeded from November 9 to the end of the control period, while the Emmaton standard was not met between December 8, 1976 and January 7, 1977, and was exceeded at times thereafter. At Chipps Island, the slightly modified Neomysis protection criteria was violated from November 10 to January 13. Even with heavier than normal upstream releases, the Delta seemed poised on the brink of disaster.[36]

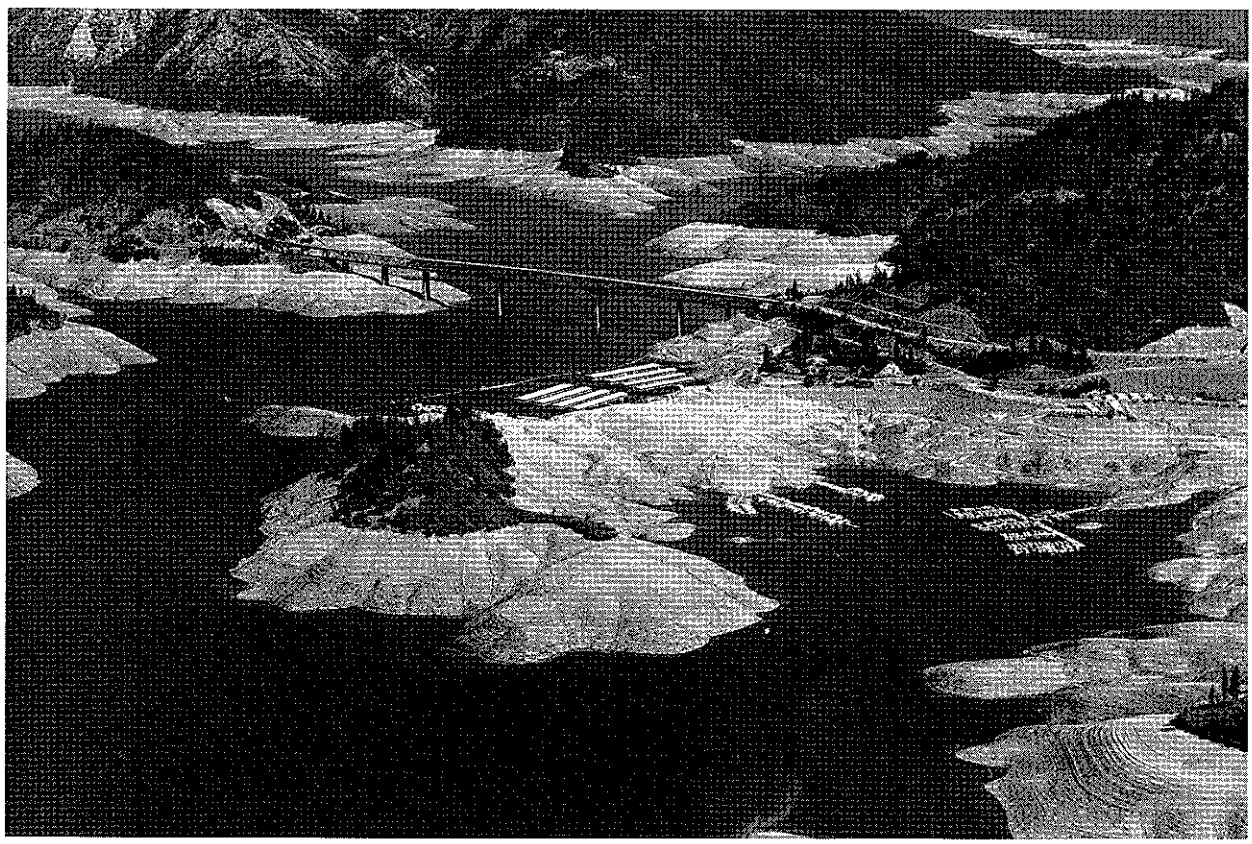
The Delta was, of course, far from being alone in its precarious water supply situation. As the severity of the second consecutive dry year became increasingly apparent, water project managers labored to revise operational forecasts and prepare to cope with the anticipated serious summertime shortages of water. The Bureau of Reclamation, acting on the assumption that 1978 would bring a third year of drought, projected a minimum carryover requirement on October 1, 1977, of 1.9 million acre-feet in major Central Valley Project reservoirs; a quantity sufficient to meet only water rights entitlements for 1978. For 1977, the Bureau prepared allocation plans for several potential runoff contingencies, down to a projected inflow of only three million acre-feet into the Shasta, Trinity and Folsom reservoirs. At that level of inflow, the Central Valley Project would reduce deliveries to water right contractors along the Sacramento River and the San Joaquin River below the Mendota Pool by 25 percent, with a similar cut planned for municipal and industrial customers. Other agricultural water users were expected to take a 50 percent deficiency in water deliveries.[37] By early February, however, prospects had darkened to the point that the Bureau had to announce even stricter reductions on other than water rights entitlements. Municipal and industrial users were guaranteed only half their normal supplies, while other agricultural contractors were left with a mere one-quarter of the water usually available for irrigation. The situation in areas served by Friant Dam was even grimmer, with only about 3 percent of normal deliveries projected if rain and snow continued to avoid the southern Sierra for the remainder of the season.[38] The State Water Project, too, was forced to announce delivery restrictions, with municipal and industrial users taking a 10 percent cut in entitlements, Feather River diverters a 50 percent reduction, and San Joaquin Valley irrigators a 60 percent deficiency. According to the operational plan adopted on February 15, 1977, the State Water Project would be able to deliver 1.15 million acre-feet, about half as much as in 1976. Looking ahead to 1978, if that water season followed the pattern of 1924, the state project would be able to meet 60 percent of its municipal and industrial commitments but only 10 percent of its agricultural water contracts.[39]

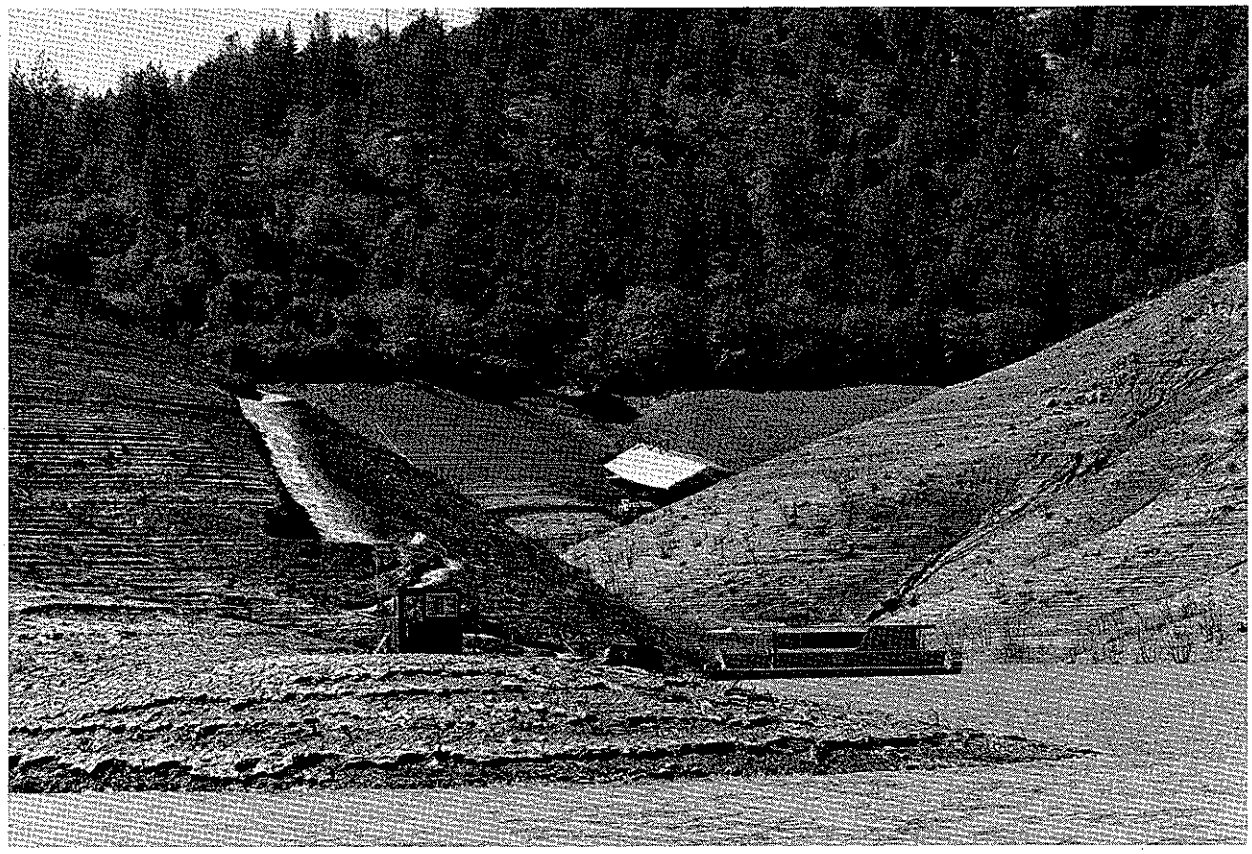
In the fall of 1976, as the rains failed to arrive and the Department of Water Resources presented their package of Delta alternatives, the State Water Resources Control Board began its re-evaluation of Delta water quality criteria adopted on an interim basis in D-1379. The Board intended to break the proceedings into two phases, the first dealing with the operations of the state and federal projects, beneficial uses of water in the Delta, and the quality of water necessary to protect those uses. During the second phase, the actual description of operating criteria would be considered. Phase I deliberations began on November 15, 1976, and continued into early December, but the potentially significant hearings were overshadowed by the more immediate problems of the continuing drought.

On January 20 and 21, 1977, the Board held hearings to consider the modification of Delta standards for the current dry year. The Department of Water Resources indicated that its position was especially critical, because if Basin Plan objectives remained in force and the Bureau of Reclamation provided no more than the 3,000 second-feet of outflow that constituted its share of meeting the November 19th criteria, the State Water Project would

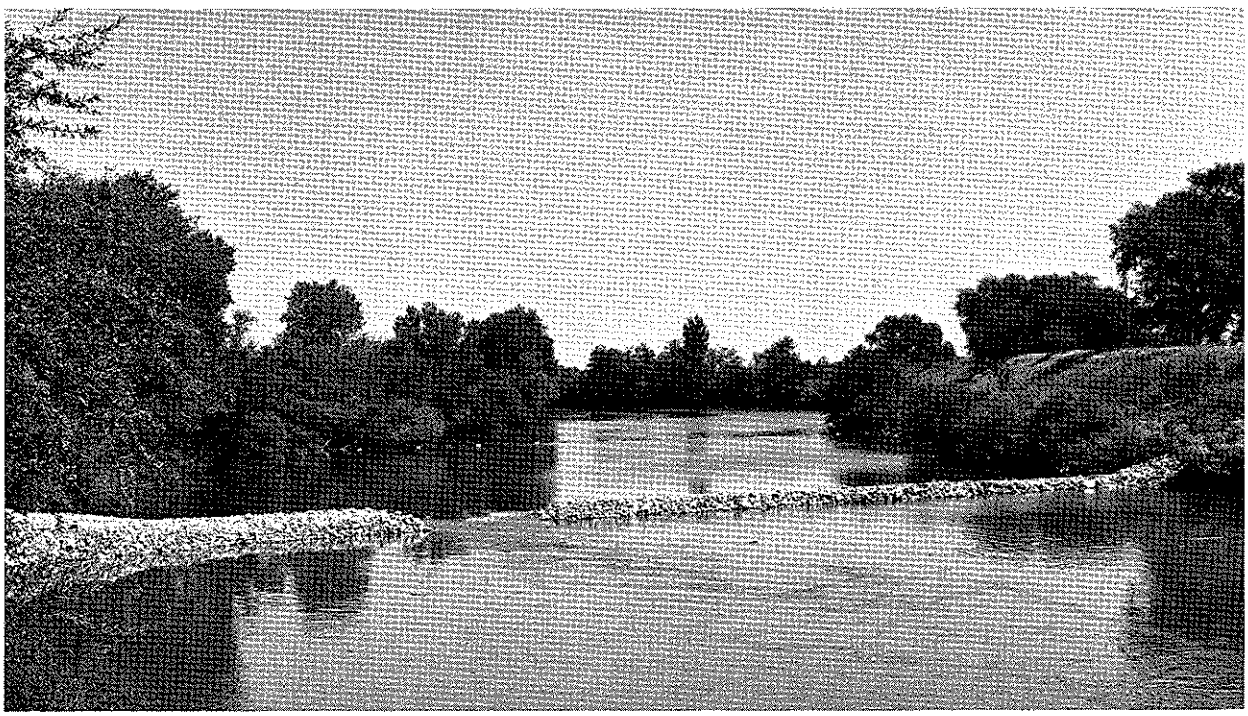


Shasta reservoir at the end of the 1976 irrigation season. After the first of two critically dry years, Shasta was left with only 1,291,000 acre-feet in storage, as compared to a capacity of over 4,500,000 acre-feet. (USBR photos)





The drought of 1976 at Lake Shasta. A boat marina shed has been left high and dry by the receding waters.



Sutter Slough rock barrier. In late summer, 1976, the Department of Water Resources installed an emergency rock barrier in Sutter Slough to force more of the Sacramento River's flow past the Delta cross-channel at Walnut Grove, where water could be diverted to the San Joaquin Delta.

have to supply all remaining Delta requirements from Oroville. Under those conditions, the deficiencies imposed on contractors would be equal to those announced in mid-February, and Oroville would be drawn down to about 1.2 million acre-feet by fall and State Water Project reservoirs south of the Delta would retain only 100,000 acre-feet. Not only would the extremely low carryover threaten operations in a succeeding dry year, but power production and cool water releases for salmon spawning would also be jeopardized. Relief for the state project could come either from a Bureau of Reclamation commitment to assist in meeting Basin Plan criteria or through modification of the water quality standards applicable to the Delta. The Bureau had already indicated that its 1977 operations were predicated on minimal Delta outflows, forcing the Department to request the State Water Resources Control Board to alter the objectives. The Department proposed that the Basin Plan be amended to allow chloride concentrations at Emmaton and Jersey Point to reach 1,400 mg/l from August through March rather than August through December, on the grounds that the impact of the modification on Delta agriculture would be slight because it would not affect the irrigation season. The Rock Slough criteria, perhaps the most difficult to achieve in a dry year, would be changed to require water of 100 ppm chloride or less to be available at the Contra Costa Canal intake as little as 26 percent of the time, depending on runoff volumes, as opposed to the 65 percent figure specified in the Basin Plan. In a move sure to stir some controversy, the Department declared that the Antioch municipal and industrial standard was no longer in effect because the Department had determined that the Contra Costa Canal constituted an overland delivery system within the meaning of the objective providing protection on an interim basis until an overland facility was completed. For fish and game, the Chipps Island Neomysis objective would be raised to 5,000 mg/l chloride, and striped bass spawning salinities at Antioch would be increased from 1.5 millimhos EC to 4.0 millimhos, following the terms of the still unsigned Four-Agency Fish Agreement. With those relaxations, and assuming 1924 runoff levels and State Water Project responsibility for water quality control in excess of the November 19th criteria, the state project could increase deliveries to 1.5 million acre-feet and retain 1.58 million acre-feet in Oroville, the minimum reservoir level specified in power contracts.[40]

On January 27, 1977, the State Board published in draft form interim Delta standards. The Antioch municipal and industrial criteria were suspended for 1977 as were both TDS and chloride standards for Cache Slough. Rock Slough TDS objectives were dropped and the chloride criteria was modified to provide a maximum of 250 mg/l and a level of 150 mg/l for a percent of the time determined by Sacramento Valley inflow. At under 5 million acre-feet of inflow, the 150 mg/l standard would be maintained 49 percent of the year but up to 90 percent on the sliding scale if inflows exceeded 15 million acre-feet. The lower objective would be suspended altogether if the salt sensitive paper companies, Crown Zellerbach and Fibreboard, were able to secure alternative water supplies. Agricultural standards remained unchanged from the Basin Plan. Fish and wildlife objectives were modified as recommended by Department of Fish and Game, and in accordance with the draft of the Four-Agency Fish Agreement. The bass spawning salinity at Prisoners Point was unchanged though definite dates, April 1 to May 7, were assigned rather than determination based on water temperatures. In the western Delta, the period from April 1 to April 14 was covered by a Chipps Island outflow index of 6,700 second-feet followed a 1.5 millimhos EC limit at Antioch from April 15 through May 7. The bass spawning criteria for the western Delta were to be altered again whenever project users were taking deficiencies in firm supplies, a virtual certainty in 1977. In that event, the Antioch and Chipps Island Spawning objectives were replaced by outflow index criteria from April 1 to May 7 based on a formula that derived outflow from:

$$6700 \text{ cfs} - \frac{(D)}{(700 \text{ ac ft})} \times 100 \text{ cfs}$$

"D is the deficiencies in acre feet taken by project users during the same period, excluding Friant Division of the CVP."[41] Following May 7, Neomysis survival flows were determined by water availability, with an outflow of 3,000 second-feet for the rest of May and 2,500 second-feet in June and July specified for dry and critical years. Suisun Marsh salinities were restricted to 15.6 millimhos EC from October through May in a dry or critical year, as measured at Chipps Island.[42] In making its recommendations, the Board intended "to help spread the burden of the critically dry year as broadly as possible."[43] Although all beneficial uses in the Delta would not be fully protected, the degree of protection afforded by the interim standards was probably greater than would have been possible without the federal and state water projects.

Following release of the interim proposals, interested parties were given until February 4 to submit written comments to the Board, and another hearing was scheduled for February 8. The response to the proposed relaxations was predictable. Water users in the San Joaquin Valley represented by the Kern County Water Agency and the Tulare Lake Basin Water Storage District argued for further reduction in the Rock Slough objectives, while both the Contra Costa County Water District and the Water Agency, along with the two paper companies and other Delta interests, objected that the modifications had gone too far. Conservationists including the Sierra Club expressed concern over the adequacy of protection provided for Suisun Marsh and the Delta environment.[44] At the February 8, 1977, meeting the Board approved the Interim Water Quality Control Plan as drafted, including provisions for the control of the Delta cross-channel gates to limit cross-Delta diversion of young bass, and curtailment of export pumping in May and June to further protect the juvenile fish.

Work was also proceeding in the spring of 1977 on the general revision of Delta standards begun the previous fall. In preparation for the second round of hearings, the staff of the State Water Resources Control Board presented a trial set of water quality objectives in March, 1977, based on testimony gathered during Phase I. The trial objectives were designed simply as a basis for discussion at hearings set to begin in late April, and did not represent any official expression of intent by the Board. The staff hoped to maintain water quality levels equivalent to those that would have been available without the Central Valley Project or the State Water Project. Agricultural standards as defined by the trial objectives were significantly higher than those previously adopted. The 1975 Basin Plan required April through July salinities at Blind Point to be under 2.2 mmhos EC in noncritical years and 3.6 mmhos in critical years. However, the new trial objectives called for an absolute maximum of 1.0 mmhos at Emmaton during that period, with 0.4 mmhos to be maintained for from 115 to 75 days within that time, depending on the volume of Sacramento basin runoff. Stations in the central Delta were handled in a similar fashion. In the southern Delta no specific objectives were suggested pending the definition of physical facilities to protect that area. Trial objectives for municipal and industrial water at Rock Slough were the same as those established in the 1977 Interim Water Quality Control Plan. At Antioch limits of 150 mg/l and 250 mg/l chloride were provided for a percentage of each year determined by upstream water availability. Fish and wildlife objectives were based on a draft of the Four-Agency Fish Agreement and resembled the criteria included in the 1977 interim plan with additional standards for salmon migration and Suisun Marsh protection. The trial objectives were not a policy, but only one suggestion of quality standards the Board might subsequently adopt.[45]

By mid-February, 1977, the difficulty of meeting Delta water quality standards, even as modified, was painfully obvious. Rock Slough salinity was in excess of even the 250 mg/l chloride standards, and Emmaton hovered near or over its 1,000 mg/l limit. The failure of the Bureau of Reclamation to release more water for Delta outflow led the Department of Water Resources to briefly halt deliveries to federal customers served by the State Water Project through the Cross-Valley Canal in Kern County. A contract provision in the agreements with local water users for the wheeling of Central Valley Project water through state facilities and subsequent letters of agreement stipulated that if the Bureau did not share in the maintenance of all Delta quality criteria, the Department was not obligated to provide water to the half a dozen local agencies whenever those objectives were exceeded. Though the interruptions of service were brief, they were enough to elicit charges from federal contractors that the state was practicing a form of blackmail against the Central Valley Project by withholding water, illustrating the kind of tensions resulting from water management decisions in a dry year.[46]

As the drought worsened, some parts of northern California, most notably Marin County, instituted or considered water rationing, and throughout the state pleas for conservation and calls for cooperation in the allocation of scarce supplies were heard. One source of assistance was the Metropolitan Water District of Southern California's decision to release 320,000 acre-feet of its State Water Project entitlement for reallocation, while increasing its diversions from the Colorado River to make up the difference. The curtailment of trans-Tehachapi pumping made 28,800 acre-feet available to the Bay Area, including about 10,000 acre-feet for hard-pressed Marin County to be delivered through the state's South Bay Aqueduct to the Hetch Hetchy system and then wheeled north through local conduits to the San Rafael Bridge. The remainder of the Metropolitan Water District entitlement was to be shared by agricultural water users in the San Joaquin Valley, including 20,250 acre-feet to non-State Water Project contractors.[47]

Difficulties in meeting the Rock Slough criteria prompted the Department of Water Resources to install two dams in the southern Delta, one on Rock Slough west of Old River and another on Indian Slough, the latter equipped with tide gates, in an attempt to isolate the Contra Costa Canal intake from Old River, where water quality had already deteriorated. The modifications were expected to route historically better quality water from Middle River to the canal pumps, though eventually a pumping plant was planned for Middle River to utilize one of three conduits of the East Bay Municipal Utility District's Mokelumne River Aqueduct to carry water directly from the interior Delta to Indian Slough and the intake channel. Although it had not yet been done, the Department of Water Resources also comtemplated reconstructing the Sutter Slough barrier that had performed satisfactorily in 1976.

A series of storms in May, 1977, came too late to substantially augment the year's meager runoff, and by the end of the month the Department of Water Resources had proposed additional water conservation measures for the Delta to stave off the effects of another potentially dry year. The Department proposed the construction of rock barriers in the San Joaquin Delta at Fisherman's Cut, Dutch Slough, and False River that would help protect water quality at the pumping plants serving Contra Costa County and the San Joaquin Valley from increasing salinity. In addition to the physical modifications, state planners urged the lowering of Delta water quality standards to reduce the demand on reservoir storage used to provide Delta outflow and suggested limiting the amount of water taken by riparian water right holders to no more than would have been available under natural conditions. The emergency measures, to be implemented beginning in September, 1977, were designed to save about one million acre-feet of water for use if the drought continued. The Department emphasized that once salt water was allowed to enter the Delta, flushing it out could be difficult and leave areas of the state dependent on the Delta for their fresh water supply in a difficult position.[48]

The impact of the second critically dry year in a row cannot be more than guessed at as yet but it promises to be one of the major landmarks in the history of the Delta and of water development in California. The balancing of water requirements and environmental considerations that has characterized the Delta debate, and indeed all discussions of the future course of the great water projects, over the past few years will certainly be subjected to new stresses and some old assumptions may have to be re-evaluated. It would be convenient to be able to gaze into a crystal ball and foretell what ultimate effect the drought will have on the Delta, but unfortunately the ability to predict even a month or two into the future is still rather rudimentary and imprecise. Yet, when the summer of 1977 finally joins the summers that have gone before it as history rather than speculation, it will more than likely be no more than a chapter, albeit an important and dramatic one, in the story of the struggle over the control of a scarce resource: fresh water. The coming summer may be the battle for the water hole on a grand scale, but it will be only one of a long succession of such battles fought across the arid West for at least a century. And regardless of what happens in 1977, the end is still not in sight.

NOTES

CHAPTER XIV - LOWERED EXPECTATIONS

1. James M. Dourgarian, "The Peripheral Canal; Environmental Concerns Catch Up with Southern Thirsty," California Journal, July, 1975, p. 249.
2. Ibid., pp. 249-250.
3. DWR, Phase II, Alternative Courses of Action to Provide Delta Protection and Adequate Water Supplies for California, March, 1976.
4. DWR, "Delta Alternative Study Status -- October 1976," pp. 3-4.
5. Ibid., pp. 5-6.
6. DWR, "Statement of the Department of Water Resources Before the Senate Committee on Natural Resources and Wildlife," November 19, 1976, pp. 13-15.
7. Sacramento Union, October 14, 1976.
8. Dan Boatwright, "Statement of Assemblyman Dan Boatwright to the Senate Committee on Natural Resources and Wildlife Regarding the Delta Alternatives Study . . . ," November 19, 1965.
9. Department of Fish and Game, "Fish and Wildlife Impacts of Delta Water Facility Alternatives," October 14, 1976, pp. 23-29.
10. Ibid., pp. 14-17.
11. Ibid., pp. 2, 5.
12. Billy E. Martin, "Remarks to California Senate Committee on Natural Resources and Wildlife Concerning Cross-Delta Alternatives," November 19, 1976, p. 4.
13. Ibid., p. 5.
14. DWR, "Delta Alternative Review State," draft, February, 1977, pp. 3-8.
15. DWR, "Summary of Federal Legislation," attached to "Statement of the Department of Water Resources Before the Senate Committee on Agriculture and Water Resources," February 15, 1977, p. 3.
16. Ibid., and DWR, Draft of "A Bill to reauthorize the Central Valley Project," dated January 28, 1977.
17. DWR, "Statement . . . ," February 15, 1977, pp. 23-24.
18. DWR, "Selection of a Delta Water Transfer Facility," May, 1977, p. 5.
19. Donald E. Owen, DWR, to Ronald B. Robie, Director, DWR, and E. C. Fullerton, Director, Department of Fish and Game, May 10, 1977.
20. Davis Enterprise, May 12, 1977.
21. Interview, Art Champ, Corps of Engineers, with Alan M. Paterson, October 22, 1976.
22. Charles R. Shoemaker, Assistant Director, DWR, "The 1976 California Drought: An Overview," presented to Assembly Water Committee and Senate Agriculture and Water Resources Committee, October 19-20, 1976, p. 2 and Figure 2.
23. USBR, Central Valley Project, Water Operations in 1976 -- A Dry Year, December, 1976, pp. 13-15.

24. Shoemaker, "The 1976 California Drought," pp. 8-11.

25. USBR, Water Operations in 1976, p. 17.

26. Modesto Bee, July 13, 1976.

27. California Farm Bureau Federation, Ag Alert, August 4, 1976.

28. DWR, "Statement . . . ," February 15, 1977, pp. 15-16.

29. Modesto Bee, July 8, 1976.

30. USBR, Water Operations in 1976, pp. 17-18.

31. Sacramento Union, July 29, 1976.

32. Sacramento Bee, August 14, 1976.

33. DWR, The California Drought -- 1977: An Update, February 15, 1977, p. 14.

34. DWR, "Statement of the Department of Water Resources for the Dry Year Hearings," January 20, 1977, p. 1.

35. USBR, Dry Year Operations Policy, 1977, Central Valley Project, January, 1977, p. 5.

36. DWR, The California Drought -- 1977, pp. 14-16.

37. USBR, Dry Year Operations Policy -- 1977, pp. 4-6.

38. News item, KMJ radio, March 22, 1977.

39. DWR, The California Drought -- 1977, pp. 51-53.

40. DWR, "Statement . . . ," January 20, 1977.

41. State Water Resources Control Board, Draft Interim Water Quality Control Plan for 1977, Sacramento-San Joaquin Delta and Suisun Marsh, January, 1977, p. 35.

42. Ibid., pp. 33-36.

43. State Water Resources Control Board, Interim Water Quality Control Plan for 1977, Sacramento-San Joaquin Delta and Suisun Marsh, February, 1977, p. 5.

44. Ibid., Appendix, "Summary of Public Comments . . . "

45. State Water Resources Control Board, "Notice of Convening of Phase II Hearing," March 15, 1977.

46. DWR, Bulletin No. 132-76, p. 4, and telephone conversation, Jerry King, USBR, and Alan M. Paterson, March 10, 1977.

47. DWR, The California Drought -- 1977, p. x, and interview, Walt Fisher, DWR and Alan M. Paterson, March 7, 1977.

48. California Farm Bureau Federation, Ag Alert, May 25, 1977.