DWR-37
Phase 5

Testimony of the Department of Water Resources on South Delta Salinity Objectives and Dissolved Oxygen Objectives in the San Joaquin River [1]

The May 1995 Water Quality Control Plan for the Sacramento-San Joaquin Delta and San Francisco **Bay** estuary issued by the State Water Resources Control Board adopted year-round south Delta salinity objectives of between 0.7 EC and 1 .O EC at four locations: (1) San Joaquin River at Vernalis, (2) San Joaquin River at Brandt Bridge, (3) Old River near Middle River, and (4) Old River at Tracy Road Bridge. In addition, a dissolved oxygen standard of 6.0 milligrams per liter or better on the San Joaquin River between Turner Cut and Stockton was adopted from September through November.

The purpose of my testimony today is to explain to the State Water Resources Control Board what the Department of Water Resources believes are the appropriate water quality implementation measures for the State Water Project's and the federal

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[1] **Presented** by John M. Ford and Stephen S. Roberts

Central Valley Project's contribution to the achievement of these objectives in the south Delta. The factors affecting salinity in the south Delta are different from those affecting dissolved oxygen levels along the San Joaquin River. I will address the salinity objectives, followed by some limited remarks on the dissolved oxygen objective.

As I will more fully explain, DWR believes that the most appropriate method of addressing and controlling salinity in the south Delta is through the construction and operation of permanent flow control structures in the south Delta. DWR believes that the Board should recognize and accept our efforts to implement the south Delta barriers program as the appropriate water quality implementation measures for the SWP and the CVP to contribute to the achievement of water quality objectives in the south Delta. However, the installation of permanent flow structures alone cannot always guarantee compliance with specific water quality objectives. With respect to the proposed Stockton Dissolved Oxygen objectives, while the Head of Old River temporary rock barrier has been installed since the 1960's to help improve D.O. levels downstream for migrating salmon, the D.O. Objective for the San Joaquin River near Stockton cannot always be met solely by operating the fall Head of Old River fish control structure. This structure is not a cure-all for D.O. Problems because it does not address all of the other factors which also influence D.O. Levels.

South Delta Salinity Problems

History

First, I will summarize some of the past history of the south Delta barriers program and the reasons that the Department, along with the Bureau of Reclamation and the South Delta Water Agency, are involved with the program. **Figure 1** illustrates the boundary of the South Delta Water Agency which is generally comprised of the lands and channels in the Delta both to the west and south of the city of Stockton. In D-1485, the SWRCB did not set agricultural standards for the south Delta. It deferred to ongoing negotiations between the SDWA, the Department of Water Resources and the Bureau of Reclamation. In 1982, the SDWA filed a lawsuit against the CVP and SWP alleging that joint project operations detrimentally affected the quantity and quality of water supply within the SDWA service area. Specifically, SDWA complained that at various times and locations water users in the SDWA suffered from poor water quality and diminished water levels.

Negotiations produced a constructive dialogue and a productive approach to addressing the concerns of the SDWA. Beginning in 1985, a series of immediate actions were undertaken in response to complaints about water levels in the SDWA. DWR dredged parts of Tom Paine Slough, a particularly shallow area in the south Delta area and installed three temporary pumps to transport water from Sugar Cut

(near Old River) into Tom Paine Slough for agricultural diversion. In addition, DWR modified the existing operations of the Clifton Court **Forebay** gates to minimize the potential for operational effects on water levels in the south Delta area. Further actions included additional interim releases from New **Melones** by the Bureau of Reclamation to improve water quality at Vernalis, and the construction of four large siphons to provide a more reliable supply of water from Old River into Tom Paine Slough.

In 1990, DWR, SDWA and USBR entered into a settlement framework to work together to develop mutually acceptable long-term solutions to SDWA water problems. We have also developed an agreement which resolves the dispute among the Department, Bureau, and South Delta Water Agency over the impacts of SWP and CVP on SDWA channels. A copy of this settlement framework and agreement is attached to my testimony as Attachment 1. Based on a series of modeling runs conducted by the Department and a SDWA consultant, a three-agency **workplan** was developed in 1987 which identified several flow structures that could be constructed in the south Delta to significantly enhance water levels and circulation. I would like to identify them now for purposes of identification and general orientation (Figure 2). Three flow control structures were identified at the following locations: Middle River southeast of North **Canal**, Old River northeast of Tracy Pumping Plant; and Grant Line Canal east of Old River. An additional fish protection structure at the Head of Old River was later incorporated to provide benefits to San Joaquin fall-run chinook salmon.

DWR has been installing and operating temporary barriers to assist SDWA diversions in the south Delta since 1991. The temporary barriers are rock structures placed across the channel with culverts placed through the rock near the low water levels. Except for the Grant Line rock barrier, the rock barrier locations are shown in Figure 2. The Grant Line rock barrier is located 5.5 miles east of the location shown in Figure 2. DWR is presently permitted to install and operate the barriers through the year 2000 and we are committed to continuing the temporary barriers program Until such time as permanent, fully operable flow control structures are constructed. DWR will ask for an extension of the permits when they expire in the year 2000.

Permanent, fully operable flow control structures are proposed as components of the preferred alternative under the joint DWR/Reclamation Interim South Delta Program. The permanent barriers would be radial gated structures, similar to the Suisun Marsh Salinity Control Structure. The ISDP preferred alternative also includes components to allow the SWP to divert up to 10,300 cubic feet per second per day, on a monthly averaged basis, when the water is available. These components are: 1) dredging 5 miles of Old River north of Clifton Court Forebay to improve channel carrying capacity, 2) constructing and operating a new intake gate at the northeast corner of Clifton Court Forebay, and 3) obtaining authorization from the Army Corps of Engineers under Section 10 of the federal River and Harbors Act to increase diversions into Clifton Court Forebay (see Figure 2).

Draft Environmental Impact Statement/Report for the **ISDP** was issued in July 1996. At the present time, we are in formal Endangered Species Act consultation under both federal and State law. We are continuing to provide additional information requested by the Department of Fish and Game, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service to supplement the information already provided in the Biological Assessment and in the draft **EIR/EIS** and its supporting documents. We hope to conclude formal ESA consultation by fall 1998. If we are successful, a final **EIR/EIS** for **ISDP** could be issued in spring 1999. Based on this schedule, we expect the completion and operation of the permanent flow control structures according to the following schedule: (1) Head of Old River fish structure and Middle River flow control structure - early 2004, (2) Old River near Tracy flow control structure - early 2005, and (3) Grant Line Canai flow control structure - mid 2006. However, as I mentioned previously, DWR and Reclamation. are committed to continuing to install and operate the temporary rock barriers at these sites until such times as the permanent fish and flow control structures are fully operational.

South Delta Hydraulic and Water Quality Background

To understand why DWR, Reclamation and the SDWA agreed upon the south Delta flow control structure solution, it is necessary first to understand the existing hydraulic and water quality setting in the interior south Delta. The south Delta area has a long history of water supply and water quality problems. When Delta conveyance

alternatives were being studied back in the early 1970's, it was recognized that additional facilities would be needed to address the specific concerns related to the south Delta area.

A principal concern for south Delta water supply is low water levels. Moderate to high water levels in the area are needed to ensure that agricultural diversion facilities have adequate draft. When water levels are low, diversion intakes can cavitate, which results in higher pumping costs and increased wear on intake pumps. Pump machinery can subsequently fail, resulting in loss of irrigation water for crops and increased costs to agricultural users in the area to replace the failed machinery. Water levels in the area are affected by a multitude of factors: low river flows entering the southern Delta at Vernalis; local channel depletions by agricultural diversions; natural tidal variations, especially during periods of extreme low tides; fluctuations in barometric pressure, and local wind direction and velocity exacerbate low water level conditions; limited channel capacities (many of the channels in the south Delta area are very shallow); and diversions at project export facilities.

Local, State and federal water project diversions in the south Delta can cause water level problems for south Delta diverters. If high rates of local diversion occur within a concentrated area during peak irrigation periods, water levels in the area will be drawn down accordingly due to the low carrying capacity of the channels. Similarly, water project exports in the south Delta can decrease local water levels. Of

particular importance are the water levels during or near the low tide. The CVP's Tracy Pumping Plant must pump 24 hours per day to meet its demands and does not have operational flexibility to curtail pumping during low tides. The SWP's diversions into Clifton Court Forebay, while generally higher than the diversions at Tracy, can be taken during high tide periods with accompanying curtailments during low tide periods, because diversions into Clifton Court are controlled by radial gates at the intake to the forebay. This is an operational change which the SWP has already adopted to help with water level problems in the south Delta.

The water quality of irrigation water in the south Delta is important both to crop variety and yield. Water quality in the area is affected by the following factors: the incoming water quality of the San Joaquin River; salt water intrusion from the Bay; local agricultural drainage returns; the circulation of water in the channels of the south Delta and the factors that influence that circulation; and SWP/CVP exports which generally provide significant improvements to water quality by improving circulation and drawing better quality water into the area. Water from Georgiana Slough, the Delta cross-channel and the Mokelumne River is usually better quality water than that in the San Joaquin River at Vernalis. During periods of high project exports and peak irrigation in the south Delta area, this water is drawn into the south Delta where it mixes with and improves the quality of San Joaquin flow.

The salinity problems in the areas of the south Delta are unique in that they frequently arise due to the dominant influence of local and upstream land-derived salts from lands that are irrigated with imported water containing a substantial salt load. This situation differs from that found in the central and northern Delta where water quality control is directly influenced by sea water intrusion and by regulating inflow.

The water quality and water level conditions of the south Delta are directly related to the circulation characteristics in the area. In major channels that carry large flows, local diversions and discharges generally exert only moderate influences upon water flow and quality. But in shallow, low capacity channels, diversions from the channel can begin to equal or exceed the flows entering the channel at the upstream end. When this happens, water can cease flowing completely through the **channel** or even begin to flow into it from both its downstream and upstream ends. What this means is that there is no flow out of the channel, creating what we call a "null zone." In this situation, there is no way to carry away the saline return flows that continue to accumulate and concentrate along the channel. This lack of circulation prevents better quality water otherwise available from the main channels from freshening the degraded supplies available to users along the channel. For your reference, **Figure** 3 is a depiction of a condition under which such null zones conditions can exist.

Temporary Barriers Operation

As stated earlier, the Temporary Barriers Program has been operating since **1991. Figure 4** shows a detailed history of the TBP installation and removal, and the history of the installation of rock barriers at Middle River and at the fall Head of Old River barrier prior to the TBP. The objectives of the TBP are the short-term improvement of water conditions for the south Delta, and the development of data for the design of permanent flow control structures.

The program involves the seasonal installation of three flow control barriers, and a spring and fall fish barrier. As stated earlier, the locations of the structures are the same as the locations for the Interim South Delta Program except for the location of the Grant Line Canal barrier. The Grant Line Canal rock barrier location on **Figure** 2 is actually located 5.5 miles to the east of the **ISDP** flow control structure, or just upstream of the Tracy Boulevard Bridge.

The operation of the rock barriers under the existing permits is also slightly different than what is being proposed for ISDP. I will discuss the differences when I discuss the ISDP.

Under the operations of temporary barriers, the spring Head of Old River fish barrier begins operation April 15 and stays in operation until June 1. Middle River and Old River at Tracy barriers begin operation on April 15. If for any reason, the HOR barrier is removed prior to May 31, or is not installed, then the Middle River and Old River at Tracy barrier flap gates must be tied open until June 1. The two flow control structures must be breached by October 1. The Grant line Canal barrier operates between June 1 and October 1. In the fall, the Head of Old River barrier is installed by October 1 and operates through November 30.

Each year DWR monitors the operation of the TBP. It monitors X2 location, Swainson's hawk nesting activities, DO levels in Middle River and Old River, and delta smelt take at the Skinner Fish facility. Each year, a monitoring plan and a monitoring report are prepared by DWR and submitted to the U. S. Army Corps of Engineers, the California Department of Fish and Game, The National Marine Fisheries Service, and the U. S. Fish and Wildlife Service.

The Relationship Between the TBP and the Vernalis Adaptive Management Plan

The San Joaquin River Agreement provides that the barrier at the Head of Old River as an essential component of the Agreement and VAMP Study. This barrier requirement can be met by either the installation of a temporary rock barrier or a

permanent structure. The San Joaquin River Agreement also states that the agricultural barriers may be needed to mitigate impacts to South Delta agriculture caused by the HOR barriers.

Flow Control Structure Operations

I would now like to discuss how the flow control structures operate and how their operation improves water levels, circulation and water quality in the south Delta. By raising the radial gates on the structures during the flood portion of the tide, water downstream of the structures can flow upstream into the channels behind the structures. When the tide reverses and ebbs, the radial gates at the flow control structures at Middle River and Old River at Tracy are closed, preventing downstream flow. The Grant Line Canal flow control structure gates are only partially closed. Keeping the Grant Line structure gates partly open during the ebb tide keeps the flow in Grant Line moving downstream while continuing to provides SDWA farmers protection during the low tide periods.

With the temporary barriers program a series of culverts with flap gates installed on the culvert's upstream end are used instead of radial gates. The flap gates open when water levels at the downstream end are higher than those in the upstream end due to the hydrostatic pressure difference. When the tide reverses, causing water levels in the upstream reach to be higher than those in the downstream reach, the

pressure differential shifts, causing the flap gates to close and preventing flow from continuing.

The net effect of this operation is that water levels are increased by retaining flood tide waters in the area and preventing them from draining out during the ebb tide. The net tidal pumping action of the flow control structures improves the circulation characteristics in south Delta areas upstream of the barriers and helps to prevent the creation of null zones. The barriers also generally improve water quality in the south Delta since salts otherwise trapped in the area are transported out of the area due to the enhanced circulation created by the barriers.

The flow control structures proposed as a component of ISDP provide operational flexibility that cannot be acquired by operating rock barriers with flap gates. When the flow control structures or the rock barriers are in Operation, the operators monitor several things: south Delta water levels, water circulation in south Delta channels (including D.O. levels and null zones), and fish blockage at the barrier sites. Optimum conditions for all monitored items can be enhanced by either closing or opening radial gates at one or more of the structure sites. With the flow control structures, gate operations will be don8 quickly through remote operations. With the rock barriers, an operator needs to be sent to the site to tie open flap gates. When the problem is solved and normal operation is ready to resume, the operator then needs

to go back to the site and untie the flap gates. Changing operations at the rock barriers is slower, and more labor intensive than the operation of the flow control structures. As a result, improvements to south Delta conditions will occur more slowly and fine tuning the system to provide optimum benefits for south Delta agriculture, water quality, and fisheries is more difficult to achieve with rock barriers. The installation of permanent structures will permit more effective "real-time monitoring" of conditions. Our experience with radial gates at the Suisun Marsh Salinity Control Structure confirms that such monitoring can be an effective tool in monitoring fish blockage.

The permanent fish and flow control structures are designed to pass design flows established by the Corps of Engineers (19,000 cfs at the Head of Old River) simply by raising the radial gates and removing the flashboards. In contrast, the rock barriers require DWR to breach the barriers if flows are forecast to exceed 7,500 cfs at Vemalis. This operation can cause safety concerns to the DWR staff installing and operating the barriers. For example, in 1996, DWR had to mobilize crews to breach the Head of Old River spring barrier when flows approached 7,500 at Vernalis. While this type of operation was necessary to protect the area against flooding, it requires tremendous coordination with regulatory agencies and contractors. This can put crews in harms way, and would be avoided with a permanent structure equipped with remote-controlled radial gates.

A local concern of the temporary barriers is impacts to recreation and navigation. The temporary rock barriers at Old River at Tracy and Grant Line Canal have trailer systems that transport boats from one side of the barrier to the other, which serves as an impediment to navigation. There is no trailer system at either Middle River or at the Head of Old River temporary barrier. With the permanent structures, all sites except Middle River will have boat locks. Due to the low number and relatively small size of boats passing the Middle River site, this site will have a trailer system to assist boat passage. As a result, ISDP will improve both navigation and recreation when compared to the TBP.

I want to emphasize that the barriers (or flow control structures) only improve water quality to the extent that they improve water circulation in the south Delta channels. And, as I have previously noted, water quality in the area is affected by many other factors. Because of this, the attainment of specific water quality objectives cannot be guaranteed by operation of the barriers or flow control structures. For instance, it is also necessary to control and dilute the salt load in the San Joaquin River at Vernalis.

The proposed operations for the ISDP permanent flow control structures and fish control structure is shown on **Figure 5.** The figure shows a month by month proposal for the structures. Starting in October, the Head of Old River fish structure is

in operation to improve down&ream 0.0. conditions for upstream migrating San Joaquin fall-run chinook salmon. Because the south Delta farmers are still irrigating, it is important that the Middle River and Old River at Tracy flow control structures also operate. In November, when agriculture water demand is lower, the Middle River and Old River at Tracy facilities are not in operation.

In April, the structures in Middle River and Old River at Tracy are placed into operation. The Head of Old River spring operation also begin to help keep the San Joaquin fall run chinook salmon smolts in the San Joaquin River. This operation continues until June 1.

From June 1 through September, Grant Line flow control structure is in operation. It should be noted that ISDP never operates the Grant Line flow control structure with the Head of Old River barrier.

ISDP seeks to provide as much flexibility in operating the flow structures as possible, because if conditions are dry, farmers may need to irrigate outside the windows of proposed flow control structure operations. During dry conditions, low river flows result in water levels that can reach critically low level, and can impact south Delta agriculture.

Examples of Flow Control Structure Operation

Now I would like to illustrate three examples of how the flow control structures significantly improve water levels and circulation in the south Delta area. The examples are:

- Operation of the three flow control structures in July of a critical year
- Operation of the Head of Old River fish structure and flow control structures at Middle River and Old River at Tracy during May of a critical year
- Operation of the Head of Old River fish structure without the Middle River and Old River at Tracy flow control structures during May of a critical year

Example 1: Operation of the three flow control structures in July of a critical year

I will be referring to a number of figures which are based on Delta modeling results and actual field data. **Figure 6** illustrates net flow patterns in the south Delta region under typical conditions during July of a critical water year. The figure shows the levels of Sacramento River flow, San Joaquin River flow, CVP/SWP exports, Delta depletion, and Delta outflow used for this example. One can observe that if no flow control structures are present; null flow zones exist in both Middle and Old Rivers. However, if the flow control structures are assumed to be in place and operating, the null flow zones are removed and net through patterns or one-way flow patterns exist in

both channels indicating that circulation in the channels improves with the structures operating.

Figure 7 shows predicted minimum water levels in the south Delta area for the same hydrology, both with and without the flow control structures. It is easy to see the significant improvement the flow control structures have on water levels. Minimum water levels increase from 1-2 feet in the entire area when the flow control structures are in place and operating.

Figure 8 shows the resultant water quality in the south Delta for this hydrology, again both with and without the flow control structures. This illustrates that while water quality in the area generally improves with the flow control structures in operation, some limitations apply. By increasing water levels in the south Delta area, a "hydraulic barrier" is created at the confluence of Old River and the San Joaquin River which causes more of the San Joaquin River flow to remain in the San Joaquin River instead of entering into Old River. The water quality of the increased flow is generally associated with Vernalis water quality which is usually poor during July of drier water year types. As you can see from the graph, Vernalis water quality in this instance is 520 ppm TDS. As these figures indicate, ISDP does not impact Vernalis flow, stage, or TDS. As you can also see from this, water quality at the San Joaquin River at Brandt Bridge gets worse with the flow structures. This water flows toward the confluence of the San Joaquin River at Turner Cut. At this point, the flow structures

cause a portion of this water to be recirculated toward the south Delta area. Note that water quality in Turner Cut gets slightly worse with the flow structures' operation because it is more influenced by **Vernalis** water quality than it is without the flow structures. The predicted increase is from 134 TDS with no barriers to 197 TDS with the flow structures.

Turning to the stations in the south Delta, water quality is dramatically improved with the flow control structures because of the improved circulation in this area. As illustrated in the previous figure. Water quality at three locations: Middle River at Howard Road, Old River near the Delta Mendota Canal and Old River at Tracy Road Bridge are 204 TDS, 406 TDS and 511 TDS respectively without the barriers. Water quality improves at each of these locations to 189 TDS, 252 TDS and 278 TDS respectively with the flow structures.

The Department has also collected field data in the south Delta area which show the effect the temporary barriers have on water elevations in the vicinity of the barriers. **Figure 9** illustrates stage data collected in Middle River before, during, and after installation of the temporary barrier in Middle River. It is easy to see that the barrier provided significantly improved minimum water levels in the area during the time it *was* installed. Likewise, **Figure 10** shows similar data at Middle River near Old River. Since this location is further away from the Middle River barrier, the effect of water levels is not nearly as pronounced but it is still clearly evident.

As noted at the outset of this presentation, water quality in the south Delta is extremely variable because of the various complex factors which affect it. To illustrate this point, I would like to refer you to **Figures 11 through 13,** which are time series plots of actual water quality data in the south Delta from 1991 through 1993. Figure **11** shows water quality at Vernalis, **Figure 12** shows water quality at Old River near Highway **4,** and **Figure 13** shows water quality at Middle River near Highway 4. These graphs clearly demonstrate the large variations in water quality previously mentioned. Although the flow control structures improve water levels and circulation in the south Delta, they do not and cannot directly address the other factors which also affect water quality in the area. Since the variations in water quality caused by these other factors can be significant, there can be no assurances that, even with permanent flow control structures, specific water quality standards in the south Delta can be met.

Example 2: Operation of the Head of Old River fish, Middle River and Old River at Tracy flow control structures during May of a critical year

Now I would like to give an example of the proposed flow and fish structures using typical conditions during May of a critical water year. In this scenario, the flow control structures at Middle River and Old River near Tracy are operating but the Grant Line Canal structure is not. In addition, the Head of Old River fish structure is operating

to improve fishery conditions for salmon smolts migrating downstream the San Joaquin River toward the west Delta and San Francisco Bay. I will discuss the fish structure at the head of Old River in more detail shortly.

Figure 14 shows the resultant net flow patterns given the hydrologic conditions shown. Again, a "null zone" exists in Middle River without the flow control structure, although one does not exist in Old River as in the previous example. With the addition of the flow control structures, the null zone is removed and one-way flow patterns exist in each channel.

Figure 15 illustrate the predicted minimum water levels, with and without the flow control structures. Minimum water levels in the reach of Old River from the Old River at Tracy flow control structure to the confluence with Middle River and in the reach of Middle River from North Canal to the confluence with Old River are significantly improved with the flow control structures. Because the Head of Old River fish structure blocks San Joaquin flow from entering Old River at its confluence with the upper San Joaquin River and because the Grant Line Canal structure is not operating during May (gates are raised), minimum water levels between the Head of Old River, Old River at the confluence with Grant Line Canal, and Grant Line Canal itself experience a small decline. However, the Department feels the water levels in this reach are adequate for south Delta irrigation needs, **especially** during this time of year when flows in the Delta are generally higher.

Figure 16 shows predicted water quality conditions in the south Delta for the given hydrology and fish and flow structure configuration. Similar to the previous example during typical conditions for July, water quality at Middle River at Howard Road, Old River near Middle River, Old River at Tracy Road Bridge and Old River near the Delta-Mendota Canal experience significant improvements in water quality with the barriers; from 369 TDS to 31'3 TDS, from 370 TDS to 331 TDS, from 387 TDS to 321 TDS and from 408 TDS to 282 TDS, respectively. San Joaquin River flow which is prevented from entering Old River now flows further down the San Joaquin River where a portion of that flow enters the south Delta via Turner and Columbia Cuts. Because the water quality of this flow is largely equivalent to **Vernalis** water quality (in this example 398 TDS), water quality at San Joaquin River at Brandt Bridge, Turner Cut, Columbia Cut, and at Clifton Court **Forebay** is slightly degraded with the barriers in place. This situation again points out the variability in south Delta water quality that is inherent as a result of the complex factors affecting it. The barriers, while solving some of the problems, cannot remove the effects of the other factors.

Example 3: Operation of the Head of Old River fish structure without the Middle River and Old River at Tracy flow control structures during May of a critical year

I would now like to comment on the barrier at the head of Old River. The operation of the fish structure at the head of Old River is designed to keep San Joaquin fall-run chinook salmon in the San Joaquin River. The fish structure reduces

the flow down Old River, ensuring that water flowing at **Vernalis** continues to flow toward Stockton. In the absence of this fish structure, much of the water flowing at **Vernalis** enters Old River at its confluence with the San Joaquin River, and only a portion of the Vernalis flow continues down the San Joaquin River towards the city of Stockton. The proposed structure at the Head of Old River provides two likely separate seasonal benefits for migrating fish.

During the fall of years when flows at **Vernalis** are low, the San Joaquin River experiences low dissolved oxygen levels near the Port of Stockton. Low dissolved oxygen conditions in the fall can impede the upstream migration of San Joaquin River salmon during the spawning season. By increasing the flow which remains in the San Joaquin River, circulation in and around Stockton is improved which assists in relieving low dissolved oxygen conditions and improves the passage of migrating adult fall San Joaquin salmon. DWR, at **DFG's** request, has been installing a barrier at the head of Old River in the fall of most years for 24 years.

DWR and Reclamation also propose to operate the Head of Old River barrier from mid-April through May to improve San Joaquin River salmon smolt survival through the Delta. During the spring, young salmon smolts from the tributaries to the San Joaquin River begin their out-migration toward the ocean. Having a barrier during this period can help improve the survival of salmon smolts by preventing them

from entering Old River where they become more susceptible to entrainment at agricultural diversions and project export facilities.

The Department believes that the installation and operation of the proposed fish barrier is an efficient and effective way to provide more protection for San Joaquin River anadromous fish. The likely benefits of the Head of Old River barrier have been widely recognized through several important and recent actions such as the Central Valley Improvement Act, the Bay-Delta Accord, the Board's June 1995 Water Quality Control Plan, and the Vernalis Adaptive Management Plan.

However, the Department also feels it is essential that the flow and fish structures be considered together as a package. When the agricultural and fish barriers are operated simultaneously, they partly mitigate each other' s adverse effects. The fish barrier prevents San Joaquin salmon from being trapped behind the agricultural barriers; while the agricultural barriers prevent the fish barrier from adversely affecting water levels and water quality for Delta farmers and resident fish.

To illustrate this last point, please refer to Figure 17 which illustrates the same typical hydrologic conditions during May of a critical year type as used previously in **Figures 14-16**. This example, however, assumes that only the Head of Old River fish structure is in place; the agricultural flow control structures are not operating. Note that minimum water levels in the south Delta area are significantly reduced. This can

be expected because the normal flows entering into the south Delta service area from **Vernalis** have been blocked by the Head of Old River fish structure. No relief is afforded to this situation by the proposed flow control structures at Middle and Old Rivers at Tracy. By comparing the minimum water levels in this scenario with those shown in **Figure 15,** it can be been that virtually all of the water levels in the south Delta area are significantly lower than the "no barrier" case. Although south **Delta** water quality is generally predicted to be slightly better than the **"no** barriers" case, Old River at Tracy Road Bridge shows a dramatic reduction in water quality. Water quality at this location goes from 387 TDS in the 'no-barrier" case to 574 TDS for the scenario with the Head of Old River structure only. It is important to note, however, that the situation improves with the installation of the Middle and Old River at Tracy flow control structures, as a comparison of **Figure 17** with **Figures 15 and 16** demonstrates.

By way of closing **DWR's** testimony with regard to the proposed south Delta salinity objectives, DWR believes that the peculiar nature and complexity of water quality problems in the south Delta, in addition to water level and circulation problems, requires special attention as the Board looks at implementation alternatives for the 1995 Water Quality Control Plan. DWR believes that the Board should recognize and accept our efforts to implement the south Delta barriers program as the appropriate water quality implementation measures for the contribution of the SWP and the CVP to the achievement of water quality objectives in the south Delta. However, the

installation of permanent flow structures alone cannot always guarantee compliance with specific water quality objectives.

Dissolved Oxygen Objectives In the San Joaquin River

Now, I will briefly discuss the **SWRCB's** Dissolved Oxygen Objective. While the Head of Old River temporary rock barrier has been installed in the fall since the 1960's to help improve D.O. levels downstream for migrating salmon, the D. 0. objective for the San Joaquin River near Stockton cannot always be met solely by its operation. This structure is not a cure-all for D. 0. problems because it does not address all of the other factors which also influence D. 0. levels. I will begin with some background on the D.O. problem and end with a discussion of what has been done so far and what still needs to be done.

Background

The perennial D. 0. problem in the Stockton Ship Channel and surrounding tributaries results from a combination of several factors. Long residence times, stagnant waterways, upstream municipal wastewater discharges, algae blooms, and summer high temperatures all contribute to depleted D. 0. concentrations. Many of these factors are caused by the physical system. As the shallow San Joaquin River channel feeds into the deep ship channel, the river velocities are slowed. This causes

the suspended organic loads being transported downstream to settled out in the ship channel. This catchment basin accumulates large amounts of organic material which has a high oxygen demand and is detrimental to D. 0. levels. The accumulating organic loading overwhelms the ability of the river system to replenish the consumed oxygen. Because the water movement in this area is reduced, other factors are given more time to contribute to the D. 0. problem.

The Stockton Ship Channel configuration (see SWRCB staff **Exhibit 1, Figure X-1**) has an eastern dead end that has no water circulation other than feeder pipelines delivering oxygen-consuming material. The Stockton wastewater treatment plant discharge is just upstream of the port. The plant discharge further aggravates the D.O. problem. These nutrient rich waters can support intense populations of algae which cause severe fluctuations in dissolved oxygen concentration and add significantly to the BOD load when the algae dies. The higher *water* temperatures decrease the D. 0. saturation level as much as 4 **mg/l**, and also accelerates decomposition of the organic materials.

Head of Old River Fish Structure

The D. 0. problem is difficult to solve and many different measures may be involved. One activity that has provided some benefit has been the Department of Water Resources' installation of the temporary barrier at the Head of Old River in the

fall . The barrier **diverts** Old River flow down the San Joaquin River to promote the return of salmon migrating upstream. The supplemental flows help improve the D. 0. between Turner Cut and Stockton. Dissolved oxygen is increased by providing more flow to diminish residence times and disperse the suspended loads. The permanent structure proposed in the Interim South Delta Program (ISDP) would continue to help the D. 0. problem in this stretch of river.

To properly address the D. 0. problem, a combination of other factors must be managed in addition to increased flows. More stringent control of the regulated discharges affecting D.O. would help in the long term, but uncontrolled loading from non-point sources such as the closed end of the ship channel, in-situ production of organic matter and residual deposits will still pose a continuing threat. If these sources were controlled, the reduced BOD load would still impact D. 0. levels when reverse flows and dampened tidal action prevail. While the Head of **Old** River fish structure will help improve D. 0. levels in the fall, it is only part of a comprehensive long-term plan to help meet the **SWRCB's** D.O. objective. Earlier operation of the fish structure in coordination with pollution control measures may help to meet the D.O. objective in the late summer. DWR will consider such operation of the structure provided water levels and circulation in the south Delta are protected and the Tracy wastewater treatment plant discharges are taken into account.

This concludes my remarks.

Figure - 1 South Delta Water Agency Boundary

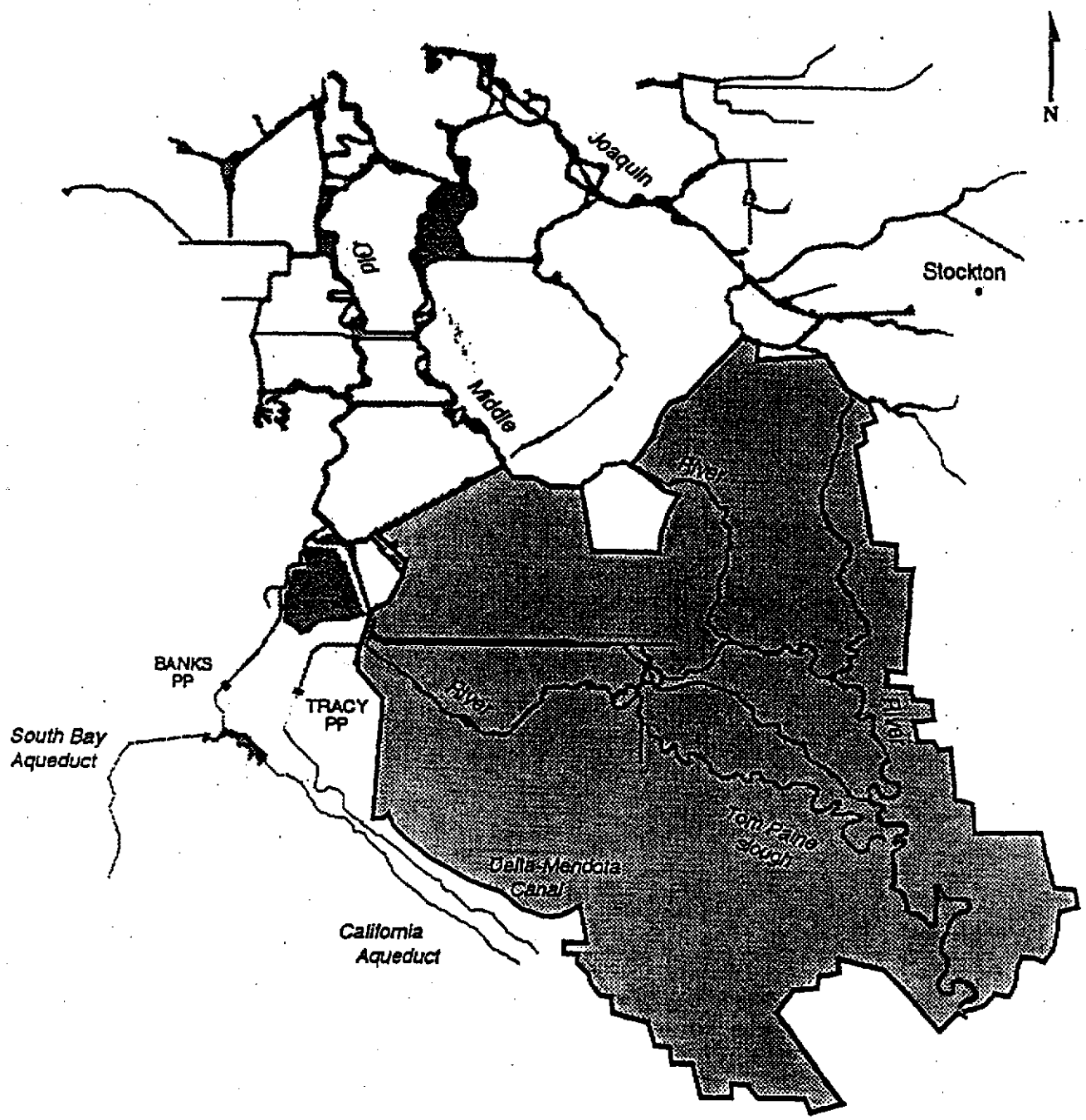


Figure - 2 Proposed South Delta Barriers

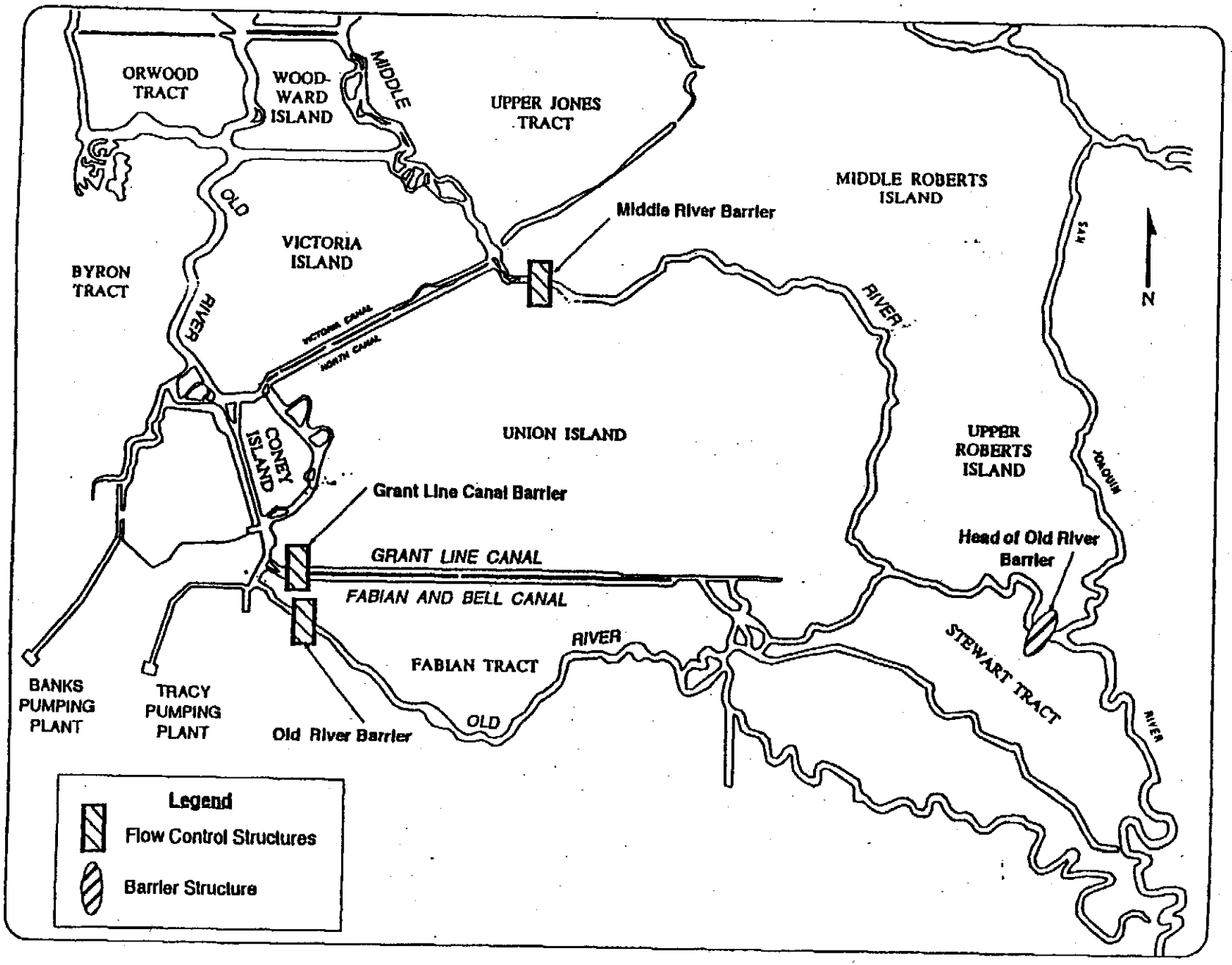
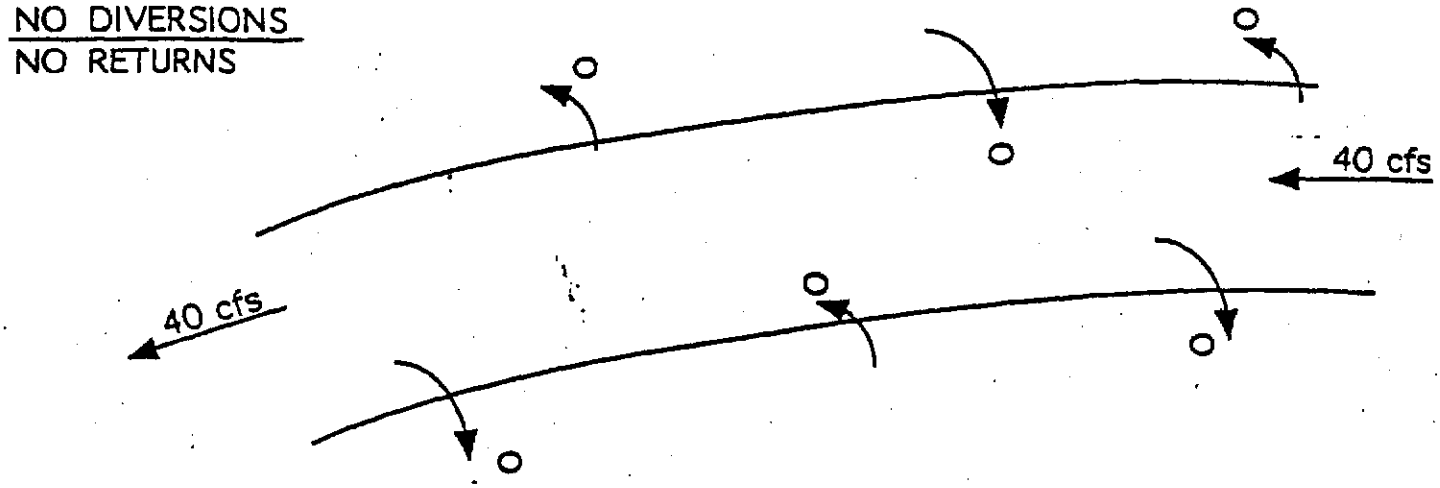
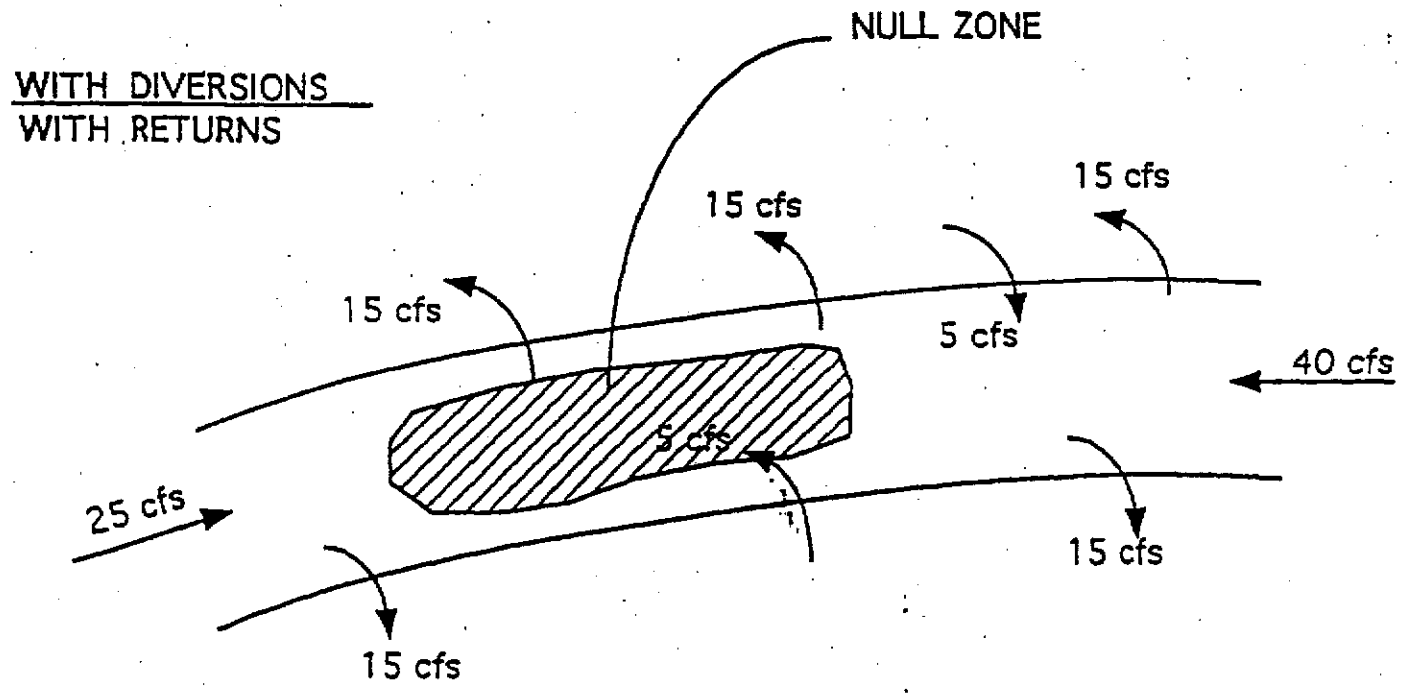


Figure - 3


NO DIVERSIONS
NO RETURNS
40 cfs
40 cfs


NULL ZONE
WITH DIVERSIONS
WITH RETURNS
15 cfs
15 cfs
15 cfs
5 cfs
40 cfs
5 cfs
25 cfs
15 cfs
15 cfs

Dates of Installations and Removals of the Temporary Barriers

Figure 4

Year	Middle River				Old River near Tracy (DMC)				Spring Head of Old River			
	Installation		Removal		Installation		Removal		Installation		Removal	
	Started	Completed	Started	Completed	Started	Completed	Started	Completed	Started	Completed	Started	Completed
1987		May-15	End of Sep	End of Sep								
1988	May-26	May-26	Sep-23	Sep-23								
1989		Apr-12	Sep-26	Sep-26								
1990		Apr-16	Sep-29	Sep-29								
1991	Apr-04	Apr-05	Sep-27	Sep-27	Aug-14	Aug-30	Sep-28	Oct-13 (i)				
1992	Apr-08	Apr-10	Sep-28	Sep-29	Apr-15 boat port. on	May-01 May 09	Sep-30	Oct-09 (ii)	Apr-15 boat-port. on	Apr-23@4ft Apr-26@6ft May-01	Jun-02	Jun-08
1993	Jun-14	Jun-17	Sep-23	Sep-24	May-12	Jun-01	Sep-27	Oct-06				
1994	Apr-23	Apr-25	Sep-29	Oct-05	Apr-22 boat-port. on All culverts tied open (5/18-6/1)	Apr-24 May-01	Sep-26	Oct-10	Apr-21 boat-port. on	Apr-23@10ft May-01	May-18	May-20
1995	Aug-08	Aug-11	Oct-10	Oct-10	Aug-03	Aug-08	Sep-27	Oct-06		(vii)		
1996	May-16	May-20	Sep-29	Sep-29	May-12	Jun-10 (iii)	Sep-29	Oct-16	May-06	May-11	May-16	Sep-03 (iv)
1997	Apr-03	Apr-07	Sep-27	Sep-28	Apr-08	Apr-17	Sep-30	Oct-07*	Apr-09	Apr-16	May-15	May-19

Year	Fall Head of Old River (v)				Grant Line Canal			
	Installation		Removal		Installation		Removal	
	Started	Completed	Started	Completed	Started	Completed	Started	Completed
1987	Sep-09	Sep-11		Nov-28				
1988	Sep-22	Sep-28		Dec-02				
1989	Sep-27	Sep-29	Nov-27	Nov-30				
1990	Sep-10	Sep-11		Nov-27				
1991	Sep-09	Sep-13	Nov-22	Nov-27				
1992	Sep-08	Sep-11	Nov-30	Dec-04				
1993	Nov-08 (vi)	Nov-11	Dec-03	Dec-07				
1994	Sep-06	Sep-08	Nov-28	Nov-30				
1995	(vii)							
1996	Sep-30	Oct-03	Nov-18	Nov-22	Jun-17	Jul-10	Oct-02	Oct-15
1997					May-21	Jun-04	Sep-26	Oct-15*

(i) Barrier notched on Sept. 28, 1991. Construction resumed on Oct. 10 and finished on Oct. 13.
(ii) Barrier notched on Sept. 30, 1992. Construction resumed on Oct. 2 and finished on Oct. 9.
(iii) Construction was delayed on 5/17 and resumed on 6/5 due to high flows.
(iv) Barrier was breached on 5/16 on an emergency basis, but complete removal wasn't done until 9/3, after Corps demanded permit compliance of complete removal.
(v) Barrier was installed in previous years.
(vi) Installation delayed due to high flows.
(vii) Not installed due to high San Joaquin River flows.
* Scheduled completion date.

Figure 5

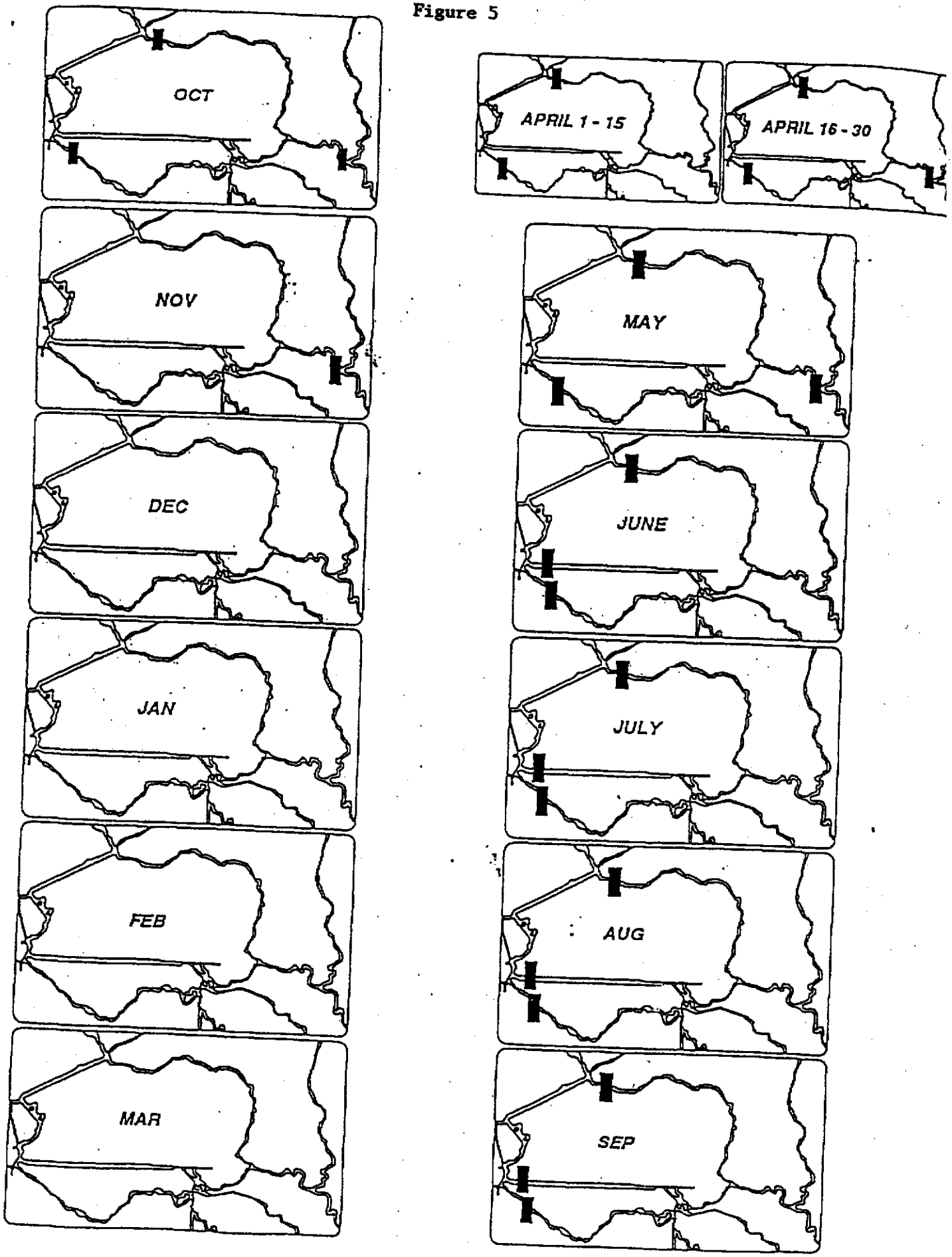
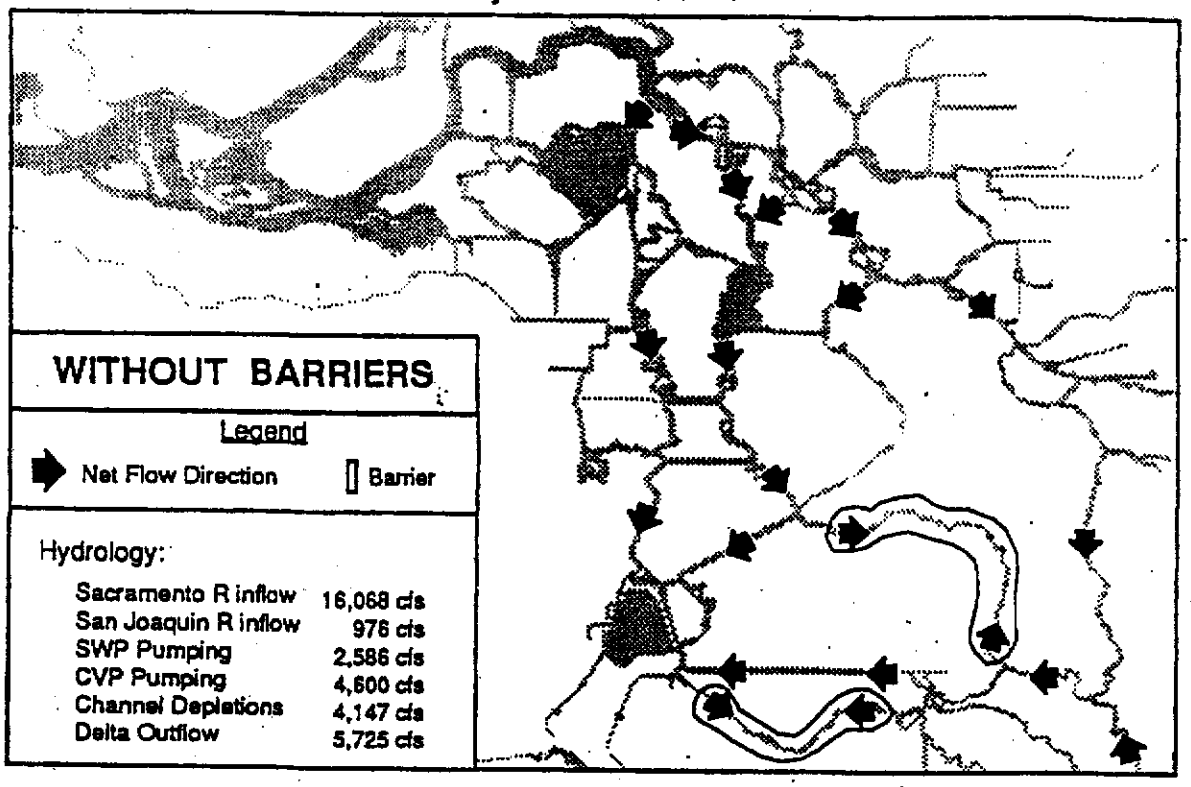

OCT
NOV
DEC
JAN
FEB
MAR
APRIL 1 - 15
APRIL 16 - 30
MAY
JUNE
JULY
AUG
SEP

Figure 6
Net Flow Direction
Without and With Barriers
July of Critical Year



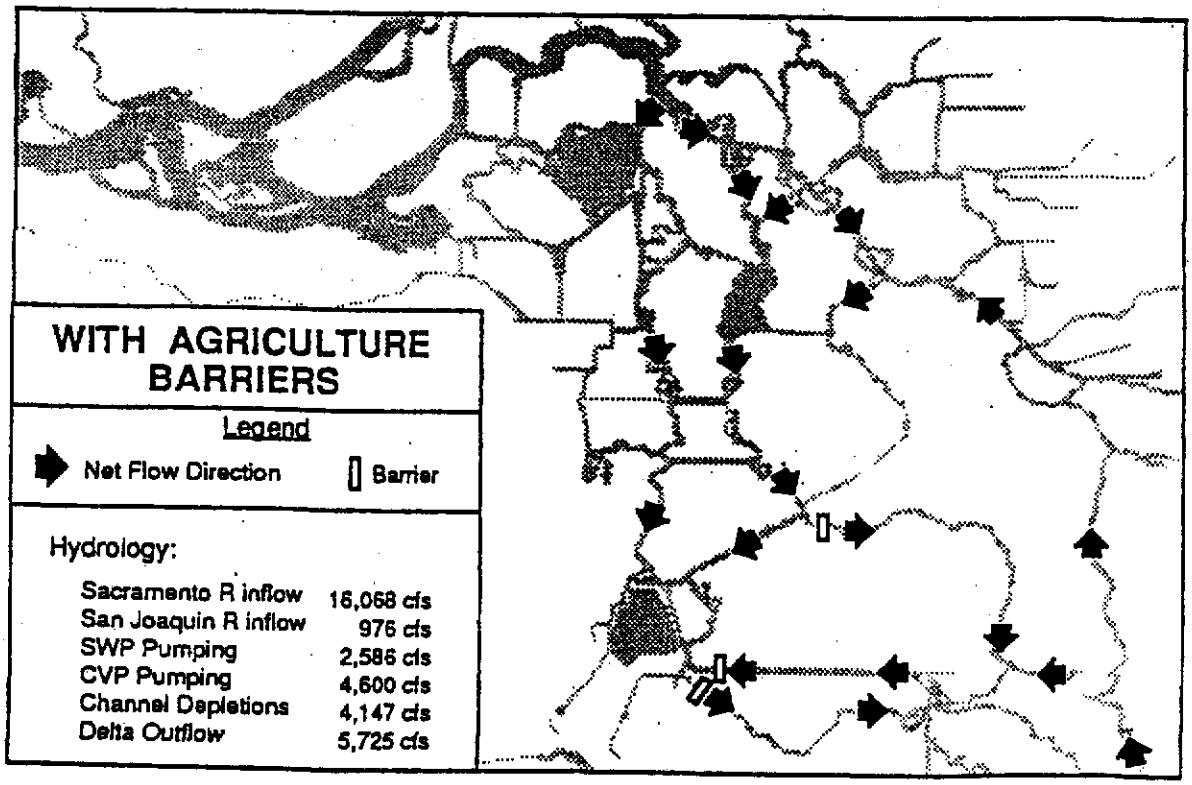
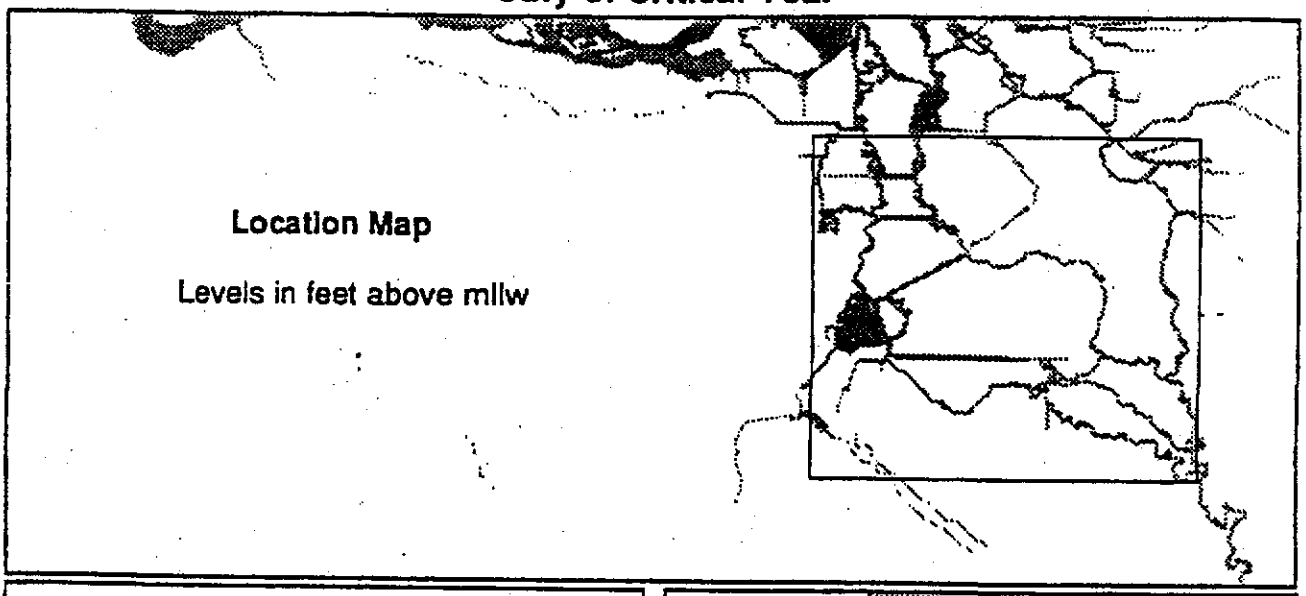


Figure
Minimum Water Levels under Various Barrier Configurations
July of Critical Year

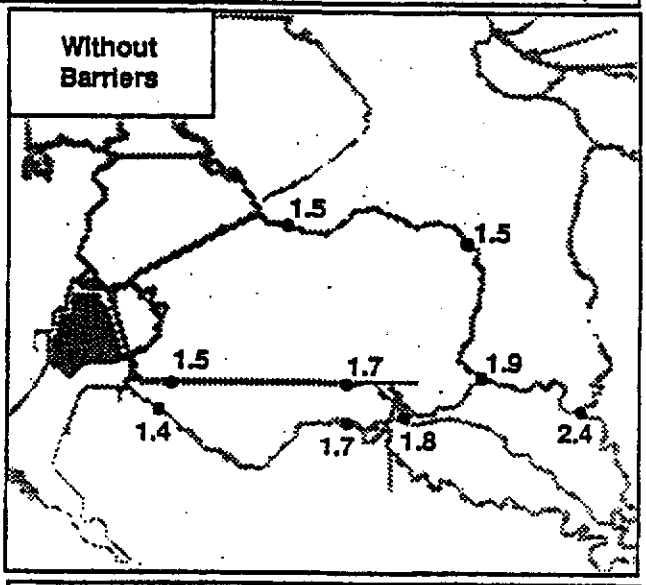


Legend

Barrier

Hydrology:

Sacramento R inflow	16,068 cfs
San Joaquin R inflow	976 cfs
SWP Pumping	2,586 cfs
CVP Pumping	4,600 cfs
Channel Depletions	4,147 cfs
Delta Outflow	5,725 cfs



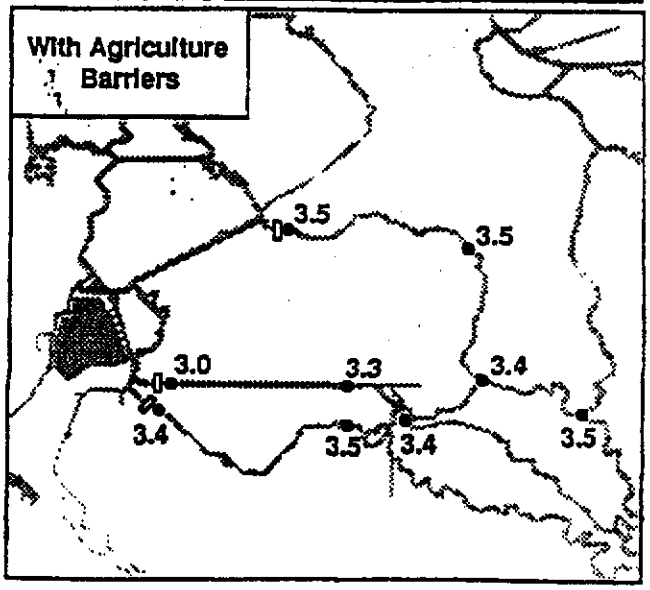
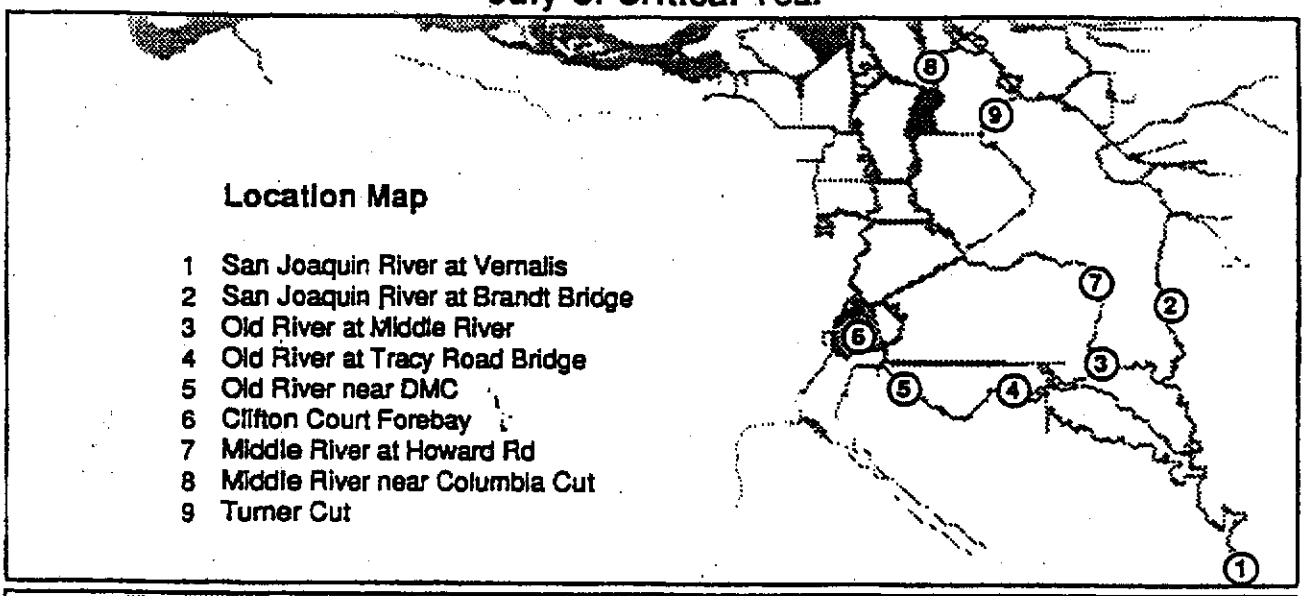
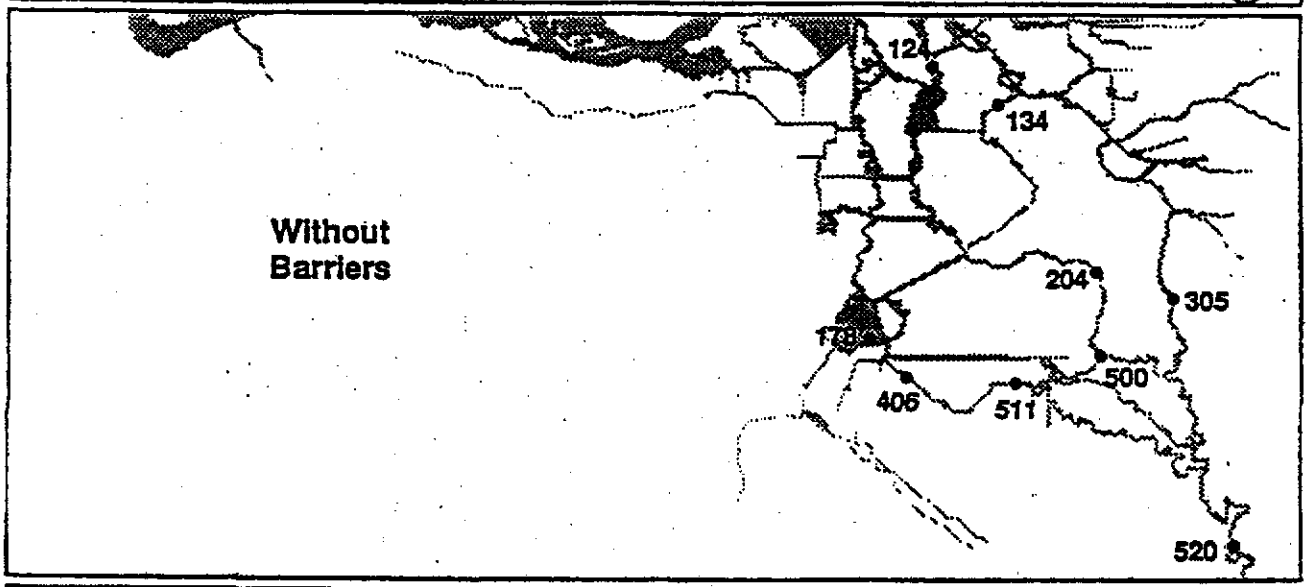


Figure 8
Monthly Average TDS under Various Barrier Configurations
July of Critical Year





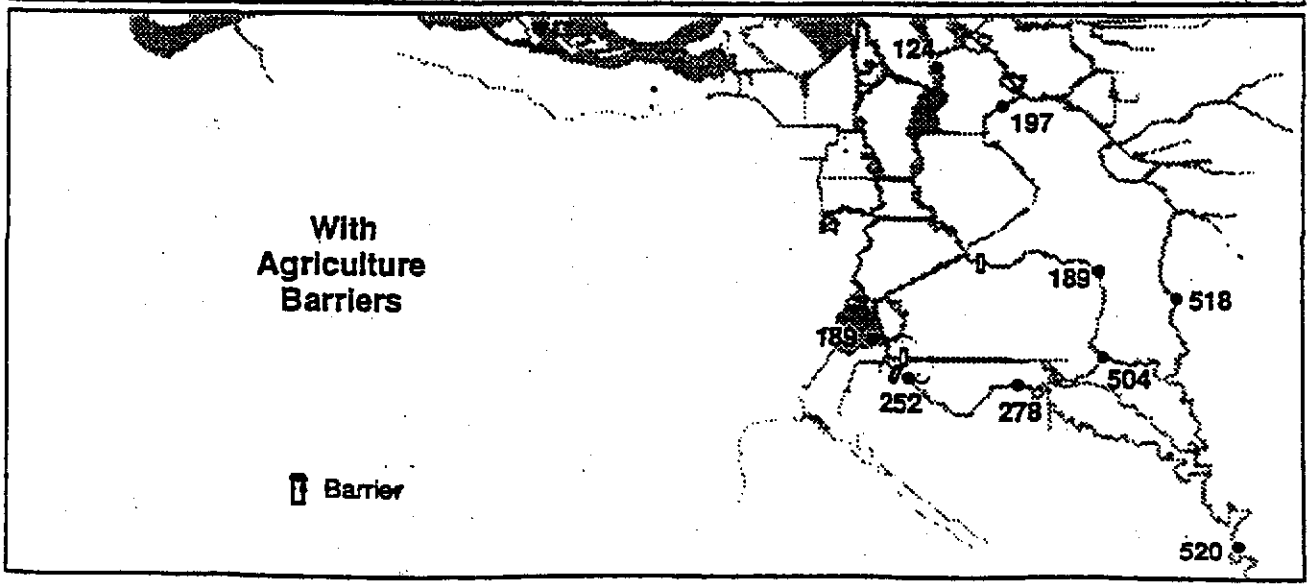


Figure 8 B

DWR

Monthly Average TDS (EC) under Various Barrier Configurations July of Critical Year

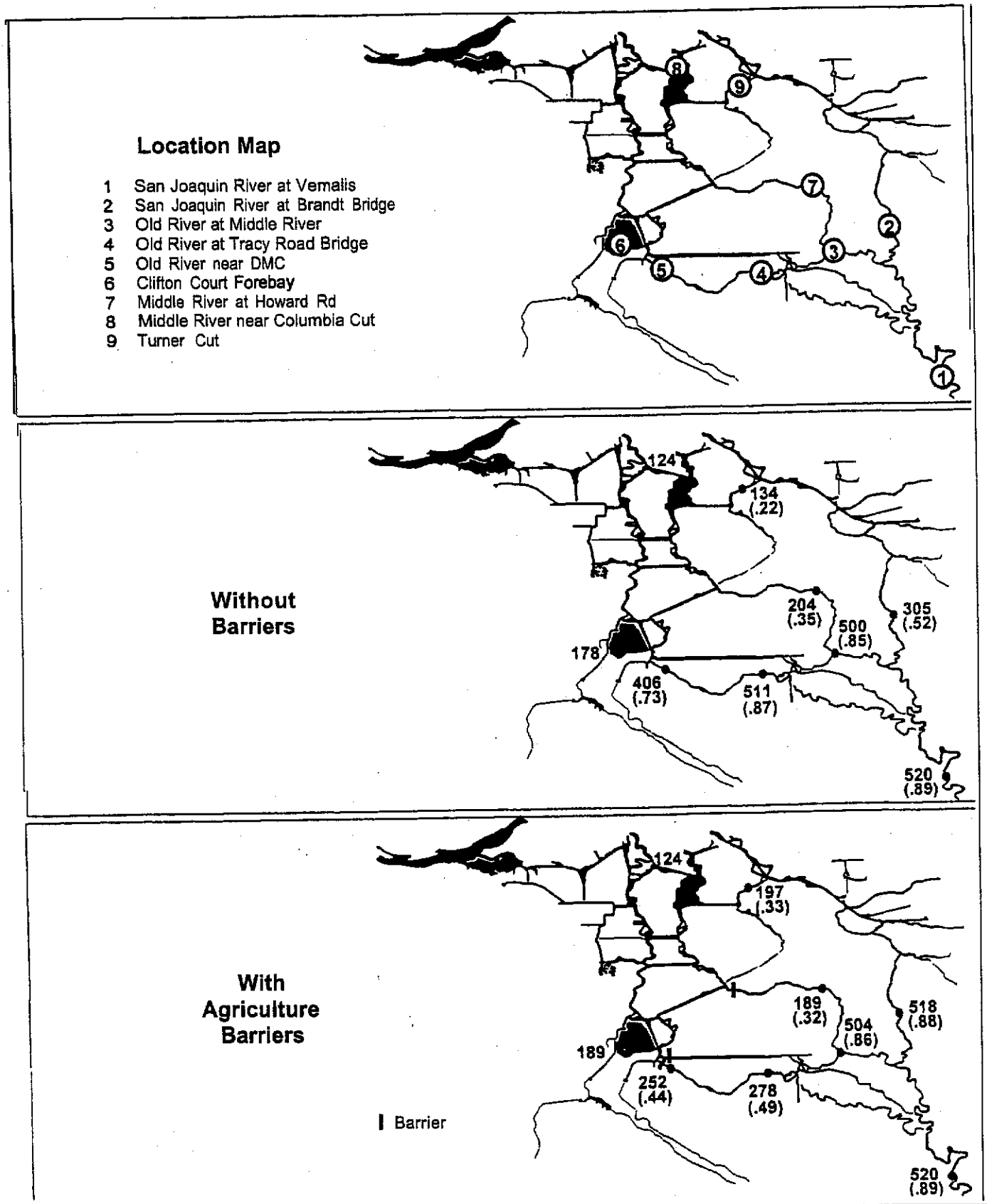


Figure 9
Stage Upstream of Temporary Barrier at Middle River

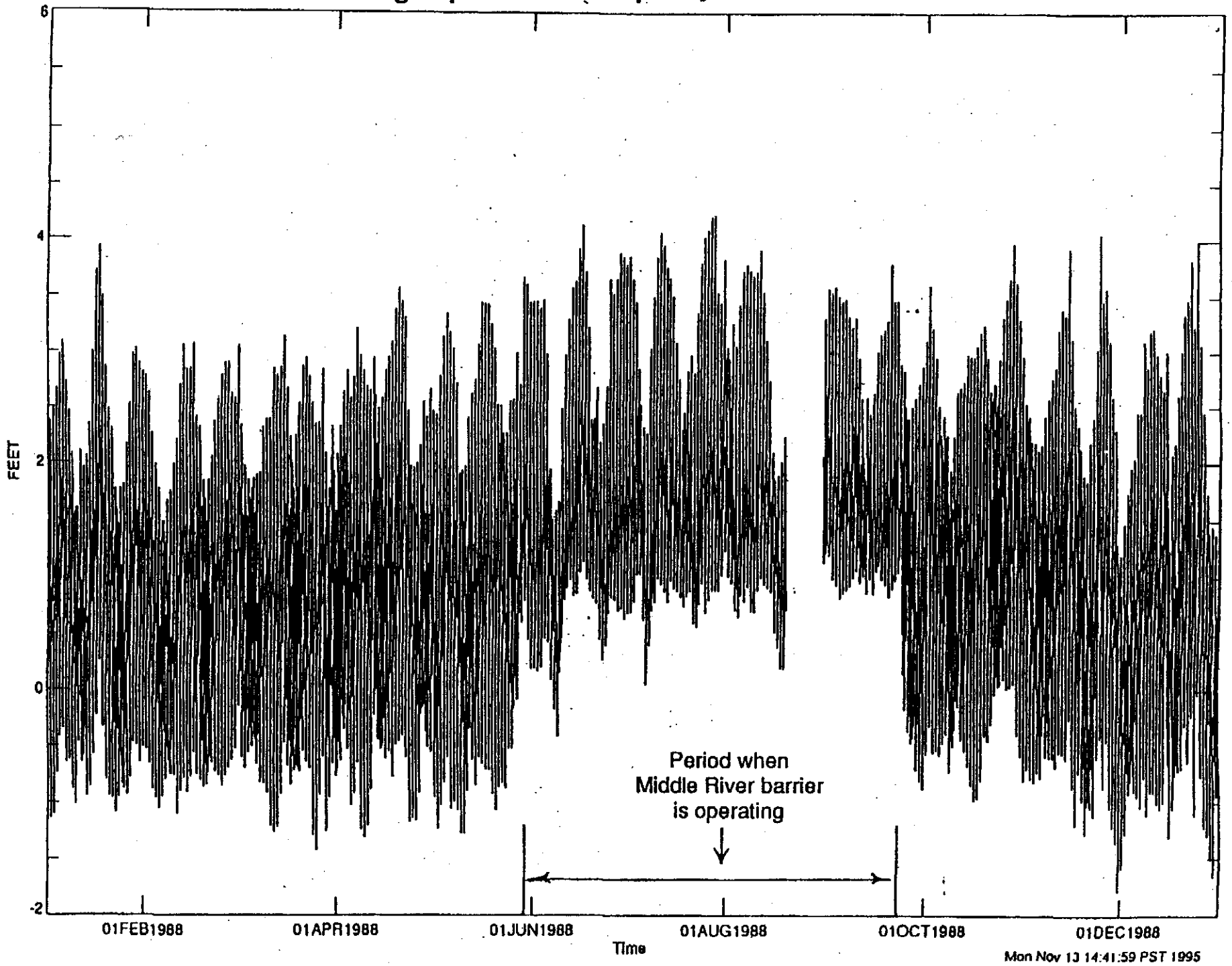


Figure 10
Stage at Middle River near Old River

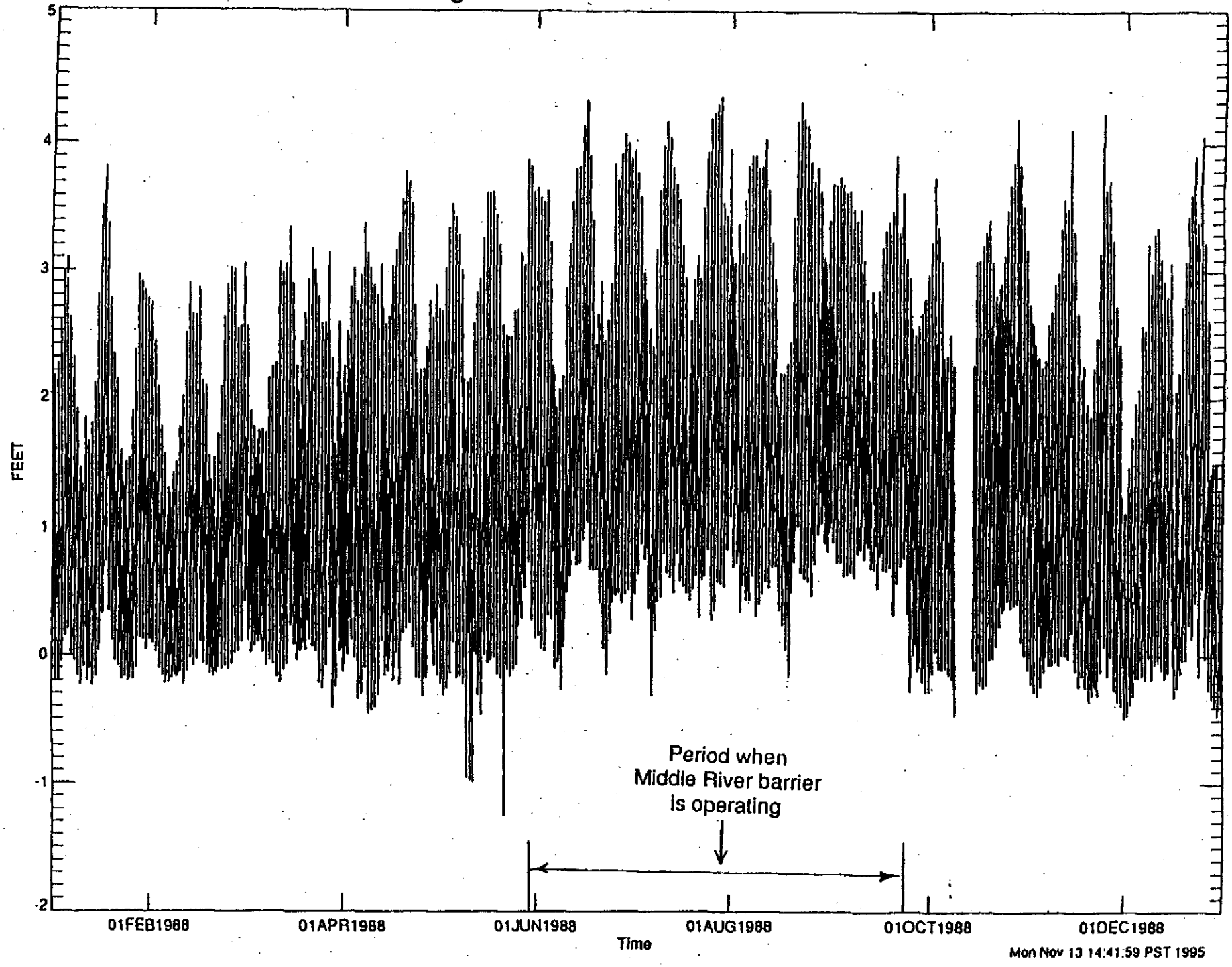


Figure 11
Daily Salinity (EC) at Vernalis

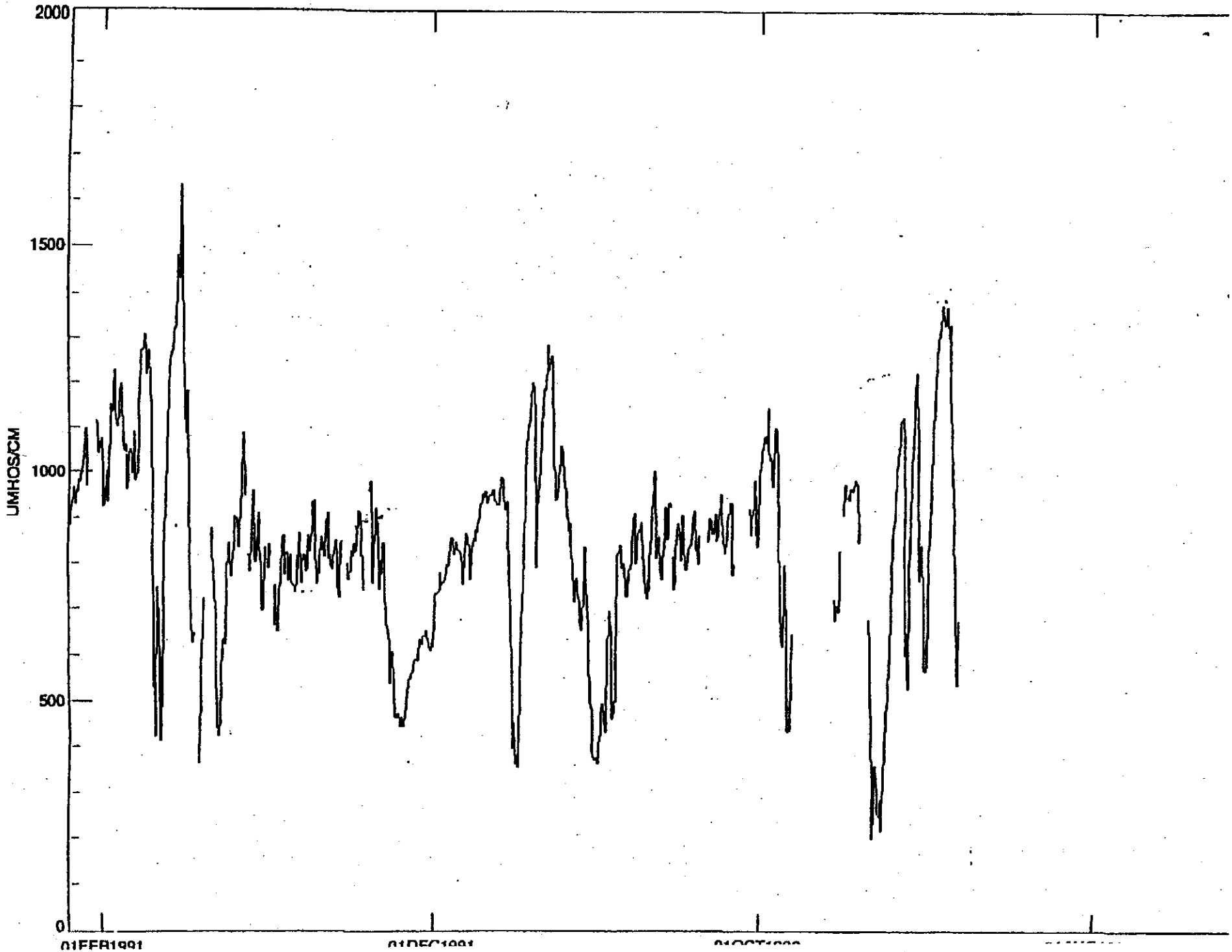


Figure 12
Daily Salinity (EC) at Old River near Highway 4

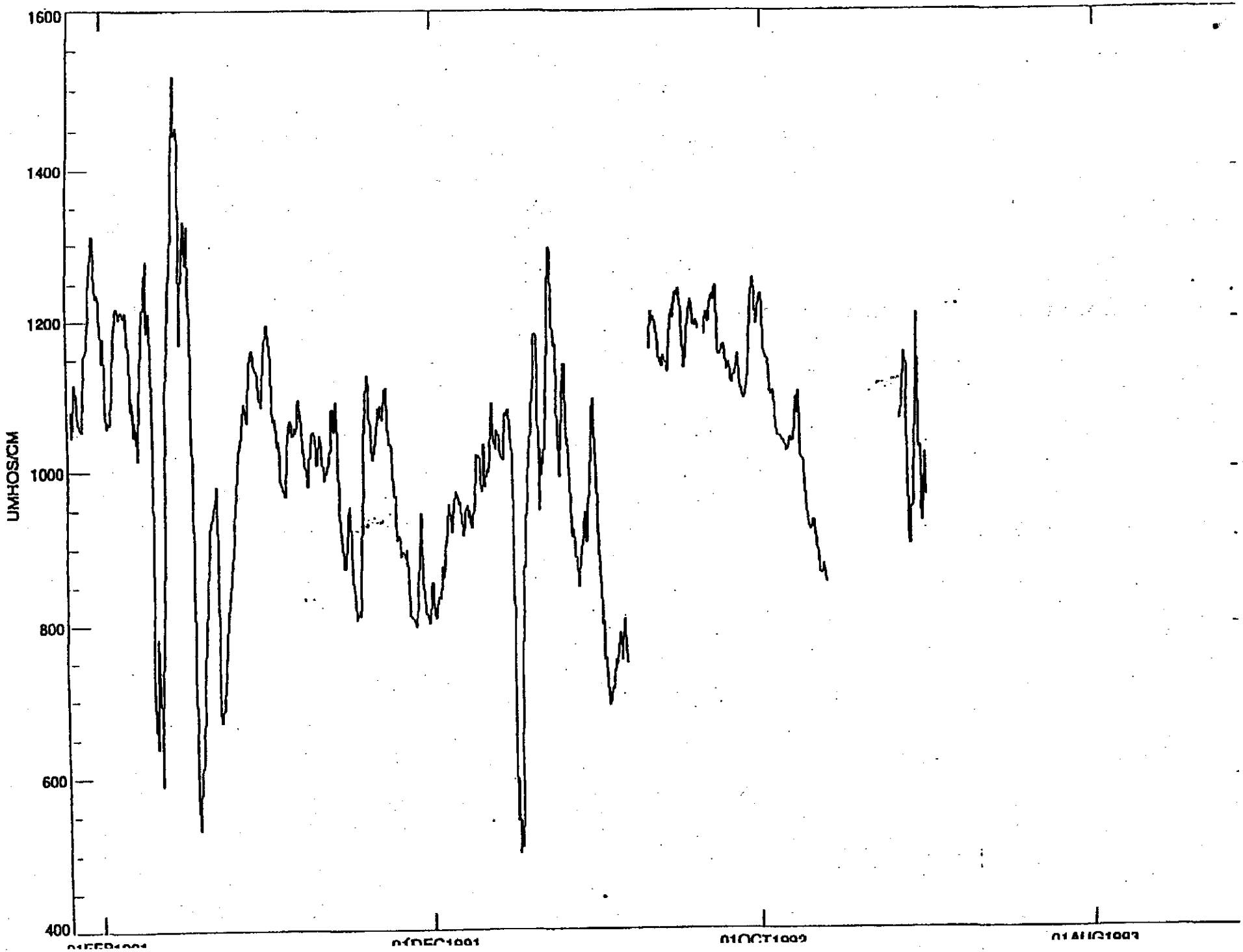


Figure 13
Daily Salinity (EC) at Middle River near Highway 4

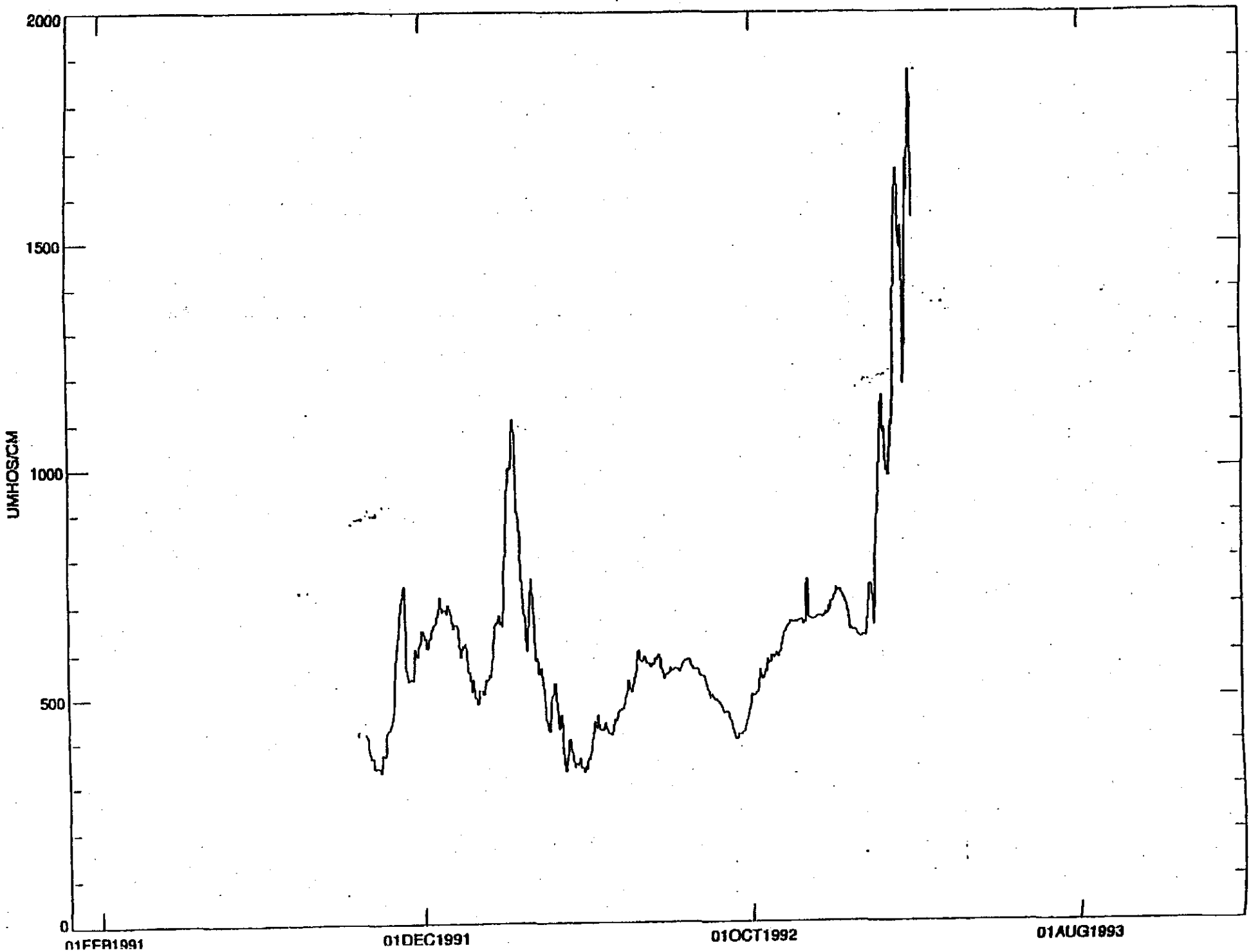
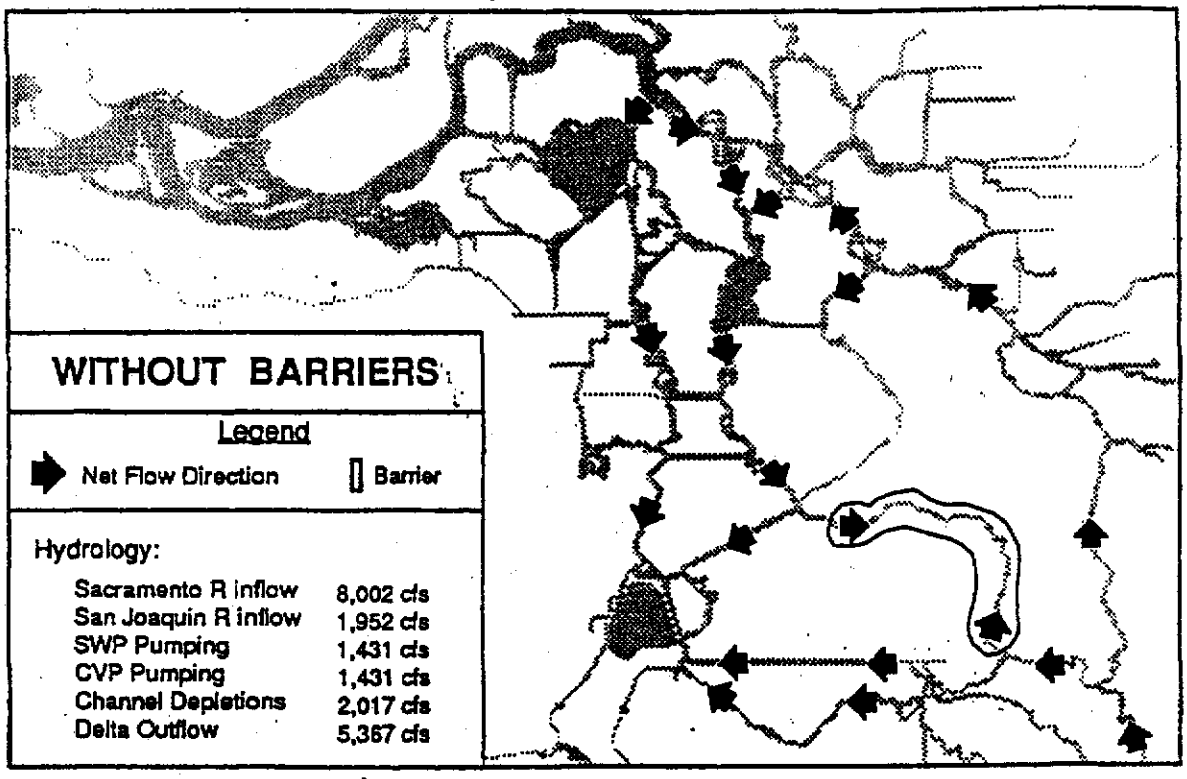


Figure 14
Net Flow Direction
Without and With Barriers
May of Critical Year



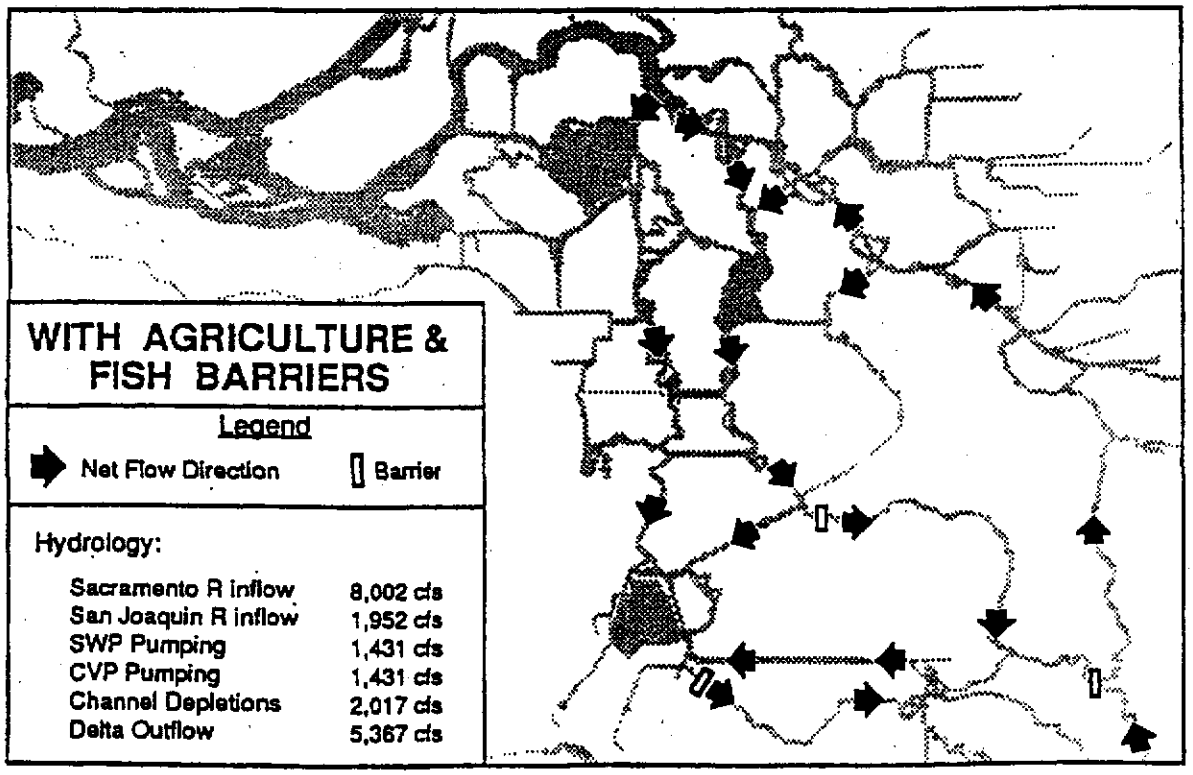
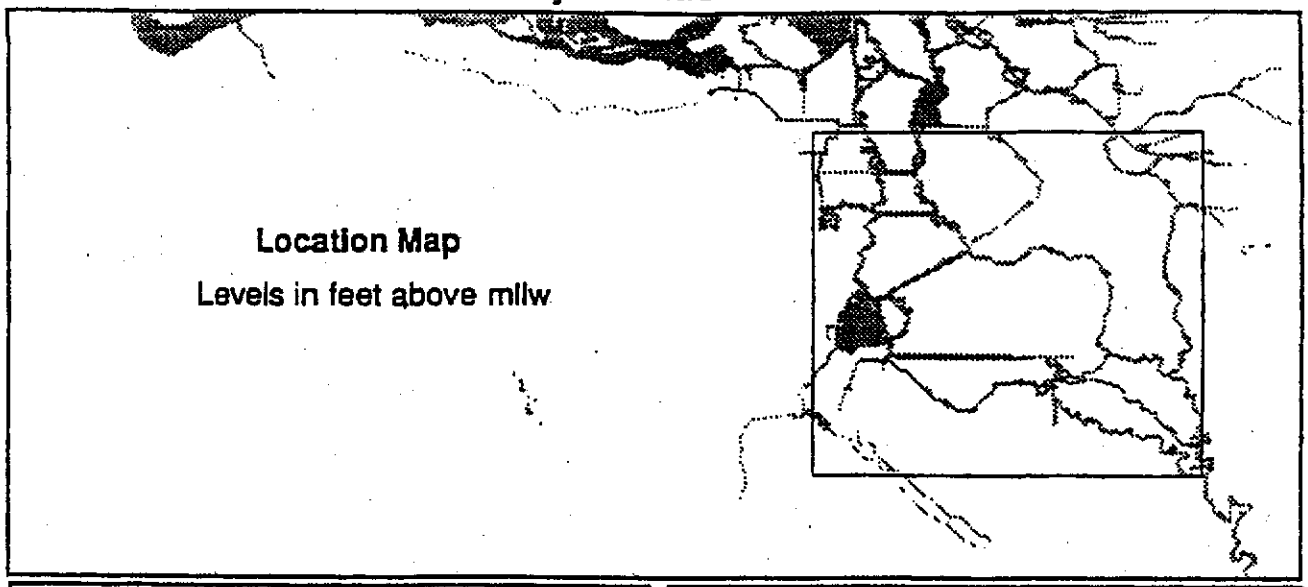


Figure 15
Minimum Water Levels under Various Barrier Configurations
May of Critical Year

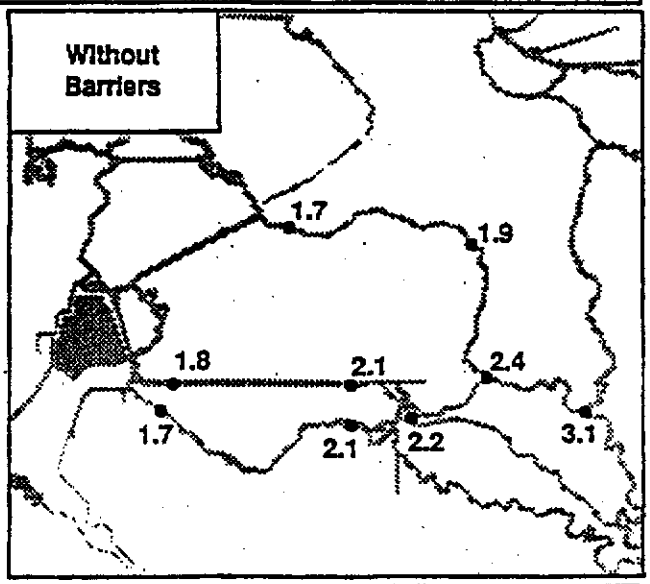


Legend

▯ Barrier

Hydrology:

Sacramento R inflow	8,002 cfs
San Joaquin R inflow	1,952 cfs
SWP Pumping	1,431 cfs
CVP Pumping	1,431 cfs
Channel Depletions	2,017 cfs
Delta Outflow	5,367 cfs



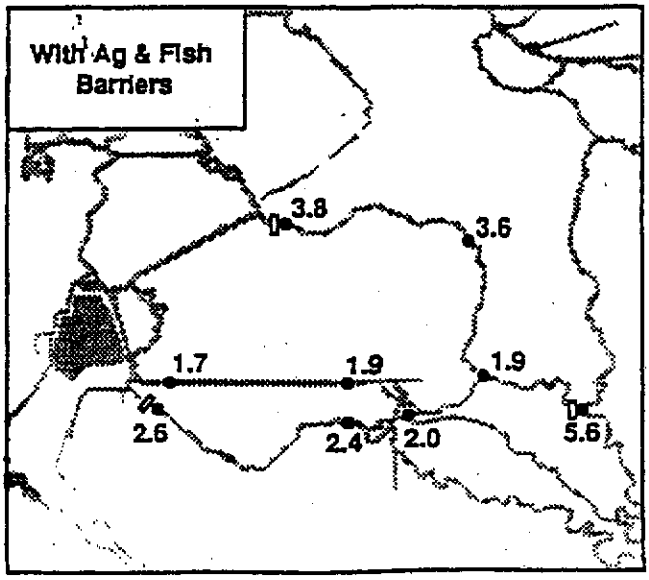


Figure 16
Monthly Average TDS under Various Barrier Configurations
May of Critical Year

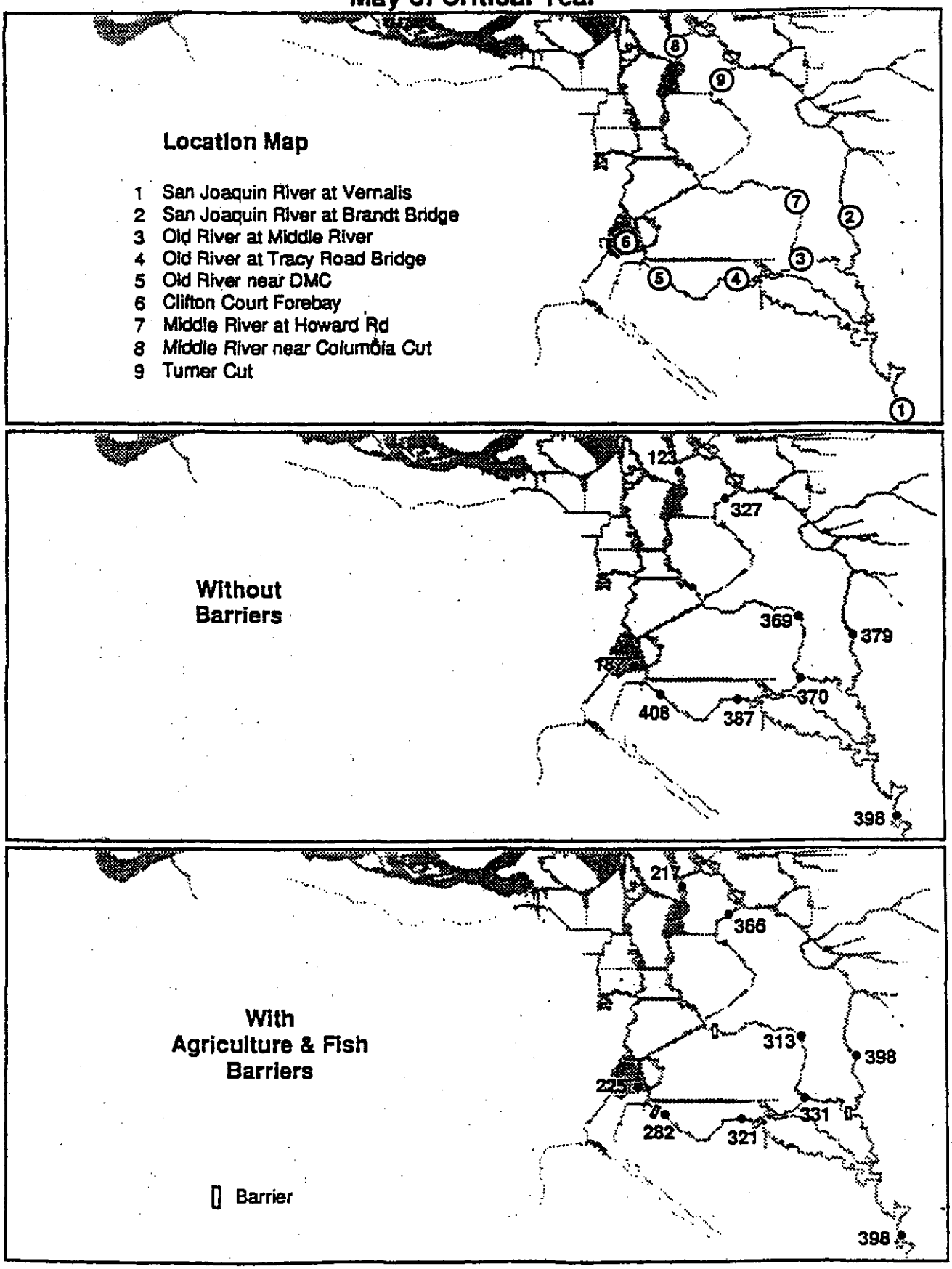
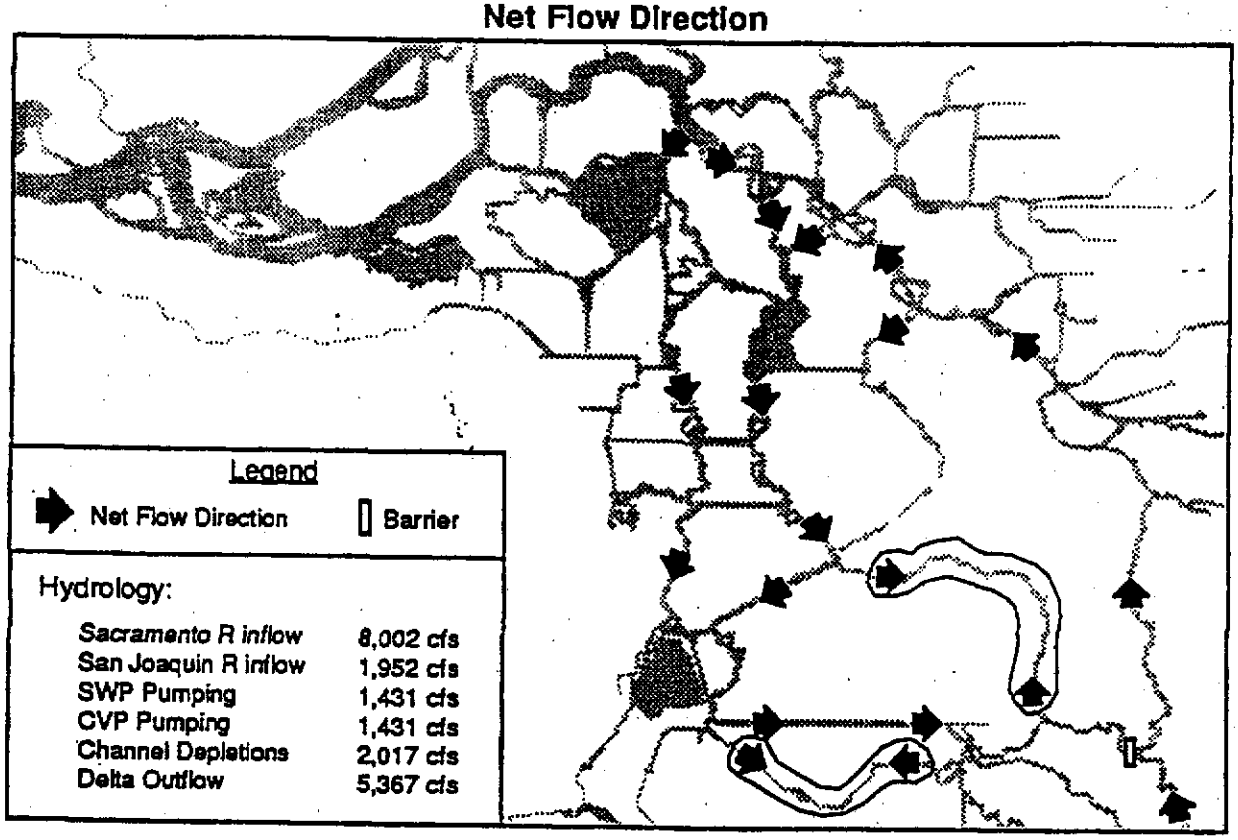
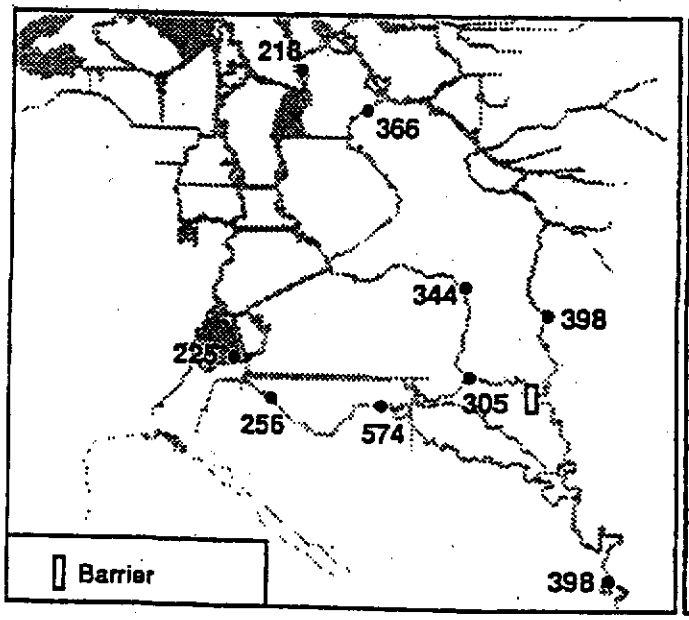
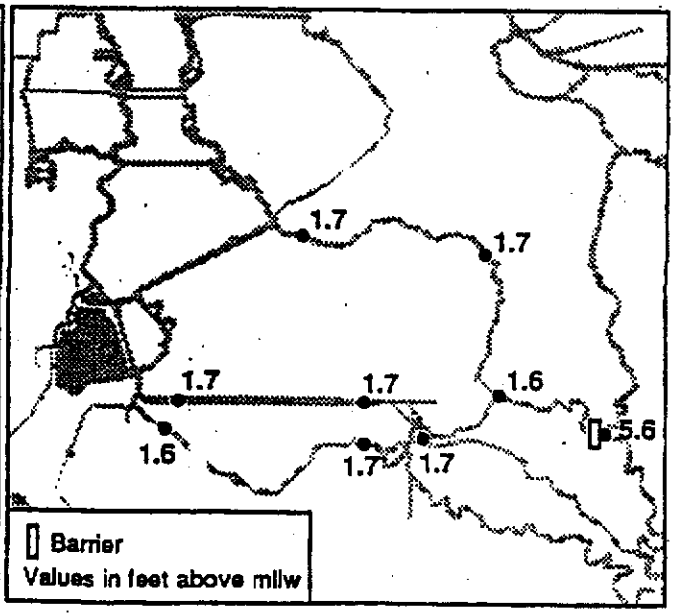


Figure 17
Delta Conditions under Operation of Fish Barrier
May of Critical Year







DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 445-9248

AUG 28 1990

Summary of Settlement of South Delta Water Agency, et al. v. United States of America, et al., Civ. No. S-82-567-MLS (E.D.Cal.)

Attached is a proposed agreement providing for the settlement of the South Delta Water Agency lawsuit referenced above. This summary sets forth the background of the draft agreement and its major provisions.

The Lawsuit

The SDWA lawsuit, filed in 1982, alleged (1) that operations of the Central Valley Project have reduced the quantity and diminished the quality of inflow of water of the San Joaquin River to the SDWA; (2) that operation of the CVP and State Water Project export pumps have caused lowering of water levels, reversing flows, and diminishing the influence of the tides in the SDWA; and (3) that the Secretary of the Interior's designation of the "Stanislaus River Basin" was contrary to Public Law 87-874 by incorrectly designating the boundaries of the Stanislaus River Basin, by not including within that basin the lands within SDWA, by not determining present and future needs of Southern Delta as a part of that basin, by not requiring that diversions of water to areas outside that basin be subordinate to the needs of the lands within Southern Delta as a part of that basin. SDWA asked for declaratory, injunctive relief, costs, and attorneys fees.

The United States and SDWA settled SDWA's Motion for Preliminary Injunction (to restrain the United States from executing contracts for the diversion and sale of water from New Melones Reservoir) by stipulating that any contracts entered into by the United States are subject and subordinate to any water rights related to lands in SDWA which may finally be determined to be superior or paramount. Further activity on the lawsuit was postponed indefinitely while the parties attempted a negotiated settlement.

The Negotiations

Department of Water Resources signed a letter of intent with SDWA in September 1985. DWR developed a work plan containing interim and some potential final actions to mitigate for alleged impacts of the SWP on water levels and flows within SDWA. SDWA agreed to these provisions. The letter of intent between DWR and SDWA describes conditions and responsibilities of these agencies to develop a permanent solution for any adverse impact within SDWA from SWP operations.

In June 1986, DWR signed a joint powers agreement with South Delta Water Agency regarding interim mitigation in SDWA. The agreement provides for dredging Tom Paine Slough, constructing siphons in Tom Paine Slough, if needed, constructing a seasonal weir in Middle River, and developing operational criteria for Clifton Court Forebay.

In October 1986, DWR, United States Bureau of Reclamation, and SDWA entered into an agreement to provide a framework to settle SDWA's lawsuit. All three parties agreed to work together to develop mutually acceptable, long-term solutions to the water supply problems of water users within SDWA. To facilitate negotiations, the parties agreed to a stay of all actions in the litigation. USBR agreed to provide releases of water from New Melones Reservoir for an interim period during the negotiation process. Participation by USBR in implementing the plan depends upon obtaining Congressional authorization and/or appropriations.

DWR implemented the operational criteria immediately following the interim agreement in 1986. DWR also completed dredging in Tom Paine Slough in October 1986 and installed siphons in June 1989. DWR constructed the Middle River weir in May 1987, and removed the center portion at the end of September 1987. DWR reinstalled the removable center portion of the weir for the 1988, 1989 and 1990 irrigation seasons. These activities improved water levels, circulation, and quality within parts of the SDWA.

The Settlement

The proposed contract is thus the product of long hours of discussions among the parties. The parties made extensive use of a hydrodynamic model to determine the most viable alternative for improving SDWA water flows and circulation. Hydrodynamic simulation of the flow requirements of channels within SDWA under various conditions of SWP and CVP operations, boundary

conditions, and San Joaquin River flows provided the basis for determining the appropriate alternatives to alleviate water level and circulation problems within SDWA. This proposal represents the negotiators recommendation for settlement of the lawsuit with no admission of liability.

The main provisions of the contract include:

1. The parties agree to proceed with the design, construction and operation of certain barrier facilities in the channels of SDWA which serve as the cornerstone for the settlement of those portions of the lawsuit relating to the alleged impacts of the export pumping operations of the SWP and/or CVP in SDWA.

2. The Contract sets forth certain interim releases to be made from New Melones Reservoir and other related actions to be taken by USBR as a temporary solution to that portion of the litigation relating to San Joaquin River flows and water quality as measured at Vernalis.

3. The Contract also provides the framework for USBR and SDWA to negotiate an amendment to this Contract to provide a permanent settlement to the remaining issues in dispute which concern the quantity and quality of water and salt load entering SDWA from the south via the San Joaquin River system.

Conclusion

We believe this contract adequately addresses the parties concerns. The next step is to complete the environmental review required by both the National Environmental Policy Act and the California Environmental Quality Act to examine the environmental effects of this action and its alternatives. Our staffs have released a draft EIR/EIS examining the impacts of this action and other elements of the South Delta Water Management Plan.

Each party also has its own approval process. We urge that such processes be initiated as soon as possible to lead to the final execution and implementation of this settlement agreement.

Acknowledgements

Finally, we wish to acknowledge the efforts of the following people who have worked on this draft agreement.

DWR	SDWA	USBR
Bob Potter	Dave Whitridge	Dan Fults
Karl Winkler	Alex Hildebrand	Susan Hoffman
Craig Trombly	Gerald Orlob	Colette Diede
Susan Weber		Steve Palmer
Katy Striemer		Ted Roefs
Dave Schuster *		Tony Colon
Kamyar Guivetchi		Paul Fujitani
Dwight Russell		
Mary Scoonover		

* on behalf of the State Water Contractors

Sincerely,

David N. Kennedy
Director
Department of Water Resources
1416 Ninth Street
Sacramento, CA 95814

Dated: 8-28-90

Lawrence Hancock
Director
Mid-Pacific Regional Office
Bureau of Reclamation
U.S. Department of the Interior
2800 Cottage Way
Sacramento, CA 95825

Dated: Aug. 28, 1990

Jerry Robinson
President
South Delta Water Agency
Board of Diredtors

Dated: Aug 28, 1990

August 27, 1990

DRAFT CONTRACT AMONG THE UNITED STATES BUREAU OF RECLAMATION, THE CALIFORNIA DEPARTMENT OF WATER RESOURCES AND THE SOUTH DELTA WATER AGENCY

This Contract, made this day of _____, 19_, by and among the UNITED STATES OF AMERICA (hereinafter USBR) acting through the Secretary of the Interior; the STATE OF CALIFORNIA (hereinafter DWR) acting through the Director of the Department of Water Resources; and SOUTH DELTA WATER AGENCY (hereinafter SDWA), a public agency in the State of California, created by Stats. 1973 c.1089 (Water Code Appendix 116).

RECITALS

A) The SDWA was established by the California Legislature in 1973 (Stats. 1973 c. 1089) for the general purpose of negotiating and entering into agreements with the United States and/or the State of California for the purpose of 1) protecting the water supply of the lands within the SDWA against intrusionof ocean saiinity and 2) to assure the lands within the SDWA a dependable supply of water of suitable quality sufficient to meet present and future needs.

B) The USBR, pursuant to authorizing acts, is operating in the State of California, the federal Central Valley Project ("CVP") for the development, conservation and utilization of water resources in California.

C) DWR, pursuant to authorizing acts, has under construction and is operating the State Water Resources Development System, hereinafter referred to as the "State Water Project" ("SWP"), for the development, conservation and utilization of water resources in California.

D) The relative rights of the SDWA, USBR and DWR (hereinafter the "parties") to the reasonable and beneficial use of waters within SDWA and the impact on the water rights of those landowners located within the boundaries of the SDWA which allegedly results from the operation of the CVP and SWP have been the subject of dispute between the parties, and are presently the subject of a legal action entitled South Delta Water Agency et al. v. United States of America, et al., Civ. No. S-82-567-MLS (E.D.Cal.)(hereinafter "the lawsuit").

E) It is the purpose of this Contract 1) to resolve between the parties, that portion of the lawsuit relating to the effects of both the CVP's and the SWP's Delta export pumps and operations upon water levels and circulation within SDWA channels by improving the water level, water circulation and water quality within the channels of the SDWA; and 2) to delineate certain interim actions to be taken by USBR as a temporary solution to the remaining portion of the lawsuit between USBR and SDWA relating to San Joaquin River flows and water quality and to provide a framework to negotiate an amendment to this Contract between USBR and SDWA to provide a permanent settlement to that remaining portion which concerns the quantity and quality of water and salt load entering SDWA from the south via the San Joaquin River system.

F) To this end, the parties have cooperated in evaluating the potential uses of certain barrier facilities to alleviate water level and circulation problems in SDWA channels. In conducting these evaluations, the parties have developed and employed computer models to simulate hydrodynamic conditions in the Delta, including SDWA channels, under various assumptions about present and future conditions affecting those channels, including the assumed construction of certain SWP, CVP and barrier facilities within SDWA channels to alter the hydrodynamic conditions that would otherwise prevail.

G) In addition, DWR has provided for the dredging of portions of Tom Paine Slough and the installation of siphons on *Tom* Paine Slough and has installed a temporary barrier facility in Middle River, and these actions have resulted in improvements in water quality, water circulation and water levels in certain areas of SDWA.

H) Thus, based on their evaluations, and in accordance with the provisions of this Contract, the parties have decided to proceed with the design, construction and operation of certain barrier facilities in the channels of SDWA which serve as the cornerstone for the settlement of those portions of the lawsuit relating to the alleged impacts of the export pumping operations of the SWP and/or the CVP in SDWA.

I) This Contract sets forth certain interim releases to be made from New Melones Reservoir and other related actions to be taken by USBR as a temporary solution to that portion of the lawsuit relating to San Joaquin River flows and water quality as measured at Vernalis.

J) This Contract also provides the framework for USBR and SDWA to negotiate an amendment to this Contract to provide a permanent settlement to the remaining issues in dispute which concern the quantity and quality of water and salt load entering SDWA from

the south via the San Joaquin River system.

CONTRACT

1. Definitions

a. Delta: The Sacramento-San Joaquin Delta as defined in Section 12220 of the California Water Code as of the date of execution of this Contract.

b. South Delta Water Agency (SDWA): Includes all the lands within **SDWA's** boundaries at the time the contract is executed as described in Section 9.1 of the South Delta Water Agency Act, Chapter 1089 Statute of 1973. The lands within the SDWA are located within the Sacramento-San Joaquin Delta.

c. Central Valley Project **(CVP)**: The federal Central Valley Project of the United States as administered by the Department of the Interior, Bureau of Reclamation **(USBR)**.

d. State Water Project **(SWP)**: The State Water Resources Development System as defined In Section 12931 of the California Water Code.

e. **Water** Year: The period from October 1 of any year through September 30 of the following year.

f. SWRCB: The State Water Resources Control Board.

g. Grant Line Canal: Includes the Grant Line Canal and the Fabian and Bell Canal.

2. Purpose

The purpose of this Contract is:

a) to resolve that portion of the lawsuit relating to the effects of both the **CVP's** and **SWP's** Delta export pumps and operations upon water levels and circulation within SDWA channels by providing for the design, construction, operation, testing and evaluation of certain barrier facilities which will afford SDWA an adequate agricultural water supply in terms of quantity, quality and channel water levels to meet the reasonable and beneficial needs of those water users located along those portions of Old River, Middle River and Grant Line

Canal that lie within SDWA; and

b) to delineate certain interim actions-to be taken by USBR pertaining to the remaining portion of the lawsuit between USBR and SDWA relating to San Joaquin River flows and water quality and to provide a framework to negotiate an amendment to this Contract between USBR and SDWA, with DWR as a signatory, to provide a permanent settlement to that remaining portion which concerns the quantity and quality of water and salt load entering SDWA from the south via the San Joaquin River system.

3. **Barrier Facilities and Water Level, Circulation and Quality within portions of SDWA**

a. Barrier Facilities

1) The following barrier facilities shall be designed, constructed, operated and maintained in accordance with Exhibit A of this Contract which is incorporated herein by this reference for all purposes.

a) On Middle River **1/2** mile upstream of the confluence of Middle River, Trapper Slough, and North Canal.

b) On Grant Line Canal **1/2** mile east of Old River.

c) On Old River **1/2** mile upstream of Delta-Mendota Canal intake.

2) A barrier on Old River **1/2** mile downstream of Head may also be constructed if the parties determine during the Implementation Phase described in Exhibit A that it is needed to fulfill the purpose stated in Article 2.a. of this Contract.

b. Barrier Facilities Operation

1) The barrier facilities shall be operated to circulate water through SDWA channels as described in Article 5 of Exhibit A.

2) DWR and USBR shall plan and operate the barrier facilities to allow San Joaquin River water to enter Old River at its upstream bifurcation from the San Joaquin River only when necessary for circulation, fisheries or other needs.

c. CVP and SWP Export Facilities Operations

Computer model studies conducted by the parties to analyze the performance of the barrier facilities listed in Article 3.a., assuming the specific boundary conditions defined in Exhibit A, indicate that the circulation patterns created by the operation of the existing SWP and CVP export facilities provide water on the northwest side of the barrier facilities listed in Article 3.a.1) of water quality and water levels desired by the parties to this Contract. Therefore, DWR and USBR agree to:

1) Use the existing SWP and CVP export facilities to continue drawing water to the northwest side of the proposed barrier facilities listed in Article 3.a.1) by exporting water through the existing export facilities for delivery to the SWP and CVP water contractors.

2) Provided however, if either DWR, or USBR, or both construct additional Delta facilities that change either project's export location or export rate, these facilities and the existing facilities shall be operated to maintain water quality and water levels on the northwest side of the barrier facilities listed in Article 3.a.1) at the quality and levels SDWA would probably have experienced with the existing export facilities and the barriers in place.

d. Barrier Facility Performance

The purpose described in Article 2.a. of this Contract will be fully satisfied when the barrier facilities are designed, constructed and meet performance criteria as set forth in this Contract.

The parties have used a computer model to analyze possible locations of barrier facilities and their expected affect on water levels and circulation in SDWA. The parties specifically *recognize that their computer model analyses* have not been intended, nor can they be relied upon, to provide absolute predictions of actual hydrodynamic conditions that may be realized by the construction and operation of the barrier facilities.

Instead, the parties have used these analyses only to determine whether the construction and operation of various barrier facilities, under specified boundary conditions, could reasonably be expected to improve water levels and circulation in certain SDWA channels. *On* the basis of their evaluations, the parties have decided to proceed with the design, construction and operation of certain barrier

facilities in SDWA channels in accordance with the provisions of this Contract and to fulfill the purpose stated in Article 2.a. of this Contract. The facilities, however, must be capable of meeting the conceptual design objectives under the assumed boundary conditions listed in Exhibit A.

The barrier facilities shall be designed, operated and evaluated in accordance with the following:

1) Under the specific boundary conditions defined in Exhibit A, the barrier facilities must be capable of supplying the channel depletions listed in Exhibit A.

2) Since the required performance capability of the barrier facilities can probably not be verified under the precise boundary conditions specified in Exhibit A, the ability of the barrier facilities to meet them if those boundary conditions did exist shall be tested by measuring performance under measured conditions approximating the assumed boundary conditions and using engineering and computer model analyses to determine whether the measured performance indicates that the barrier facilities would meet design performance. requirements under the design boundary conditions.

3) DWR and USBR will not guarantee and this Contract is not intended to guarantee that the design boundary conditions described in Exhibit A represent the most critical conditions that might be experienced in Middle River, Grant Line Canal, Old River and Tom Paine Slough. The boundary conditions selected in the model are to simulate reasonable but "stressed" conditions in SDWA to test whether the barrier facilities will be able to function satisfactorily in most actual situations.

4) The parties agree that the design, construction, operation and maintenance of these barrier facilities cannot guarantee any particular resulting water level or pattern of circulation. Therefore, the purpose described in Article 2.a. of this Contract will be fully satisfied if the barrier facilities are installed and function as designed in accordance with Exhibit A.

5) Operations of the barrier facilities shall be based on an analysis of actual tide conditions, real time output from monitoring stations, forecasted tides and channel depletion rates. The analysis shall be performed by DWR and evaluated by the Technical Advisory Committee **(TAC)**, with Guidance and Management Committee **(GMC)**

input and approval, as described in Article 5, using data collected through the monitoring program.

4. Water Quality and Flows at Vernalis and Framework for Permanent Settlement

a. Interim Water Quality and Water Flows at Vernalis

1) From the date of execution of this Contract until such-- time as a mutually acceptable, long term agreement as provided for in Article 4.b. is reached, the "Agreement on Framework for Settling Litigation Brought By the South Delta Water Agency Against the United States and the California Department of Water Resources" ("Framework Agreement") of October 10, 1986 shall remain in effect until March 1, 1991. The parties agree to terminate the "Framework Agreement" as of March 1, 1991 at which time it shall have no further force and effect.

2) The parties agree that effective March 2, 1991, the formula attached as Exhibit B, as may be modified pursuant to Article 4.a.3), shall be used in place of the "Framework Agreement" to determine the releases to be made from New Melones Reservoir for water quality and flow purposes in the SDWA. The parties recognize that the allocation of the total Additional Supply (AS) term in the formula is no-, yet developed sufficiently to adequately determine the foregoing releases. The parties agree that a period of not more than six months from August 15, 1990 is required to determine the allocation so that it can be used for the purposes desired in this agreement.

3) USBR shall further develop the formula and submit it to SDWA by January 15, 1991. USBR and SDWA shall by February 15, 1991, either agree to use the formula, as may be modified after review by SDWA, or if USBR and SDWA cannot agree then the formula shall be submitted to the GMC for review. If the GMC cannot reach unanimous consent and SDWA refuses to use the formula developed by USER as described above, then the releases shall be 70,000 acre feet or more if it is determined that additional water supplies are available for water quality and flow purposes in the SDWA by USBR, and SDWA may pursue the remedy provided under Article 10.b.2) and in which case USBR may suspend its actions *under* Article 4.

4) Prior to March 1 of each year, USBR will prepare a forecast and hold discussions with SDWA to determine the optimum use of the quantity of water available for water quality and flow purposes. Releases of this quantity of water from New Melones Reservoir will be made on a biweekly schedule requested by SDWA for water quality and flow purposes in the SDWA.

5) The quantities of water released from New Melones as determined according to Articles 4.a.1), 4.a.2), 4.a.3) and 4.a.4) above, 1) are not intended to supercede the water quality terms and conditions of Permits Nos _____, and any changes or amendments thereto as established by SWRCB Decision D-1422, and 2) shall be consistent with the Act of October 23, 1962, Pub. L. No. 87-874 (76 Stat. 1173).

6) USBR may reduce releases specified above if compelled by an emergency as defined in Article 10.c.3)a) or if the total New Melones water supply is not sufficient to meet the foregoing releases.

7) USBR will work with SDWA and consider appropriate measures to avoid salinity variations at Vernalis beyond the limits of plus or minus .075 EC (millimhos/cm) and to notify SDWA when USBR becomes aware of any anticipated variation outside those limits.

b. Framework for Negotiated Amendment to This Contract.

USBR and SDWA agree to negotiate, with DWR as a signatory, an amendment to this Contract in the form of a mutually acceptable, long term agreement, to resolve that portion of the lawsuit relating to water quality and flows at Vernalis as described above in Article 2.b. To further that purpose, the amendment is intended to address the San Joaquin River water flow and quantity within SDWA and the avoidance of future impacts on water use within SDWA. Nothing in this Contract or its amendment is intended to preclude the participation by the State of California in any long term solution pursued under this Contract and its amendment.

Various solutions to the long term water supply problems in the San Joaquin Basin are being pursued. These are:

1) Solutions to the long term water supply problems of the water users within the Calaveras and Stanislaus River basins and SDWA are currently being explored in the USBR and DWR joint Stanislaus-Calaveras Water

Optimization and Conjunctive Use Study. USBR is also initiating the San Joaquin River Resource Management Initiative to evaluate methods of improving the water related environment in the San Joaquin River Basin. As part of these studies, alternatives that improve water quality in the San Joaquin River Basin will be developed, which will benefit SDWA. The Environmental Impact Statement for the above Initiative is scheduled for completion March 1, 1994.

2) Where appropriate, take action consistent with the objective of providing sufficient tributary flows into the main stem of the San Joaquin River to meet the requirements of valid riparian and senior water rights in the main stem of the San Joaquin River and in SDWA.

3) Work with various districts, water users, water purveyors, etc to develop -ways to control drainage effluent so as to reduce salinity in the San Joaquin River.

The parties agree that the various solutions proposed above and other relevant means will be explored such that by January 1995 an amendment to this Contract can be executed. Items to be included in the cost of implementation of the mutually acceptable long-term agreement shall be a part of the negotiation of this amendment. This does not alter the SDWA dollar amount stated in Article 6.f. If such an amendment is not executed by January 1995, the parties shall agree to an extension of time if sufficient progress is being made toward execution of an amendment or absent such amendment SDWA may pursue the remedy provided in Article 10.b.2) in which case USBR may suspend its actions under Article 4.

5. Committees

The Guidance and Management Committee (GMC) and Technical Advisory Committee (TAC) made up of representatives of the parties shall be formed to implement this Contract.

a. Guidance and Management Committee

1) The Guidance and Management Committee shall be formed upon execution of this Contract.

2) The primary purpose of GMC is to implement this Contract. GMC shall oversee the Design, Implementation and Testing Phase of this Contract. This role will be

particularly important during development of the detailed design and construction of the facilities.

3) GMC shall consist of **a single** voting member from each of the parties. The voting members shall have responsibility to represent the parties in implementing this Contract either by vote or by seeking letter approval from appropriate personnel in his ***or her*** organization, depending on the significance of the issue. Additional representatives may be added upon agreement of the parties.

4) All GMC decisions, approvals or other actions shall be by unanimous consent. GMC shall make every effort to reach unanimous consent. If unanimous consent cannot be reached, the parties to this Contract shall attempt to reach a resolution. If the parties are unable to reach a resolution, the terms of Article 10 of this Contract shall apply.

5) GMC shall meet at least every six months to determine the effectiveness of the barrier operation and to address any other issue relevant to this Contract.

6) GMC has authority to resolve disputes of TAC.

b. Technical Advisory Committee

1) TAC shall perform duties as required under **this** Contract or ***as requested by GMC.***

2) TAC consists of technical representatives from each of the parties.

3) TAC shall meet at least quarterly to review technical data relating to impacts and performance of the barrier facilities.

4) TAC shall make recommendations to GMC on technical matters.

5) Any disagreement on any matter shall be presented to GMC for resolution.

6. Costs and Cost Sharing

a. Costs of constructing, operating and maintaining the barrier facilities are to be shared.

b. The parties agree that any cost-sharing is not to be considered an assessment of the proportionate impact of the CVP or SWP on water levels and circulation in SDWA, nor an admission that either project has a particular impact on water levels or circulation in any specific channel in SDWA.

c. The amount to be spent for all costs associated with design and construction of the barrier facilities within SDWA shall be limited to 40.0 million dollars. This amount shall increase 4 percent per annum during the Implementation Phase. The parties acknowledge that DWR has spent three million dollars on dredging of Tom Paine Slough, installation of siphons in Tom Paine Slough, installation of a barrier in Middle River, development, execution and evaluation of computer model runs, and monitoring of conditions in SDWA, and that these costs shall be included in the cost-sharing arrangements. If the barrier facilities cannot be constructed within the dollar limit, GMC shall meet and seek a resolution to the problem pursuant to Article 5.a.4).

d. The parties agree to share barrier facilities construction costs in the following proportions: USBR 40 percent and DWR 40 percent. DWR will seek appropriations from the State General Fund or funds from related water development mitigation agreements or legislation for 20 percent (1) for reimbursement of the incremental costs of the facilities attributable to changes in design or construction for the benefit of fishery or navigation, and (2) to mitigate for impacts of other upstream water users or waste dischargers. In the event such funds are not available, DWR and USER shall split the barrier facility construction costs evenly. It is understood that USBR's participation in implementing any plans will depend on Congressional authorization and/or appropriation and that its ability to agree to any provision of plans requires an act of Congress. The term "costs" shall include those costs identified in paragraph 6.c., and any other costs including financing necessary to implement this Contract, as agreed upon by GMC.

e. Operation and maintenance costs of the completed barrier facilities shall not be included in the 40. million dollar limit. These costs will be shared in the following proportions: USBR 50 percent and DWR 50 percent.

f. As its share of items 6.c. and e., SDWA shall make payments based on the following schedule:

1) A one time payment of $50,000 upon execution of this Contract.

2) An annual payment of $30,000 when a barrier facility at Old River is functioning. This may include a temporary barrier facility.

3) The annual payment will increase to $60,000 when the permits for the permanent barrier facilities are obtained.

4) The annual payment will **increase** to $120,000 when all barrier facilities are functioning.

5) 'The annual payment will increase to $200,000 when the amendment to this Contract is executed pursuant to Article 4.b. That amendment shall identify the phasing of this increase in payment. This amount shall increase 4 percent per annum for the term of this Contract. Of the amount SDWA pays annually it may deduct 15 percent for its expenses associated with the Contract and its amendment.

SDWA shall make its entire payment to DWR until money is authorized and appropriated by Congress and spent by USBR for construction of the barrier facilities. After this date SDWA shall pay DWR SO percent and USBR 50 percent of the annual payments listed in steps 2 and 3 above. Because **DWR's** obligations will be met at the end of step 4 above, DWR shall receive its full share of the SDWA annual payment at that time. **SDWA's** increase in payment in step **5** shall be paid to USBR. Therefore, under step 4 SDWA shall pay DWR **$85,000** and USBR $35,000. Upon completion of the amendment pursuant to Article 4.b. listed in step 5 above SDWA shall pay USBR $85,000 and DWR $85,000 with the aforementioned 4 percent per **annum** escalation to be split evenly between USBR and DWR.

7. Environmental Compliance and Permits

All parties' obligations are subject to compliance with the California Environmental Quality Act, and the National Environmental Policy Act, and no final decisions shall be made unless they are in accordance with the California Environmental Quality Act and the National Environmental Policy Act. All parties shall comply with all applicable laws and regulations of the United States and the State of California, and shall obtain all legally required permits or licenses from appropriate Federal, State or local authorities. All parties shall cooperate in the preparation of appropriate documentation and in obtaining required licenses and permits, including

obtaining right of way permits. Lead agencies for obtaining appropriate permits and licenses shall be determined by the parties as necessary, taking into account the relative resources of all parties.

8. Consents

a. Nothing contained in this Contract is intended to or does limit the rights of the parties beyond the obligations stated in this Contract.

b. This Contract shall not affect, bind, prejudice, impair, restrict or limit vested water rights within SDWA or the water rights of the United States or DWR.

c. The SDWA shall not oppose U.S. Corps of Engineers permits or other permits or actions related to additional facilities needed to increase esports up to 10,300 cfs rated capacity at the SWP Harvey 0. Banks Pumping Plant, or change of point of diversion as long as DWR is in compliance with this Contract.

ci. The SDWA shall not oppose U.S. Corps of Engineers permits or any other permits or actions related to increased exports from CVP Delta facilities, or wheeling, or change of use or point of diversion, or interconnection of facilities as long as USBR is in compliance with this Contract and its amendment.

9. Term of Contract

This Contract shall continue in full force and effect through 2035. During the life of this Contract any party may, by written notice, seek to revise or amend this Contract. Any revision or amendment must be reached by mutual consent of the parties.

10. Settlement of Lawsuit and Remedies

a. Settlement with DWR

1) In consideration of the obligations assumed by DWR under this Contract, SDWA agrees not to pursue its lawsuit on the merits against DWR during the Implementation Phase described in Exhibit A.

2) At the conclusion of the Design, Implementation and Testing Phase and in consideration for DWR having fulfilled its obligation to design, construct and test facilities as described in Exhibit A, SDWA shall dismiss with prejudice its lawsuit as against DWR and any other pending claims against DWR based on any alleged adverse impact of any action of DWR on water quality, low water levels or circulation within SDWA, and further, to refrain from initiating any similar claims, for so long as DWR is fulfilling its obligations under this Contract, This limitation of actions by SDWA shall extend also to any and all administrative proceedings related to operations of the SWP directly affected by this Contract. At the expiration of this Contract, DWR shall not object to SDWA reactivating its lawsuit. If SDWA reactivates its lawsuit SDWA shall not seek reparation for any alleged damages that occurred during the term of this Contract. At the expiration of this Contract, SDWA shall be able to seek damages occurring after this Contract expires.

b. Settlement with USBR

1) In consideration of the obligations related to the purpose described in Article 2.a. assumed by the United States under this Contract, including the design, construction and testing of facilities as described in Exhibit A, plaintiffs each agree to dismiss without 'prejudice all pending claims against the United States related to such purpose, and to further refrain from reinstituting any pending claim, and from initiating any similar claim, for so long as the United States is fulfilling its obligations under this Contract related to such purpose. Plaintiffs each agree not to pursue the lawsuit related to the purpose described in Article 2.b. during the period ending January 1995 as described in Article 4.b. Upon execution of the amendment pursuant to Article 4.b. plaintiffs shall dismiss without prejudice all pending claims against the United States related to the purpose described in Article '2.b. and this amendment, and to further refrain from reinstituting any pending claim, and from initiating any similar claim, for so long as the United States, is fulfilling its obligations under this Contract and its amendment. This limitation on actions by SDWA and/or any of its individual members, shall extend also to any and all administrative proceedings related to operations of the federal Central Valley Project directly affected by this Contract.

2) No failure on the part of the United States to fulfill any of its obligations under this Contract or its amendment when executed shall be the basis for any new cause of action against the United States or any of its agencies. In the event of any such alleged failure, the sole and exclusive remedy shall be to reinstitute litigation of the relevant issues of the lawsuit.

3) Any reinstitution of any portion of the lawsuit shall be subject to all available defenses, except that the running of the time respecting the statute of limitations and laches shall be tolled from the date of the filing of the lawsuit.

c. Remedies

1) During Design, Implementation and Testing Phase

a) Occurrences Beyond the Control of CVP or SWP.

If the barrier facilities cannot be constructed as intended, or are only partially constructed for reasons beyond the control of the parties, USBR and DWR agree to modify the barrier facilities to meet the original objectives so long as the modifications do not require any additional legislative authorization, appropriation, nor will they exceed the dollar limit listed in Article 6.c. of this Contract.

b) SDWA's Remedy during Design, Implementation, and Testing Phase.

All issues that arise during the Design, Implementation and Testing Phase shall be referred to GMC for resolution. To this end, GMC may authorize additional monitoring, studies, data gathering, analysis, and any other activity deemed necessary by GMC. If the parties are unable to reach resolution of the issue SDWA's only remedy is to reinstitute the relevant portions of the lawsuit.

2) Upon Completion of the Barriers and Thereafter

a) Water Level and Circulation not What was Expected

If after construction of the facilities, water level and circulations in SDWA are consistently not what was generally described by the computer model runs, GMC shall evaluate the situation, including

possible causes and solutions. The evaluation may include additional monitoring, studies, data gathering, analysis, and any other activities deemed necessary by GMC.

i. Bngineering or Construction Error.

If the barrier facilities fail to meet the conceptual design objectives as stated in this Contract because the engineering or construction of a barrier facility was in **error**, the barrier facilities or their operations must be modified to perform as adequately as originally intended.

ii. Operations Problem Beyond the Control of **CVP** and SWP.

If the barrier facilities cannot be operated as originally intended by this Contract for reasons beyond the control of the parties, USBR and DWR agree to modify the barrier facilities operations provided that such modifications do not require any additional legislative authorization or appropriation.

b) **SDWA's** Remedy after Design, Implementation, and Testing Phase.

All issues that arise after the Design, Implementation and Testing Phase shall be referred to GMC for resolution. To this end, GMC may authorize additional monitoring, studies, data gathering, analysis, and any other activity deemed necessary by GMC to resolve the issue. **SDWA's** only remedy as against USBR **is** to reinstitute the relevant portions of the lawsuit. **SDWA's** remedy against DWR is suit on the Contract.

3) Special Circumstances

a) Emergency.

If the barrier facilities fail to meet the conceptual design objectives because of'an emergency, the purpose described in Article 2.a. of this Contract will still be considered as met. DWR **and USBR** shall notify SDWA of the emergency condition as soon as possible after they become aware of such an emergency. Emergency means a sudden unexpected occurrence, involving a clear and

imminent danger demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property or essential public services. "Emergency" includes such occurrences as fire, flood, earthquake, or other soil or geologic movements as well as such occurrences as riot, accident, or sabotage.

b) Occurrences Beyond the Control of CVP or SWP.

The purpose described in Article 2.a. of this Contract will still be considered as met if the barrier facilities performance does not meet the predicted performance because actual conditions are adversely impacted by less favorable natural tides or by channel depletions within SDWA exceeding those specified in Exhibit A, or by causes beyond the control and influence of the SWP or CVP.

c) Diversions Within SDWA.

DWR and USBR will not regulate nor be responsible for future diversion rates within SDWA nor for possible increases in water quality impacts caused by local operations within SDWA.

11. Waiver of Defaults

It is the intention of the parties that from time to time any party may waive certain of its rights under this Contract. Any waiver at any time by any party of its rights with respect to a default or any other matter arising in connection with this Contract, shall not be deemed to be ..a waiver with respect to any other rights or matter.

12. Opinions and Determinations

Where the terms of this Contract provide for action to be based upon the opinion or determination of any party to this Contract whether or not stated to be conclusive, said terms.shall not be construed as permitting such action to be predicated upon arbitrary, capricious or unreasonable opinions or determinations. In the event that any party questions any factual determination made by any other party the findings as to the facts shall attempt to be made by the GMC and if made shall be conclusive upon the parties.

13. **Assignment**

a. No assignment or transfer of this Contract or any part thereof, rights hereunder, or interest herein shall be valid unless and until it is approved by all of the parties and may be made subject to such reasonable terms and conditions as the parties may impose.

b. This Contract and all of its provisions shall apply to and-- bind the successors and permitted assigns of the parties.

14. **Books, Records, Reports and Inspections**

Subject to the applicable Federal and State laws and regulations, each party shall have the right, during office hours, to examine and make copies of the books and official records of each of the other parties relating to matters covered by this Contract.

15. **No Effect on Water Rights**

In the event that SDWA, the USBR, or the DWR shall become a party to an adjudication of rights to the use of water in the Sacramento-San Joaquin River system, this Contract shall not jeopardize the rights or position of any party hereto, and the rights of the parties hereto in respect to the use of such water shall be determined in such proceedings as if this Contract had not been entered into. This Contract shall not affect, bind, prejudice, impair, or restrict or limit vested water rights of the parties.

16. **Reservation with Respect to Statutes**

Nothing herein contained shall be construed as estopping or otherwise preventing SDWA or any person, firm, association, corporation or public body or agency claiming by, through or under SDWA from contesting by litigation or other lawful means the validity, constitutionality, construction or application of any Federal or State law, or as preventing or prejudicing the amendment or repeal of any such law.

17. Assurance Relating to Validity of Contract

This Contract shall be effective upon its execution by all parties and after approval by the State Department of General Services. Promptly after the execution and delivery of this Contract, SDWA shall file and prosecute to a final decree, including any appeal therefrom to the highest court of the State of California in a court of competent jurisdiction a special proceeding for the judicial examination, approval and confirmation of the proceedings of SDWA's Board of Directors and of SDWA leading up to and including the making of this Contract and the validity of the provisions thereof as a binding enforceable obligation upon the parties. This shall not be binding on any party unless validated in each and all of its terms and conditions as executed by the parties. In the event that this Contract is determined to be invalid by such final decree or judgement, the parties shall make all reasonable efforts to obtain validating legislation at the next session of the legislature empowered to consider such legislation.

18. Notices

All notices that are required, either expressly or by implication to be given by one party to the others shall be deemed to have been given if delivered personally, or if enclosed in a properly addressed, certified postage-prepaid envelope with return receipt requested deposited in a United States Post Office. Unless and until formally notified otherwise, notices to the parties shall be addressed as follows:

USBR:

DWR:

SDWA:

19. **SWRCB Approval**

a. After this Contract is executed by all the parties, they shall jointly petition the SWRCB to find that:

1) This Contract, when implemented, will provide reasonable protection to agricultural beneficial uses in the SDWA in terms of the impacts of, a) the SWP operations and exports on water levels, circulation, water quality and flow in SDWA, and **b)** CVP operations and exports on water levels, circulation, water quality. and flow within Middle River, Grant Line Canal, Old River and Tom Paine Slough within SDWA.

2) In terms of CVP impacts, this Contract provides interim protection at **Vernalis** for agricultural beneficial uses within SDWA on the San Joaquin River, but is not indicative of the level of protection expected to be achieved by the amendment to this Contract. That amendment will **also** consider impacts caused by other upstream water users.

3) DWR and USBR are taking appropriate action to mitigate any impacts of the SWP and CVP in SDWA.

b. After the amendment to this Contract is executed between SDWA and USBR, those parties shall petition SWRCB to find that the amendment to the Contract, when implemented, will provide reasonable protection to the agricultural beneficial uses on the San Joaquin River within **SDWA,** in regard to the impacts of the **CVP.**

20. **Equal Opportunity**

During the performance of this Contract, the parties agree as follows:

a. The parties will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The parties will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without-regard to their race, color, religion, sex, or national origin. Such action shall *include,* but **not** limited *to,* the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The parties agree to post in conspicuous places, available to employees and

applicants for employment, notices to be provided by the Contracting Officer (a Contracting Officer will be appointed by USBR to implement Articles 20 and 21 of this Contract) setting forth the provisions of this nondiscrimination clause.

b. The parties will, in all solicitations or advertisements for employees placed by or on behalf of the parties, state that all qualified applicants will receive consideration for employment without discrimination because of race, color, religion, sex, or national origin.

c. The parties will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Contracting Officer, advising the said labor union or workers' representative of the parties' commitments under Section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants and employment.

d. The parties will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulatiohs, and reievant orders of the Secretary of Labor.

e. The parties will furnish all information and reports required by said amended Executive Order and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Contracting Officer and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

f. In the event of the parties' noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended, in whole or in part, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law. If this Contract is cancelled, terminated or suspended as described above SDWA may elect to pursue its remedies pursuant to Article 10.

g. The parties will include provisions of Articles 20.a. through 20.g. in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of said

amended Executive Order, so that such provisions will be binding upon each subcontractor or vendor. The parties will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions, Including sanctions for noncompliance:' Provided, however, that in the event the parties become involved in, or are threatened with, litigation with a subcontractor or vendor as a result of such direction, the parties may request the United States to enter into such litigation to protect the interests of the United States.

21. Compliance with Civil Rights Laws and Regulations

a. The parties shall comply with Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d), Section 504 of the Rehabilitation Act of 1975 (P.L. 93-112, as amended), the Age Discrimination Act of 1975 (42 U.S.C. 6101, et seq.) and any other applicable civil rights laws, as well as with their respective implementing regulations and guidelines imposed by the U.S. Department of the Interior and/or Bureau or Reclamation.

b. These statutes require that no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving financial assistance from the Bureau of Reclamation. By executing this Contract, the Department agrees to immediately take any measures necessary to implement this obligation, including permitting officials of the United States to inspect premises, programs, and documents.

c. The parties make this agreement in consideration of and for the purpose of obtaining any and all Federal grants, loans, Contracts, property discounts or other Federal financial

assistance extended after the date hereof to the parties by the Bureau of Reclamation, including installment payments after such date on account of arrangements for Federal financial assistance which-were approved before such date. The parties recognize and agree that such Federal assistance will be extended in reliance on the representations and agreements made in this Article, and that the United States reserves the right to seek judicial enforcement thereof.

Department of Water Resources

U.S. Bureau of Reclamation

South Delta Water Agency

August 27, 1990

Draft of EXHIBIT A

TECHNICAL PORTION OF
THE SDWA, DWR AND USBR CONTRACT FOR
BARRIER FACILITIES IN THE SOUTH DELTA

Introduction

This Exhibit contains technical aspects of this Contract including a description of the conceptual design of the barrier facilities, some aspects of the criteria for detailed design and requirements of the *barrier facilities, the computer model used to analyze the barrier facilities, the boundary conditions for the computer model and the forecasting procedures for operation of the barrier facilities.

1. Design, Implementation and Testing

This Exhibit describes two aspects of design: conceptual and detailed. Conceptual design will be based on the computer model, its boundary conditions and the runs made with the model. The model is the tool for establishing the conceptual design and configuration of the barriers, the expected water levels and circulation resulting from installing the barrier facilities and of SWP enlarged forebay and increased exports from the SWP and CVP facilities. The detailed design criteria shall be represented by the final engineering drawings and specifications used for bidding and constructing the facilities. The detailed design cannot be established now, since it is beyond the range of accuracy of the computer model and since such design requires very detailed surveys and evaluation by hydraulic, design and construction engineers. Such detailed design criteria must be established by the Technical Advisory Committee (TAC) (see main Contract), the Guidance and Management, Committee (GMC) (see main Contract) and actual designers during the Implementation Phase described below.

The Design, Implementation, and Testing Phase under this Contract will span no more than five years from the date of execution of this Contract unless otherwise decided by the parties. The purposes of this implementation phase are to provide an opportunity for the construction of temporary facilities as an added validation of the conclusions reached

through model study prior to the construction of permanent structures, to complete the detailed design criteria and to construct the barrier facilities. This phase may also provide an opportunity to modify facility design or operational criteria.

2. [redacted] Design of Barrier Facilities

a. Conceptual Design Objectives

The following will be the conceptual design objectives:

1) Provide sufficient volume of flow through the barrier facilities to provide water levels upstream of the facilities for uninterrupted operation by local diverters for the design hydrodynamic conditions described in Article 4.b. of this Exhibit.

2) Provide circulation in the controlled channels.

3) Provide compatibility with fishery needs.

b. Locations

1) The following barrier facilities will be installed at the following locations to meet the conceptual design objectives and detailed design criteria of this Exhibit:

a) On Middle river **1/2** mile upstream of the confluence of Middle River, Trapper Slough, and North Canal.

b) On Grant Line Canal **1/2** mile east of Old River.

c) On Old River **1/2** mile upstream of Delta-Mendota Canal intake.

2) A barrier on Old River **1/2** mile downstream of Head may also be constructed if the parties determine during the Implementation Phase that it is needed to fulfill the purpose stated in Article 2.a. of the main Contract.

Proposed locations **of** barrier facilities are identified on Figure 1 of this Exhibit.

c. Controlled Channels

The controlled channels that apply to this Technical Portion of the Contract are:

1) Middle River beginning at the upstream side of the barrier facility noted in Article 2.b.1) of this Exhibit and ending at Old River (12.0 miles upstream).

2) Grant Line Canal beginning at the upstream side of the barrier facility noted in Article 2.b.2) of this Exhibit and ending at its east end (8.7 miles upstream).

3) Old River from the upstream side of the barrier facility noted in Article 2.b.3) of this Exhibit and ending at Head (18.9 miles upstream).

3. Detailed Design

Detailed design of the barrier facilities shall be performed by GMC and TAC in conjunction with DWR and USBR design engineers. TAC shall recommend final approval of the detailed design plans and specifications to GMC. GMC shall then give final approval of the plans and specifications. The actual detailed design plans and specifications cannot be determined until the Implementation Phase is underway. However, the detailed design shall be based on the conceptual design, interim testing data and the following considerations:

a. Cost effectiveness.

b. Minimal operation and maintenance costs.

c. All appropriate or required provisions for safety, boat traffic, and trash racks.

d. Consideration of various types of barrier facilities including but not limited to the following:

1) Barrier facility with gates - This facility would include a gate structure which houses one or more radial gates separated by piers. A flashboard structure would be constructed if needed. The facility would include electronic controls to automatically operate gates in response to changes in tides.

2) Inflatable - This facility would include an inflatable dam anchored to concrete. The dam would use electronic controls to automatically inflate and deflate in response to tidal fluctuations. or fishery concerns.

3) Temporary rock barrier facility - This facility would

be similar to the existing weir in Middle River. The weir would be modified to continue operation on a year to year basis indefinitely, thereby reducing high capital costs. These modifications would include installing automatic controls for the flap gates, constructing a concrete portage ramp, and acquiring adjoining land to store rock.

All these facilities could include a boat lock.

e. Capability to be opened on 48 hour notice to pass any forecasted high river flows, and closed within a few days when high river flows subside.

f. Compliance with CEQA, NEPA and appropriate environmental mitigation.

g. Aesthetic appearance

h. Other relevant criteria.

4. **Computer Model Runs**

a. Model

The computer model used for conceptual design of the barrier facilities is the **DWR/RMA** Delta Hydrodynamic Model. The **DWR/RMA** Delta Hydrodynamic Model will also be used to simulate the hydraulic performance anticipated with proposed barrier facility designs under the boundary conditions specified in this Article. Other mathematical models may be used as recommended by TAC and approved by GMC.

b. Computer Model **Boundary** Conditions and Delta Configuration

Computer model runs to guide the conceptual design of barrier facilities shall be based on the following boundary conditions and Delta configuration assumptions plus any other conditions which are approved by GMC. Should DWR or USBR elect to change the SWP or CVP facilities included in the assumed Delta configuration, additional model studies would be conducted to ensure that the conceptual design objectives are still met. Two basic types of '**simulations are** described below: Month-long with constant channel depletions and short-duration with peak net channel depletions. A copy of the actual data files used to run the computer model are included as Exhibits C and D to the Contract.

1) Month-Long Simulations With Constant Channel Depletions

a) Objective

Define hydrodynamic model tide and hydrology boundary conditions for evaluating the barrier facilities during one month with constant net channel depletions within SDWA.

b) Delta Tide Boundary Condition

Predicted July 1979 tide at Martinez, California (approximately the 19-year mean 28-day (tidal-day) tide) which was derived using the TIDE4S program. The program predicts hourly tide stages that were then fitted with a cubic spline to determine tide stages at 15-minute intervals for use in the DWR/RMA Delta Hydrodynamic Model.

c) Delta Rim Hydrology

Rim Inflows

Sacramento River at Sacramento with existing SWP forebay	18780 cfs
Sacramento River at Sacramento with modified SWP forebay	22680
San Joaquin River at Vernalis	1400
Cosumnes River	150
Calaveras River	100
Mokelumne River and Dry Creek	50

Rim Exports

SWP Banks Pumping Plant with existing SWP forebay	6400 cfs
SWP Banks Pumping Plant with modified SWP forebay	10300
CVP Tracy Pumping Plant	4800
Contra Costa Canal	200
North Bay Aqueduct	50

Net Delta Outflow Index

The net Delta outflow index is determined by subtracting the sum of all exports and net channel depletions from the sum of all rim inflows. The net Delta outflow index for the selected hydrology is 4500 cfs.

d) Net Channel Depletions

Background

Modified estimate of historic July 1979 diversion and drainage data to include additional net channel depletions from the crescent of Middle River (between its head and Victoria Cut) and Tom Paine Slough as previously agreed by TAC. Estimates for historic July 1979 were determined using a consumptive use analysis of 142 areas (islands) in the Delta **(DICU),** and field survey data of existing diversion siphons and drainage pipes. These data are intended to be used only for this Contract.

Data Documentation

File SDWA-779.NCD contains the nodal net channel depletions for the SDWA within the proposed four barrier facilities. Associated model nodes are presented in Figure 1. This data is an excerpt from file **NCD-7-79.SD2** which contains July 1979 Delta diversion and return data from the **DWR DICU** study modified for South Delta Water Management Program model simulations as follows:

Middle River (Nodes 104-113) increased by 10.32 'cfs Tom Paine Slough' (Nodes **151-160)** increased by 1.62 cfs.

In file **NCD-7-79.SD2** the Banta **Carbona** diversion and drainage return location is model node 4.

Equations

Net Channel Depletion = Diversion - Drainage

AF **/ 25-hr** Tidal Cycle = CFS (90000. / 43560.)

Delta Wide Net Channel Depletions

Total Delta	Drainage	Diversion	CDNET
(cfs)	1626.17	6159.92	4533.75

SDWA Net Channel Depletions Within Proposed Barriers

Total SDWA Net CD within Barriers = 764.86 CFS
= 16.9 % Total Delta Net CD
= 1580.28 Acre-ft/Tidal Cycle

SDWA Net Channel Depletions by River Reach

OLD RIVER INCLUDING SALMON SLOUGH (NODES 48 - 69):

NODE	DRAIN	DIVER	CDNET
48	5.94	2.70	-3.24
49	0.00	4.38	4.38
50	0.00	5.73	5.73
51	2.28	5.90	3.62
52	0.00	9.44	9.44
53	0.76	6.55	5.79
54	0.16	5.70	5.54
55	1.59	1.65	0.06
56	1.10	1.65	0.55
57	0.00	0.00	0.00
58	0.16	4.62	4.46
59	0.16	4.62	4.46
60	13.47	5.66	-7.81
61	0.00	7.75	7.75
62	0.00	15.13	15.13
63	25.91	88.17	62.26
64	0.40	11.43	11.03
65	0.67	1.62	0.95
66	11.62	29.80	18.18
67	11.25	62.10	50.85
68	3.34	4.44	1.10
69	2.50	0.00	-2.50

TOTAL 197.73 cfs
408.53 AF/Cycle

MIDDLE RIVER (NODES 104 - 112) :

NODE	DRAIN	DIVER	CDNET
104	0.76	23.98	23.22
105	0.76	23.98	23.22
106	6.40	43.67	37.27
107	3.20	89.74	86.54
108	2.68	37.85	35.17
109	0.00	23.41	23.41
110	0.00	21.77	21.77
111	10.04	22.48	12.44
112	4.39	32.94	28.55

TOTAL 291.59 cfs
602.46 AF/Cycle

SUGAR CUT (NODES 149 - 150) :

NODE	DRAIN	DIVER	CDNET
149	6.40	0.58	-5.82
150	36.10	91.56	55.46

TOTAL 49.64 cfs
102.56 AF/Cycle

TOM PAINE SLOUGH (NODES 151 - 161) :

NODE	DRAIN	DIVER	CDNET
151	0.00	16.62	16.62
152	0.00	7.23	7.23
153	0.00	10.34	10.34
154	0.00	1.62	1.62
155	1.59	32.82	31.23
156	0.00	6.32	6.32
157	0.00	1.62	1.62
158	0.00	9.34	9.34
159	0.00	14.04	14.04
160	0.00	1.62	1.62
161	0.00	0.00	0.00

TOTAL 99.98 cfs
206.57 AF/Cycle

PARADISE CUT (NODES 162 - 169) :

NODE	DRAIN	DIVER	CDNET
162	11.20	36.64	25.44
163	11.06	45.98	34.92
164	0.00	9.23	9.23
165	8.68	0.00	-8.68
166	0.00	0.00	0.00
167	1.45	8.72	7.27
168	5.56	0.58	-4.98
169	7.64	0.58	-7.06

TOTAL 56.14 cfs

115.99 AF/Cycle

GRANT LINE CANAL (NODES 170 - 178) :

NODE	DRAIN	DIVER	CDNET
170	9.55	14.99	5.44
171	4.12	5.30	1.18
172	1.70	21.70	20.00
173	0.94	0.00	-0.94
174	3.46	8.90	5.44
175	0.94	13.64	12.70
176	6.27	13.36	7.09
177	1.61	20.48	18.87
178	3.07	3.12	0.05

TOTAL 69.78 cfs
144.17 AF/Cycle

e) CVP and SWP Diversions

CVP diversions will be from their existing location.

SWP diversions will be from the existing Clifton Court Forebay for 6,400 cfs exports at Banks Pumping Plant or from the Victoria Island-Byron Tract-Clifton Court enlarged Forebay for 10,300 cfs exports at Banks Pumping Plant. Intake gates will be on Old River near West Canal (existing gates) for 6,400 cfs exports, and at Middle River near North Victoria Canal for 10,300 cfs exports. With 10,300 cfs exports the existing intake gates on Old River near West Canal will be used as a secondary intake (operated for water quality). Intake gates will be operated to take water into the Forebay whenever hydraulic conditions allow.

f) Channel configurations

Channel configurations as presently exist, except with dredging in Middle River immediately downstream of the Forebay intake gates (for 10,300 cfs exports).

2) Simulations With Short-duration, Peak Net Channel Depletions

a) Objective

Define hydrodynamic model tide and hydrology boundary conditions for evaluating proposed barrier facilities with short-duration, peak net channel depletions in the SDWA.

b) Delta Tide Boundary Condition

Predicted tide for July 14-22, 1979 (excerpt from tide described in Article 4.b.1)b) above). Tide data for July 14-16 are used to "warm up" the simulation.

c) Delta Rim Hydrology

Delta rim inflow and export data for the modified SWP export forebay described in Article 4.b.1)c) above. Net Delta outflow index varies daily in accordance with the specified net Delta channel depletions.

d) Net Delta Channel Depletions

Outside the four barrier facilities

Estimate of historic July 1979 diversion and drainage return data described in Article 4.b.1)d) above are used for both quantity and distribution. The same values are used for all nine days.

Within the four barrier facilities

The modified estimate of historic July 1979 diversion and drainage return data described in Article 4.b.1)d) are used for distribution only. The quantities specified in that Article under the Section entitled "SDWA Net Channel Depletions by River Reach" are adjusted to achieve the following total net channel depletions:

For Middle River: The daily net channel depletions from the crescent of Middle River (between its head and Victoria Cut) measured during July 17-22, 1988 (DWR Middle River Monitoring Report, May 1989). The mean July 1988 net channel depletion is used during the three-day "warm up" period.

For Old River (including Salmon Slough, Sugar Cut, Tom Paine Slough, Paradise Cut and Grant Line

Canal: Daily net channel depletions varying from the modified estimate of historic July 1979 data by the same proportion as the measured Middle River data.

Adjusted total net channel depletions for each reach in the SDWA within the four barrier facilities and the adjustment factors derived from the Middle River monitoring data are presented in Table 1 (below).

Using program NCDADJ1, monthly nodal diversions and drainage returns specified in Article 4.b.1)d) are adjusted for each reach to achieve the target daily net channel depletion while maintaining the same depletion distribution.

TABLE 1
ADJUSTED DAILY NET CHANNEL DEPLETIONS
FOR THE SOUTH DELTA BY REACH 1/

		REACH NET CD (CFS) 2/					
DATE	FACTOR 3/	MR	OR	SC	TPS	PC	GLC
MONTHLY 4/		292	198	50	100	56	70
JULY 1988							
14-16	0.634	185	125	32	63	35	44
17	0.736	215	146	37	74	41	52
18	0.284	83	56	14	28	16	20
19	1.346	393	266	67	135	75	94
20	1.233	360	244	62	123	69	86
21	0.514	150	102	26	51	29	36
22	0.784	229	155	39	78	44	55

1/ Daily July 1988 net channel depletions for Middle River are from the DWR Middle River Monitoring Report (May 1989). The value for July 14-16 is the July 1988 mean monthly net channel depletion. Daily net channel depletions for all other reaches were determined by multiplying the reach monthly depletion by the adjustment factor.

2/ Reach abbreviations: MR = Middle River; OR = Old River; SC = Sugar Cut; TPS = Tom Paine Slough; PC = Paradise Cut; GLC = Grant Line Canal.

3/ Daily adjustment factors were determined by dividing the respective daily net channel depletion measured in Middle River by the Middle River monthly net depletion.

4/ Monthly net channel depletions are defined in Article 4.b.1)d) above.

5. Operations and Maintenance

a. Operations

During the Implementation Phase, DWR and USBR will use any test facilities the parties construct to gain more information about how to construct and operate permanent barrier facilities.

Once the permanent barrier facilities are installed, DWR and USBR will continually review and improve barrier facility operations by:

1) Conducting ongoing testing operations in connection with tides, seasonal variations of tides and flows and agricultural use.

2) Reviewing and improving tide forecasting techniques, including use of astronomical variations, computer models and correlations between various parameters.

3) Testing and investigating inter-relationships of barrier facility operations.

Operations will be based on actual tide conditions, real time output from monitoring stations, forecasted tides and channel depletion rates and will include periodic opening of barriers to provide circulation while maintaining adequate water levels.

Using the procedures established above, the barrier facilities will be operated to meet the conceptual design objectives cited in Article 2.a. of this Exhibit. Gate operations may be either automatic, electromechanical, based on a pre-determined schedule or through a manual override capability. Adjustments in gate operation may be made based on changes in channel depletion (seasonal variations), schedules of SWP and CVP diversions and forecasted tidal conditions. If the agreed upon computer model (Article 4.a, this Exhibit) shows that such changes in operations would cause the conceptual design objectives to not be met or to be less frequently met, the changes must be approved by all parties to the Contract.

The barriers will be opened on 48 hour notice to pass an forecasted high river flows, and closed within a few days when high river flows subside. Within limitations of permits for the barrier facilities, operation will not be on arbitrary seasonal dates.

All gates and controls will be maintained to ensure that they work properly. DWR will be responsible for gate operations and maintenance.

b. Monitoring

Water levels, flow velocity, in-channel water quality, drainage water quality, fish and other environmental concerns will be monitored both upstream and downstream of the facilities according to criteria recommended by TAC and approved by GMC. This data will be used for the improvement of barrier facility operations when agreed upon by GMC and to ensure that the barriers' mechanical functioning meets the detailed design criteria.

A monitoring program will be established based on criteria recommended by TAC and approved by GMC and will continue for the term of this Contract.

c. Dredging

In addition to the construction of the barrier facilities, sections of various channels may be dredged to improve conveyance and reduce drawdown. These channels may include Old River west of Sugar Cut, Middle River between Old River and Highway 4, and Victoria Canal and Middle River north of Highway 4 (see Figure 1). GMC, with input from TAC, upon review of monitoring data will determine if dredging is necessary.

6. Forecasting

Forecasting procedures will be established by TAC, with input from DWR's Division of Operation and Maintenance and the Central Valley Operation Coordinating Office, and will be used to evaluate possible future tide stages, water quality, and flows. The forecasting will be accomplished using estimates for variables such as wind direction and speed, Delta inflows, tidal predictions, barometric pressure, and air temperature. Reference stations will be established throughout the SDWA area and elsewhere to assist in modifying the forecasting procedures (see Figure 1 for locations). Also, SDWA will provide, to the extent available, information on expected irrigation diversion and return rates to improve forecasting capability.

The results from the forecasting will be reported using a procedure established by TAC. This procedure will include the timing and the format of reports. TAC will evaluate the performance in relation to the conceptual design objectives of the temporary facilities during the Implementation Phase.

Forecasting procedures may be developed by any of the parties to this Contract, but application of these procedures for purposes of modifying operation of barrier facilities must be evaluated by TAC and approved by GMC.

Model simulation assumptions to predict future conditions will be determined by TAC and approved by GMC. Relatively minor changes and/or improvements may be made to the model without approval by TAC or GMC. However all changes shall be reported to TAC.