

CASE STUDY REPORT #63  
FRIANT DAM (MILLERTON LAKE)  
SAN JOAQUIN RIVER

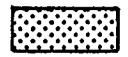
I. Project Description

The 350-mile San Joaquin River originates near the crest of the Sierra Nevada southeast of Yosemite National Park. The river enters the Delta near Stockton, sharing the estuary with the Sacramento River. The upper San Joaquin Basin drains 1,650 square miles to the Friant Dam site, located east of Fresno. Flow in the San Joaquin was first altered by Friant Dam in the 1944-47 period with the filling of Lake Millerton. The reservoir, with its storage capacity of 520,000 acre-feet, covering 4,900 acres, is operated by the Bureau of Reclamation as part of Central Valley project for flood control and irrigation. Water stored by the dam is diverted south to the Kern River along the Friant-Kern Canal, and north to the Chowchilla River along the Madera Canal (see Figure 1). Inflow to Millerton Lake is influenced by an extensive system of hydroelectric power plants and reservoirs (see Figure 2) operated by the Southern California Edison Company and the Pacific Gas and Electric Company. The operations are coordinated with the Bureau of Reclamation to obtain maximum use of all stored water in the upper San Joaquin River Basin.

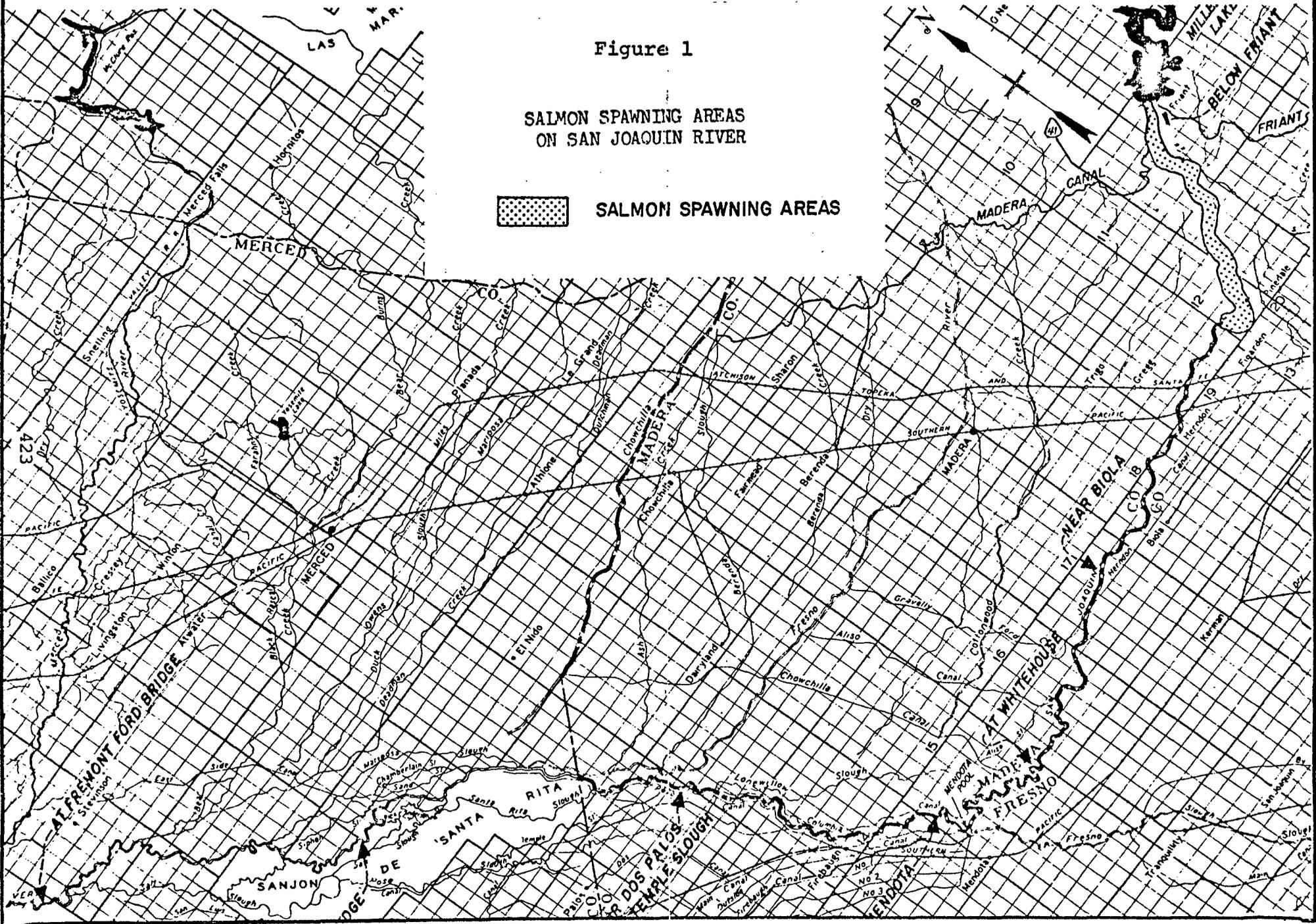
At the lower end of the San Joaquin River pumps at the Tracy pumping stations lift Sacramento-San Joaquin River water (and fish) 197 feet into the Delta Mendota Canal and the California

Figure 1

SALMON SPAWNING AREAS ON SAN JOAQUIN RIVER



SALMON SPAWNING AREAS



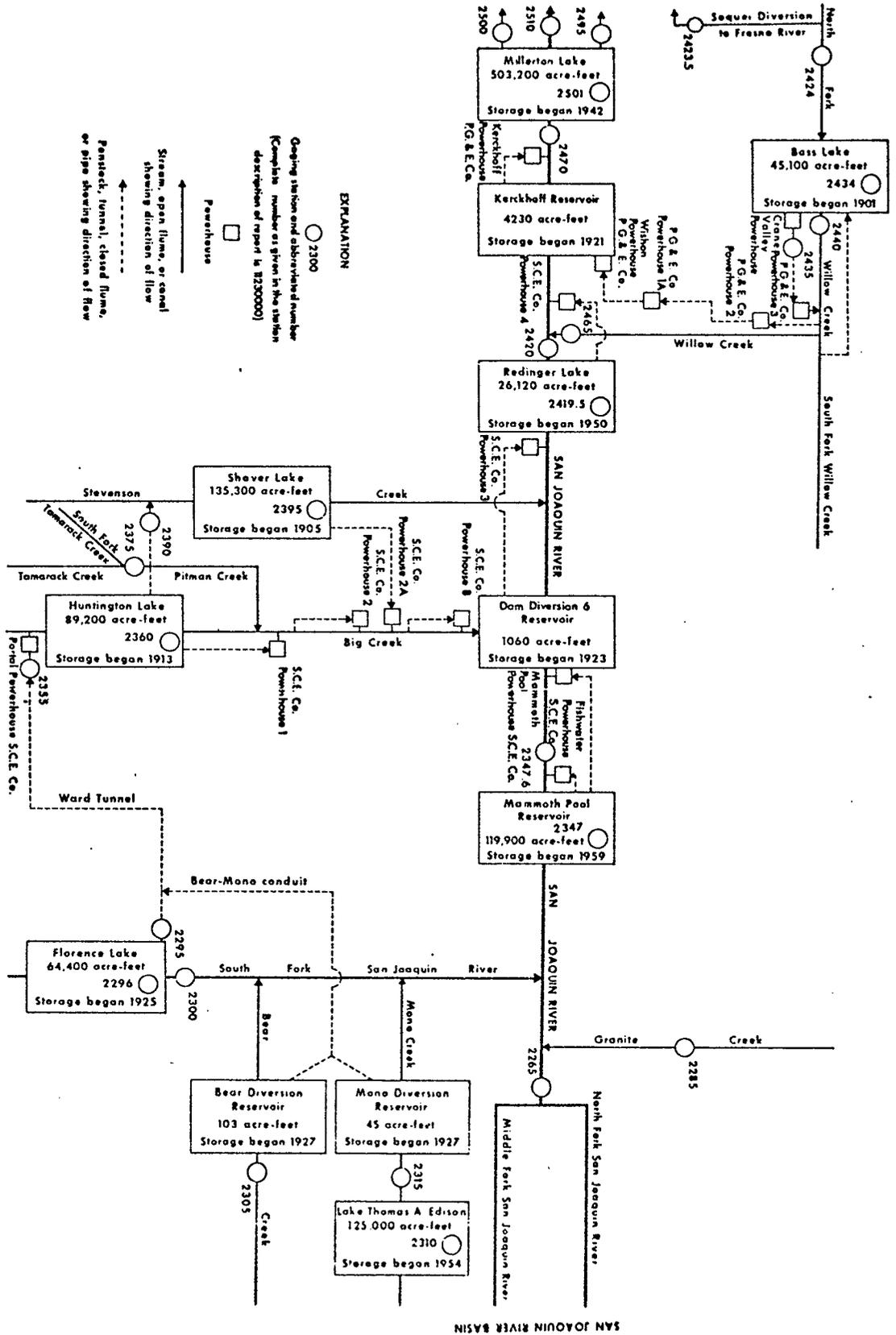


Figure 2

**SCHEMATIC DIAGRAM SHOWING DIVERSIONS AND STORAGE IN SAN JOAQUIN RIVER BASIN**

Source: U. S. Geological Survey, 1973, water resources data for California.

aqueduct. The 117-mile Delta Mendota Canal parallels the San Joaquin but flows in the reverse direction (south). Some of this water is finally delivered into the San Joaquin River at the pool formed by the Mendota Dam. From the Mendota Pool, most of the water is diverted into private canals that were previously supplied by the San Joaquin River. Below the Mendota pool much of the dry season flow in the river is agricultural wastewater.

## II. Pre-Project Condition

The natural flow of the San Joaquin River peaks in May and June, the period of the greatest snowmelt, at average flows greater than 5,000 cfs. Unimpaired flows calculated from runoff estimates (U. S. Bureau of Reclamation Central Valley Operations Records) show the seasonal distribution and the magnitudes of stream flow under natural conditions (see Figure 3). The San Joaquin drainage maintained mean monthly stream flows over 250 cfs during the extremely dry year of 1924 (see Figure 3). The Department of Fish and Game (1940) noted that during the dry year of 1939 most of the suitable spawning areas were adequately covered with water and the water level was satisfactorily constant.

The San Joaquin River in the Valley has historically been used extensively for agricultural water supply. During the irrigation season an average flow of 2,000 cfs was diverted from the river in the vicinity of Mendota. Twenty-two miles downstream an additional 350 cfs was removed at Temple Slough (see Figure 1).

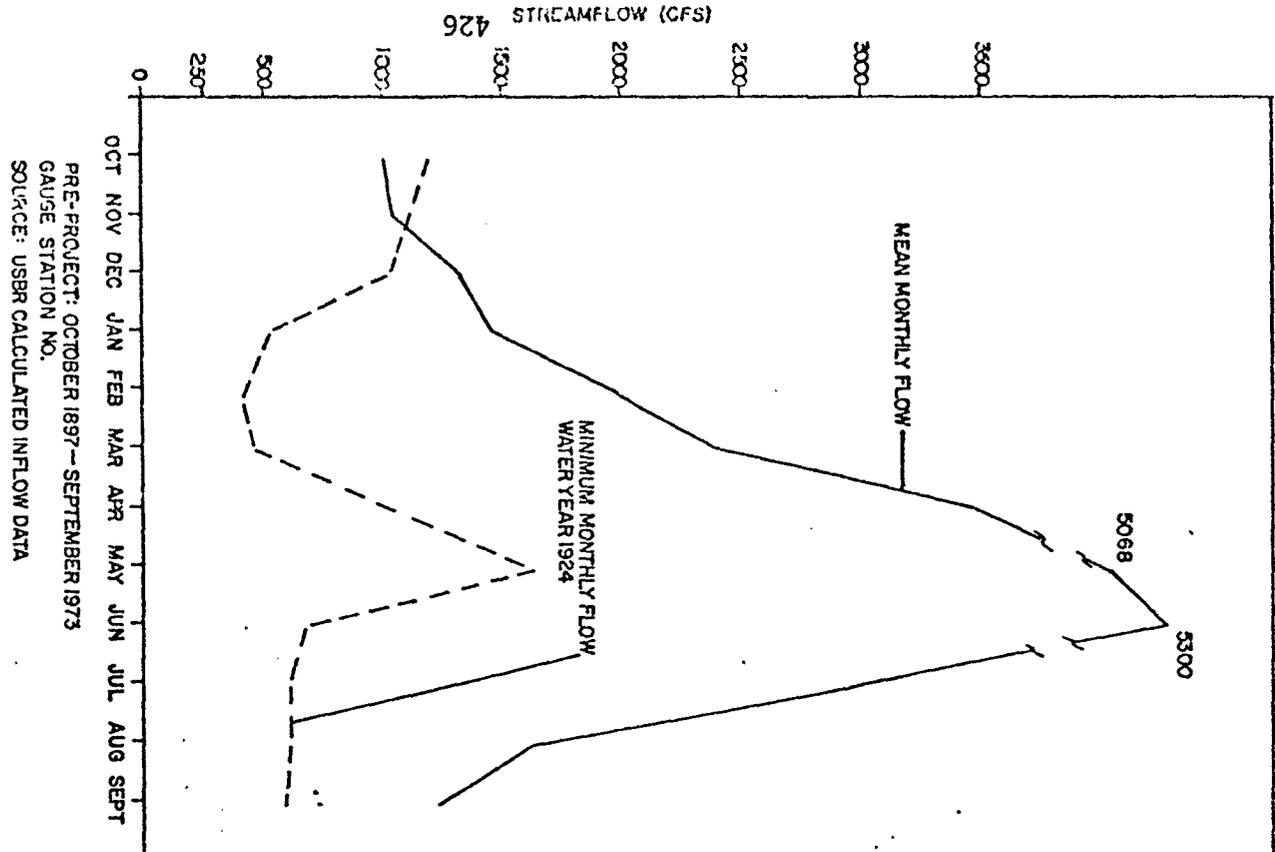
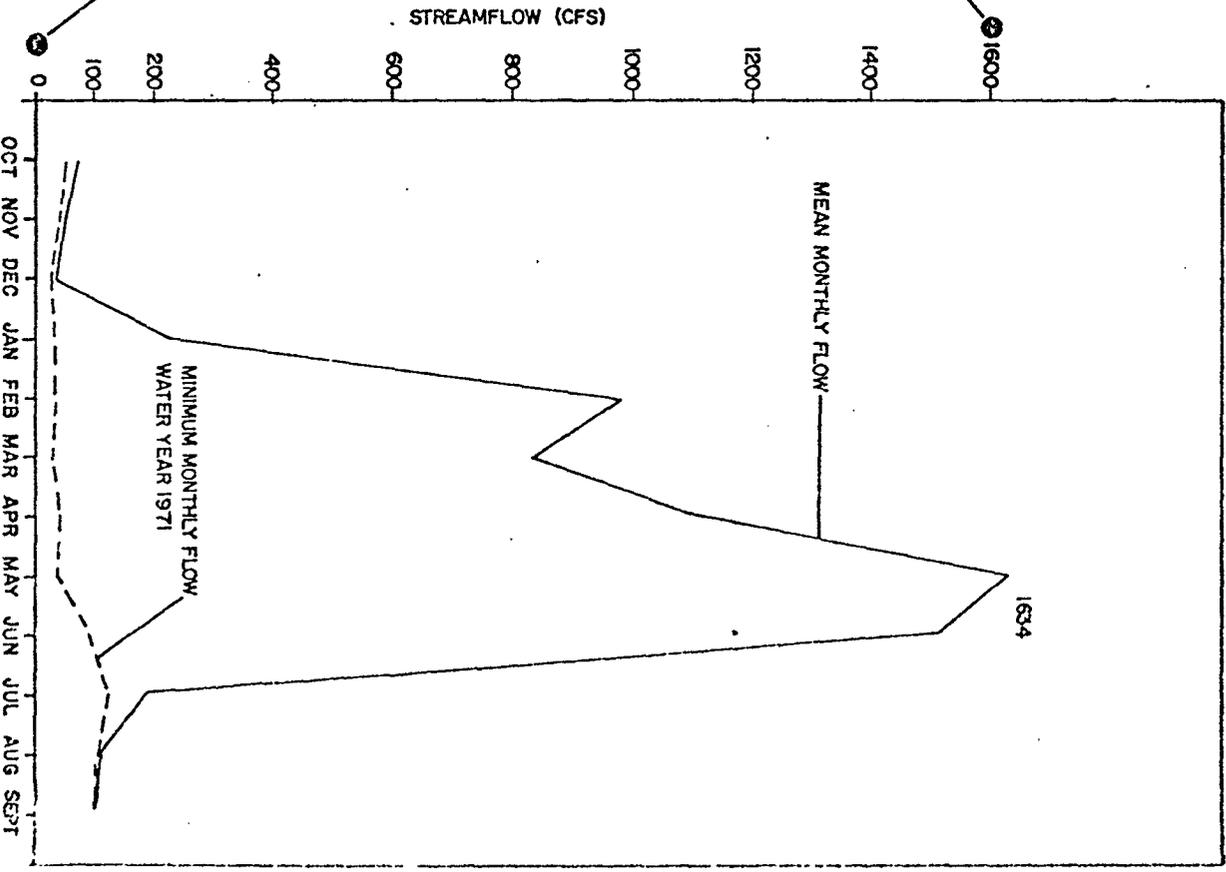


FIGURE 3  
STREAMFLOW CONDITIONS, SAN JOAQUIN RIVER  
FRIANT DAM



During years of high stream flow a large amount of water was by-passed at Temple Slough. On the other hand, when stream flow was low a sand bag dam (called sack dam) was constructed and the entire flow of the river was diverted. The diversion of the stream flow along the lower San Joaquin created hazards for the anadromous fish that were annually present in the river. These fish included king salmon, steelhead trout, striped bass, American shad, and sturgeon. The king salmon were the most important fish species that used the river up to and above the Friant Dam project. There were spring and fall run king salmon with the major run occurring in the spring. The sack dam had a definite adverse effect upon the fall run king salmon because it generally blocked the river until it was washed away by increased stream flows in the late fall. Occasionally during a particularly dry year the sack dam was installed early and consequently a large part of the spring run would be lost. It was observed that fish could find their way through irrigation canals and ditches to a point above the barrier dam. In spite of these hazards a large spring run and a much smaller fall run of king salmon were maintained in the San Joaquin River below Kerckoff Reservoir.

To determine the effect of the Central Valley Project upon the fishes of the San Joaquin River system and the Sacramento-San Joaquin Delta, the Department of Fish and Game conducted a stream habitat survey in 1939. The survey revealed that there were 417,000 square feet of gravel riffle in the 26 miles of the upper San Joaquin between the old Lanes bridge and Kerckoff

Powerhouse. Friant Dam blocks off 36 percent of this area. It was anticipated at this time that expected releases from Friant Dam would not be sufficient to support the existing fisheries resources of the river (DFG, 1940).

There are no estimates of the sizes of anadromous fish populations using spawning grounds in the San Joaquin River before the start of construction of Friant Dam in 1942. Subsequently, during 1942 and 1943 when the dam had blocked the river but had not yet altered the stream flow, estimates of king salmon and steelhead populations were made by the Department of Fish and Game. In 1943 there were about 35,000 spring run king salmon -- 1,000 fall run king salmon and 500 steelhead trout.

### III. Project Development

The Central Valley Project embodying the proposals of the Central Valley Water Plan was undertaken by the U. S. Bureau of Reclamation with Shasta and Friant being the first major impoundments. Water Rights applications 5637, 5638, and 9369 pertaining to the appropriation of water from the San Joaquin River at or near Friant Dam were filed by the Department of Finance on behalf of the State of California and were assigned to the U. S. Bureau of Reclamation in 1939.

The State Engineer was, at that time, authorized to issue permits to appropriate water and also subject the appropriations to terms and conditions that utilize the water in the public interest. The State Senate Interim Committee on Fish and Game, by resolution,

urged the State Engineer to impose terms on the permits issued to the Bureau to require the release of water from Friant Dam necessary to protect fish and wildlife. Upon the advertisement of the application to appropriate water to be stored and diverted at Friant Dam, the Department of Fish and Game protested the application and stated that certain releases of water are necessary for the preservation of fishlife. The Bureau of Reclamation maintained that it was not legally required to do so. On July 23, 1951, Edmund G. Brown, then Attorney General of the State of California, acting as legal counsel for the DFG, issued an opinion, summarized as follows:

"The United States is not required by State law to allow sufficient water to pass Friant Dam to preserve fish life below the dam. The United States is required by Federal law to make adequate provision, consistent with the primary purposes for which Friant Dam was constructed, for the conservation, maintenance and management of wildlife, including fish, in the waters impounded by the dam."

The Bureau of Reclamation maintains a minimum pool at Miller-ton Lake which protects the fishery resource in that reservoir.

This litigation accomplished little for the preservation of San Joaquin River salmon, but a Department of Fish and Game report (1971) noted that it did effect a "better mutual understanding that has been highly beneficial to fish in other areas". A court order in 1950 led to the construction of an emergency fish-way and the stream flow release to make it operable at sack dam.

This structure was to enable salmon to migrate upstream through an irrigation canal system roughly paralleling the San Joaquin and entering the river further upstream where there was stream flow. The discharge of the canals was too low and the temperature was too high, resulting in only 36 salmon completing the circuit.

In 1952 a California State Senate Resolution (no. 41) stated that the Department of Fish and Game should file any necessary protests on a petition submitted by the Bureau to change the point of diversion of appropriated water for the Friant Dam project. The resolution further stated that the Department of Fish and Game should request permission from the Attorney General to employ independent counsel in the matter of the protest.

On December 30, 1954 a formal hearing was held by the State Water Resources Control Board in the matter of petitions to change the point of diversion and place of use under Water Rights License 1986 (application 23) of the United States. The position of the Department of Fish and Game is described in Decision 935 which was issued by the Board in regard to the Bureau's application and is summarized as follows:

- "1. Salmon runs were destroyed by the construction of Friant Dam.
2. Salmon runs should be re-established and maintained by minimum flow releases.
3. Flows required to re-establish and maintain the salmon runs will have a greater number of beneficial uses than a similar quantity of water appropriated and used as

planned by the United States.

4. Statutes prohibit the willful and negligent destruction of fish and wildlife and require that the needs of the San Joaquin River watershed, including the requirements for maintenance of fishlife, be satisfied before water is exchanged or exported as contemplated by the United States.
5. Any destruction of the salmon runs that has resulted from the construction of Friant Dam has been accomplished by the wrongful and unlawful act of storing and diverting water at the dam without a permit to appropriate unappropriated water, and of changing points of diversion upstream without authorization and in violation of downstream rights. Thus the United States cannot take advantage of its own wrong and now claim that salmon runs do not presently exist in the San Joaquin River.
6. Water required for fishlife is not subject to appropriation.
7. The State Water Rights Board has the authority and public interest requires that permits issued to appropriate water from the San Joaquin River be conditioned subject to maintenance of such minimum flows as required to re-establish and maintain fish life."

The Department of Fish and Game presented a statement to the Division of Water Resources at hearings on the San Joaquin River water applications. This statement included minimum instream flow

requirements for the section of the San Joaquin between Friant and the sack dam. Three alternatives for rehabilitation and maintenance of the San Joaquin salmon populations were presented to the Board and amounts of water required for each alternative were listed as shown below.

<u>Alternatives for Salmon Maintenance</u>	<u>Release from Friant in Acre-Feet per Year</u>
Maintenance of Spring Run Alone	150,000
Maintenance of the Fall Run Alone	108,000
Maintenance of both the Spring and Fall Run	165,000

In each case it was noted by the department that a large portion of the water could be used for irrigation downstream. A minimum instream flow release schedule was established for the section between Friant and sack dam. During the course of the hearing, the amounts of water required for the three alternatives were decreased as shown below.

<u>Alternatives for Salmon Maintenance</u>	<u>Releases from Friant in Acre-Feet per Year</u>
Maintenance of Spring Run Alone	60,233
Maintenance of Fall Run Alone	49,020
Maintenance of both Spring and Fall Run	77,146

The minimum instream flow release requirements of the lower San Joaquin River (between Friant and sack dam) that would be provided by the alternative release programs from Friant are shown

in Table 1. The reasons for these minimum instream flow requirements as described by the Department of Fish and Game in the statement to the Board is shown in the paragraphs below.

"During the peak runs 350 cfs should be allowed, after fish have spawned the flow can be dropped to 200 cfs and still keep the nests covered. The increase in flow of water released from Friant in May, June and July for the spring and fall runs combined and spring run only are to provide enough water to get salmon up the long sandy stretch from Mendota to Friant. It was assumed that at least 100 cfs was needed to keep downstream migrants moving satisfactorily from February through May. The fall run requires a minimum flow of 350 cfs beginning in October, to provide for passage upstream."

The Department of Fish and Game recommended that primary consideration be given to rehabilitating and maintaining the fall run of San Joaquin salmon instead of the spring run. The fall run salmon commence their upstream migration where temperatures are cool and as a result they are not often subjected to lethal temperatures. Also the adverse effects of being bruised on shallow riffles were not considered as critical with the fall run fish because they have a relatively short time to live before spawning. During this time they are in cooler water and there is a reduced chance of serious attack from fungus and bacteria.

The methodology used by the Department of Fish and Game in the formulation of recommendations for salmon maintenance primarily

Table 1

MINIMUM FLOW OF SAN JOAQUIN RIVER REQUIRED FOR PROPAGATION OF SALMON  
(All amounts in cubic feet per second)

Month	SPRING AND FALL RUNS COMBINED					SPRING RUN ONLY					FALL RUN ONLY				
	Minimum Flow Requirements					Minimum Flow Requirements					Minimum Flow Requirements				
	"Below Priant Gage"	"Near Biola Gage"	White- house Gage	Mendota to Sack Dam	Below Sack Dam	"Below Priant Gage"	"Near Biola Gage"	White- house Gage	Mendota to Sack Dam	Below Sack Dam	"Below Priant Gage"	"Near Biola Gage"	White- house Gage"	Mendota to Sack Dam	Below Sack Dam
Jan.	200	200	200	150	100	200	200	200	150	100	200	200	200	150	100
Feb.	200	200	200	150	100	150	150	150	150	100	200	200	200	150	100
Mar.	150	150	150	150	100	100	100	100	100	100	150	150	150	150	100
Apr.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
May	200	200	200	200	200	200	200	200	200	200	100	100	100	100	100
June	300	300	300	300	200	300	300	300	300	200	0	0	0	0	0
July 1st 1/2	350	350	300	300	200	350	350	300	300	200	0	0	0	0	0
July 2nd 1/2	200	200	0	0	0	200	200	0	0	0	0	0	0	0	0
Aug.	100	0	0	0	0	100	0	0	0	0	0	0	0	0	0
Sept.	100	0	0	0	0	100	0	0	0	0	0	0	0	0	0
Oct.	350	185	185	185	150	350	0	0	0	0	350	185	185	185	150
Nov.	350	185	185	185	150	350	0	0	0	0	350	185	185	185	150
Dec.	350	185	185	185	150	200	0	0	0	0	350	185	185	185	150

Source: California Department of Fish and Game, 1971.

consisted of observations of the upstream migrant salmon during the various stream flows resulting from the operation of Friant Dam and other downstream dams. The department maintained a counting station at the Mendota Dam and also observed the stream during some experimental releases from Friant. Massive mortality was observed during the spring run when the flow was less than 200 cfs on the lower San Joaquin.

The State Water Resources Control Board finally concluded in Decision 935 that "to require the United States to bypass water down the channel of the San Joaquin River for the reestablishment and maintenance of the salmon fishery at this time is not in the public interest and the protests of the Department of Fish and Game to the subject applications are dismissed at this time".

A more recent effort to secure minimum stream flows on the San Joaquin River was made in 1971.

Senate Concurrent Resolution No. 64 directed the California Department of Fish and Game to prepare a series of reports regarding Federal water projects in California. These reports identified those developments which have had an adverse effect on salmon and steelhead populations, to assess the numbers of salmon and steelhead lost, to assess the damage to the environment, and to estimate the cost of mitigating the damage.

In relation to recreating salmon runs below Friant the DFG stated (1971):

"Probably the greatest expense to the Bureau of Reclamation would be the loss of a large amount of San Joaquin water

which the Bureau has constructed canals for and has contracted to deliver. Our estimates of 140,000 acre-feet for the fall run, 200,000 acre-feet for the spring run or 210,000 acre-feet for both are no more than order of magnitude estimates. Being able to pick up 60,000 to 100,000 acre-feet from these releases would reduce the loss a little."

Current DFG estimates state that a minimum of 300,000 acre-feet would be necessary to recreate both runs (Toffoli, pers. comm.).

The Department of Fish and Game concluded that in the case of Friant Dam and the San Joaquin River that re-establishing the salmon runs "would be very expensive and the chances of total or near total failure would be so great that the Department must recommend that the Legislature give serious consideration to enhancing runs of salmon in other rivers of the San Joaquin system as compensation for loss in that part of the San Joaquin above the mouth of the Merced River".

The Merced river is presently considered as the San Joaquin tributary with the greatest potential for salmon enhancement if increased fish flow releases became available in the San Joaquin Basin (Toffoli, pers. comm.). This river presently supports the southernmost population of Pacific salmon and flow releases from the mouth of the Merced would benefit a large portion of the lower San Joaquin River.

#### IV. Post-Project

The stream flow regime of the San Joaquin River was catastrophically reduced by the operation of Friant Dam. Since the construction of Friant Dam and its two associated canals (Madera and Friant-Kern Canals), river habitat for both the spring run and fall run king salmon between the dam and the Merced River is lost. The operation of Friant Dam stores and diverts the spring flood runoff, which formerly had been used by the spring run to reach the spawning grounds, and also made successful the downstream migration of smolts. The flow released at Friant during the irrigation season is no more than needed for irrigation water demands. As a result, diverters usually cut off the stream flow of the San Joaquin River at Temple Slough before, instead of after, the spring run has passed upstream.

The spring run migrates during the time of peak stream flow discharges in May or June, which are warm weather months. Under reduced stream flows during this period, lethal water temperatures have been recorded in the San Joaquin River below Friant Dam. Salmon were observed by the Department of Fish and Game migrating upstream from the mouth of the Merced River to the site of the old Sack Dam in a stream flow slightly greater than 100 cfs. Many bruised and injured fish were observed and massive mortality occurred during hot weather. In 1944 (at a time when spearing was still legal) and again in 1947, stream discharges of approximately 100 cfs enabled 5,000 to 6,000 fish respectively, to migrate upstream past the Department of Fish and Game's counting station

at Mendota Dam. During 1945 and 1946 the stream flow bypassed at the head of Temple Slough was adequate at the time of spring spawning migrations. At the Mendota counting station 56,000 spring salmon were estimated in 1945 and 30,000 spring salmon in 1946. The fall run was not counted. Figure 4 graphically displays the decline in the San Joaquin king salmon.

The San Joaquin salmon runs above the mouth of the Merced River were the southernmost in North America. They were considered extinct by the Department of Fish and Game in 1950. Since that time, a few fish have occasionally been seen in wet years in the San Joaquin River. These fish are considered strays from other rivers rather than surviving remnants of the San Joaquin run.

The salmon runs have no real hope of being re-established due to damage to the stream habitat below Friant Dam. Siltation and vegetation encroachment has taken over a great deal of the spawning gravel. Gravel mining operations in the stream channel below Friant Dam have been gradually progressing upstream from the Fresno area.

At present there is no route by which king salmon or any other anadromous fish could find their way upstream to Friant or downstream from Friant to the ocean. Presently the San Joaquin for a short distance below Friant is managed as a catchable trout fishery by DFG. There is also a good fishery for bass, catfish and other warmwater species in this reach.

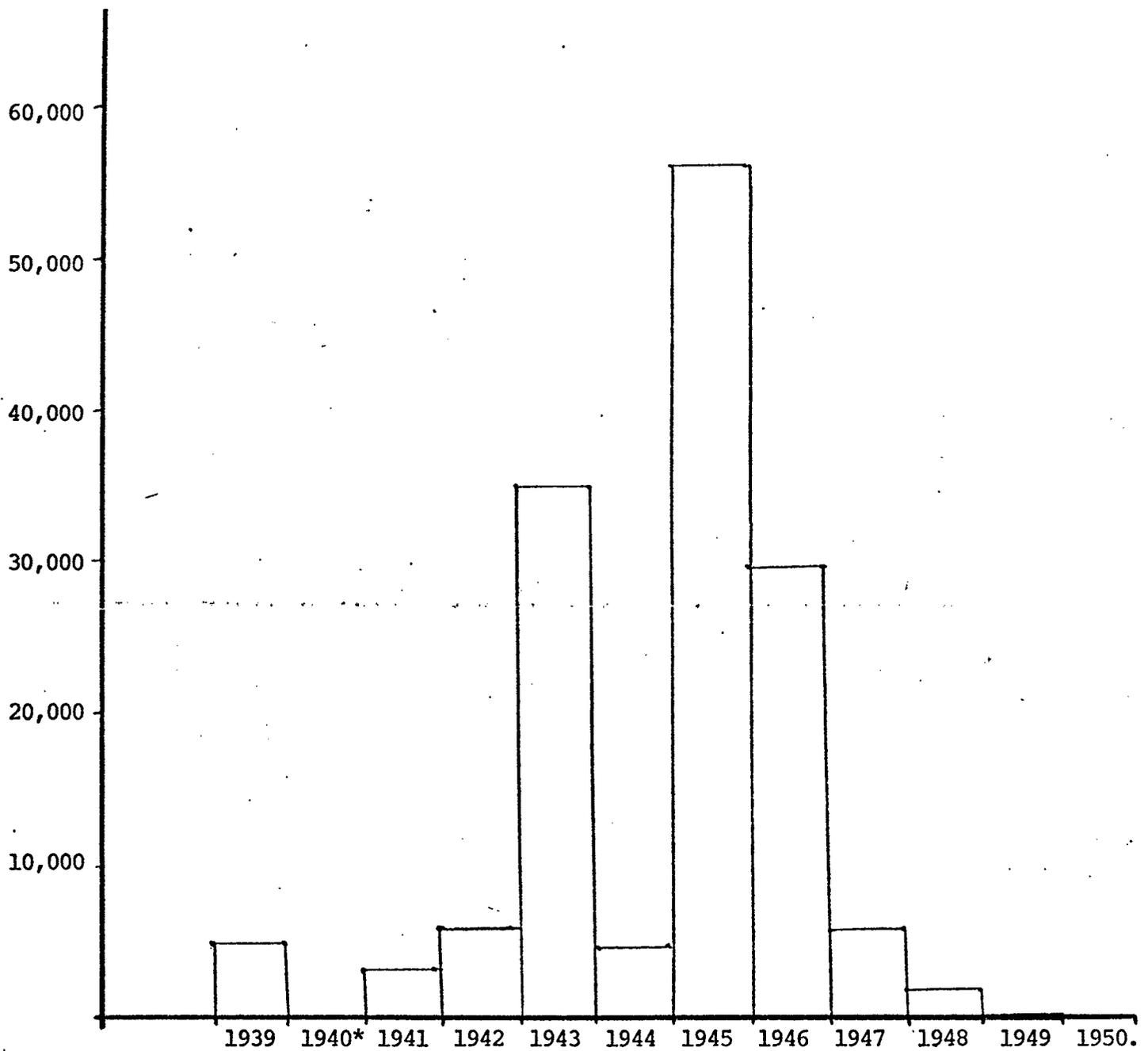


Figure 4

POPULATION ESTIMATES OF SPRING RUN KING SALMON IN THE SAN JOAQUIN RIVER DURING AND AFTER THE CONSTRUCTION OF FRIANT DAM

\* No record

Source: Water Rights file, DFG exhibit.

## V. Conclusions

The operation of Friant Dam in conjunction with its conveyance facilities (Friant-Kern Canal and Madera Canal) disruptively altered the streamflow in the San Joaquin River. None of the storage in Lake Millerton is allocated to instream flow reservations for fish and wildlife. Consequently, the altered instream flow resulted in the extinction of the large population of spring and fall run king salmon that historically used San Joaquin River upstream of the Merced River.

During the period of project development several efforts were made by the DFG and the California State Senate to establish an instream flow reservation. A final attempt in 1954 resulted in the SWRCB Decision 935 which did not require the United States to bypass water down the channel of the San Joaquin for the re-establishment and maintenance of the salmon fishery. During the SWRCB hearing the DFG recommended minimum instream flow reservations. The technical methods used by the departments relied heavily upon data gathered from instream observations during the initial post-project period. Primary consideration in determining the instream flow needs was given to adult king salmon for passage and spawning flows.

The possible effectiveness of the instream flow reservation proposals made in 1954 will remain unknown because the population is extinct. Recent studies (see New Melones Case Study Report #50, 50A) completed in the San Joaquin River System have shown that salmon populations are also limited by spring flows for the out-migration of juvenile salmon. Since these considerations were not used in 1954, the value of achieving the proposed minimum flows is irrelevant.

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