ENVIRONMENTAL IMPACT STATEMENT

NEW MELONES LAKE
STANISLAUS RIVER, CALIFORNIA

SUPPLEMENTAL DATA
ON USE OF CONSERVATION YIELD

PREPARED BY

BUREAU OF RECLAMATION

FOR

U.S. ARMY ENGINEER DISTRICT, SACRAMENTO, CALIFORNIA

JAN 1973

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Prepared by

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NEW MELONES LAKE
STANISLAUS RIVER, CALIFORNIA

Supplemental Data
on Use of Conservation Yield

SECTION I. INTRODUCTION

An environmental impact statement on the New Melones Lake, Stanislaus River, California, was prepared by the U.S. Army Engineer District, Sacramento, California, in May 1972, and subsequently revised June 21, 1972. The statement discussed the environmental impacts caused by the construction of the dam and the creation of the larger reservoir.

Although some phases of operation were covered, the statement did not include the effects which may be induced by the use of the project water yield. These supplemental data have been prepared for the purpose of covering the present environmental conditions and the impact that can, at this time, be foreseen from the contemplated operation of the project. Since the exact area or areas in which the water will be used cannot be determined specifically at this time, several alternative areas in which New Melones yield might be used and which have an indicated need for additional water have been evaluated and are discussed herein. The Bureau of Reclamation will prepare an environmental statement on the use of New Melones yield prior to start of operation of the facilities as a part of the Central Valley Project.

As authorized by Congress, New Melones Reservoir, upon completion of construction by the Corps of Engineers, will become an integral part of Bureau of Reclamation's Central Valley Project, and the water yield will be disposed of as a part of Central Valley Project operations. The authorizing legislation provides . . . "That before initiating any diversions of water from the Stanislaus River Basin in connection with the operation of the Central Valley Project, the Secretary of the Interior shall determine the quantity of water required to satisfy all existing and anticipated future needs within that basin and the diversions shall at all times be subordinate to the quantities so determined."

These determinations will recognize all existing water rights as well as the existing and projected requirements for water supplies in the local areas adjacent to the Stanislaus River, both upstream and downstream from New Melones Dam, which need to rely on water supplies from that source. After satisfying the needs of the local areas, any remaining water would be available for export to other CVP service areas. An average of 285,000 acre-feet annually of conservation yield, including up to 70,000 acre-feet in any one year for water quality purposes, will be made available by New

Melones. After meeting release requirements for water quality, which will average about 35,000 acre-feet per year on a long-term basis, there will be about 250,000 acre-feet per year for meeting local needs, and 285,000 acre-feet per year if the New Melones yield is pumped from the Delta. The figures of 250,000 acre-feet and 285,000 acre-feet are used in this report although it is recognized that there may be some revisions of these figures by reason of the contract entered into between the United States and the Oakdale and South San Joaquin Irrigation Districts on prior existing water rights.

Officials of the Bureau of Reclamation, working with officials of the counties of Calaveras, Tuolumne, Stanislaus, and San Joaquin are determining the quantity of water necessary for the local existing and future needs. Until such determination is completed the amount of water, if any, to be exported on a long-term basis from the basin cannot be determined. Present indications are that, although a substantial portion of the total New Melones water yield may be required in the future for these local needs, for a number of years some portion of this water supply may be available for use in other areas served by the Central Valley Project.

Since the actual place of use for this water supply will not be determined until water service contracts have been executed, it is not possible to describe the exact impact on the environment resulting from its use. There are, however, several alternative areas within the Central Valley Project which have an urgent need for additional water in which it might be used on either an interim or permanent basis.

The relative urgencies of needs in these various areas, and the corresponding priorities to be considered in selecting the areas to which the water will be marketed cannot and should not be selected at the present time because of changes in pertinent conditions which are likely to occur between the present and 1980, the earliest date when water service is first expected to become available from New Melones.

The Bureau of Reclamation planning up to the time of authorization of New Melones in 1962 contemplated that the operation and water yield of that project would be integrated with the Initial Phase, East Side Division, which it then appeared would be authorized in the relatively near future. Events transpiring since 1962 now make it appear that the originally planned Initial East Side Division may be deferred.

In addition, a question has arisen as to the adequacy of the present Central Valley Project water supply to meet the requirements of the existing contracts and at the same time meet Delta water quality criteria equivalent to those established in State Water Resources Control Board Decision 1379. This decision is now in litigation. Depending on the outcome of this litigation, and also upon the

final establishment of Federal water quality standards for the Delta by EPA, which might have an effect on Central Valley Project operations, it is possible that some portion or all of the water yield of New Melones surplus to the needs of the basin may be needed to maintain Central Valley Project's ability to fulfill existing water contracts.

The position of the United States regarding Decision 1379 is that the United States cannot be made subject to any terms or conditions imposed by a State agency which would in any way interfere with or affect the operation of Federal projects for the purposes for which such projects were authorized by Congress. In any event, the Regional Water Quality Control Board specified in Decision 1379 that the water quality standards mentioned therein were interim standards and that they would be reviewed and modified in 1978. Since the New Melones Project facilities will not be completed until after 1978, it does not seem pertinent to speculate more extensively on the impact of D-1379 on the New Melones Project.

A similar question has also been raised by State Water Resources Control Board Decision 1400, on streamflows to be maintained in the lower American River, as to the availability of water to serve the lower portion of the Folsom South Canal service area. This decision is also in litigation. Any New Melones water surplus to the needs of the basin might be required urgently in this area as a result of these actions.

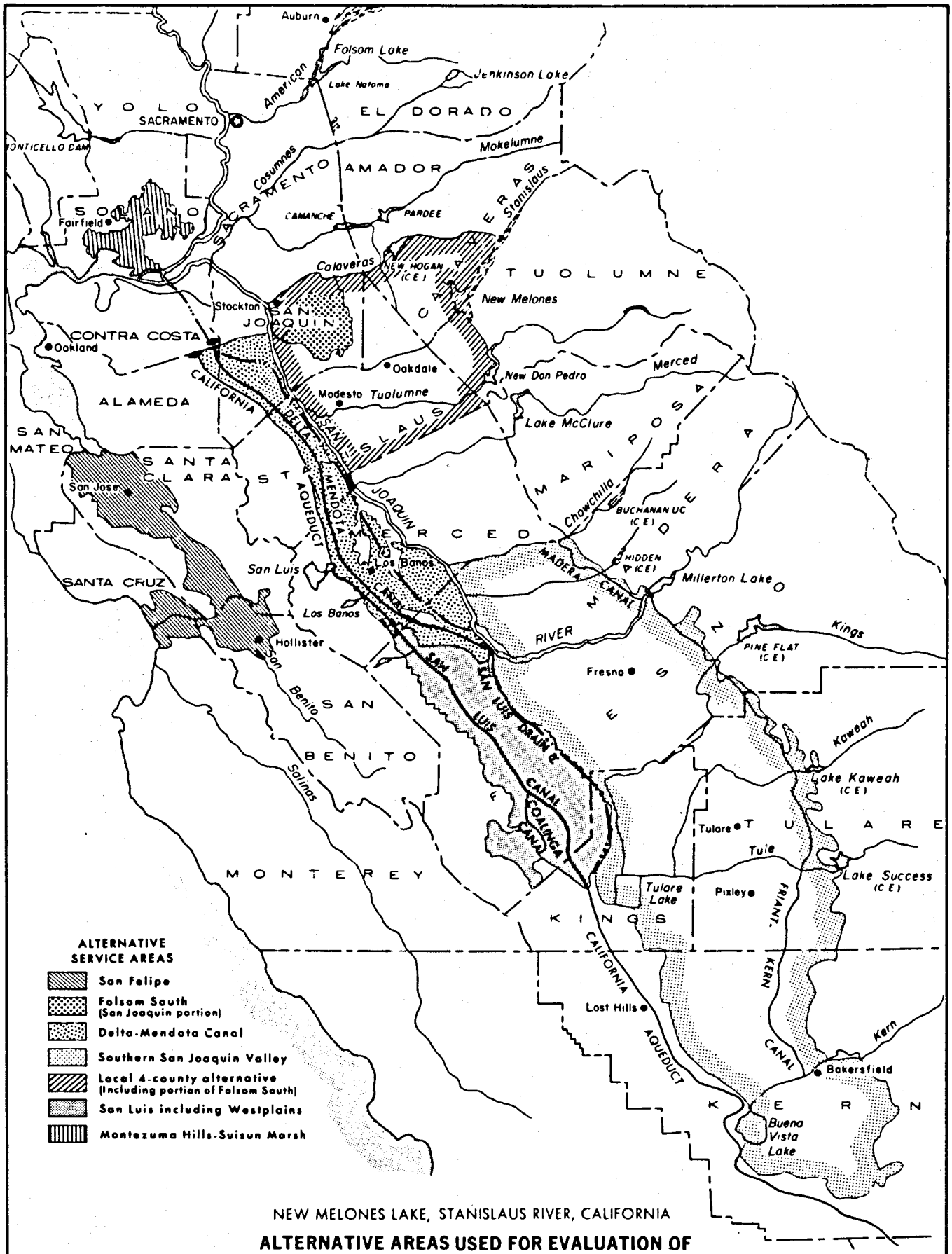
Until the full effect of such considerations as Decisions 1379 and 1400 are known, the uses of the conservation yield must be purely speculative. The final routing of this water from New Melones Reservoir cannot be determined at this time and the environmental impact thereof fully evaluated. Until closure of New Melones, at the earliest in 1978, there will be no environmental impact of the operation of the dam.

Decision 1400 like Decision 1379 seeks to alter Central Valley Project operations and thus raises the same question of State jurisdiction over Federal projects. The position of the United States regarding Decision 1400 is the same as that previously described for Decision 1379.

At the earliest practical date and well before New Melones Dam becomes operational, the Bureau of Reclamation will prepare an environmental statement covering the anticipated impact resulting from the actual use of the new water yield.

These supplemental data on the use of New Melones Lake conservation yield summarize the kinds of impacts to be expected from the use of this water yield in six possible service areas of need and for water quality releases in the Sacramento-San Joaquin Delta.

The alternate areas (chart 1) selected for evaluation of impacts in which New Melones water might be used are as follows:



NEW MELONES LAKE, STANISLAUS RIVER, CALIFORNIA

ALTERNATIVE AREAS USED FOR EVALUATION OF IMPACT OF USE OF NEW MELONES WATER

NOVEMBER 1972

Prepared by Bureau of Reclamation

CHART 1

1. Local service - portions of Calaveras, Tuolumne, San Joaquin, and Stanislaus Counties, including Folsom South service area--San Joaquin County portion.

2. Southern San Joaquin Valley (demonstration area - Pixley Irrigation District).

3. San Felipe Division.

4. San Luis Unit (demonstration area - Westplains portion).

5. Delta-Mendota Canal service area.

6. Suisun Marsh - Montezuma Hills Unit.

7. Sacramento-San Joaquin Delta - Water Quality.

The following discussion summarizes the status of each of the alternative areas in regard to planning, authorization, or construction:

A. LOCAL SERVICE AREA

New Melones Dam and Reservoir was authorized by the Flood Control Act of December 22, 1944. This authorization subsequently modified by the 1962 Flood Control Act (P.L. 87-874). Construction was initiated in July 1966. Construction of the diversion and outlet works tunnel is in progress. The next major contract is for construction of the dam and spillway. Award is tentatively scheduled for December 1972. In September 1971 the Bureau completed the Regional Director's proposed feasibility report on the Sonora-Keystone Unit, which covers a plan for development of a water supply for a portion of Tuolumne County. The Bureau of Reclamation currently is making necessary studies on behalf of the Secretary of the Interior to determine the quantity of water required to meet the local needs as provided in authorizing legislation.

The Auburn-Folsom South Unit was authorized in 1965 by Public Law 89-161. Construction was initiated in 1967. Reaches 1 and 2 of Folsom South Canal, to serve Folsom South area, will be completed in spring 1973. Completion of the remaining portion of the canal is tentatively scheduled for about 1978, depending on continued appropriations of construction funds.

The New Melones authorization did not include provisions for construction of conveyance facilities to serve the local area with water from New Melones Lake.

It is anticipated that the area would be served water conserved by New Melones Reservoir both by diversions directly from the reservoir and by diversions out of the Stanislaus River downstream from New Melones Reservoir. It appears likely that the areas in Calaveras and Tuolumne Counties to the north and south of New Melones Reservoir would be served by pipeline conveyance facilities. A very preliminary study of serving the areas in Tuolumne County indicate the need for about 25 miles of pipeline and associated pumping plants with maximum capacity of 50 c.f.s. Similar requirements are envisioned for serving the Calaveras County portion, although no specific studies have been made as yet. However, further studies are planned for Tuolumne County and have been programmed for Calaveras County.

The areas in Stanislaus County could be served by the construction of canals located to the north and south of the Stanislaus River at about the 200-foot elevation line. Diversion from the river could be made by gravity with a diversion dam below existing Goodwin Dam or by pumping from the river.

Service to the areas in San Joaquin County would probably be made by use of natural channels in association with construction of some new canals.

The southerly portion of San Joaquin County, including that portion of the Folsom South service area below Calaveras River, could be served by diversion of New Melones water into Littlejohns Creek. The water would then flow down the creek, passing through a suitably altered Farmington Reservoir from which canals could extend northward, to Calaveras River and southward to Lone Tree Creek. Some portions of this area might also be served by allowing New Melones water to flow down the Stanislaus and San Joaquin Rivers for rediversion at appropriate points in the service area.

Detailed studies of the optimum method of service, the exact facilities required, and the resulting impact for these areas will be made prior to start of operation of New Melones Reservoir and in conformity with areas which actually contract for water from this source of supply.

B. SOUTHERN SAN JOAQUIN VALLEY

The Bureau of Reclamation has completed a feasibility study on water supply development for the east side of the San Joaquin Valley. The results are contained in the report, East Side

Division, Initial Phase, December 1965, Revised June 1966, and a reevaluation report, East Side Division, Initial Phase, September 1968. The Bureau of Reclamation has just completed a brief reconnaissance study for a Cross Valley Canal plan of development and is now making a feasibility study of this plan. This study is to be completed in fiscal year 1974.

Water from New Melones Reservoir could be conveyed to the southern San Joaquin Valley primarily by two methods. The first is by way of a canal from the Stanislaus River to at least the Madera Canal service area where an exchange could be effected and the Madera Canal supply utilized south of the San Joaquin River through the Friant-Kern Canal. Such a plan would involve a diversion facility on the Stanislaus River at or below existing Goodwin Dam. A canal with a capacity of about 750 c.f.s. or less and about 80 to 100 miles long depending on how far south it would need to extend to serve the Madera Canal service area.

This method and route of conveyance could also be combined as a part of the proposed East Side Division. The feasibility report on the Initial Phase development contemplated that New Melones water could be used in the East Side Division service area by conveyance in the proposed East Side Canal.

The second method of conveying New Melones water to the southern San Joaquin Valley area would be the more recently proposed Cross Valley Canal plan now under study. This plan envisions that 300,000 acre-feet or more of water might be delivered to the area through use of existing Federal and State storage and conveyance facilities on the west side of the valley, and construction of a Cross Valley Canal between these west side conveyance facilities and Friant-Kern Canal on the east side, with appropriate modification of the latter canal to permit the conveyance of the imported water partially through reverse flow.

Modification of Friant-Kern Canal probably would require the construction of at least one new check in the canal and installation of low head pumping plants on all of the checks over which the water supply would need to be moved. No enlargement of Friant-Kern Canal would be required for 300,000 acre-feet of imported water.

New construction would be required for the proposed Cross Valley Canal connection. Three general locations are currently under study. One in conjunction with or adjacent to the Cross Valley Canal to be constructed by the Kern County Water Agency.

This would extend from the California Aqueduct near Tupman to the Friant-Kern Canal near Bakersfield, a distance of 18 miles. The second alternative location is located adjacent and parallel to State Highway 46. The canal would extend from the California Aqueduct near Lost Hills to the Friant-Kern Canal west of Famoso, a distance of about 25 miles. The third alternative location is just north of the Kern County line. The canal would extend from the California Aqueduct near Devils Den to the Friant-Kern Canal near Delano, a distance of about 39 miles.

The Cross Valley Canal would have a capacity of 1,000 c.f.s., and pumping plants with total heads of 120 feet, 170 feet, and 207 feet, respectively, for each alternative location described.

C. SAN FELIPE DIVISION

The San Felipe Division was authorized in 1967 by Public Law 90-72. Advance planning studies began in 1969, and are continuing at present. The only construction which has been completed is that portion of the Pacheco Diversion Tunnel within the San Luis Reservoir. Further construction of the project facilities awaits appropriation of additional construction funds. The environmental statement for the project is in preliminary draft form.

This division (see Chart 2) consists principally of a tunnel extending westward from the existing San Luis Reservoir, conveyance canals and appurtenant facilities to provide a supplemental water supply in portions of Santa Clara, San Benito, Monterey, and Santa Cruz Counties for irrigation, municipal, and industrial use, as well as for fishery enhancement and recreation.

Water for the San Felipe Unit will be conveyed to the existing O'Neill Forebay from the Sacramento-San Joaquin Delta either through the north portion of the State's California Aqueduct or the Federal Delta-Mendota Canal.

Conveyance of the San Felipe Division from the San Luis Reservoir will be by the 10.3-mile Pacheco Tunnel. The tunnel intake and the first 1.8 miles of the tunnel already exist, having been constructed prior to the completion of the San Luis Reservoir. The tunnel intake is set below the minimum operating storage level of the reservoir, to permit diversions even where San Luis Reservoir is drawn down to its lowest stage.

The Pacheco Canal will originate at the Pacheco Tunnel outlet works with a capacity of 670 c.f.s. for the first 1.3 miles where the Hollister-Watsonville Conduit will branch off. The Pacheco Canal will continue for another 3 miles with a reduced capacity of 550 c.f.s., terminating at Pacheco Pumping Plant. At this point, 550 c.f.s. will be lifted 161 feet into the Santa Clara Canal, serving the south Santa Clara service area, and delivering 450 c.f.s. into the 62 acre-foot Coyote Afterbay for use by the north Santa Clara service area.

About 45 percent of the total San Felipe supply will be distributed in the north and south Santa Clara subareas through existing percolation ponds, thus disturbing these areas as little as possible. Conveyance to higher and more distant percolation sites on the west side of the north Santa Clara Valley will require a cross valley conduit to be built by a local agency.

The Hollister-Watsonville Conduit will be 42.9 miles long, with an initial capacity of 315 c.f.s. Approximately 5.8 miles from its beginning, 94 c.f.s. will be lifted by the Hollister Relift Pumping Plant into the Hollister Relift Canal which will terminate at the 20 acre-foot Hollister Reservoir. The Relift Canal will serve the higher lands of the eastern portion of the Hollister service area. Deliveries will be made to the west through gravity turnouts, and to the east through a series of canalside pumps.

Other diversions made by gravity from the Hollister-Watsonville Conduit will be 36 c.f.s. to the San Juan Bautista Canal, and 25 c.f.s. to the Bolsa Canal just below the 1,030 acre-foot Hudner Reservoir, located at an existing farm reservoir. The Hollister-Watsonville Conduit, terminating at a bifurcation structure near Watsonville, will divert 39 c.f.s. to the Watsonville North Conduit and 21 c.f.s. to the Watsonville South Canal. Data pertaining to the conveyance canals and regulatory reservoirs are shown on page 9.

Water delivered to O'Neill Forebay will be pumped through the existing San Luis Pumping-Generating Plant into the existing San Luis Reservoir. The designed capacity of this plant is adequate to pump San Felipe water; however, the time of its operation as a pumping plant will necessarily be increased to include pumping of a portion of the San Felipe supply while San Luis Reservoir is being filled.

Conveyance facilities

Canal or conduit	Length (Miles)	Capacity in C.F.S. Beginning	End
Pacheco Tunnel	10.3	670[a/]	670
Pacheco Tunnel Inlet Channel	1.7	--	--
Pacheco Canal	4.3	670[a/]	550
Santa Clara Canal	27.4	550	450
Hollister-Watsonville Conduit	42.9	315	61
Hollister Relift Canal	9.5	94	31
San Juan Bautista Canal	8.5	36	36
Bolsa Canal	4.4	25	25
Watsonville North Conduit	2.4	39	28
Watsonville South Canal	4.8	21	21
Total conveyance conduits	116.2		

Regulatory reservoirs

Reservoir		Dam	
Name	Reservoir capacity (acre-feet)	Height above streambed (feet)	Type
Coyote	62	35	Earthfill
Hollister	20	30	Earthfill
Hudner	1,030	40	Earthfill

a/ Capacity requirements of Pacheco Tunnel and Pacheco Canal are less than the sum of Santa Clara Canal and Hollister-Watsonville Conduit, as the peak demands of the two last-named facilities do not occur simultaneously.

D. SAN LUIS UNIT

The San Luis Unit of the Central Valley Project was authorized by Congress in 1960 by Public Law 86-488. Construction was initiated in 1962. The main project facilities have been completed and in operation since December 1967, except the San Luis Drain which is now under construction (see Chart 3).

The following is the present status of all project features. The final environmental statement on the San Luis Unit was filed with the Council on Environmental Quality October 4, 1972. Westplains service area construction needs are included in the partially constructed distribution and drainage system.

1. Completed facilities

a. San Luis Dam and Reservoir. Storage for the San Luis Unit is provided by the San Luis Dam, a zoned earthfill structure which is located on San Luis Creek about 12 miles west of Los Banos, California. It has a total capacity of 2,041,000 acre-feet and a surface area of 13,000 acres. The maximum drawdown of the water surface is 218 feet.

b. San Luis Pumping-Generating Plant. The San Luis Pumping-Generating Plant is located at the toe of San Luis Dam on the left abutment. When operated as a pumping plant, the capacity of the eight units varies with the head; it equals 11,000 cubic feet per second with a dynamic head of 290 feet. When the waterflows are reversed, the plant can discharge 13,100 c.f.s. at a dynamic head of 197 feet, and has an electrical generating capacity of 424,000 kilowatts.

c. O'Neill Dam and Forebay. O'Neill Dam, a zoned earthfill structure, is located 2-1/2 miles downstream of San Luis Dam. It has a total capacity of 56,000 acre-feet and an active capacity of 20,000 acre-feet in the top 8 feet which are used for reregulation. Surface area for the reservoir is 2,200 acres.

d. O'Neill Pumping Plant. San Luis Unit water flowing in the Delta-Mendota Canal is diverted through the 2,500-foot-long intake channel and pumped by the O'Neill Pumping Plant at the left abutment of the O'Neill Dam into the O'Neill Forebay. When operated as a pumping plant, the six pumping units have a combined capacity of 4,200 cubic feet per second with a dynamic head of

44 to 56 feet. When infrequent reverse flows are required to supplement the flow in the Delta-Mendota Canal, the plant can discharge up to 4,000 c.f.s. and dissipate the energy of the releases by functioning as a generator with a capacity of 25,200 kilowatts.

e. San Luis Canal. San Luis Canal begins at San Luis Forebay and carries both Federal and State water 101.5 miles south to Kettleman City. At mile 15.8 of the canal, the Dos Amigos Pumping Plant lifts water an average of about 125 feet permitting a gravity flow to the end of the canal. The initial San Luis Canal capacity is 13,100 cubic feet per second and reduces to 8,350 cubic feet per second in the last reach. The State's share of these capacities is 7,000 cubic feet per second which is delivered into the southern portion of the State's California Aqueduct at Kettleman City.

f. Dos Amigos Pumping Plant. The Dos Amigos Pumping Plant lifts water an average of about 125 feet from the initial reach of the San Luis Canal for gravity flow south. The plant consists of six vertical-shaft pumping units. The total capacity of the plant is 13,200 cubic feet per second.

g. Los Banos Detention Dam and Reservoir. Two detention dams provide flood protection for the San Luis Canal. The Los Banos Detention Dam is on Los Banos Creek about 7 miles southwest of Los Banos, California, with a storage capacity of about 34,500 acre-feet and a surface area of about 640 acres. Besides protecting the San Luis Canal, it provides flood protection to the town of Los Banos and vicinity. A minimum pool is provided for recreation, with 20,500 acre-feet of storage and a surface area of 470 acres.

h. Little Panoche Detention Dam and Reservoir. A second detention dam is located on Little Panoche Creek south of Los Banos Creek and has a storage capacity of 5,600 acre-feet with a surface area of 190 acres. No minimum pool is provided for recreation.

2. Partially completed facilities

a. Pleasant Valley Pumping Plant and Coalinga Canal. About 75 miles south of the O'Neill Forebay, the Pleasant Valley Pumping Plant will ultimately lift 1,050 cubic feet per second 180 feet from the San Luis Canal to the Coalinga Canal. The plant is essentially completed.

The 12-mile-long Coalinga Canal will head at the Pleasant Valley Pumping Plant and run in a southerly direction to deliver irrigation supplies and to furnish water at the city of Coalinga's turnout for municipal or industrial uses. The canal will have a capacity of 1,000 cubic feet per second. The first 6 miles of the canal are already constructed.

b. Distribution and drainage system. Water will be distributed throughout the service area from the San Luis Canal by about 1,000 miles of underground water distribution pressure pipelines ranging in size from 10 to 90 inches in diameter. About 350 miles of pipelines are already constructed or under construction. Pumping plants on the uphill side of the San Luis Canal will lift water to the areas above the canal.

The drainage collection system will comprise about 500 miles of buried pipeline ranging in size from 8 to 60 inches in diameter. It will collect the subsurface agricultural drainflows from individual farm drainage systems for disposal into the San Luis Drain. It is expected that onfarm field drainage systems will be installed by individual irrigators as needed to maintain the agricultural productivity of the lands under conditions of rising shallow ground-water tables. The area to be covered by the drainage collection system lies predominantly along the eastern portion of the service area, and although initially small, about 20,000 acres, will ultimately include about 300,000 acres.

c. San Luis Drain. The San Luis Drain will be a concrete lined canal extending from near Kettleman City at the southern end of the Federal San Luis service area, 188 miles northward to the western edge of the Delta near Antioch. Kesterson Regulating Reservoir will be constructed adjacent to the drain about two-thirds of the way from Kettleman City to the Delta. The reservoir will consist of earth dikes, about 6 feet high, constructed around and within 4,700 acres to pond water in interconnected cells of about 100 acres each. The reservoir will have an average depth of about 3 feet and provide about 14,000 acre-feet of storage. Construction of the first stage of Kesterson Reservoir, 1,300 acres, and 41 miles of the drain southward from the reservoir is now almost completed. Appropriate vegetation will be planted along the shoreline to control erosion and provide wildlife habitat.

The drain will be constructed with a capacity increasing from 100 cubic feet per second at its head, mile 188 near Kettleman City, to 300 cubic feet per second from mile 154 to Kesterson Reservoir to meet the estimated long-term requirements of the Federal San Luis service area. The capacity north of Kesterson Reservoir to the Delta will be increased by 50 percent to 450 c.f.s. This will provide operational flexibility to utilize the regulatory capability of the 14,000 acre-foot Kesterson Reservoir and thus control discharge of the drain into the Delta. Future conditions in the Delta will determine whether or not the drain discharges should be restricted, and if so, whether to periods of large Delta outflow when dilution would be maximum or to periods of small Delta outflow when the drain outflow might help dilute downstream domestic and industrial waste discharges and repel ocean salinity. Drainflow treatment facilities, as needed, will also be provided to prevent any adverse effects of drain discharge on the receiving waters.

E. DELTA-MENDOTA CANAL AREA

Construction of Delta-Mendota Canal as a part of the Central Valley Project was authorized by the River and Harbor Act of 1935 as reauthorized by the River and Harbor Act of 1937, the Reclamation Project Act of 1939, and the Central Valley Project, California, Reauthorization Act of October 17, 1940. Construction of the canal began in 1946, and it has been in operation since 1951. Water is lifted 200 feet by the Tracy Pumping Plant to the head of the canal where it flows 117 miles to the Mendota Pool on the San Joaquin River. The only immediate requirement to deliver New Melones water would be the maintenance of the canal at full capacity. It also may be necessary in the future to raise the canal lining.

There has been some impairment of capacity due to growths on the canal bottom and sides of various aquatic organisms. Studies are in progress to find ways of alleviating this problem.

F. SUISUN MARSH - MONTEZUMA HILLS

Studies by the Bureau of Reclamation for providing a water supply for maintenance and enhancement of fish and wildlife habitat in Suisun Marsh and water service for municipal, industrial, and agricultural use in the Montezuma Hills Unit area were initiated in fiscal year 1967 under Delta outflow

studies. A reconnaissance appraisal report on the Montezuma Hills Unit (including Suisun Marsh) was completed in October 1971. A feasibility study has been authorized. The study is scheduled to start in fiscal year 1974.

The Suisun Marsh Research and Testing Program of the Bureau of Reclamation began in 1965. The purpose of this program is to determine the change in water quality that can be affected through release of high quality water from the Solano Project. Progress reports on the program were prepared in July 1967 and March 1968.

The U.S. Bureau of Reclamation, Fish and Wildlife Service, and the State Departments of Water Resources and Fish and Game under a July 13, 1970, agreement are performing studies necessary to evaluate ecological effects of water development on the Sacramento-San Joaquin Estuary. The reconnaissance report on the Montezuma Hills Unit represents an initial phase of the study under that agreement (see Chart 4).

In the plan for the Montezuma Hills Unit, the Denverton Channel (710 c.f.s. capacity) would convey water from Calhoun Cut, a manmade westerly extension of Lindsey Slough, for a distance of about 9 miles west to Denverton Slough on the eastern edge of Suisun Marsh. Pump lifts along the channel route would provide for distribution of agricultural water supply. A pump lift from the channel at or near its terminus would divert municipal and industrial supplies. A tidal gated structure separating the channel from Denverton Slough would release water supplies to Suisun Marsh.

For municipal and industrial service, channel capacity of 180 cubic feet per second is planned. Immediately upstream of the terminal channel closure, water would be diverted by a pumping plant and conveyed by pipeline to Collinsville. Since plans for development of the service area are indefinite at this time, no delivery of water to intermediate points of service between Denverton Channel and Collinsville was considered.

For agricultural service and Suisun Marsh water deliveries, channel capacity of 530 cubic feet per second is planned. Agricultural service would require all of this capacity during peak months of the irrigation season, with agriculture and marsh deliveries sharing the capacity the remainder of the year. Maximum capacity for meeting marsh water needs would be available during the period September to March, when very little agricultural water would be delivered.

G. SACRAMENTO-SAN JOAQUIN DELTA WATER QUALITY

The release of the conservation yield for purposes of improving Delta water quality would require no new structures, but would probably necessitate the rehabilitation and upgrading of downstream water control structures to meet the requirements of a year-round flow.

H. PROJECTIONS OF IRRIGATION NEEDS

Recent reports on projections of California agriculture from the University of California at Davis have been interpreted by critics of water development as meaning that there is no further need for irrigation in California at present and nor will there be by the year 2000 unless drastic changes in population projections occur before that time.

One of these reports (Bulletin 847), however, states in the conclusions, "Numerical estimates presented herein should not be regarded as unconditional forecasts of the future. Rather they are projections of output and acreage which would be required to meet future food and fiber requirements under a specific set of assumptions which are made explicit in the study. The reasonableness of the projections will depend on the extent to which the basic assumptions are well chosen approximations of the future."

The studies relating to the potential impact of San Joaquin Valley West Side Development were to determine possible effects of increased agriculture production. The water rate for the State of California service area is considerably higher than many other service areas. These higher rates will force farmers to grow crops that will provide payment capacities sufficient to meet these water charges.

Based on a specified set of assumptions in Bulletin 847, the researchers estimated the total requirement of these crops. Using this projection and the projected buildup in irrigated acreage, they concluded "there is a danger of overdevelopment of irrigated acreage in California in the next decade or more, in the sense that specialty crop prices are likely to be depressed." These researchers continue, "It would appear prudent, therefore, for water planners to reexamine carefully the prospective agricultural demand for water in California and pace water developments accordingly."

There are no statements in these reports condemning water resource development nor indicating the need to stop all development. The authors' purpose is to focus attention on the overall agricultural situation and make planners aware that current developments are in fact large enough to have an effect in the product market.

Throughout these reports, the authors indicate the hazards in making projections and specifically in Bulletin 847 state, "The term 'projection' rather than 'prediction' or 'forecast' generally is used to make clear that the results are conditional on the basic assumptions used. That is, if the basic assumptions of future population, income, consumption patterns, competitive advantage, technological change, etc., are not realized, the projections derived therefrom will be distorted."

The report qualifies the acreage projection as follows: "It is emphasized that these acreages are derived as a residual, or balancing figure, from specific projections of U.S. demand, California's market share position, and yields per acre. Any errors in these assumptions would reflect themselves directly in the acreage projections. Thus, acreage projections should be viewed as the logical result of a set of plausible but highly uncertain values of other key variables. The acreage projections for minor individual commodities within a group are particularly sensitive to misspecifications of the basic assumptions." The references shown are part of the qualifications the researchers placed on their answers. To benefit from the full meaning intended, they need to be viewed in context.

The Federal and State water resource planning agencies have reassessed the future irrigation water requirements. In general, future requirements have been reduced or scaled down. As a result, the Bureau of Reclamation has recommended a delay in authorization or building of several projects such as English Ridge, Paskenta-Newville, and Lower Trinity River. When the future requirements exceed supply, these would be viable projects that could meet the need.

One of the major objectives of the University of California study was to illustrate what kinds of effects could occur with overdevelopment. There is time to restudy water use and requirements, and the University study showed the need for analysis that accounts for the overall agriculture effect, not just one project service area. The current trend away from intensive irrigation projects reflects the planning agencies awareness of this problem. Even though there may not be an

immediate need for large blocks of new land irrigation, projects to protect existing irrigation development and projects for development of populations in nonagricultural areas are still necessary.

The above discussion is intended to generally clarify the purpose of the University of California's West San Joaquin Valley studies to which some critics of water development for irrigation repeatedly refer.

SECTION II. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

A. LOCAL SERVICE AREA

1. General. The local service area includes those portions of Calaveras, Tuolumne, San Joaquin, and Stanislaus Counties which need additional water and which could be served practicably from New Melones. It extends from the lower mountainous region of the Sierra Nevada through the foothill and valley lands to the Sacramento-San Joaquin Delta. The area is bounded on the north by the Calaveras River and New Hogan Reservoir; on the south by the Stanislaus-Merced County line; on the west by the San Joaquin River; and on the east by a line parallel and adjacent to State Highway 49, the northwest shoreline of New Melones Reservoir, a north-south line between New Melones Dam and the shoreline of New Don Pedro Reservoir at a point just below the junction of Wood Creek, and the northwest shoreline of New Don Pedro Reservoir and Tuolumne River to the Stanislaus County Line. This area includes about 1,700 square miles.

   For discussion purposes that portion of the service area in Calaveras and Tuolumne Counties will be referred to as the upper basin and the portion in San Joaquin and Stanislaus Counties as the lower basin.

   The upper basin is typical of the lower mountainous and foothill zones in that the area as a whole is rather sparsely populated. The major urban centers are San Andreas and Angels Camp.

   The lower basin, by contrast, is well populated, particularly on the valley floor. Major urban centers are Stockton, Modesto, Oakdale, Ripon, Riverban, Manteca and Turlock. A well established agri-business exists in the valley portion of the lower basin.

   The preliminary estimated water requirements of the local service area are shown below:

Local Service	M&I	Irrigation
	(Acre-feet)	
Tuolumne County	25,000	10,000
Calaveras County	4,000	24,000
Stanislaus County	25,000	480,000
San Joaquin County (Exclusive of Folsom South service area)	2,000	120,000
	56,000	634,000

The San Joaquin County portion of the Folsom South service area has the following water requirements:

District	M&I	Irrigation
	(Acre-feet)	
Stockton-East	45,000	100,000
Central San Joaquin W.C.D.	-	80,000
San Joaquin County W.C.D.	-	60,000
	45,000	240,000

2. Climate. The area has a generally semiarid, two-season climate typical of the Central Valley. It is characterized by a long, hot, dry summer season from May through October and a cool, rainy season during the months of November through April. Most of the rain falls during the months of December through March. Normal annual rainfall is 16 to 35 inches through the area. Daytime temperatures occasionally exceed 100°F., while winter temperatures range into the low twenties with occasional drops below 20°F. Some snow occurs on rare occasions at the higher elevations.

3. Geology. The area is located on the western slope of the Central Sierra Nevada and extends into the great Central Valley of California. The older rocks in the area are pre-Tertiary metamorphic and intrusive igneous rocks, locally of unequal strength and complex structure. These rocks are often referred to as the bedrock series and include schist, quartzite, slate, crystalline limestone, metavolcanic rocks, granitic rocks, and ultrabasic rocks. Overlying the bedrock series are essentially undeformed geologic materials of Tertiary age and younger. These materials include the Ione formation, the rhyolitic pyroclastics and sediments of the Valley Springs formation; the andesitic debris of the Mehrten formation; older river channel deposits, recent stream deposits; and flood plain and valley fill deposits of the San Joaquin Valley.

4. Soils. The soils of the four-county area may be segregated into four broad groups: basin soils, Recent alluvial soils, older valley fill soils and upland soils. The basin soils are found on the valley floor in the Delta region and extend eastward, gradually changing to the Recent alluvial fan as the elevation increases. These alluvial soils change to the older valley fill soils in the lower elevation foothills. The higher foothills are overlain by the upland group of soils.

The basin soils are fine textured clays, some of which contain a high percentage of organic matter. The Recent alluvial soils were formed by the depositing of materials eroded from higher elevations in the watershed and transported by the streams that transect the area. These soils are well drained, of coarse to medium texture, and can grow a multitude of climatically adapted crop types.

The older valley fill soils are similar to the recent alluvial soils in that they were also formed by upstream erosion. However, this group of soils has undergone extreme profile development, resulting in the formation of dense clay or hardpan subsoil layers which critically limit the movement of soil moisture and plant root development.

Typically, these soils occur on land exhibiting a gently undulating to strongly rolling relief, with small mounds generally in evidence.

The upland soils were formed in place from weathering and decomposition of parent rock materials. Soil depths are largely dependent upon the amount of precipitation, and the weathering and decomposition which has occurred. Depths of soil vary from about 8 to 12 inches in the areas of low rainfall in the foothills.

5. Hydrology. The water supply of the local service area originates as direct precipitation and surface and subsurface inflow. A portion of the surface water supply is used within one area while the remainder either drains away from the area to the Delta or is retained in storage reservoirs for export to outside areas.

   The principal runoff of the major streams, Stanislaus and Tuolumne Rivers, occurs during late spring and early summer months from the melting of the Sierra snowpack. The flow of the Calaveras River and minor streams is primarily from rainfall and occurs in direct relation to rainfall in the area. Both precipitation and runoff vary widely from year to year.

   In the Calaveras and Tuolumne County portions of the area, small irrigation and M&I supplies are obtained from direct diversion of streamflows and from small storage developments. Ground water in this area is not a significant source of supply. The main surface supplies for the lower basin are the Calaveras, Stanislaus, and Tuolumne Rivers. Ground water,

replenished by surface runoff, and by percolation from applied water, conveyance losses, and direct precipitation, is another principal source of water for irrigation in the valley floor lands.

The average annual flow of the Stanislaus River near Knights Ferry for the 50-year period 1907-08 through 1956-57 was 1,113,000 acre-feet. During the period the flows ranged from a high of 2,320,000 acre-feet in 1910-11 to a low of 258,000 acre-feet in 1923-24. Stanislaus River flow is controlled by existing developments of the Pacific Gas & Electric Company and by the Oakdale and South San Joaquin Irrigation Districts.

The Tuolumne River forms the southern boundary of the Tuolumne County portion of the service area and flows through the southern portion of the Stanislaus County portion. The average annual runoff of the Tuolumne River above La Grange Dam for the period 1920-21 through 1954-55 was 1,700,000 acre-feet. The maximum annual runoff for the period was 3,750,000 acre-feet in 1906-07, and the minimum was 754,000 acre-feet in 1923-24. Flow of the Tuolumne River above La Grange Dam is largely controlled by major storage reservoirs and diversion facilities of the city and county of San Francisco and of the Modesto and Turlock Irrigation Districts.

The Calaveras River has a much smaller and lower elevation drainage basin. The average annual runoff of the Calaveras River at Jenny Lind for the 50-year period 1907-08 through 1956-57 was 162,000 acre-feet. During that 50-year period the maximum runoff was 539,000 acre-feet in 1910-11 while the lowest flow was 13,000 acre-feet in 1930-31. The flow of the Calaveras River above Jenny Lind is impaired by New Hogan Reservoir. The impairments to the flow above New Hogan are minor.

Water is diverted from the Stanislaus River Basin above New Melones Reservoir by small diversions of the Pacific Gas & Electric Company. These are the Utica system with an average diversion of about 30,000 acre-feet annually of which about 20,000 acre-feet returns to the Stanislaus River; and, the Phoenix system with a diversion of about 18,000 acre-feet annually. Below New Melones the major diversions are those of Oakdale and South San Joaquin Irrigation Districts. These diversions at Goodwin Dam amount to about 600,000 acre-feet annually. Diversions from Goodwin Dam to the mouth total about 50,000 acre-feet annually.

Water is exported from the Tuolumne River Basin above New Don Pedro Reservoir by the Hetch Hetchy system of the city and county of San Francisco. This diversion presently exports about 250,000 acre-feet annually. The projected ultimate requirement for the city of San Francisco is about 419,000 acre-feet annually. The safe yield of the Hetch Hetchy Project is 254,000 acre-feet/year. The remaining supply would be obtained through exchange from New Don Pedro Reservoir. Modesto, Turlock, and Waterford Irrigation Districts are the main divertors below New Don Pedro Reservoir. For the period 1944 through 1958, their diversions averaged 875,000 acre-feet annually.

The present development of the Upper Calaveras River Basin is limited to relatively minor diversions to meet in-basin demands. The major development on the Calaveras River is New Hogan Reservoir, a Corps of Engineers multipurpose project. The water supply yield of the reservoir, estimated to be about 70,000 acre-feet annually, is to be used by Calaveras County Water District in the Jenny Lind area and Stockton-East Water District in lower San Joaquin County.

One other development in the area is Salt Springs Valley Dam and Reservoir on Rock Creek in Calaveras County. This 11,000 acre-foot storage facility is a source of water supply to serve the Rock Creek Valley area in Stanislaus County via the Rock Creek Ditch.

6. Topography. The area extends generally from the Calaveras River on the north to the Tuolumne River on the south. East to west it extends from about the San Joaquin River well into the lower reaches of the Sierra Nevada. In general, the lands range in elevation from about sea level to about 2,000 feet in the northeast corner of the service area near San Andreas. Between these two extremes lie areas of moderately rolling lands marked with small alluvial plains along local stream tributaries. The major streams in the area are the Stanislaus, Calaveras, and Tuolumne Rivers and Littlejohns Creek, Rock Creek, and Dry Creek with San Joaquin River forming the western boundary of the service area.

7. Vegetation. The upper basin lies primarily in the foothill woodland plant community with the typical large trees being digger pine, interior live oak, blue oak, valley oak and California bay. Larger shrubs characteristic of the community include California buckeye, several species of Ceanothus, cascara, redbud and poison oak. Winter rains result in

characteristic spring growths of annuals such as the lupine, California poppy and numerous small and colorful composites. In the lower basin, where not farmed, the vegetation consists primarily of large areas of open grasslands with occasional single trees or groves of valley oak and black walnut. Larger trees and shrubs along the usually intermittent natural waterways consist of willows, Fremont cottonwoods, red alder, sycamore, and buttonbush. There are extensive growths of aquatic plants (tule and bulrush) in the drains which cross the area.

8. Fish and Wildlife. In the upper basin the largest mammal is the black-tailed deer. Coyotes and bobcats occur but are rare. The gray fox, striped skunk, racoon, opossum, Beechy ground squirrel, Botta pocket gopher and black-tailed jackrabbit are all found regularly in this area. Cottontail and brush rabbits are the most important small game mammals.

   The most conspicuous large birds are the turkey vulture and the red-tailed and Swainson hawks. Game birds consist of California quail and mourning doves. The upper limit of the basin has mountain quail and the lower edge, pheasants. Passerine birds are abundant seasonally but acorn woodpeckers, kingbirds, mockingbirds, Brewer blackbirds, Bullock orioles and Western bluebirds are characteristic.

   The sport fishery in the upper basin is primarily on warm water species such as largemouth bass, smallmouth bass, sunfish, and catfish. In the reservoirs with well oxygenated cold water layers rainbow trout populations are maintained by stocking. Some brown trout also occur. King salmon and steelhead trout move into the larger rivers such as the Stanislaus to spawn. Native fishes consist of Sacramento squawfish, hardheads, hitch, Sacramento suckers and cottids. The introduced carp is ubiquitous.

   In the lower basin the larger mammals have been virtually excluded by urban and farm development. Small, more tolerant mammals such as the striped skunk, racoon, opossum, Beechy ground squirrel and Botta pocket gopher abound. Along the streams where cover and water remain the cottontail rabbit is common and the black-tailed jackrabbit is still found in the open, less intensely cultivated section.

Birdlife is much the same as that in the upper basin except that marsh loving birds such as killdeer, red-winged blackbirds and herons are more common. In the winter the open fields may be used as resting and feeding areas by ducks and geese. The introduced pheasant is the most important game bird.

The fishes are all warm water species with the exception of seasonal migrations of salmon and steelhead moving to upstream spawning areas. The lower reaches and some sloughs have runs of American shad and striped bass in season.

9. Rare and Endangered Species. No rare or endangered species is known to exist in the local service area.

10. Vectors. Mosquitos are the principal vector in the area. Several species of mosquitos of public health importance may be produced in large numbers in the area when suitable aquatic habitats are present. C. tarsalis and C. quinquefasciatus occur in the area and are considered primary vectors of encephalitis. Both are produced in a wide range of aquatic habitats containing either fresh or foul water such as roadside ditches, seepage pools, flooded depressions, and other semipermanent and permanent bodies of water containing emergent vegetation.

Several species of Aedes mosquitos also occur in the general area. In addition to their public health importance, large numbers of biting mosquitos also cause severe economic losses by lowering meat and milk production, by reducing the efficiency of agricultural and industrial workers, by interfering with recreation enterprises, and by lowering the value of real estate.

Several other groups of insects occur in sufficient numbers to create public health and economic problems. Among these are several species of small gnats of the family Heleidae and black flies.

Vectors of terrestial origin, including arthropods such as ticks, mites, fleas, and flies, and rodents such as ground squirrels, chipmunks, rats and mice may be present in the area particularly at recreation sites and in the upper basin. The public health importance of these vectors involves a number of human diseases including Rocky Mountain spotted fever, Colorado tick fever, tick paralysis, dysentery, typhoid, tularemia, typhus, and plague.

11. Recreation. The area being considered in this evaluation includes a variety of outdoor recreation opportunities. Among the many activities are swimming, sightseeing, fishing, hunting, boating, water skiing, camping, riding and hiking, and picnicking. The area includes two state parks, Caswell Memorial and Turlock Lake, which provide a variety of facilities for the public. Well developed County Parks to permit day and overnight use exist at Woodward and Modesto Reservoirs provide a full range of recreation facilities. Tulloch Reservoir on the Stanislaus River, below New Melones Dam, also provides recreational opportunities. There is some activity on the Stanislaus River below Goodwin Dam. However, use is limited by low flows, particularly during the summer months.

The fiscal year 1970-71 visitation for the two state parks totalled about 161,000 for the year. Yearly attendance at Woodward Reservoir averages about 400,000 persons except in years of low water supply, while yearly attendance at Modesto Reservoir averages about 300,000.

12. Historical and Archaeological. The upper basin portion of the service area includes considerable historic significance as a part of the Mother Lode. At the eastern edge of the service area is the historic State Highway 49 associated with the Gold Rush period. In addition to the communities of San Andreas and Angels Camp, which are located just east of the service area, other historic communities and sites are Knights Ferry, Copperopolis, Jenny Lind, Altaville, Columbia, La Grange, Kentucky House, and Fourth Crossing.

The area was the locale of early California Indians of the Miwok and Yokut groups. Within and adjacent to the local service area, the locations of 20 villages of the Northern group of the Valley Division of Miwok and Yokut Indians have been identified. These villages were located in the foothills in the vicinity of Knights Ferry, Jacksonville, Cooperstown, between the Tuolumne and Stanislaus Rivers and between New Don Pedro and the New Melones Reservoir site. Another group of villages were located around Vallecito, Murphys, and San Andreas.

The Yokuts are reported to have occupied the plains along the Merced, Tuolumne, Stanislaus and Calaveras Rivers. They also lived along the east side of the lower San Joaquin River.

A review of the Federal Register, Volumne 36, number 35, National Register of Historic Places discloses there are no historical sites of national significance within the proposed service area.

13. Pattern of Land Use. The earliest activities in the area were fur trading and gold mining. The fertile valley lands were utilized to grow hay and grain and to raise beef cattle for sale to the miners.

By 1875 gold mining had passed its heyday and there was a period of adjustment in which the development of large-scale lumbering hydroelectric power facilities and specialized agriculture occurred. In more recent times there has been some revival of mining activities, the establishment of complex industrial and commercial enterprises, increased irrigated agriculture, and development of the recreational potential of the area.

Agriculture particularly in the lower basin is the major economic activity. Other sources of income are food processing and manufacturing industries and recreation. In the upper basin, the principal agricultural use of the land is for dry farmed livestock grazing and poultry raising. Tuolumne County in 1969 had some 18,000 head of cattle and calves valued at $2-3/4 million. Poultry production grossed just under one million dollars. In Calaveras County the 1969 livestock production amounted to $3 million, poultry and eggs just under $1 million and field crops $-1/2 million.

In the lower basin, principal crops are alfalfa, irrigated pasture, other miscellaneous field crops, fruits and nuts and vineyards. Livestock and milk production are also major items. The total agricultural production for the county was valued at almost $250 million in 1969. Milk was the leading single commodity at $27-1/2 million. Other important crops were almonds, $13 million; asparagus, $16 million; grapes, $27 million; tomatoes, $25 million. Livestock production grossed $13 and eggs $22 million.

Stanislaus County, which ranked first in the State in 1969 in peach production, had a total agricultural production of $219 million.

Principal crops were peaches, $23 million; walnuts, $9-1/2 million; apricots, $6 million; livestock, poultry and aviary, $111-1/2 million; and milk, $41 million. Total value of field crops was almost $29 million and of vegetable production over $17 million.

Included within the service area are the following water service organizations: Stockton-East Water District, Central San Joaquin Water Conservation District, San Joaquin County Flood Control and Water District, South San Joaquin Irrigation District, Oakdale Irrigation District, Modesto Irrigation District, Waterford Irrigation District, Turlock Irrigation District, Calaveras County Water District, and Tuolumne County Water District No. 2.

Within the Calaveras and Tuolumne County portion of the area, several large foothill subdivisions have been established to provide opportunities for retirement, recreation or second homesites in a foothill setting. Two of the more developed of these are Copper Cove adjacent to Tulloch Reservoir and the Don Pedro Development near New Don Pedro Reservoir.

Within the lower basin are several major urban areas, the largest of which are Stockton in San Joaquin County and Modesto in Stanislaus County. Some of the other larger communities are Manteca, Turlock, Escalon and Oakdale. In the upper basin, the larger communities are San Andreas and Angels Camp. All of these towns together with the other smaller communities primarily serve agriculturally oriented businesses and people.

The dominant manufacturing activity in Stanislaus County is food processing. Approximately 60 percent (about 8,800) of all manufacturing workers were employed in this industry in 1969. The major food processing center is the Modesto area which lies within the local service area of New Melones. In San Joaquin County, approximately 40 percent (about 7,000) of the workers were engaged in food processing plants.

A good transportation network exists in the area. State Highway 99 passes from north to south along the western edge, State Highway 49 traverses the area from north to south just above the eastern edge of the service area. Major east-west routes connecting Highways 99 and 49 are Highway 4 passing through Farmington and Copperopolis; Highway 120 passing through Manteca and Oakdale; and Highway 132 passing through Modesto, Hughson and La Grange. A network of country roads also serves the area. Both the Southern Pacific and Atchison, Topeka and Santa Fe Railroads have lines running north-south through the area.

14. Water Quality. The major rivers which supply irrigation and municipal and industrial diversions to the local service area are the Tuolumne, Stanislaus, Calaveras, and San Joaquin Rivers.

The Tuolumne River upstream of Waterford is excellent in mineral quality, soft, and suitable for all beneficial uses. In the vicinity of Waterford, gas wells discharge saline waters into the river. This causes a considerable increase in mineral concentrations in the reach from Waterford to the mouth, particularly during low flows. Occasionally, Tuolumne River water becomes harmful for irrigation of some crops due to excessive chloride concentrations. Above the Tuolumne, San Joaquin River water ranges from excellent to injurious to some crops for irrigation. The chloride concentration at times exceeds the recommended limits for domestic use, and the hardness ranges from soft to very hard. Irrigation returns, ground-water accretions, and waste discharges have caused mineral concentrations to increase along this reach of the river. Below the Tuolumne, San Joaquin River mineral quality is somewhat better than that upstream due to the diluting effects of the Tuolumne River.

The quality of the Stanislaus River at Tulloch Reservoir is very high. The chemical quality meets U.S. Public Health Service Drinking Water Standards. Since 1958, the first full year under Tri-Dam Project operation, the conductivity of the Stanislaus River at Tulloch Dam has ranged from 35 to 255 micromhos with an average value of 66 micromhos. The low conductivity makes Stanislaus River water excellent for irrigation use, and most of the water is consumptively used for irrigation. In the 1958-66 period, conductivity near the mouth of the Stanislaus River varied between 44 and 335 micromhos with an average of 212 micromhos. This increase in conductivity is due to irrigation return flows and ground-water accretions between Tulloch and the mouth. Conductivities are higher during the low streamflow period from July to October. These higher concentrations are acceptable for agricultural use but are less effective in diluting the much higher concentrations in the San Joaquin River. Under present conditions, the summertime flows in the San Joaquin River at Vernalis are comprised mainly of irrigation return flows. The conductivities are higher in years of low flow. Based on data collected from 1951 to 1965, the mean monthly specific conductance of the San Joaquin River near Vernalis ranges from 150 to 840 micromhos during normal flow years and from 650 to 1,330 micromhos during low flow years. The diluting effect of the Stanislaus River outflow is very important to the quality of the San Joaquin River at

Vernalis. For example, during the summer of 1961, an unusually dry year, the Stanislaus flow, which is normally about 15 percent, comprised less than 1 percent of the Vernalis flow. As a result, the conductivity at Vernalis ranged from 1,250 to 2,270 micromhos. There are no longer any direct discharges of municipal or industrial wastes to the Stanislaus River as the various discharges now use holding ponds and land disposal methods for their wastes. Hence, dissolved oxygen levels are no longer depleted to the low levels that used to occur. However, nutrients from Stanislaus River agricultural drainage add to the already enriched San Joaquin River which receives high nutrient loads from agricultural drainage and sewage effluent. These nutrients promote algal growth which in turn causes excessive variations in dissolved oxygen and pH through diurnal photosynthesis and respiration. Excessive algal growth and die-off is one of the causes of low dissolved oxygen levels during fall months occurring in the San Joaquin River downstream from Stockton, which has resulted in fish kills.

The Calaveras River below New Hogan Reservoir is of excellent chemical and biological quality. Based on water quality measurements since 1964, the dissolved oxygen level has generally been above 90 percent of the saturation level. The conductivity has varied from 132 to 264 micromhos since January 1965.

The following table 1 summarizes and compares the specific conductance or conductivity of the Tuolumne and Stanislaus Rivers:

Table 1. Historical average annual specific conductance at mouth of Tuolumne and Stanislaus Rivers, 1951-65 (in micromhos)

	Tuolumne	Stanislaus
Critical years	571	227
Normal years	310	120
Wet years	148	87
1951-65	235	100
Maximum historical	2,851	507
Minimum historical	50	50

15. Air Quality. The air in the Calaveras and Tuolumne portion of the area generally is of good quality. On occasion, some pollution is present due to the activities of a cement plant at San Andreas.

    The air quality in the lower basin is typical of the Central Valley in that smog conditions do occur when the appropriate climatic conditions prevail.

16. Aesthetics or Scenic Values. Due to its lower elevation location, some scenic values of the area are seasonal. In the spring and early summer, the foothill and valley lands are well known for the display of native spring grasses and flowers and the orchards in blossom. Interesting geological formations occur in portions of Calaveras and Tuolumne Counties particularly along State Highway 49. The many rock "fences" in the Copperopolis area are of considerable interest.

B. SOUTHERN SAN JOAQUIN VALLEY

1. General. That portion of the southern San Joaquin Valley in which New Melones water might be used comprises about 4 million gross acres of some of California's finest agricultural land. Bounded on the east by the Sierra Nevada foothills, on the west by the valley trough, and varying from 25 to 40 miles wide the area extends for some 200 miles from Chowchilla River to the foothills of the Tehachapi Mountains south of Bakersfield. The area includes parts of Madera, Fresno, Kings, Tulare and Kern Counties.

   The Pixley Irrigation District was selected as representative of the kind of area to be served by the Cross Valley Canal. The district is located in Tulare County in the vicinity of the town of Pixley about 45 miles north of Bakersfield and 16 miles south of Tulare. The district is roughly rectangular in shape and extends 11 miles west and 7-1/2 miles east, and about 3 miles north and 5 miles south of Pixley. The western boundary of the district is the Atchison, Topeka, and Santa Fe Railroad tracks. The lands of the district are contiguous and comprise a net area of about 70,500 acres. The town of Pixley, along with several small areas within the exterior boundaries of the district are excluded. The excluded areas contain about 1,000 acres.

2. Climate. The climate is typical of that in the San Joaquin Valley, with mild winters and hot dry summers. The mean monthly temperature varies from about 47 degrees F. in December to about 83 degrees F. in July. The average frost-free period of about 260 days extends from the first part of March to the latter part of November. Short periods of freezing temperatures are experienced infrequently. The average seasonal precipitation is approximately 7.3 inches.

3. Soils. Practically all of the 70,000 acres within the Pixley Irrigation District is irrigable. About 23,000 acres of these lands are of excellent quality and will produce a wide range of crops. Some 27,000 acres, although having adequate soil depths, are limited in their crop adaptability and productivity by saline and alkaline conditions. The remaining 20,000 acres, in addition to being affected by saline and alkaline conditions, also have shallow depths.

4. Hydrology. The existing water supply is derived primarily from runoff of the mountains and foothills of the Sierra Nevada. Rainfall occurring on the lands of the area contributes to the supply. About four-fifths of the annual precipitation occurs between the last of October and the first of April, but snow storage in the high Sierras delays the runoff from that area until April, May, and June, in which months half the normal annual runoff occurs. By July, the natural streamflow drops to a small fraction of the average discharge.

The seven main streams contributory to the southern San Joaquin Valley area, the Chowchilla, Fresno, San Joaquin, Kings, Kaweah, Tule and Kern Rivers, have a total annual runoff varying from 1 million to over 10 million acre-feet. The annual runoff averaged approximately 5 million acre-feet for the period 1894-1947. The sequence of wet and dry years is irregular, but not infrequently several wet years or several dry years occur in succession. The most critical of these dry periods of record is the 7-year period, 1928-34.

Ground-water storage and use are of prime importance in meeting the area's existing water needs. A large measure of conservation is obtained by extensive use of the ground-water reservoirs underlying the area. These underground reservoirs store streamflows during periods when water use is less than runoff for later use when the use-runoff relationship is reversed.

Throughout much of the east side of San Joaquin Valley, three primarily distinct bodies of ground water occur. Proceeding downward from the land surface they are an unconfined and semiconfined fresh ground-water body in the more Recent alluvial deposits, a fresh water body confined under the clay layer in the earlier alluvial and lake deposits, and a body of saline water in the lower continental or marine sediments underlying the fresh water.

Replenishment of the unconfined ground-water body is principally by seepage from streams, losses from canals, and deep percolation from irrigation. The confined ground-water bodies are replenished through continuity with the unconfined ground-water body and downward penetration of water through the confining clay layer.

Extensive use of ground water is made in the southern San Joaquin Valley with some 40,000 irrigation wells obtaining water from this source. At the present time, nearly all of the municipal, industrial, and domestic needs of the area and 50 percent or more of the agricultural uses are supplied by ground-water pumping. The large amount of pumping substantially exceeds the amount of replenishment to the ground-water bodies, and the existing overdraft is increasing rapidly.

Since the water-bearing materials are not fully continuous in the ground-water reservoir and the overlying areas rely on varying amounts of pumping, the extent of the ground-water overdraft varies considerably. In some areas, water use and supplies are in reascnable balance, while in others, the use greatly exceeds the supply. The depth to ground water varies from 5 to 600 feet, with much of the water pumped from depths of 50 to 200 feet. As the depth to ground water increases, the cost of pumping increases, and at some point the particular crop being raised in an area can no longer be produced economically. This is now occurring in some areas.

Water quality is another factor to be considered. As wells are deepened to reach the receding ground water, there is the possibility of tapping the saline water zones underlying a portion of the area. Pumping of saline water already has occurred in parts of Kern County.

The westerly portion of the area along the valley trough also has a quality problem of a differing nature. These low elevation lands are located where depths to ground water are relatively shallow. However, much of the ground-water recharge to this westerly portion is from reused irrigation water from the higher elevation lands on the east. Some of this reused percolated water is so heavily laden with salts that its use is precluded for agriculture.

In the southern portion of the area where most of the ground-water pumping is concentrated, long-term depletion of the ground-water supplies has caused critical ground-water problems. For some time, the average annual use has been far greater than the average annual supply. As a result, ground-water levels have sharply declined for those areas where supplemental surface water supplies have not been made available.

5. Topography. The Pixley Irrigation District is located on the floor of the San Joaquin Valley generally on lacustrine deposits and recent alluvial outwash from the southern Sierra Nevada Mountains. The topography is flat and slopes gently to the west and the trough of the valley. The natural drainage channels are not deeply incised and streams are intermittent. Most natural drainage has been extensively modified by agricultural practices except for portions of the Pixley National Wildlife Refuge.

6. Vegetation. Natural vegetation has been replaced by agricultural activities except for waste areas and some lands in the Pixley National Wildlife Refuge. Originally virtually no trees existed except for water-associated species such as willow, buttonwillow and Fremont cottonwood. Orchards and domestic horticultural plantings have changed this. Remnants of the fresh water marsh which occupied the lowermost valley are rare and found only in drainage ditches and other nonagricultural areas. Some poorly drained alkaline flats and playas which have not been converted to agriculture still have some characteristic Atriplex communities.

7. Fish and Wildlife. The project service area has long been devoted to agriculture. Normal wildlife associations have been disrupted and only those animals and birds that adapt to close association with man and manmade rural environments now exist. Valley quail occur in limited numbers. The introduced pheasant is found in the marshy drainages and in the irrigated pastures. The mourning dove is common seasonally and nests in the area. The Pixley National Wildlife Refuge is located just south of the service area and is important for waterfowl resting and depredation control purposes.

8. Rare and Endangered Species. The ranges of the Giant Garter Snake and Blunt-nosed Leopard Lizard include the proposed service area. The range of the endangered San Joaquin Kit Fox once included the service area but due to intensive agricultural development, only stray animals from the undisturbed part of its range could now occur.

9. Vectors. A vector evaluation of the area to be served by the proposed East Side Division, which includes this alternative area, was provided by the Public Health Service of the Department of Health, Education and Welfare. Mosquitos are the principal aquatic vectors. Encephalitis is now the most important mosquitoborne disease. Records of the U.S. Department of Agriculture show that equine encephalitis cases occurred in the area during 16 years of the 17-year period, 1939 through 1955. During 15 of these years, these counties had an incidence in excess of one encephalitis case per 1,000 horses. An endemic incidence in humans of both western equine and St. Louis encephalitis occurs in the Central Valley. Several species of Aedes mosquitos, including Aedes nigromaculis, A. dorsalis, and A. vexans, also occur in the general area.

   Other groups of problem insects include deer and horseflies, gnats, and black flies. Vectors of terrestrial origin include arthropods such as ticks, mites, fleas, and flies and rodents such as ground squirrels, chipmunks, rats and mice.

10. Land Subsidence. The southern San Joaquin Valley area includes one of three principal subsidence areas of the San Joaquin Valley. This is the Tulare-Wasco area located approximately between the towns of Tulare and Wasco and extending about 15 miles to the east and to the west of U.S. Highway 99. Based on U.S. Coast and Geodetic leveling surveys, lines of equal subsidence have been developed on maps of the area. Based on these data, volumes of subsidence have been developed for two periods of time. For the Tulare-Wasco area there was a subsidence of 2,150,000 acre-feet during the period 1926-62 and 860,000 acre-feet during the period 1962-70 for a total of just over 3 million acre-feet.

11. Recreation. The primary recreational opportunities are located just to the east at the many foothill reservoirs. These include Millerton Lake, Pine Flat Lake, Lake Kaweah, Success Lake, and Isabella Lake. There also are two state parks and Lake Woollomes on the Friant-Kern Canal plus several county and private recreation areas. These developments provide a total of 4 million recreation days of use annually.

12. Historical and Archeological Sites. No archeological sites are known to exist in the demonstration area and no surface indications have been reported. Although no survey has been made by a qualified archeologist, the area was known to have been inhabited by the Yokut Indians.

The National Register of Historic Places has been consulted and no historic sites occur in the service area under discussion, and none are currently proposed for registration.

13. Air Quality. No industry occurs in the immediate vicinity. Sources of air pollution would be cattle feedlots, dust from agricultural activities such as plowing and harvesting. Agricultural burning is permitted during certain periods and is a source of smoke. This usually occurs in the fall and early winter.

14. Aesthetics or Scenic Values. The flat undeveloped character of the landscape and the unattractive climate together with the almost complete development for agriculture makes this a largely unattractive area. The presence of the Pixley National Wildlife Refuge and the Kern National Wildlife Refuge contributes to these values, however, due to the large flights of waterfowl which seasonally concentrate there.

15. Pattern of Land Use. The discovery of gold in California brought a tremendous immigration and the needs of a burgeoning population for food gave the impetus which led to permanent development in the east side southern San Joaquin Valley.

The first irrigation diversions from the main streams were made in the early 1860's. A survey of irrigated lands in 1879 revealed 140,000 acres under irrigation. Growth has continued since that time progressively and continuously to meet the food and fiber needs of the State and the Nation. At present over 75 percent of the irrigable lands in the area are irrigated.

About 1900, with the improvement in pump design and availability of electric power, a new source of supply, ground water, became availabe. The farmers were not long in making use of this new supply to expand irrigated acreage. The series of dry years during the late 1920's and early 1930's brought about a sharp reduction in the surface water available and the irrigators were forced to draw heavily on the ground-water basin to maintain lands already in production. The resulting heavy overdraft caused serious ground-water level declines.

The implementation of the Central Valley Project was effective in stabilizing ground-water levels in some areas and in some cases there has even been some replenishment. However, in those areas which have not benefited from Central Valley

Project service, ground-water levels have continued to decline and the need for additional supplemental supplies still exists.

Today land use is primarily concerned with intensive irrigated agriculture. Where a sufficient water supply is not available or alkaline soils predominate, grazing is the principal activity. The portion of the land devoted to urban or industrial use is minimal and limited to the vicinity of the important transportation corridors and to agriculturally oriented activity.

16. Water Quality. Major surface water quality problems generally have not been experienced in the Tulare Basin Subregion. The perennial streams which rise in isolated parts of the Sierra Nevada are not subject to major manmade waste loads, as most surface water is applied to the land. Irrigation return water forms a major portion of the summer base flow in the lower reaches of the larger streams.

Ground water near Tulare Lake has experienced an increase in dissolved solids concentrations over the years. In only a few locations has ground water been abandoned as a result of quality degradation. However, a potentially serious problem does exist if actions are not undertaken to establish a salt balance within the basin. By 1960, the unfavorable salt balance had resulted in the application of an average of more than half a million tons of dissolved solids per year to subregion soil moisture and ground water. Suitable salt levels in the root zone have been maintained only by the practice of leaching the salts downward through the application of excess water.

Significant portions of the ground water exceed the recommended total dissolved solids concentration in the USPHS Drinking Water Standard. Nitrate concentrations in some ground water approach or exceed the levels recommended by the Drinking Water Standards. High nitrogen concentrations are usually attributed to waste water effluent, leaching of fertilizers used in irrigated agriculture, or naturally occurring nitrogen.

C. SAN FELIPE DIVISION

1. General. The San Felipe Division area comprises some 448,000 acres in the Santa Clara Valley from San Jose to Hollister and the coastal area of the lower Pajaro River Basin in the vicinity of Watsonville. The Santa Clara Valley is in Santa Clara and San Benito Counties, bounded on the east by the Diablo Range and on the west by the Santa Cruz Mountains and the Gabilan Range. The valley extends southerly some 75 miles from the southern tip of San Francisco Bay to south of Hollister where the Gabilan Range merges into the Diablo Range. The valley is divided into north Santa Clara and south Santa Clara subareas in Santa Clara County, and the Hollister subarea principally in San Benito County. The Watsonville subarea is in the lower Pajaro River Basin in Santa Cruz and Monterey Counties and joins with the Hollister subarea by a narrow strip along the Pajaro Gap, known as Chittenden Pass.

San Felipe Division water requirements are as follows:

Subarea	M&I	Irrigation	Percolation
		(acre-feet)	
North Santa Clara	0	48,000	119,000
South Santa Clara	10,500	27,800	5,000
Hollister	34,000	12,000	0
Watsonville	10,700	6,300	0
	55,200	94,100	124,000[a/]

a/ 10,700 acre-feet of this supply is expected to be pumped for irrigation.

Assuming a total water supply for irrigation of 100,000 acre-feet it is expected that 16,000 acres of new land at 3 acre-feet per acre and 40,000 acres of supplemental irrigation at 1-1/3 acre-feet per acre would be supplied.

2. Climate. The climate of the San Felipe Division is characterized by wet winters and dry summers. Mean annual precipitation on the valley floor ranges from 13 inches at San Jose to 21 inches at Watsonville. The temperatures range from 15° to 116° F. annually. Greater rainfall occurs in the mountainous areas than on the valley floors. The mean annual rainfall at the crest of the Santa Cruz mountains is 44 inches while the Diablo Range has a mean annual of 29 inches.

Each subarea has characteristic climatic conditions due to its location. North Santa Clara, further inland than other subareas, has a fairly even climate, tempered also by its proximity to San Francisco Bay. South Santa Clara is more isolated by mountains and is subject to somewhat greater ranges in temperature. Hollister is between two mountain passes, Pacheco Pass on the east and Chittenden Pass to the west through which flow the sea breezes that modify the climate. Watsonville is along the ocean front where the prevailing westerly winds during the dry season gather moisture from the ocean, forming fogs at night that usually disappear about midday, but frequently continue longer. The temperate climate of the service area provides an agricultural growing season of from 232 days to 305 days.

3. Geology. The San Felipe Division area is comprised of a series of mountain ranges and intervening valleys belonging to the north-west trending coast ranges of middle California.

The major relief features are from east to west: the Diablo Range, the Santa Clara Trough; Gabilan Mesa and the Santa Cruz Mountains, linear ranges west of the trough divided by a low sag, the Pajaro Gap; the Salinas River Valley, and the Sierra de Salinas.

The project service area is comprised of the Santa Clara Trough and the lower reaches of the Salinas and Pajaro Rivers. The Santa Clara Trough is divided by a low alluvial fan near Morgan Hill into two sections. The northern section, the Santa Clara Valley proper, drains northward via Coyote Creek into the south end of San Francisco Bay. The southern portion of the trough drains through Pajaro Gap between Gabilan Mesa and the Santa Cruz Mountains via the Pajaro River into Monterey Bay. Both the Salinas and the Pajaro Rivers have cut deep canyons along their lower reaches. These canyons were subsequently drowned and then filled with riverborne sediments. Later uplift exposed these sediments in the present, broad, flat, alluviated valleys. Minor fluctuations of land elevation relative to sea level and concurrent erosion have produced large terrace areas above the river flood plains. Like the Salinas and the Pajaro Rivers the Santa Clara Trough is deeply alluviated and Coyote Creek is slowly filling in the south end of San Francisco Bay.

The alluviated areas, both in the Santa Clara Trough and the river valleys, are the ground-water reservoirs on which agriculture depends. In the Santa Clara Valley small reservoirs on the periphery of the valley are used, in part, for ground-water recharge. Still, overdraft of ground water in the San Jose area has caused ground subsidence and both the northern end of the Santa Clara Valley and the Pajaro and Salinas Rivers are vulnerable to sea water intrusion with continued lowering of the ground water.

The San Andreas Fault is but one, though by far the largest, of several active faults in the area. It is notable for its known length, upwards of 600 miles, and for the dominance of horizontal over vertical movements. It is also notorious for the number of destructive earthquakes generated along it. At the eastern margin of the Diablo Range, near the inlet to the Pacheco Tunnel, is the Tesla-Ortigalita Fault. Minor quakes have been recorded in recent years along its trace, and there is evidence of recent movement along the fault, though not in the immediate vicinity of the tunnel portal. The boundary between the Diablo Range and the northern part of the Santa Clara Trough is the Calaveras and Hayward Faults. Many minor and microquakes have been recorded in recent years along these faults. The Calaveras is particularly characterized by the active creep presently being displayed along its trace in many locations. The San Andreas Fault is the western border of the southern Santa Clara Trough; it then passes on the west side of the Santa Cruz Mountains. The Pajaro Gap is a topographic sag where Gabilan Mesa and the Santa Cruz Mountains are separated by the San Andreas Fault. The west side of the northern Santa Clara Valley is bordered by a series of faults en echelon to the San Andreas, and oblique to the trough border. One of these, the Sargent Fault, has had recent activity recorded.

4. Soils. The lands of this division can be grouped into four broad physiographic groups based on characteristics such as soil, topography, and drainage, which are very closely correlated with the productivity of the lands within comparable climatic conditions. These four groups are described as follows:

   a. Upland areas have shallow, residual soils with unfavorable relief, and are found at the higher elevations.

b. Alluvial fans and flood plains have deep Recent alluvial soils of medium texture except near certain rivers and creeks where they are sandy or gravelly. In general, because of desirable soil depth, good drainage, smoothness of relief and moderate to good water retention, they form the most favorable agricultural soils.

c. Low terraces are mainly between the alluvial fans of the valley floor and the uplands. The relief is usually flat to rolling and may have considerable erosion with medium to heavy textured soils near the surface and with more compact, heavier textured subsoils.

d. Basin areas occur generally below the alluvial fans. The soils are heavy textured, dark colored, fertile, and comprise very flat relief. These soils are usually affected with varying amounts of soluble salts.

Soil types and textures vary within the above described groups for the different subareas depending on the parent source, being sandier for instance in the Watsonville subarea, and heavier textured in the north and south Santa Clara subareas. Adjacent to Monterey Bay there are some Recent alluvial coastal beach and sand dunes that have no agricultural value, but are used for recreational purposes. In north Santa Clara, tidal marshes along the fringe of the San Francisco Bay are heavy textured and very saline. The marshes may be reclaimed for urban or industrial use.

The alluvial fans and flood plain on which the Hollister subarea is located have desirable soil depth, good drainage, smooth relief, and moderate to good water retention. They contain very good agricultural soils. The low terraces between the alluvial fans and uplands have medium to heavy textured soils near the surface and with more compact, heavier textured subsoils.

5. Hydrology. The streamflow within the study area originates in the surrounding mountains. Most of the streams are short, flow intermittently, and have relatively small watersheds. Flows are insufficient to furnish a dependable surface supply, and except for minor surface supplies, all existing development of local surface water is for percolation.

Principal streams in the north Santa Clara subarea are Coyote, Alamitos, Guadalupe, Los Gatos, and Stevens Creek, flowing into San Francisco Bay. All are controlled to some degree by dams which store water for percolation.

The Llagas and Uvas-Carnadero Creeks are the principal streams in the south Santa Clara subarea, draining south to the Pajaro River; each controlled by a dam storing water for percolation.

The Hollister subarea is drained by Pacheco Creek from the east and San Benito River from the south. Both of these streams flow into the Pajaro River. Releases from the reservoirs on these streams are used for percolation to ground water.

Corralitos Creek in the Watsonville subarea originates in the Santa Cruz Mountains and flows south into the Pajaro River. The limited runoff from this stream is diverted for use by the city of Watsonville.

In general, the ground-water reservoir is composed of continental sediments deposited in alluvial fans, flood plains and tideland deposits. This underground reservoir will store streamflow during periods when water use is less than runoff for later use when the use-runoff relationship is reversed. As a result of local surface storage development, water is placed in underground storage by percolation releases from these reservoirs.

Each subarea has three ground-water zones: (1) a semi-perched water body overlying the confined zone; (2) a main confined water-bearing zone; and (3) a main unconfined water-bearing zone which is the principal source of recharge to the confined zone.

6. Topography. Most of the San Felipe Division service area is a flat, gently sloping valley floor. It is surrounded by low, rolling to steep foothills which develop into the Diablo Range to the east and the Santa Cruz Mountains to the west. Tidelands occur to the north along the tip of San Francisco Bay as well as the westerly edge of the Watsonville area. The valley floor ranges from sea level to about 450 feet. The hill elevation rises to over 900 feet. The Santa Clara area is divided into two drainages by an alluvial divide near the town of Morgan Hill. The north Santa Clara area is drained by Coyote Creek, Guadalupe River, and other minor streams which flow into

San Francisco Bay. The south Santa Clara, Hollister, and Watsonville areas are drained by the Pajaro River which flows through the Watsonville area into Monterey Bay. Principal tributaries to the Pajaro River are Llagas Creek and Uvas-Carnadero Creek in the south Santa Clara area, the San Benito River and Pacheco Creek in the Hollister area, and Corralitos Creek in the Watsonville area.

7. Vegetation. Although most of the nonurbanized land is utilized for agricultural purposes, native trees and shrubs fringe the natural drainage courses. The foothills between the mountain ranges and valley floors are generally grassland and utilized for dry pasture. The mountains to the west support medium to heavy growths of native trees and shrubs. Remnants of redwood associated plant communities exist on the upper slopes of the Santa Cruz Mountains and irregularly along the Pajaro River. The mountains to the east have less growth because of the lower rainfall. Here the vegetation types range from savanna to oak woodland. The upper slopes have some chaparral and the canyon bottoms even where flows are intermittent have a stream woodland character.

8. Fish and Wildlife. The larger wildlife is associated with the natural areas generally on the uphill side of the canals. The intensive cultivation of the valley floors limit wildlife in these areas to smaller forms such as cottontail rabbits, striped skunks, spotted skunks, opossums, racoons, grey foxes, ground squirrels, various genera of mice, and pocket gophers.

   The black-tailed deer is the big game animal of the area and often moves into the edge of the cultivated areas to feed where it often is considered a nuisance. Two larger carnivores inhabiting the same general areas as the black-tailed deer are the coyote and the bobcat. Neither is common.

   Because of the varied natural and cultivated vegetation birdlife is abundant and includes numerous nongame species in addition to game birds such as the California quail, ring-necked pheasant, mourning dove, and band-tailed pigeon. The intense development of the valley floor has eliminated most of the habitat attractive to waterfowl. The river courses still, however, have wood ducks and occasionally mallards. Coots are ubiquitous wherever permanent water is found. Water birds of all kinds abound

in the marshes along the portion of the service area bordering south San Francisco Bay.

Anadromous fish once ran into all suitable streams with access to the sea. With the possible exception of the lower Pajaro River it is unlikely any anadromous fish now attempt to ascend any streams. Present fish life consists of exotics such as planted trout, warm water fish species, and those natives which could adapt to the intermittent flow and pollution from various sources. The Pajaro River may contain several subspecies of minnows and a sucker which are endemic to Monterey Bay streams. These fishes, if still in existence, are of interest biologically as well as geologically as being evidence of some form of stream capture from the Central Valley system.

Warm water fisheries occur in reservoirs such as Anderson and Coyote and some trout fishing is provided by the California Department of Fish and Game through their catchable trout program.

9. Rare or Endangered Species. The streams tributary to Monterey Bay, including the Pajaro River, have records of some unique subspecies of fish which are found nowhere else. The present status of the Monterey sucker, Catostomus mniolitus, the Monterey hitch, Lavinia exilicauda harengus, and the Monterey western roach, Hesperoleucus symmetricus subditus, is uncertain. Recent attempts to collect them have not been successful. They are closely related to similar subspecies to the north and west and would therefore be susceptible to submergence by hybridization if Sacramento-San Joaquin subspecies were brought in by the project. It is possible that due to previous water development, introductions, pollution, or other activities these interesting fish have been lost. Their status, both environmental and taxonomic, will have to be determined. The California Condor once included the area in its range but it is unlikely that even strays will now be seen.

10. Vectors. Mosquitos and other waterborne vectors are a nuisance seasonally and limited to the time of year when standing water is available. Salt marsh mosquitos, while not produced in the subarea, are occasionally found in nuisance numbers in the western section due to favorable winds from the coastal marsh. Aquatic airborne vectors are kept under control by the local mosquito abatement district.

11. Recreation. The State Department of Parks and Recreation operates several areas in Santa Cruz and Monterey Counties that are readily accessible to the local population. They also operate the water-oriented recreation facilities at the San Luis Unit. They consist of the San Luis Reservoir, O'Neill Forebay, and Los Banos Detention Reservoir. All of these facilities are located some 20 miles to the east over the Pacheco Pass.

The county of Santa Clara Parks and Recreation Department administers recreation at 21 parks including the existing reservoirs of the Santa Clara County Flood Control and Water Conservation District. The county parks provide a wide variety of activities. A total of over 5 million recreation days were realized at the park units.

These parks serve the public with a wide variety of recreation activities. They consist of four foothill, two streamside, three mountain, one valley floor, one arboretum, eight water recreation, and two marine type parks.

The recreation facilities are available for use year around and visitation has been recorded in every month of the year. However, the most active part of the recreation season is from March to October.

12. Historical and Archeological Sites. The San Felipe Division is located in an area important to California history. Because of its generally mild climate, the richness of the original fauna and flora, the nearness to San Francisco Bay, the Pacific Ocean, and streams which supported anadromous fish runs, the aboriginal population was high. This also attracted the mission builders and the division is rich in remains of that phase of California history. Perhaps the earliest irrigation works in this part of the State are those which were located at Mission San Juan Bautista. Archeological and recent historical sites are plentiful in the area although many have been destroyed by urban and agricultural development. A survey and possible excavations will be carried out before construction of the division facilities.

The division facilities do not pass through any site included in the National Register of Historic Places established pursuant to the National Historical Preservation Act of 1966 (80 Stat. 916, 16 USC 470).

At San Juan Bautista, a State historical monument preserves an early example of the Spanish-Mexican-Gold Rush periods of California history and is included in the National Register. Two other sites in the San Felipe Division are eligible for inclusion in the Register. They are New Almaden, 14 miles south of San Jose, and the Frank Norris Cabin, 10 miles west of Gilroy. None of these, however, would be affected by construction of the project facilities.

13. Pattern of Land Use. The principal land use in the northern part of Santa Clara County is urban. The southern part of Santa Clara County is substantially agricultural and should remain an important agricultural area. The Hollister area is and will remain an agricultural center. Watsonville area is presently agricultural, but will experience considerable urban growth. The only source of water to the service area, except for parts of northern Santa Clara County which receive supplies from Hetch Hetchy and the State of California, is ground water. The leading types of farming categories of the San Felipe service area are truck crops consisting of artichokes, lettuce, celery, cauliflower, garlic, beans, peppers, cucumbers, tomatoes, onions, and brussel sprouts; orchards including apples, prunes, apricots, pears, cherries, and walnuts; berry crops; miscellaneous field crops such as alfalfa, barley, sugar beets, grain-hay, and varietal grapes, nursery stock, livestock and dairying. All the communities except for those north of Coyote are agriculturally oriented. The San Jose metropolitan area, however, is presently causing pressures on the agricultural community in the southern portion of Santa Clara County.

14. Water Quality. Quality of surface waters in the Pajaro River steadily deteriorates from the headwaters, primarily the result of mineralization by irrigation return flows. The present quality of the Pajaro River at Chittenden containing mostly return flows during the summer months of May to September generally varies from 650 to 1200 mg/1 TDS. The Pajaro River is the only drainage outlet from the Pajaro River Basin. The water quality of Coyote Creek and Guadalupe River, which drain the North Santa Clara sub service area, is of such poor quality that the rivers are not used for M&I or irrigation supply as they reach the metropolitan areas. Ground water quality varies throughout the basin (South Santa Clara Valley, Hollister, and Watsonville service areas), but generally is of poor quality in areas of heavy pumping for agricultural use. In parts of the upper basin, high concentrations of boron exist. In the lower portions, there are high concentrations of iron and nitrate. The existing ground water

quality ranges from: (1) 300 to 1200 mg/1 total dissolved solids; (2) 0-45 mg/1 nitrate; and (3) 01 to 3.0 mg/1 boron.

A water quality problem in the basin involves ground water degradation as the result of waste discharges. In the Gilroy-Hollister ground water basin, ground water impairment near the Hollister industrial waste disposal site is occurring. In addition, road construction in the Llagas and Uvas Creek watersheds have resulted in siltation of surface waters. In the Watsonville area, overflows of sewage pumping and treatment facilities in the past have resulted in temporary surface water pollution of the lower Pajaro River.

15. Air Quality. In general, the air quality in the San Felipe service area is very good with the possible exception of the city of San Jose. During the rainy season, prevailing winds are from the north or south, resulting in clear or rainy weather, respectively. During the summer they are from the west or northwest, rising in the forenoon and subsiding in the evening.

    Each subarea has characteristic climatic conditions due to its location. North Santa Clara, further inland than other subareas, has a fairly even climate, tempered also by its proximity to San Francisco Bay. South Santa Clara is more isolated by mountains and is subject to somewhat greater ranges in temperature. Sea breezes modify the climate of Hollister, which lies between two mountain passes, Pacheco Pass on the east and Chittenden Pass to the west. Watsonville is along the ocean front where the prevailing westerly winds during the dry season gather moisture from the ocean, forming fogs at night that usually disappear about midday, but frequently continue longer.

    Outside the community of San Jose there is no heavy industry in the service area. Atmospheric conditions are occasionally such that air pollutants from the south San Francisco Bay area penetrate the area. Seasonally, agricultural burning, spraying, or ground preparation contribute to air pollution. This condition, however, is of short duration.

16. Aesthetics or Scenic Values. The general aspect of the surrounding hills is pleasing and the California mission character of the country with the historic aspects and vineyards contribute to a generally scenic landscape despite agricultural and urban development.

17. Level of Economic Development. The economic development of the service area is highly diverse and covers the entire spectrum from major urban development in Santa Clara County to major agriculturally supported communities in San Benito, Santa Cruz, and Monterey Counties.

North Santa Clara experienced a large influx of military personnel and civilians during and after World War II. Industrial development was greatly accelerated in the vicinities of San Jose, Sunnyvale, Mountain View, and Milpitas. By the end of the decade the agricultural trend was declining, and manufacturing and urban living was increasing. With the educational and cultural climate of the north county resulting from Stanford University, University of Santa Clara, and San Jose State College located in the county, plus the cultural attractions of San Francisco, the period 1950-60 produced a spectacular growth in manufacturing and urban population. The educational and cultural climate of the area seemed highly conducive to bring professional, managerial, and scientific personnel to the area. During this period total employment increased by more than 100 percent from 109,900 to 228,000; agricultural employment decreased by 30 percent from 16,200 to 11,100; manufacturing increased by more than 200 percent from 22,100 to 70,300; durables employment increased by 470 percent from 9,000 to 51,600; trade employment increased by 80 percent from 22,600 to 40,700. In the 1960's the economic growth continued at a rapid pace; however, the rate started declining in the latter half of the decade. Much of this growth was attributed to the electronics and aerospace industries which probably explains the declining rate during the latter part of the decade. The north county's labor force is highly skilled, consisting of a large proportion of trained engineers and scientists.

The other portions of the subarea have not industrialized as rapidly as north Santa Clara County and continue to look to agriculture as the major industry.

D. SAN LUIS UNIT

1. General. The San Luis Unit contains a gross area of about 600,000 acres on the west side of the San Joaquin Valley. It is approximately 70 miles from north to south and 13 miles wide. It roughly parallels the San Luis Canal from the vicinity of Los Banos Reservoir to the point where State Highway 41 crosses the canal. The Westplains portion, used as a demonstration area, is generally that portion of the unit to the west of the San Luis Canal extending from about 5 miles north of Panoche Creek to State Highway 41. It has a total acreage of 200,000 acres of which 160,000 acres are in the San Luis Unit service area. Most of the Westplains area lies in Fresno County, with a small portion in Kings County.

   In the Westplains portion of the San Luis Division, the New Melones yield would be used for a supplemental irrigation supply. This would permit the area to irrigate all of its lands as needed rather than just some portion each year. This supplemental surface supply would also relieve the burden on ground-water pumping.

2. Climate. The climate of the area is semiarid, characterized by hot dry summers and cool, moist, foggy winters. The area is in a rain shadow of the Coast Range. Annual rainfall on the service area averages about 7 inches, 90 percent of which falls between the first of November and the last of April. Average temperatures (Fahrenheit) range from the middle 40's in January to the low 80's in July. Daytime temperatures in summer frequently are over 100° and nighttime temperatures in winter occasionally fall below 32°. The average length of frost-free growing season is about 280 days.

3. Geology. The service area lies where the eastern foot of the Coast Range mountains meets the San Joaquin Valley floor. The Coast Range mountains consist of a complex, folded and faulted uplift, predominantly of marine sandstone and shales of Cretaceous to Miocene age. The valley alluvial fill consists of variably pervious sediments that comprise the ground-water basin, much of which is important as a source of irrigation water. Along the western edge of the valley, the alluvial sediments overlap the easterly

dipping marine sediments. Some of the alluvial deposits were involved in the folding and have been steeply tilted to the east by recent uplifts.

4. Soils. Most of the lands in the service area occupy the gently sloping coalescing alluvial fans laid down by creeks emerging from the Coast Range. These soils rank among the highest in the San Joaquin Valley in potential productivity and adaptability to a wide variety of high value crops. In general, the higher portions of the area have permeable medium-textured soils which are class 1 and 2; in the lower portions the soils become finer textured, slowly permeable, and have increasing accumulations of water-soluble salts. The excellent soils coupled with a long, hot growing season make the area ideal for farming operations.

5. Hydrology. Before construction of the San Luis Unit, irrigation development relied almost entirely on ground water available from two basic sources. A shallow perched water table, easily accessible but of poor quality severely restricts the diversity of crops raised. A deeper artesian aquifer provides a limited source of better quality water from which withdrawals greatly exceeded the rate of recharge. The resultant overdraft resulted in a steady decline in the artesian pressure, lowering water levels in the deep wells, and contributing to a general subsidence of ground surfaces in the area. Good quality ground water is expensive because the wells are deep and have a relatively short life. The cycle of pumping from the artesian aquifer and return through the perched water table jeopardizes continued agricultural productivity in many areas. The shallow ground-water table is rising and increasing in salinity in some parts of the service area.

   Where watercourses enter the service area along the western edge, there are narrow gullies with maximum depths from 20 to 40 feet and widths from 50 to 100 feet. All of these gullies disappear within the service area as channels are obliterated either naturally by alluvial fans of the streams or artificially by land leveling for farming purposes. During a large storm, these channels may carry high flows containing much sediment; after the storm, however, these flows decrease rapidly. The streams are dry most of the time.

6. Topography. The service area parallels the trough of the San Joaquin Valley, and its western edge lies almost at the base of the foothills on the valley's western edge.

It is a broad plain, sloping gently northeasterly to the valley trough. The elevation varies from about 200 feet along its eastern edge to about 485 feet along the western border. The land has smooth slopes and only a few undulations. Most of the area drains to the sea by way of the lower San Joaquin River through the Delta and into San Francisco Bay, but the southern portion drains southward to the closed Tulare Lake Basin.

7. Vegetation. The service area lands fall mostly within the valley grassland plant community. The western edges approach the foothill woodland and chaparral communities and some plants from these zones occur in the service area.

   Where land has been under irrigation, very little original vegetation is left except in waste areas and along roads and ditch banks. In these instances, introduced species of Brome grass and oats are common along with mustard, filaree, bindweed, spikeweed, cocklebur, and thistle.

   Where irrigation is intermittent or the land is dry farmed or pastured, natural grassland species such as California needlegrass, pine bluegrass, and poverty three-awn together with the more common introduced grasses such as soft cheat, six-weeks fescue, and wild oat still occur. Trees and shrubs occur sparsely near old homesteads, developed water, or near intermittent watercourses.

8. Fish and Wildlife. No permanent streams exist in the service area so fish are not influenced by the proposal.

   The sparse and specialized grassland cover, intermittent water supplies, and high summer temperatures have combined to create a sparse wildlife fauna in the project service area.

   Where irrigation has been carried on, the introduced ring-necked pheasant has become an important game bird. The composition of the small nongame bird population has also changed from drought tolerant species such as the meadowlark and the burrowing owl to Brewers blackbirds and similar species requiring permanent nearby water supplies.

   Under natural conditions, the species composition of bird-life in this part of California varied widely according to season. A very different population is found during the wet months from that seen during the summer and fall. The

largest all-season species are the turkey vultures and red-tailed hawk. Game birds consist of California quail where water, either natural or developed, and suitable cover exists and mourning dove in areas where suitable food plants are found and a water supply is within flying distance. The killdeer, lesser nighthawk, western kingbird, and mockingbird are typical of the smaller birds occurring in the spring or near irrigated areas. During the late fall and winter, waterfowl use portions of the open fields and valley floors for resting or feeding areas.

No large mammals are common in the district. The black-tailed deer will move into the western edge of the district during the winter and early spring but in limited numbers. The coyote and bobcat both include the district in their range but have been so reduced in numbers by control and development that they are rarely seen.

Rodents are the most common and some such as the Beechy ground squirrel occur in some instances in nuisance numbers and are subject to control measures. Numerous species of mice, the dusky footed woodrat, and the Botta pocket gopher are commonly found. The black-tailed jackrabbit is common and brush rabbits and cottontail rabbits are found where suitable cover and water occur. Other small mammals include shrews and moles.

Skunks, racoons, and opossums all occur in the district but are limited by the lack of permanent water supplies.

Amphibians are scarce due to the hot dry summer and paucity of natural permanent water supplies. The western spadefoot toad, California toad, and the introduced bullfrog are associated with permanent water. Reptiles are more common. The northwestern fence lizard is the most commonly observed lizard although the horned lizard and varigated skink are also common. At least six species of snakes occur including the Pacific rattlesnake. The most common dryland snake, however, is the Pacific gopher snake. The valley garter snake is frequently found near water.

9. Rare or Endangered Species. In 1965, the California Fish and Game Commission deemed the Kit Fox (Vulpes macrotis mutica) a protected fur-bearing mammal, and the Secretary of the Interior in 1966 listed the San Joaquin Kit Fox as an endangered species. The current range of the San Joaquin Kit Fox extends from the Tehachapi Mountain foothills at the southern end of

the San Joaquin Valley, north along the foothills of the western San Joaquin Valley, almost to Los Banos, and on the eastern edge of the valley north to about 20 miles south of Porterville. The range contains about 3,000 square miles of appropriate habitat and skirts along the southwestern edge of the service area. The present Kit Fox population is estimated at 1,000 to 3,000 foxes over the entire range.

The feeding range of the California Condor (Gymnogyps californianus) extends along the Diablo Range (western rim of the San Joaquin Valley) north to the headwaters of Los Banos Creek, about 10 miles south of the latitude of the town of Los Banos. At no location does the service area overlap the feeding range of this endangered land bird.

The Blunt-nozed Leopard Lizard (Crotaphytus wislizenii silus), classified as endangered by State and Federal classification, occurs in scattered locations in the San Joaquin Valley, in the foothills of Tulare and Kern Counties, and up the eastern portions of the Coast Range foothills, over an area of about 16,200 square miles. It inhabits sparsely vegetated plains, alkali flats, low foothills, grasslands, canyon floors, large washes, and arroyos. It is absent or scarce in areas of heavy vegetation or tall grass. The service area falls within the range of this reptile.

The Giant Garter Snake is classified as rare. This snake lives on the floor of the Central Valley from Sacramento and Antioch southward to Buena Vista Lake. It is one of the most aquatic of garter snakes and is confined to areas around permanent fresh water. Its range is about 11,300 square miles. No population estimate has been obtained.

10. Vectors. Aquatic pests such as mosquitos are seasonal over the whole area but persist longer in the irrigated portions. Terrestrial vectors are associated with small mammals such as ground squirrels (fleas = sylvatic plague) and rabbits (tularemia and plague).

11. Recreation. None of the service area is known for significant recreational opportunities. Some hunting for doves occurs, usually in the vicinity of watering places, and quail are sought in the limited areas where suitable cover occurs. No fishing exists except in the nearby San Luis Reservoir, O'Neill Forebay, and the canals associated with them. Where irrigation now occurs, pheasant hunting is the main recreational activity.

Prior to construction of the reservoirs in the San Luis Unit, local residents had available to them only the city parks in Los Banos, a small State park on the San Joaquin River, and a county park on the Merced River. These parks are primarily day-use areas. The Mendota Pool is popular angling water, as are the many canals, drains, and sloughs.

12. Historical and Archeological Sites. The National Register of Historic Places (36 F.R. 3310) as amended has been consulted and no historic or archeological places or sites are in the project area. Local sources know of no Indian sites.

Prior to construction of the San Luis Canal, an archeological survey was made of areas which might be affected and known items of archeological value were salvaged.

13. Pattern of Land Use. The population of the service area is sparse and almost entirely rural. Total population in and adjacent to the service area is estimated to be about 28,400 including about 9,100 people in the nearby communities of Coalinga and Avenal.

Agriculture is the major economic activity. The predominant crops are irrigated grain, cotton, alfalfa seed, field crops, melons, and small but increasing acreages of deciduous orchards. Some of the nonirrigated lands are used for dry farm grain and native pasture.

There was relatively little economic opportunity until the development of electrically driven pumps and electric transmission systems gave irrigators access to the deeper and more reliably productive ground-water zones. In 1922, only about 33,000 acres were under irrigation. By 1960, more than 500,000 acres were irrigated although available ground-water supplies were not adequate to irrigate this entire acreage each year. Since increased supplies became available from the San Luis Canal in late 1967, the irrigated acreage has been increasing.

There are few local merchandising and servicing enterprises in the area. The existing small communities are primarily residential. Except for packing sheds, cotton gins, auction yards, and similar activities directly related to the marketing of agricultural products, there are no industrial or commercial enterprises of significance.

The area is served by highways, farm roads, and railroads. Several State highways cross the service area and the new Westside Freeway, Interstate 5, approximately parallels the western edge of the service area.

14. Water Quality. Before construction of the San Luis Unit, irrigation in the service area relied almost entirely upon local ground-water supplies. These ground-water supplies have a salinity of from 800 to 1,500 milligrams per liter total dissolved solids. Some of these waters have excessive boron content. San Luis Unit import supplies have 200-300 mg/l TDS.

15. Air Quality. The quality of air is high, although it may become seasonally degraded from dust and smoke from agricultural working, harvest, and burning.

16. Aesthetic and Scenic Values. The lower hills and plains of the eastern slope of the Coast Range are noted for their spectacular displays of spring flowers. This is a brief and ephemeral occurrence, but people come from all parts of California, particularly the Bay area, to experience it.

E. DELTA-MENDOTA CANAL SERVICE AREA

1. General. The portion of the Delta-Mendota Canal service area now provided with a nonfirm project water supply lies generally between Interstate Highway 5 and State Highway 33 in portions of San Joaquin, Stanislaus, Merced, and Fresno Counties. Ten water districts are included.

   In the Delta-Mendota Canal service area the projected additional water requirements are as follows:

	M&I	Irrigation (acre-feet)	Wildlife
Delta-Mendota Canal	10,000	106,735	-
Mendota Pool	4,000	6,268	1,330
	14,000	113,003	1,330

2. Climate. The climate is typical of the San Joaquin Valley being characterized by mild winters and hot, dry summers. The Delta-Mendota Canal service area ranges from the Delta where cool breezes and fogs tend to alleviate the hot summers to the heart of the San Joaquin Valley near Fresno where the average temperature in July is 81° F. Over the whole area, however, the mean low is in January with 45° F. and the high is in July with a mean of about 76° F. Rainfall also varies over the area with the average annual rainfall being 14.3 inches at Stockton and 11.1 inches at Fresno. The average growing season is about 267 days.

3. Geology. The service area is generally located in the main depositional area of major alluvial fans and interfans, although the upper slopes are in the foothill rim which is composed mostly of interfan facies. The lower

portion of the area is on the outer rim of piedmont fans (basin rim). The piedmont fan alluvium is composed of west side (Coast Range) material. The outer rim facies occur as a prominent belt at the toe of the piedmont apron and may have occasional beds of river-laid sand wedged between the piedmont sediment.

4. Soil. The piedmont alluvium is the principal soil in the service area and is composed exclusively of sediments deposited by the coalescing fans of Coast Range streams. The alluvium is usually clayey, light brownish grey or brown, calcareous, and with deep, permeable, often stratified subsoils. Both surface and subsoil drainage is usually good. Slight to moderate alkali conditions are occasionally present in soils on lower fan levels. Fair to excellent yields of truck and field crops are obtained with irrigation.

5. Hydrology. The Coast Range Mountains flanking the west side of the San Joaquin Valley form a natural barrier against coastal winds and fogs and create a rain shadow on the west side of the valley. Only a few intermittent creeks such as San Luis, Los Banos, Little Panoche and Panoche drain the arid eastern slope and enter the valley. Most of these creeks do not reach the San Joaquin River, the only natural drainage outlet in this part of the valley. These small creeks have maintained a relatively low and fluctuating discharge over the years. Small levees and shallow ditches were constructed near the mouths of some of the larger creeks to control and utilize annual runoff.

   Another local source of water is the ground water which is tapped by deep wells. Irrigation overdraft of the confined Sub-Corcoran ground water and corresponding decline of piezometric heads has caused subsidence. In the 50-year period 1905-1955, Sub-Corcoran piezometric levels in the lower portion of the service area declined from 130 to 300 feet. Land subsidence in the same area ranged from 3 to 8 feet. This information applies generally to the Dos Palos vicinity. Shallow wells along the basin rim or outer rim of the piedmont fans are often saline.

6. Topography. The landscape is generally flat with local relief rarely exceeding 5 to 7 feet. The slope is gentle to the east from the foothills of the Coast Range toward the San Joaquin River-Fresno Slough channels. The surface is generally undissected except in the upper reaches near the foothills. Where basin deposits, which are mostly river alluvium occur at the toe of the slope, the surface is flat but poorly dissected by flood plain channels.

7. Vegetation. Native vegetation in the lower basin consisted of tules and tule grasses. Today only a few remnants of these original plants exist in waste or uncultivated places. On the higher portions of the service area, the natural vegetation consists of annual grasses and associated herbaceous plants during years of favorable rainfall. Foxtail chess, filaree, fescue, burclover, and several species of wild oats, barley, and needlegrass occur. The upper area is noted for its spring display of wildflowers. Trees did not naturally grow in this part of California except along the rivers in the lower part of the basin. The most abundant shrubs were sagebrush and several species of Atriplex. The whole area has been under cultivation for many years and except for some dry farmed or grazed portions, the original vegetation has given way to cultivated crops, vineyards, and orchards.

8. Fish and Wildlife. The Delta-Mendota Canal service area has been under cultivation in some areas more than a hundred years. The wildlife complex originally inhabiting the area has been drastically altered. The only mammals now found there are the smaller species which are capable of adapting to the changes wrought by man and agriculture.

Included are the opossum, racoon, Beechy ground squirrel, striped skunk, gray fox, cottontail rabbit, Botta pocket gopher, and a number of mice genera. The natural slough-grassland ramains have small populations of mink, river otter, beaver and muskrat. It is also possible that the blacktail deer and the coyote could occasionally be seen in the grassland.

Pheasants are common and valley quail occur where the agricultural land is bordered by adequate brush cover as along some sloughs and in the grasslands. The mourning dove is plentiful seasonally and nests where large bushes or trees are found.

The service area is noted for the waterfowl found seasonally in the grasslands and sloughs adjacent to the lower portions, generally to the east. Ducks and geese occur in large numbers and move onto the harvested fields. The presence of numerous gun clubs in this area attests to its importance for waterfowl.

The cultivated areas do not have a varied reptile or amphibian population. Agricultural practices tend to also discourage this form of wildlife. However, the northwestern fence lizard, California horned lizard, varigated

skunk, California striped racer, San Joaquin whip snake, Pacific gopher snake, valley garter snake, and western pond turtle occur wherever habitat remains. The western spadefoot toad, California toad, Pacific treefrog and bullfrog are not uncommon.

Fish life consists of generally the same species found in the Delta. Warm water sport fish include largemouth black bass, bluegill sunfish, green sunfish, brown bullheads, white catfish, channel catfish, crappie, and Sacramento perch. Nongame or forage fish include threadfin shad, carp, Sacramento squawfish, hitch, hardhead, and Sacramento large-scaled sucker. The striped bass, American shad, King salmon and steelhead trout pass through via the San Joaquin River or the Delta-Mendota Canal by capture at the Tracy Pumping Plant.

9. Rare and Endangered Species. The only rare or endangered species known to occur here is the Giant Garter Snake. Its range includes the sloughs and rivers of the lower parts of the service area. The Blunt-nosed Leopard Lizard includes this area in its range although the specific habitat required for this species occurs only in the upland portions and then in small amounts. The thick-tailed chub is found in the adjacent natural waters.

10. Vectors. As in other watered portions of the San Joaquin Valley, water associated vectors such as mosquitos abound and are prevented from becoming overwhelming by mosquito control programs. Both Aedes and Anopheles mosquitos occur and are important disease vectors of man and stock. Nonaquatic vectors such as fleas and ticks are carried by small mammals and can locally be dangerous disease carriers. Agricultural practices have tended to discourage this source except where produce is stored.

11. Recreation. Water based recreation is relatively abundant due to the nearness of the Delta, the San Joaquin River, the numerous canals and the San Luis-O'Neill Reservoir complex. The lower portions of the service area are in the famous grasslands of the San Joaquin Valley and famous for their waterfowl hunting. Numerous duck clubs exist in that portion of the state. In addition, dove and pheasant hunting is popular and productive. Other upland game such as cottontail rabbit is also plentiful. Fishing opportunities abound in natural waters bordering the lower sections of the service area as well as in manmade waters such as canals and waterways.

12. Historical and Archeological Sites. The National Register of Historic Places (36 F.R. 3310) has been consulted and no historic sites are present in the project area and none are currently being considered for registration. Some new lands are expected to be brought under irrigation and no archeological survey by a competent authority has been made. The area was known to be inhabited by Indian tribes and although much has been salvaged, it is probable that more exists.

13. Land Use. Irrigated agriculture within the Delta-Mendota Canal service area has been practiced since before the turn of the century. In the early days, as now, the primary source of water was and is surface supplies from the San Joaquin River and extensive canal systems. Agriculture today is still the principal activity in the area. In 1970 the total value of the agricultural production was just under $80 million.

The Delta-Mendota Canal, a unit of the Central Valley Project, is a principal source of water for the area. In addition to providing a water supply to the various districts along the canal, Delta-Mendota also provides exchange water to Mendota Pool to replace San Joaquin River supplies which are used in the Friant-Kern Canal and Madera Canal service areas. Over 200,000 acres of land are under irrigation from water supplied by Delta-Mendota Canal. Principal crops are barley, alfalfa, miscellaneous field crops, melons, tomatoes, and fruits and nuts.

Included within the service area are about 25 water service organizations, most of which receive full, supplemental or temporary water supplies through the Delta-Mendota Canal. The California Aqueduct also supplies some water.

Principal towns within the service area are Tracy and Los Banos. Other communities are Westley, Crows Landing, Newman, Gustine, Patterson, Dos Palos, Firebaugh, and Mendota. All of these towns primarily serve agriculturally oriented businesses and people. Food processing is the major manufacturing activity in the area.

The area has a good transportation network. The major north-south route is recently completed Interstate 5, the westside freeway. State Highway 33 is another north-south route, while the major east-west highways are 132

which runs from Modesto to Vernalis, 140 from Merced to Gustine, 152 through Los Banos and 145 to Firebaugh. A network of county roads also serves the area. The Southern Pacific Railroad parallels Highway 33 and extends through the service area from Tracy to Mendota.

In the eastern portion of the service area, from about Gustine to Dos Palos, is a 96,000-acre area referred to as the "Grasslands." The water rights to these lands were purchased by the United States in 1939 from Miller and Lux, Inc., for Central Valley Project purposes. These lands lie entirely below the Delta-Mendota Canal and are utilized primarily for waterfowl habitat along with livestock grazing. Water for waterfowl is supplied to Grasslands Water District, which lies within the Grasslands area, from the Delta-Mendota Canal under contract.

14. Air Quality. Air quality in the Delta-Mendota Canal service area is presently good except for seasonal agricultural dust from land preparations and burning of agricultural wastes. No heavy industry exists in the vicinity although Bay Area and Contra Costa County industrial air pollutants and smog occasionally are carried into this part of the valley.

15. Aesthetic and Scenic Values. These values for all practical purposes are nonexistent. The springtime display of orchard blooms and some wildflowers on the hills is pleasing. The lower areas still have waterfowl flights which can be spectacular.

16. Water Quality. Streams draining the low altitude Coast Ranges on the west side of the valley are small and flow intermittently, being dry several months each year. Their water is more highly mineralized than that of the east side streams, and at low flows is generally of poor quality. A large volume of water is imported into the subregion from the Sacramento-San Joaquin Delta by the Delta-Mendota Canal. The imported water is largely of Sacramento River origin and of good quality.

Salt Slough on the valley floor carries large volumes of irrigation drainage during the irrigation season. During the winter months it carries storm runoff and ground-water outflow. Water in the slough is generally sodium chloride in type, very hard, and occasionally is unsuitable for agricultural use.

Ground water west of San Joaquin River varies greatly in quality. Much of this water has high total dissolved solids, attributed to concentration by evaporation in areas where the water table is high, to intrusion of connate brines, and to recharge from highly mineralized west side stream waters and irrigation return flows. West side ground water contains significant concentrations of boron and sulfate, considerably higher than in water on the east side of the river.

Except for wells adjacent to the foothills of the Coast Range the quality of ground water in the Banta-Carbona area is generally classified as possibly harmful for irrigation use. Water from the foothill wells generally contains concentrations of boron which place the water in the possibly harmful category for irrigation. Average quality values are 830 mg/l total dissolved solids, 170 mg/l chlorides, and 1.0 mg/l boron.

The quality of ground water in the service area of the West Stanislaus Irrigation District and the El Solyo Water District requires modified farming practices such as additional leaching. The average quality is 770 mg/l total dissolved solids, 160 mg/l chlorides, and 0.9 mg/l boron.

Most of the wells in the Patterson Area are shallow. There are a few wells over 200 feet deep used for municipal, industrial and irrigation purposes. The shallow water is generally unsuitable for irrigation use. Median quality values are 1,000 mg/l total dissolved solids, 90 mg/l chlorides, and 0.7 mg/l boron. Sulfates also are excessive and average 450 mg/l for deeper wells and 650 mg/l for shallow wells.

The quality of ground water in the Orestimba Creek to Mendota area varies considerably from place to place. For this reason, the area has been divided into six subareas from north to south and average qualities computed for each. The following table lists the median quality of ground water in these subareas. Certain quality characteristics in four of the subareas are discussed briefly below.

In the Salt Slough-Los Banos Creek subarea there is a wide difference in quality between water in the shallow and deep aquifers. Average values shown in the following table pertain only to the deep aquifer. Available analyses of the shallow ground water also indicate very poor quality, with average values of 1,600 mg/l chlorides, 4.3 mg/l boron, 1,600 mg/l sulfates, and 77 percent sodium.

The Firebaugh subarea comprises a narrow band of land adjacent to the San Joaquin River, extending from the vicinity of Dos Palos south to Mendota Dam. Ground water in this strip of land is much less mineralized than in the other subareas listed; however, its high percent sodium makes it possibly harmful for irrigated agriculture.

The portion of the west side area south of Mendota is a small part of the larger Mendota-Huron area, where depths to usable ground water are great and the available ground water is being mined from storage. The water is of poor quality, with average concentrations of 1,700 mg/l total dissolved solids, 350 mg/l chlorides, 1.9 mg/l boron, and 730 mg/l sulfates. High sodium percentages average 67 percent and often exceed 75 percent. In spite of its generally poor quality, ground water in this area is usable for a limited number of salt tolerant crops because of favorable soil and drainage conditions.

F. MONTEZUMA HILLS UNIT AND SUISUN MARSH

1. General. The unit is located in southern Solano County, northeast of San Francisco. At the present time, outside of established municipal communities, there is no dependable water service of any appreciable significance in this area. There is a need and a potential for development of municipal, industrial, and more intensive agricultural land use in this area. Its location, about 30 to 40 miles northeast from San Francisco, highlights its importance for absorbing spillover from mushrooming residential growth of the Bay area, and providing recreational opportunities for the large metropolitan population.

   Elevations range from sea level in Suisun Marsh to elevation 390 feet in Montezuma Hills on the east. The topography ranges from gentle slopes to rolling hills. From an elevation of 10 feet in the small community of Dozier to the north, the land rises southward to a plateau and a series of rolling hills with a maximum elevation 386 feet and then drops rapidly to elevation 5 feet on the north bank of the Sacramento River.

   The Suisun Marsh adjoining the extreme western tip of the Delta in south-central Solano County consists largely of an intricate system of slough and channels separating land areas. It is comprised of about 84,000 acres of land and water in an area 20 miles long and 12 miles wide. About 55,000 acres of the marsh are leveed or partially leveed island areas lying below elevation 10 feet, and about 29,000 acres are water surface. The Suisun, Goodyear, Cordelia, Montezuma, Nurse, and Denverton Sloughs, and numerous other small waterways surround the land areas. Suisun Marsh area contains about 10 percent of California's remaining natural wetlands. It is an important feeding and resting area in the Pacific Flyway.

   There is a threat that future increases in fresh water diversions upstream will lengthen the duration of periods of high salinity in waterways of the marsh with a possible resultant decrease in waterfowl food production. A major function of the proposed unit will be to provide fresh water for the preservation of the Suisun Marsh.

In the Suisun Marsh-Montezuma Hills service area, the water supply of 250,000 acre-feet from New Melones (not including water quality releases) could be used in various combinations to serve all or part of the M&I, irrigation and/or wildlife habitat. Various combinations of use are possible. One alternative could be to use the New Melones yield for M&I and irrigation functions and other CVP supplies for wildlife maintenance. Another could be using the yield to meet all of the 150,000 acre-foot requirement for wildlife and the remaining 100,000 acre-feet for M&I and irrigation.

Water Requirements

	M&I	Irrigation (acre-feet)	Water quality and wildlife
Montezuma Hills	112,000	148,000	-
Suisun Marsh	-	-	150,000

The irrigation water supply of 148,000 acre-feet would be used to bring 54,500 new acres in the Montezuma Hills into production.

2. Climate. The Sacramento-San Joaquin Delta area has a mediterranean-type climate with warm, rainless summers and cool, moist winters. Cool ocean breezes entering the Delta area through the Carquinez Strait, very strong at times in the western portion, temper the extreme heat conditions which occur in other parts of the Central Valley. Prevailing winds over most of the Delta are from the west. The mean temperature is about 60°F. with 45°F. to 50°F. from December to March, and about 75°F. plus from June to September. Rainfall averages about 14 inches annually.

3. Geology. The Montezuma Hills Unit, in the southwestern corner of the Sacramento Valley is a topographic and structural basin underlain by a thick accumulation of sediments eroded from the surrounding mountains and foothills by the Sacramento River and its tributaries. The low

ridges east of the town of Vacaville are erosional remnants of older sedimentary material--the Tehama formation and related continental sediments which underlie the younger deposits throughout the plain. They are the principal source of ground water in many parts of Solano County.

A series of northwest-trending low ridges of bedrock extend from Vacaville to the Montezuma Hills. These low ridges and the Potrero Hills on the northern edge of the Suisun Marsh are considered to be marine deposits of Eocene age. The Montezuma Hills are an uplifted region of nonmarine sedimentary material of Pleistocene age. The basin deposits in the Suisun Marsh area are commonly composed of mud, muck, and peat.

4. Soils. The Montezuma Hills have clay soils developed from softly consolidated sediments under a grass cover. The soils, deep and well drained but slowly permeable, are best suited for sprinkler irrigation. Future land use is expected to be predominantly orchards and vineyards.

   Soils of the Suisun Marsh are composed of alluvial material from mixed sources. The surface layers of these soils are strongly acid, black, platy muck, or clayey muck which becomes strongly acid upon drainage. In general, the soils of the marsh are very deep, poorly drained, and strongly saline.

5. Hydrology. Principal streams of the Montezuma Hills service area are Denverton and Montezuma Sloughs along the western edge, and Cache and Lindsey Sloughs along the eastern edge. Water in Denverton and Montezuma Sloughs is unsuitable for domestic use because of high salt content from sea-water intrusion. Water from Lindsey Slough, supplied from the Sacramento River, is now being used for irrigation on adjacent lands. Water in Cache Slough is used for irrigation of adjacent lands and for municipal and industrial use by the city of Vallejo.

   In the flat plains of the unit service area just north of the Montezuma Hills, high ground-water table exists. All ground-water recharge from the higher elevation lands migrates to this area and natural drainage of subsurface water from this area is sluggish. As the result of winter rains, ground-water tables remain high through the early

part of the growing season. Much of this area would be restricted to the growing of shallow-rooted crops.

In the Montezuma Hills south of the flat plains, natural movement of ground-water recharge to lower elevations is good. Buildup of the water table due to agricultural development would be low, as the area is expected to be sprinkler irrigated and water application closely controlled.

6. Topography. Predominant landforms include dissected uplands and hills extending between Vacaville, Fairfield, and Rio Vista. Low terraces merge with the alluvial flood plain and into the slough area of the marsh. The flood plain lands adjacent to the streams are level to undulating.

7. Vegetation. The most abundant submerged waterplant in sloughs and ponds of the marsh is ditch grass, while horned pondweed, and sego pondweed are common in some localities. Extensive stands of the latter species have disappeared because of damage by carp.

Control of undesirable climax growth in the Suisun marshes is difficult because of high water tables. Vast flats are covered with pickleweed. Other marshy areas still have stands of brass button, saltgrass, and arrow grass interspersed with alkali bulrush, smartweed, dock, and baltic rush. There is a marked tendency for low growing desirable food plants, as well as shallow open water areas to be gradually replaced by dense stands of hardstem bulrush or tule, Olney bulrush, and cattail. Scattered here and there throughout the marsh are clumps of common reed, although this species has not become a major pest in this locality.

Plant species found growing on ditch banks, levees, and the drier parts of the marshes are too numerous for a complete list to be included in this statement.

Among the most prominent of these were fat hen saltbrush, Australian saltbrush, coyote bush, pigweed, alkali heath, gum plant, silverweed, and san spurry.

During 1959 the California Department of Fish and Game inventoried the vegetation in the Suisun Marsh. Three plant species occupied just over 50 percent of the estimated

50,534 acres covered by vegetation. Salt grass covered 25.7 percent, pickleweed 18.8 percent, and alkali bulrush 6.2 percent. Twelve other plants individually covered from 1 to 5 percent of the marsh, and together about 33 percent.

8. Fish and Wildlife. Important species of fish in the Suisun Marsh consist of white catfish, brown bullhead, largemouth black bass, sunfish, striped bass, American shad, king salmon, white sturgeon, carp and other fish species normally found in the Delta area.

   Varied wildlife species inhabit the marsh including long-tailed weasels, spotted and striped skunks, opossums, gray foxes, bobcats, minks, muskrats, river otters, beavers, racoons, cottontail rabbits, and black-tailed jack rabbits. The marshlands also host California quail, ring-necked pheasants, mourning doves, and a heron rookery.

   Isolated brackish tidal marsh areas provide habitat for five species of rails, coots, gallinules, marsh hawks, and many small animals.

   Waterfowl species native to, or wintering in, the marsh include pintail, American widgeon, mallard, shoveler, green-winged teal, ruddy duck, canvasback, scaups, gadwall, buffleheads, scoters, Canada geese, snow geese, and white-fronted geese.

   The marsh is a vital segment of winter habitat for waterfowl in the Pacific Flyway, with as many as 500,000 to 750,000 birds using it at any one time during midwinter of normal water years. Uses increase greatly in dry years when other areas are not so attractive. A population inventory conducted in January 1957 indicated that 20 percent of all waterfowl wintering in California were located within the Suisun Marsh.

   It is regularly a major wintering area for California's most numerous duck, the pintail. Other puddle ducks wintering in the area include the American widgeon, mallard, shoveler, and green-winged teal.

9. Endangered Species. Two species of rare or endangered fish occur in the Delta, the thick-tailed chub, and the Sacramento perch.

The greater sandhill crane is considered rare and occurs in the Delta. The range of the rare American peregrine falcon includes the Delta. A number of birds which have been considered for the rare and endangered list but whose status is yet undetermined also occur in the Delta. They include Anthony's green heron, American osprey, Samuel's song sparrow, and the Suisun song sparrow.

The Giant Garter Snake is an endangered species whose range includes the Delta.

10. Vectors. Suisun Marsh with its large surface area of standing water as well as the brackish tidal channels is a well known source of water associated nuisance insects. Mosquito abatement procedures using insecticides have been successful in some measure. The use of persistent insecticides is not compatible with the wildlife and policies function of the marsh and other methods of insect control are being sought by control agencies. The Montezuma Hills area, being higher and well drained, is not now a producer of aquatic associated vectors. Terrestial vectors such as ticks and fleas are associated with small mammals such as black-tailed jackrabbits and ground squirrels.

11. Recreation. At the present time the Suisun Marsh is used extensively for waterfowl hunting, bird watching and some warm water game fishing. The Montezuma Hills are not extensively used except for some pheasant hunting by private gun clubs.

12. Historical and Archeological Sites. There are no known historical or archeological sites in the area. The Potwin Tribe of the Wintun Indians inhabited the Suisun Marsh area and undoubtedly have left yet undetected archeological sites. An archeological survey by a qualified archeologist will be made before construction. The National Register of Historic Places has been consulted and no historic sites are listed for the project area.

13. Pattern of Land Use. In 1927 the State of California established the 1,880-acre Joice Island Game Refuge, and in 1948 the 8,560-acre Grizzly Island waterfowl management area. In addition to these State refuge areas, some 200 private duck clubs (ranging in size from 30 to 1,000 acres) own or lease a total of about 28,000 acres of the marsh.

Today, primary uses of the Suisun Marsh are for cattle grazing and waterfowl management. Only about 5,900 acres in the marsh are used for cultivated crops, chiefly grain and grain hay.

Lands lying within the proposed agricultural service area of the Montezuma Hills Unit are presently used primarily for livestock grazing, and dry-farmed grain or grain-hay.

14. Water Quality. Waters adjacent to Suisun Marsh face the serious threat of water pollution caused primarily by discharge of insufficiently treated municipal and industrial waste discharges from the Fairfield, Solano County area.

Salinity conditions in waterways of the marsh have progressively worsened since the early 1900's. The degree of salinity in the Suisun Marsh has been related to the total amount of seasonal streamflow out of the Sacramento-San Joaquin Delta to the east of the marsh, and to the volume of tidal flows in the Sacramento River in the vicinity of Collinsville. In addition to the effect on salinity levels in the marsh of upstream water diversion and use other contributory factors are the deepening and widening of the Sacramento River between Collinsville and the juncture of Cache Slough between 1913 and 1936 and the deepening and widening of the San Joaquin River between 1927 and 1933 for the Stockton Deepwater Channel.

15. Air Quality. Activities in the Suisun Marsh and, with the exception of seasonal agricultural burning, in the Montezuma Hills do not contribute to air pollution. The industrial area to the south in Contra Costa County and the exhaust from the jet aircraft at Travis Air Force Base both cause decreases in air quality over the area. The industrial source is the most obvious. Ocean breezes tend to keep the area clear although these too at times bring industrial and urban smog into the area from the San Francisco Bay complex.

16. Aesthetics and Scenic Values. This area is not noted for its scenic or aesthetic aspects. The appeal, however, of the large marsh area, its waterfowl, birdlife and unique assemblages of marsh plants is great. Many people apparently enjoy the unique experience the marsh furnishes. It contains about 10 percent of the remaining marshlands in California and is nationally an important example of estuarine marsh.

G. SACRAMENTO-SAN JOAQUIN DELTA WATER QUALITY

1. General. Quality of water in the Delta is determined by four major factors. These are: (1) Quality and quantity of inflow waters from the Sacramento and San Joaquin Rivers; (2) quantity of diversion and quantity and quality of waste return flows within the Delta; (3) the degree of mixing that takes place within the system of waterways; and (4) activities which change flow regimen of the waterways such as dredging for navigation and levee maintenance.

In the report, "San Joaquin Master Drain Effects of Water Quality on San Francisco Bay and Delta," January 1967, U.S. Department of the Interior, Federal Water Pollution Control Administration (now E.P.A.), current water quality data were used to establish the contribution of total dissolved solids (TDS), chlorides (Cl), total nitrogen (n), phosphorus (P), and biochemical oxygen demand (BOD) by streams tributary to the Delta. The quality data were adjusted to reflect median streamflow conditions for present upstream development by establishing a relationship between streamflow and pollutant load in pounds per day. As excerpted from table 16 of the above report, the resulting "design" quality inflow for the Delta tributary streams in a typical July and January for present conditions is shown in the following tabulation. (Eastern Delta streams include the Cosumnes, Mokelumne and Calaveras Rivers and Dry Creek.)

	Sacramento River	San Joaquin River	Eastern streams
		July Condition	
Flow, c.f.s.	10,968	902	309
TDS (mg/l)	123	684	139
Cl (mg/l)	14	166	14
N (mg/l)	0.3	1.0	0.3
P (mg/l)	0.07	0.25	0.07
BOD (mg/l)	0.8	2.2	0.8
		January Condition	
Flow, c.f.s.	21,509	2,228	1,138
TDS (mg/l)	88	308	88
Cl (mg/l)	8	86	8
N (mg/l)	0.3	1.0	0.3
P (mg/l)	0.07	0.16	0.07
BOD (mg/l)	0.8	1.2	0.8

The present quality of the Delta waters is generally adequate in most respects to maintain the beneficial water uses. The quality has generally improved over the last few years. The organic waste loads have been reduced by providing treatment facilities for both municipal and industrial waste sources. Also, salinity intrusion has been controlled by fresh water releases from reservoirs of the Central Valley Project. But, while evidence of gross pollution has been largely eliminated, the extremely rapid, recent growth in the tributary area population and industrial activity has left some problems unsolved and created new ones.

Water quality problems that exist at present in varying degrees in the Delta may be categorized as (1) eutrophication and related dissolved oxygen deficiencies; (2) salinity; (3) toxic materials; and (4) bacteriological quality.

2. Eutrophication and Dissolved Oxygen Deficiencies. The most significant enrichment problems in the Delta occur in the San Joaquin River, dead-end sloughs in the eastern Delta which receive wastes but have very little flow, and in the western Delta channels where municipal wastes together with industrial process and cooling water return flows constitute a potential problem to western Delta water supplies.

These problems occur mainly in the late summer and fall and coincide with low river flows, high temperatures, and the harvesting season when fruit and vegetable canneries are in full operation. During summer months, the San Joaquin River is essentially a waste drain enriched by agricultural, municipal, and industrial wastes. The river is extremely turbid as a result of silt accompanying drainage and high algal populations resulting from enrichment. Typical summer plankton counts in the Delta system have ranged from 3 million cells per liter in the Sacramento River at Walnut Grove to more than 70 million cells per liter in the San Joaquin River below Mossdale. These algal blooms occur almost every summer and are indicative of excessive enrichment of San Joaquin River waters.

Increasingly, in recent years, low dissolved oxygen levels have been recorded in the Delta. These low oxygen levels are attributable to respiration and decay of algae and to decay of wastes from municipal and industrial processes. The most serious impact from the low dissolved oxygen levels has been on salmon migrating through the San Joaquin and Old River systems in the vicinity of Stockton. The following tabulation of data from the Bureau of Reclamation's water quality sampling program show minimum dissolved oxygen in this area that was

recorded from 1968 through 1970. These low dissolved oxygen levels take place only in the dead-end sloughs of the eastern Delta and in the southeastern Delta channels such as Old River and the Stockton Ship Channel near Stockton. Low dissolved oxygen levels do not presently occur in the western Delta-Suisun Bay area. The mean dissolved oxygen reading from all stations in the Delta-Suisun Bay Surveillance Program for 1969 and 1970 was 8.9 mg/1, with dissolved oxygen levels seldom falling below 8.0 mg/1.

Station name	Minimum recorded D.O. (mg/1)
*Beaver Slough near Thornton	0.2
*Hog Slough near Thornton	3.8
*Sycamore Slough near Lodi	0
*Disappointment Slough near Lodi	0.9
Stockton Ship Channel at Light 40	3.6
Old River at Tracy Road	2.8
*Snodgrass Slough at Southern Pacific Railroad Bridge	4.0
*White Slough at Rio Blanco Tract	0.3

* Dead-end sloughs
(A minimum D.O. level of 5.0 mg/1 is deemed necessary for maintaining the Delta resident fishery and higher dissolved oxygen levels may be necessary for maintaining the migratory fishery.

3. Salinity. Due to seasonal salinity incursion into the extreme western Delta, municipal and industrial water diversions from the Delta waterways must be discontinued and process water purchased from the Contra Costa Canal, CVP, during the late summer months. Federal and State water quality standards for the western Delta now require maintenance of a maximum average of 1,000 p.p.m. chlorides (measured over a 2-week period) during a typical water year at Jersey Point (San Joaquin River) and Emmaton (Sacramento River). The average annual maximum seasonal salinity intrusion (average for the maximum month) at Jersey Point under CVP operating conditions from 1954 through 1968 has been about 750 p.p.m. TDS (300 p.p.m. CL). For similar hydrological years (natural Delta inflow index) under preproject conditions, the estimated average salinity at Jersey Point would have been about 1,400 p.p.m. TDS (600 p.p.m. CL).

Some increases in winter salinities in the western Delta have been recorded in the vicinity of the Contra Costa Canal intake during recent years. Based on water quality sampling data, these increases appear to be attributable to winter leaching of agricultural lands in areas of the Delta adjacent to Old River and along the San Joaquin River upstream of the Delta.

Table 20 of DWR Bulletin No. 123, "Delta and Suisun Bay Water Quality Investigation," dated August 1967 presents the average season quantities and qualities of agricultural drainage for the Delta in 1964. For August 1964 the drain flows amounted to about 1,200 c.f.s. and the quality averaged from about 240 TDS p.p.m. in the northern Delta, 676 TDS p.p.m. in the western Delta, to 860 TDS p.p.m. in the southeastern Delta. In January 1964, the drainflows amounted to about 1,600 c.f.s. and the quality averaged from about 860 TDS p.p.m. in both the northern and southwestern Delta, and 890 TDS p.p.m. in the western Delta.

A major portion of the southern Delta does not benefit by salinity reduction incident to present cross-Delta water diversion. A combination of depleted streamflows that contain a high proportion of drainage return flow due to upstream water use and municipal and industrial waste disposal within the channels degrade quality of water in this area. On some occasions in the past, this water quality degradation has produced high concentrations of TDS in water diverted to the Central Valley Project. Agricultural diverters using waters from the lower San Joaquin River have often been damaged in the past due to high TDS concentrations resulting from upstream agricultural return flows.

Water quality standards adopted by both the Federal and State Governments require maintenance of 500 p.p.m. TDS at Vernalis on the San Joaquin River in the extreme southern Delta.

Since the CVP began operation in 1944 ocean salinity has caused no major problems in the eastern Delta area. Salinities in some of the smaller channels rise during the summer months due to agricultural return flows and during winter months due to agricultural leaching operations. State and federally adopted standards require maintenance of typical year annual average TDS concentration of 450 p.p.m. or less at some control stations in the central portion of the Delta.

4. Toxic Materials. Waters flowing into the Delta are used and reused for agricultural purposes many times prior to reaching the Delta. During the course of this use, chlorinated hydrocarbon pesticides and organophosphate compounds accumulate in the water and are brought into the Delta. Municipal and industrial waste discharges, agricultural operations in the Delta, and accidental spills or discharges of chemicals also contribute to toxicity levels of Delta waters. The following tabulation excerpted from table 20 of the study report, "San Joaquin Master Drain Effects on Water Quality of San Francisco Bay and Delta," January 1967, U.S. Department of the Interior, Federal Water Pollution Control Administration, shows concentrations of pesticides in Delta waters for the period 1963-66 This tabulation derived from California Department of Water Resources data would be indicative of present levels of toxic materials in the Delta, with the exception of DDT and DDD compounds. Since the mid-1960's the use of nondegradable pesticides has declined, and there are indications that the pesticide levels in the Central Valley and the Delta have declined since the 1963-66 period, and will continue to decline in the future.

Pesticide Compound	San Joaquin River @ Vernallis			Sacramento River @ Walnut Grove			San Joaquin River @ Antioch		
	mean	peak	% [a]	mean	peak	% [a]	mean	peak	% [a]
Chlorinated Hydrocarbons									
(No. of Analyses)			(109)			(113)			(68)
DDT-DDD	<.070	.400	82	<.055	.200	75	<.058	.170	94
Toxaphene [b]	<.100	.930	32	<.040	.400	16	<.037	.320	6
DDE	<.032	.100	41	<.032	.100	46	<.030	.050	47
Heptachlor Epox.	<.032	.065	34	<.030	.040	48	<.030	.050	56
Lindane	<.031	.070	33	<.030	.070	32	<.032	.100	47
BHC [b]	<.030	.070	6	<.030	.100	9	<.031	.080	3
Dieldrin	<.032	.075	13	<.032	.150	16	<.033	.100	9
Heptachlor	<.030	<.030	4	<.030	.040	5	<.030	.030	0
Thiophosphates									
(No. of Analyses)			(60)			(52)			(49)
Parathion	<.060	13.9	5	<.060	5.08	4	<.060	5.30	4
Malathion	<.060	.120	8	<.060	.080	10	<.060	.080	6
Baytex	<.060	1.20	10	<.060	<.060	4	<.060	<.060	10
Ethion	<.060	<0.60	10	<.060	<.060	2	<.060	<.060	2

a % = percent of samples in which detected
b Presumptive

Fish kills caused by toxic waste discharges have occurred at various times. Industrial wastes have killed large numbers of fish in localized areas, and agricultural pesticides have been responsible for fish kills in the Delta and Central Valley. The majority of these kills were the result of accidental spills or discharges. Striped bass and other fishes have died during late spring and early summer for many years. The cause or causes are as yet unknown but seasonal changes in water quality and toxic pollutants are suspected. Pesticides are found throughout the waters and bottom sediments of the Delta system. The more persistent chlorinated hydrocarbon pesticides are uniformly found throughout the system at a higher level than the less persistent organophosphate compounds. The sediments having the highest pesticide content are found in the western Delta. The compound DDT was predominant in all samples.

5. Bacteriological Quality. Bacteriological quality of Delta waters as measured by the presence of coliform bacteria generally depends upon the proximity and method of pretreatment of wastes discharged into the Delta. Highest concentrations of coliform organisms are found in the western Delta.

Future enforcement of treatment requirements for municipal waste effluents discharging into receiving waters of the Delta and tributary streams by the State Water Resources Control Board plus waste discharge restrictions on commercial and pleasure boating should eliminate most problems of bacterial contamination.

SECTION III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTIONS

General. At this point in time it is impossible to identify either the exact location of New Melones water use or the quantity of water to be used in any given area. For analytical purposes, the impact of using New Melones water was developed for six alternative potential service areas on a per acre-foot basis. This was accomplished by analyzing several "demonstration areas" to determine the socioeconomic effect of a full water supply on areas which might receive service from New Melones. These effects were then reduced to values attributable to each acre-foot and it was assumed that similar values would be realized from each acre-foot of New Melones water which might be served in any of the six potential service areas. If for any unforeseen reason no water service were provided to these areas, benefits would still be realized through downstream releases to the Delta, as discussed elsewhere in this statement.

It is estimated that an annual quantity of 285,000 acre-feet of water would be made available by New Melones Reservoir. Of this amount an estimated average of 35,000 acre-feet annually will be used to improve water quality but could be recovered in the Delta area. This would leave 250,000 acre-feet for use in the local service area or with the recovered water quality water, the entire 285,000 acre-feet would be made available for export to areas served from the Delta.

The magnitude of the socioeconomic impact of using water conserved by New Melones Reservoir will vary depending upon in which area or areas the water is used. These varying potential impacts can be estimated by applying the previously indicated per acre-foot effect for each area to the New Melones water supply considered for use in that area.

Population Growth. A concern has been expressed over the continued growth of population and the concentration of people in metropolitan areas or the encroachment of urban populations on lands which are valuable agriculturally or aesthetically. The role of water supply and development in this process is frequently questioned. It has been suggested that imported supplemental water supplies should not be brought into metropolitan areas or agricultural areas adjacent to rapid growth zones as these will encourage further urban growth, sprawl, air, noise, and visual pollution. In addition, it has been suggested the availability of these water supplies will encourage urban developers to move onto more valuable agricultural lands. The secondary impacts associated with population may develop with or without water importation. The extent they develop is largely determined by the wisdom and efficiency of local governing bodies

which can promulgate zoning and building ordinances more favorable to land uses which suit the environmental setting.

The secondary impacts of additional and firm water supplies in the demonstration service areas are not clearly definable at this time. The development of State and local zoning regulations and their enforcement will control whether or not the service areas remain in farmland or are converted to urban, park, or industrial uses.

The addition of competitive irrigation water supplies should help agriculturists who are threatened by urban development to remain in agricultural production. Continuing overdraft of the ground water with the attendant lowering of the water table, in addition to causing land subsidence, and in some instances deterioration of water quality, also necessitates even deeper wells. This increases water costs beyond what the agriculturist can afford. Supplemental surface supplies will prevent this and thereby assist the farmer to resist urbanization and meet competition.

Impacts During Construction. Construction activities will, despite contractual provisions, result in some adverse impacts from noise, movement of heavy equipment and dust. These, however, will occur only during the construction period. Safety hazards will be increased during construction although contractual specifications are stringent.

There will be some temporary dislocation of transportation whenever construction of pipelines, ditches, or canals cross or in some instances parallel roads or highways.

Impacts on Delta. The impact of using New Melones yield on the Delta can occur in several ways. For the areas in which the delivery of New Melones water does not involve passing through the Delta pumping plants, such as the local service area or the Folsom South Canal service area, the significant effect would be the difference in inflow to the Delta from the San Joaquin River system. The actual inflow quantities would depend on the release pattern from New Melones when operated in coordination with other CVP facilities to meet the objectives of the Central Valley Project. Under an integrated operation, the total inflow from Federal sources would be the same, i.e., the quantity required to meet the Federal share to maintain such quality as may be determined necessary for the Delta.

If the total conservation yield of New Melones were to pass through the Federal and State pumping facilities, the 285,000 acre-feet would amount to 3.5 percent of the 8 million acre-feet expected to be pumped by the year 2020. Passing this additional water through

the pumps, however, will contribute further to the need for year-round pumping, a feature already required by the San Luis Unit and the California Aqueduct.

Year-round pumping may have some adverse effect on the fishery in the Delta. The pumping draft will be greater during the time of the downstream salmon migration and some salmon losses are probable. Anadromous fish species, salmon, striped bass, and shad occupy the Delta at the height of the pumping season and are subject to major pumping influence. Resident fish species, such as black bass, crappies, bluegills, and catfish are not affected to as great an extent since they do not have the migratory instinct and do not move downstream as part of their life cycle. With year-round pumping from the Delta, the hazard to Delta fishery is no longer merely seasonal. Losses of anadromous fish, particularly striped bass and shad, occur in the Delta because their young are so small when first hatched that it is virtually impossible to screen them out of the plants. The Tracy Fish Collecting Facility achieves an efficiency of up to 90 percent in salvaging salmon and striped bass over an inch in length by use of a louver-type fish diversion and collector. The State's Delta Pumping Plant uses a similar collection system. A portion of the larval and fingerling fish passing the pumps and taken into the canal system are lost to the Delta and their originating river systems, but a large proportion apparently finds its way into the San Luis Reservoir and the O'Neill Forebay where they are taken by anglers. The magnitude of the real loss, i.e., the fish irrevocably lost to the anglers, which can be assigned to the transfer of the New Melones yield, is still unknown. Methods for reducing this adverse impact at the pumping plants are still under study. A portion of the adverse effect on the fisheries will be corrected through construction of a Federal-State Peripheral Canal, which includes fish protection facilities at its intake, which is proposed as a means of diverting Sacramento River water into a hydraulically isolated channel around the Delta to the State and Federal pumping plants. The Bureau of Reclamation is presently preparing an environmental impact statement on the Peripheral Canal to accompany its feasibility report to Congress.

Interim measures to protect fish in the Delta prior to construction of the Peripheral Canal were agreed to in a Memorandum of Understanding approved on March 10, 1969, by the U.S. Bureau of Reclamation, the U.S. Bureau of Sport Fisheries and Wildlife, the California Department of Water Resources, and the California Department of Fish and Game. Measures to offset adverse effects of year-round pumping at Tracy include (1) improving fish salvage operation at Tracy, and (2) reducing pumping at Tracy and providing increased outflow during critical periods to the maximum extent possible consistent with other project purposes.

Return Flows and Drainage Needs. One of the more critical items in water resource planning and development is the disposal of unusable waste water (drainage effluent). Considerable consideration has been given to this matter by the Bureau of Reclamation with respect to the San Joaquin Valley.

The quantity of additional return (drainage) flows which might be expected from use of New Melones water would be highly variable depending on actual use. Return flows could vary from zero in the case where the supply was used for water quality in the Delta, or as a 100 percent replacement supply for a present source such as overdrafted ground water to a maximum return flow where the supply was used to irrigate all new lands.

It is anticipated that the most likely use of the water will be for use as a supplemental and replacement supply. Based on knowledge obtained from projects now in operation, it appears that the maximum additional surface drain flows which could be expected from the use of 250,000 acre-feet of water on new lands would be in a range of 15,000 to 20,000 acre-feet per year of maximum 200 p.p.m. on the east side of the valley, and about 25,000 to 35,000 acre-feet per year of 2,000 to 3,500 p.p.m. subsurface (tile) drain flows if used on the west side of the valley. The actual quantities should be much less since most of the yield is anticipated to be used as supplemental or replacement water supplies.

The San Luis Unit of the Central Valley Project includes the San Luis Drain, now under construction, to dispose of the subsurface agricultural drain flows from the service area. The San Luis Drain will be a concrete-lined canal extending from near Kettleman City, 188 miles northward to the western edge of the Delta near Antioch. Almost two-thirds of the way up, Kesterson Reservoir is being constructed and will provide regulatory storage for operational flexibility for controlling discharges into the Delta to periods when conditions in the Delta are most favorable. Drain flow treatment facilities, as needed, will also be provided to prevent any adverse effects of drain discharge on the receiving waters.

The feasibility report for the East Side Division (June 1966) considered that direct participation by the water users in a valleywide master drainage plan would be the most desirable and most likely method of disposal of the drain flows. However, as an alternative, it was considered that the Federal Government could participate in the master drain plan on behalf of the water users, and provisions for appropriate project cost and water service charge adjustments were included in this contingency.

A drain is important and necessary, but would not be needed for some period of time, possibly 20 years or more, after the project goes into operation. Before that time, it is probable that a master drain will be implemented.

After an almost 2-year study, the San Joaquin Valley Drainage Advisory Group, in its Final Report, January 1969, presented a possible plan that permits a greater degree of direct local participation than the master drain plan. The basic plan is the same in that the primary facility is an open-lined canal or canals located near the trough of the valley and discharging into western Delta receiving waters.

The report concludes that it is exceedingly difficult to accurately forecast the quantity or quality of drainage effluent which will occur in the future because of the quantity and quality of irrigation water applied within or upslope from the affected areas, the dissimilar nature of the soils involved, and the extent to which irrigation return flows are reused. The advisory group further concluded that disposal of unusable waste water could be provided by one or a combination of the following:

1. Exportation from the valley through one or more conduits.
2. Reclamation.
3. Irrigation of wildlife areas.
4. Evaporation.

For each particular area of the valley and the conditions there at a given time, an economic analysis would generally favor one of the above methods, or a combination of methods, over other alternatives. The methods can be expected to change from time to time in the future, as actual needs become more definitely known and as the users develop more knowledge concerning alternatives 2, 3, and 4 listed. Future advances in technology of waste water reclamation may change techniques and/or reduce the cost of drainage disposal and conveyance.

The key to successful handling of the drainage problems of the San Joaquin Valley is to provide an immediate economically and financially feasible drainage disposal facility for use by those areas with presently critical problems, and to permit a future determination of the most satisfactory long-range drainage disposal program for other areas.

The Bureau believes this is a logical approach to the dispersal of additional drain flows, if any, which may result from use of New Melones water supply which only would be a small part of the total drainage problem.

Impacts on Climate. The change of an ecological unit as large as the San Joaquin Valley from a mediterranian dry grassland in which virtually no rain falls from May to October each year, to a landscape in which irrigated crops are grown on hundreds of thousands of acres, has had an impact on the local climate. The valley is more humid and the extremes of summer temperature are believed to be moderated somewhat. No change in rainfall or season length has resulted. The valley as a whole, however, is a better place for man, although great changes have been brought about in the population of other forms of native animal and plant life as a result of the new water requirements. The effect of the New Melones yield on climate will be negligible when considered in the total amount of water used in the southern San Joaquin Valley.

A. LOCAL SERVICE AREA

1. General. Use of New Melones water yield in the local four-county service area would be multipurpose in nature to meet the needs of a supplemental water supply for both municipal and industrial and irrigation uses. Provision for use of a portion of the reservoir yield for fishery and water quality releases is covered in the main section of the environmental statement on New Melones Lake.

   New Melones Lake, through storage, will make an additional 250,000 acre-feet of water supply available annually over the scheduled releases to be made for fishery and water quality purposes.

   The New Melones supply would not be adequate to meet all of the indicated water requirements of the four-county local service area. If the 250,000 acre-feet of yield were to be used in the local area, its type of use can not now be specifically stated. However, it is expected that about 100,000 acre-feet would be used to meet municipal and industrial needs while the remaining 150,000 acre-feet would be for irrigation. The irrigation supply could satisfy about 35,000 acres of new irrigation at a rate of 3 acre-feet/acre and about 50,000 acres of supplemental irrigation at rate of one acre-foot/acre.

   It is assumed that the 35,000 acre-feet released downstream from New Melones Dam for Stanislaus River water quality

maintenance would not be recoverable for use in either the local service area or the San Joaquin County portion of the Folsom South Canal service area.

2. Hydrology. The most significant impact on surface hydrology would be the increase in return flows to the small local streams and drainages. Even with diversion of this portion of the yield out of the Stanislaus River for service to the local area, there would be an improvement in flows in the lower river over those which occur historically. The following tabulation shows the average monthly flows at Ripon which would have occurred (based on 1921-46 period of study) under project operation and under existing conditions. The average monthly flows reflect the release of water for minimum flows needed for fish and flows needed for water quality purposes. The approximate reach of river at which most of the diversions would occur is below Knights Ferry.

Month	Average monthly flows (c.f.s.) below Knights Ferry with service to local area	Average existing monthly flows (c.f.s.)
Jan	197	370
Feb	384	1,199
Mar	424	1,654
April	135	1,582
May	282	2,409
June	297	920
July	132	30
Aug	130	0
Sept	132	0
Oct	190	0
Nov	194	0
Dec	223	87

In the 5 months from July through November, there would be flows averaging well in excess of 100 c.f.s. where little or no flow now exists. Flood control and conservation storage would reduce the high winter-spring flows down the river and into the Delta severalfold. There would be no significant effect on the Calaveras and Tuolumne Rivers.

The impact on the ground-water supplies of the area would be most significant in the lower basin area where some portion of the water applied to the land for irrigation would percolate to recharge the ground-water basin. The

ground-water overdraft in the San Joaquin County portion of the service area would be diminished by reduced pumping and recharging from new surface supplies.

3. Fish and Wildlife. Conversion of lands from native pasture to irrigated farmland or suburban living sites will result in loss of big and upland game habitat. Native habitat along the intermittent streams should improve with additional return flows in the summer months and birds and small furbearers as a whole should be benefited.

Pheasants should increase in numbers with the newly irrigated lands of the service area. California quail populations on the service area will be reduced since these birds will not inhabit intensively irrigated areas except where they adjoin brushy habitat. Quail numbers should increase on the eastern portion due to interspersion of native pasture and brushy draws with the irrigated lands. It is expected that, overall, quail populations would decrease moderately with this plan of project operation.

Conversion of dry farmed and grazing lands to irrigation will result in a minor decrease in dove densities and harvest. Rabbit numbers and harvest should increase slightly with the project. Fur animals, especially muskrat, racoon, and skunk, would benefit from development of the area.

It is estimated that, overall, the development would provide a net increase in upland game hunting.

There would be some increase of waterfowl nesting along drains where suitable habitat develops. Water from irrigation return flows should benefit by making temporary water areas permanent, thus attracting increased waterfowl. Any existing marsh or wet areas which might be reclaimed for cultivation would reduce waterfowl habitat.

The benefits to fishery in the lower Stanislaus River are discussed in the environmental statement proper. There would be no measurable effect on the fishery resources of the Calaveras and Tuolumne Rivers.

Some of the lower intermittent drainage courses would provide additional angler days of warm water fishing with their improvement in flow due to irrigation return flows.

In the Folsom South Canal service area portion, the agricultural development entails conversion of some sloughs and marsh areas to farmland, which will result in a slight loss to resident fish. However, many of the drains and lower drainage courses will provide warm water game fish habitat. Drainage flows from the service area and waste water from the canal will benefit fish life in Littlejohns Creek, Dry Creek, Calaveras River, and Mormon Slough. Largemouth bass, bluegill, sunfish, and catfish will be benefited. It is estimated that streams and sloughs in the service area with the project will provide a net increase in fishermen-days.

Conversion of dry farmed and grazing lands to irrigated crops could result in a 10 to 15 percent decrease in dove densities and harvest. Rabbit numbers and harvest will increase slightly with the project. Based upon hunter use trends and land use changes, it is estimated that the development will provide a net increase in hunter-days for upland game.

Fur animals, especially muskrats, racoon, and skunks, will benefit.

On the Folsom South service area, there will be some increase of waterfowl nesting along the drains where suitable habitat develops. Marsh areas of the service area may be reclaimed and cultivated thus reducing waterfowl habitat. In general, the changes are expected to more or less balance. The net project effect is expected to be a slight increase in duck nesting and a slight decrease in duck and goose wintering use, with waterfowl harvest remaining unchanged.

4. Vectors. The provision of an additional water supply to irrigate lands in the area may aggravate existing mosquito sources and create new aquatic habitats favorable for mosquito production unless appropriate prevention and control measures are provided.

5. Recreation. The impact on the recreation directly associated with the Stanislaus River is covered in the main section of this environmental statement. The most significant impact on recreation that could occur with the local service area would be provision of a water supply to Stanislaus County for the purpose of maintaining a higher water level in Woodward Reservoir during the recreation season. Stanislaus County has indicated some interest in such a supply and some discussions have been held on the

matter. The use of New Melones water supply in the local service area would not affect other recreation activity to a significant degree.

6. Historical and Archeological Sites. Use of the water in the local service area would have no effect on historical sites of either local or national significance. The most likely impact would be disturbance by land development of midden which may exist at ancient Indian village sites.

7. Land Use. The agricultural development would entail conversion of some 50,000 to 70,000 acres of land from dry farming to irrigated farming. There would be some land leveling in connection with change to irrigated farming. This probably would be minimal since much of the irrigation, particularly in the foothill areas, would be of the sprinkler-type irrigation. Incidental to the preparation of land for irrigation, some sloughs and marsh areas would be converted to farmland with the resultant loss of aquatic plants and wildlife habitat found in these areas.

   The native grasses which sprout in the spring and turn dry and brown in the summer and fall would be replaced with such irrigated crops as orchards, alfalfa, irrigated pasture and miscellaneous field crops.

8. **Water Quality. If the New Melones yield of about 250,000 (not including water quality releases) acre-feet per year is used entirely within the local service area, changes in water quality within and downstream of the local area may occur due to increased municipal, industrial, and agricultural uses. These changes are not expected to be significant.**

   If New Melones water were used for an industrial supply, that estimated ultimate demand would be about 56,000 acre-feet per year. The additional waste discharges from this supply are not expected to significantly affect water quality in the local service area, however, since basin waste discharge requirements to be implemented by the State Water Resources Control Board will upgrade the effluent quality from future municipal and industrial waste discharges in the area over existing quality levels.

   The ultimate irrigation supply which might be used within the local service area from New Melones is estimated to be about 194,000 acre-feet per year. The effects of the additional return flows from this supply on the mineral concentrations of local service area water are not expected

to be significant, since the New Melones ultimate irrigation supply represents an increase in present irrigation use within the local service area of less than 10 percent. Furthermore, to the extent that the New Melones supply would replace existing or future ground-water use for irrigation, the salt loads in the irrigation return flows would be reduced since New Melones supplies would have a much lower mineral concentration than ground-water supplies in the basin.

The effects of waste discharges from existing and future developments on basin water quality will be protected by water quality control plans implemented by the State Water Resources Control Board. To protect and enhance the quality of the Stanislaus and San Joaquin Rivers, water quality control flows of up to 70,000 acre-feet per year will be released from New Melones Reservoir. It is expected that these releases will help to maintain high dissolved oxygen levels in the Stanislaus River, lower the existing mineral concentrations in the San Joaquin River near Vernalis during the irrigation season, and aid in reducing the low dissolved oxygen condition which occurs in the San Joaquin River near Stockton during the fall.

9. Air Quality. The most significant potential change in air quality would be the increase in air pollutants due to a greater population in the area. The entire increase cannot be attributed to the project water supply, however, since normal growth patterns would dictate that most of the population influx would occur in any event, although the availability of a water supply would probably have some influence in this regard.

   Industries which have a high air pollution potential are not projected for this area.

10. Aesthetic or Scenic Values. The conversion in land use from native vegetation to irrigated agriculture would replace the spring growth of native grasses and wildflowers with cultivated crop vegetation. In the case of new orchards, the scenic values would turn to spring blossoms followed by green leafed trees during the summer months, to vivid leaf colorings in the fall. There would be some loss of natural environment in areas which became cultivated or were converted to suburban-type permanent or recreational residence areas.

11. Socioeconomic Factors. Economic impact on the local service areas was considered from the upper and lower counties' standpoint. Tuolumne and Calaveras Counties are the upper counties, while San Joaquin and Stanislaus Counties are the lower counties. These four counties have indicated a water need far exceeding the New Melones water supply.

For demonstration purposes, the values derived in an analysis of the Stockton-East Water District can be used for the lower service area. The upper service area is also agriculturally oriented but less intensive in use. Information developed for Sonora-Keystone area could be used as a corollary area for the upper service area.

The lower service area has highly intensive land use. Availability of water is directly related to the productivity and the intensity of land use in the area. A wide variety of agricultural crops are produced in the area of analysis. The values derived in the Stockton-East Water District analysis reflect this diversity and intensity.

The analysis of the effect of local use of New Melones water in both the local service and the Folsom South Canal service areas included the listing of various facets of the local economy. These factors were projected to the year 2020 to help demonstrate the with and without adequate water supply acre-foot values in the area. Table 2 gives the with values and table 3 presents the without situation. The following tabulation shows the increase associated with adequate water supply:

Item	Increase	
	Total (000's)	Per acre-foot
1. Population	148.0	1.18
2. Number employed	58.1	.46
3. Personal income	587,560.0	4,696.72
4. Assessed tangible property valuation	353,720.0	2,827.50
5. Annual property tax	40,748.6	32.57
6. Taxable retail sales	275,280.0	2,200.48

In the preceding demonstration, water was considered the limiting growth factor of the local economy. With the current overdrafting situation, a salvation supply is needed to maintain the existing economic level.

Table 2. Stockton-East Water District - With adequate water supplies.

Year	Population Estimate	Water Reg. for Study Area	Gallons Per Person	Number Employed	Income	Assessed Value	Average Tax	Taxable Retail Sales
	Thousands People	Millions Gallons	Thousands Gallons	Thousands People	Thousands People	Thousands Dollars	Thousands Dollars	Thousands Dollars
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1970	169.7	74,165.0	437.0	66.5	673,709	405,583	46,723.2	315,642
1980	208.1	81,510.0	391.7	81.6	826,157	497,359	57,295.8	387,066
1990	250.4	92,787.5	370.6	98.2	994,088	598,456	68,942.1	465,744
2000	295.1	99,385.0	336.8	115.7	1,171,547	705,289	81,249.3	548,886
2010	342.6	103,935.0	303.4	134.3	1,360,122	818,814	94,327.4	637,236
2020	398.1	109,362.5	274.7	156.1	1,580,457	951,459	109,608.1	740,466

Column:
(1) Based on Census Tract Data for 1970 and growth following series D growth rate.
(2) Water from Division of Water and Land Operations.
(3) Column 2 divided by column 1.
(4) Based on percent of total population in Stockton SMSA in 1970 (39.2 percent).
(5) Based on 1970 San Joaquin County average per capita personal income ($3,970).
(6) San Joaquin County 1970 average per capita assessed value of tangible property ($2,390).
(7) San Joaquin County 1970 average per capita tax ($9.45/$100).
(8) San Joaquin County 1970 per capita retail sales ($1,860).

Table 3. Stockton-East Water District - Without additional water supplies.

Year	Available Water Supply	Gallons Per Capita	Population Estimate	Number Employed	Income	Assessed Value	Average Tax	Taxable Retail Sales
	Millions Gallons	Thousands Gallons	Thousands People	Thousands People	Thousands Dollars	Thousands Dollars	Thousands Dollars	Thousands Dollars
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1970	56,550.0	437.0	129.4	50.7	513,718	309,266	35,627.4	240,684
1980	64,512.5	391.7	164.7	64.6	653,859	393,633	45,346.5	306,342
1990	67,015.0	370.6	180.8	79.9	717,776	432,112	49,779.3	336,288
2000	67,957.5	336.8	201.8	79.1	801,146	482,302	55,561.2	375,348
2010	68,445.0	303.4	225.6	88.4	895,632	539,184	62,114.0	419,616
2020	68,705.0	274.7	250.1	98.0	992,897	597,739	68,895.5	465,186

Column:
(1) Water from Division of Water and Land Operations and Division of Design and Construction (ground water + New Hogan water + Calaveras River water).
(2) From table 2, column 3.
(3) Column 1 divided by column 2.
(4) Based on percent employed of total population in Stockton SMSA, 1970 (39.2).
(5) 1970 San Joaquin County per capita personal income ($3,970).
(6) San Joaquin County 1970 per capita assessed value of tangible property ($2,390).
(7) Per capita average tax, San Joaquin County 1970 ($9.45/$100).
(8) San Joaquin County 1970 per capita retail sales ($1,860).

Using the assumption that the per capita consumption will be at a projected rate, and the indicated supply available in year 2020 without additional sources, the incremental population growth was determined. For the demonstration area, there would be 148,000 fewer people or about 1.180 per acre-foot of water not furnished.

In 1970, 39.2 percent of the total population in the Stockton standard metropolitan statistical area were employed. Based on this percentage, 58,100 fewer people would be employed in the demonstration area without a full supply of water.

Personal income, in the demonstration area, would be over 1/2 billion dollars less. This value was derived by applying the 1970 San Joaquin County per capita income ($3,970) to the reduced population.

The assessed tangible property valuation would be reduced by over $2,800 for each acre-foot of water lacking. This in turn would lead to over $32 less in annual property tax.

The State of California would receive tax from about $275,280,000 less taxable retail sales. Using a 5 percent sales tax rate, $13,764,000 less income from the demonstration area would be available to the State.

As can be seen from the above values, all levels of the economy would be affected by the lack of water in the demonstration area. The lack of these funds would affect all facilities and services offered the public.

Tuolumne County has indicated a need for 25,000 acre-feet of municipal and industrial water and Calaveras County 4,000 acre-feet. It is recognized there is not an immediate need for all of this water, however, future demand for the water should occur. Using a per capita requirement of 0.3 acre-foot of water per year, the municipal and industrial water would satisfy the needs of about 83,000 people in Tuolumne County and about 13,000 people in Calaveras County.

Based on the above population estimates and 1970 county per capita values, at least a portion of the effect of the local use of the water can be quantified. These financial losses are illustrated in the following tabulation.

Item	Per capita value	Total value
1. Personal income		
a. Tuolumne County	$3,110	$258,130,000
b. Calaveras County	3,070	39,910,000
2. Assessed value of tangible property		
a. Tuolumne County	3,700	307,100,000
b. Calaveras County	5,660	73,580,000
3. Average tax		
a. Tuolumne County	$8.76/$100	2,690,000
b. Calaveras County	$7.10/$100	522,000

Water used in the upper basin portion of the local area for agricultural purposes would furnish primarily a new water supply. These areas would be further developed to intensify the current livestock-oriented agricultural economy. Most of the lands in the upper service area would fall into the lower land classes. Based on information developed for the Sonora-Keystone analysis, these lands would be furnished about 2.87 acre-feet per irrigable acre.

If the local service area is not developed, it is expected that the agricultural economy will continue on the current basis. Based on this assumption, the following tabulation presents some of the per acre-foot values which would be foregone from not developing the agricultural potential of the area.

Item	Per acre-foot
1. Increased production of farm goods	$187
2. Increased farm investment	636
3. Increased real property taxes	7
4. Increased net farm income	58
5. Movement of increased production through channels of trade	30

All of the above items are annual values except item 2. In addition to the listed items, the irrigation function will create an increased demand for goods and services in the local service area, the State and the Nation as a whole. Many studies have been completed which indicate the multiplier effect that increased agricultural production has on the economy. As an illustration, a study showing the current impacts of irrigated agriculture on the Nebraska economy was

completed. The following tabulation gives the impact per dollar of net increase of agricultural output:

Current Impacts			
Direct	Induced-by	Stemming-from	Total
1.0	1.29	4.39	6.68

If this multiplier were applied to the projected increase in production of farm goods, a tremendous impact would occur.

For analytical purposes, it was determined that the Stockton-East Water District would also demonstrate the effect of New Melones export water on the Auburn-Folsom South Unit. The District includes the wide variety of problems found within the other areas of the unit.

Water requirements are mostly met through ground-water pumping. It is handled independently by the farmers, and most of the municipal and industrial water supply for the city of Stockton is provided from the ground-water basin. As the ground-water level decreases, the quality of ground water within the district deteriorates. Continued lowering of ground-water levels in the district has caused contamination in some areas of better quality as a result of salt water intrusion. It is estimated that the water table is receding from 1 to 2 feet per year.

Stockton-East Water District's present water supply consists of available ground water, conservation yield from the New Hogan Project, and a small water right on the Calaveras River. Total additional study area needs were estimated in 1970 to be about 54,200 acre-feet annually. Derivation of the study area needs is shown in the following tabulation:

Item		Water in acre-feet[a/]
Water requirement for study area		
Agricultural	179,200	
Municipal and industrial	49,000	
		228,200
Safe water supply		174,000
Study area water needs in 1970		54,200

a/ Based on information from Division of Design and Construction. Includes ground-water supply, New Hogan supply and Calaveras River supply.

Agriculture is important to the socioeconomic well-being of the study area, county, State, and Nation as a whole. Availability of water is directly related to the productivity and the intensity of land use in the area. The study area produces a wide variety of agricultural products. An indication of this diversity is given in the annual Agricultural Report of the San Joaquin County Agricultural Commissioner. The following tabulation shows the gross sale value of various categories of agricultural production in San Joaquin County in 1970.

Item	Gross sales value in 1970 (millions $)
Field crops	52.6
Vegetable crops	51.3
Fruit and nut crops	63.3
Seed crops	3.9
Nursery products	2.0
Livestock and poultry (animals)	15.8
Apiary products	.2
Livestock and poultry products (milk & eggs)	51.2
Total	240.3

In addition to the items already discussed for both service areas, the additional water supply would have many other socioeconomic effects on not only the area of water use but also the surrounding area. These effects were not quantified and are listed below.

a. The added tax base will make possible new and improved community services, i.e., schools, fire protection, sewage disposal, public libraries, police protection.

b. With the additional development, jobs would be created helping with unemployment and population dispersion problems.

c. The improved and sustained condition will offer additional varied recreational opportunities to users from a wide area.

d. More full-time farm units will help with population dispersion and income redistribution.

e. Increased food production will benefit all groups within the world's population.

B. SOUTHERN SAN JOAQUIN VALLEY

1. General. The use of New Melones water yield in the Pixley Irrigation District would be primarily for supplemental purposes. The most significant impact would be to permit the continued use of lands for agricultural purposes and alleviate ground-water overdraft and land subsidence.

   The water requirements of that portion of the southern San Joaquin Valley which could be served by the estimated annual yield of 250,000 acre-feet from New Melones are as follows:

   a. New irrigation - 8,000 acres at 3 acre-feet/acre.

   b. Supplemental irrigation - 225,000 acres at 1 acre-foot/acre.

   These figures are based on the assumption that 10 percent of the supply could be used for new lands although the most likely use for the whole supply would be for supplemental irrigation.

   An additional 35,000 acres of supplemental irrigation is possible if the full 285,000 acre-feet of New Melones yield, which would be available in the Delta, is used.

2. Land Use. In addition to permitting land already used for irrigated agriculture to remain in that use some lands not now irrigated would receive water. These are now either dry farmed or grazed. Some of them have been irrigated in the past but removed from this use because of needs elsewhere in the district. There is not expected to be a significant impact from changes in land use. No further urbanization or industrialization is expected to occur.

3. Water Quality. The water delivered to southern San Joaquin Valley from New Melones Project would supplement or replace in part existing irrigation water supplies. Providing supplemental water to irrigated lands would result in a relative increase in the total dissolved solids deposited in the soils or ground water within the Tulare Lake Basin. Providing a replacement water supply to those areas which are presently served from ground water would be expected to improve the overall quality of the ground and surface water and the conditions within the port root temporarily. This would result from the replacement of relatively high

saline ground water (about 800 mg/l median value) with the 200-300 mg/l from the Sacramento Delta. However, the relative benefits from importation of a better quality water will eventually be masked by the overall degradation of the ground-water supplies from the long-term deposition of salts from the irrigated agricultural lands throughout the basin. The only long-term solution which presently seems feasible is a surface drain which will convey subsurface waste water (high in TDS) to the Delta or other more desirable points of disposal.

4. Fish and Wildlife. The project service area has long been committed to agriculture. Normal wildlife associations have been disrupted and only those animals and birds that adapt to close association with man and manmade environments now exist.

   An additional supply of up to 10,000 acre-feet could be provided to the Pixley National Wildlife Refuge which is adjacent to the district, including the Kern National Wildlife Refuge. This additional supply would make possible the preservation and enhancement of waterfowl resources and result in an increase of 36 million days of waterfowl use.

   There would be no effect upon the pheasant and quail population if no new lands were irrigated.

5. Rare and Endangered Species. The Giant Garter Snake requires an aquatic habitat. The continued use of irrigation water and drains will have no effect on the existing environment which would be attractive to this animal. The San Joaquin Kit Fox will not be affected since the effect of the operations will be to maintain present land use patterns. The Blunt-nosed Leopard Lizard could lose more of its territory in the lowermost or western portions of the area.

6. Vegetation. The provision of a supplemental water supply to an already intensively developed agricultural area will not deplete the limited supply of natural vegetative cover in the service area. No change in the vegetative types is expected due to the project, and vegetative cover will continue to vary according to the cropping patterns.

7. Air Quality. No changes in air quality of the service area are expected. Since the water provided will be largely to supplement existing supplies or to replace ground water

the use of the area's resources is not expected to change to uses which will contribute to further air quality degradation

8. Socioeconomic Factors. To demonstrate the effect of the New Melones export water on the East Side Division area, the Pixley Irrigation District was chosen for analytical purposes. The PID is located entirely within Tulare County about 45 miles north of Bakersfield and 16 miles south of Tulare.

   The district lands are contiguous and comprise a net area of about 70,000 acres. It is about 18-1/2 miles by 8 miles, roughly rectangular in shape. Included within the district boundaries is about 5,000 acres in the Pixley National Wildlife Refuge.

   Water supplies are derived from direct precipitation, temporary import of Friant-Kern water, and by pumping from the San Joaquin Valley ground-water basin. The contribution to the water supply of the area from natural runoff is minor. The delivery of water from the Friant-Kern Canal has resulted in a general slowing down of the decline in ground-water levels. However, these supplies have not been sufficient to meet all overdrafts and serious water shortage conditions continue to build.

   The substantial and increasing water needs of the East Side area can be met only through importation of additional supplies from surplus water sources outside the area. An estimated 1 million acre-feet or more are annually now being obtained by overdrafting the ground water in the San Joaquin Valley.

   Unless the declining level of ground water is stabilized one of the major agricultural producing areas of the Nation will be in serious jeopardy. Tulare County continually ranks in the top 10 producing counties nationally. The study area is an important producing unit of the county and follows general land use pattern of the county. An indication of the wide diversity of agricultural production is shown in the following tabulation of gross sale values in 1971 of Tulare County:

Item	Gross Sales Value in 1971 (millions $)
Feed crops	75.8
Seed crops	.1
Vegetable crops	13.5
Fruit and nut crops	190.8
Nursery products	2.9
Livestock and poultry	67.0
Livestock and poultry products	52.3
Apiary products	.2
Total	402.6

The district is lightly populated at the present time containing about 1,600 people in the 1970 census. No major industrial development is anticipated in the future within district boundaries; therefore, a slow growth rate is anticipated. However, the production from within the Pixley Irrigation District creates a demand for processing and marketing facilities in the surrounding areas. Also, the goods and services needed will stimulate growth in many areas. Based on the census tract data for 1970 and growth generally following a series D growth rate with a depressed growth rate after 1980, the following population is estimated for the Pixley Irrigation District.

Year	Population
1970	1,600
1980	1,900
1990	2,100
2000	2,200
2010	2,250
2020	2,400

Presently about 49,000 acres are under irrigation in the Pixley Irrigation District. Water requirements are met from ground-water pumpage (120,600 acre-feet) and temporary import of Friant-Kern water, about 30,000 acre-feet annually. Ultimate demand for the District is 171,200 acre-feet annually. The safe-ground yield is 76,000 acre-feet annually, leaving an import requirement of 95,200 acre-feet.

The present overdrafting situation creates many adverse conditions. A general land subsidence is caused and a cone of depletion which has a tendency to concentrate any water quality problems. The declining water level increases the

associated pumping costs. Each additional foot of lift increases the pumping costs by $0.067 per acre-foot lifted.

Water is very much the limiting production factor in the highly productive PID. An adequate supply must be maintained to continue the intensive land use now occurring in the district. Each acre-foot of water not available to the agricultural economy will have the following effects in benefits foregone.

Item	Per acre-foot value
1. Decreased production of farm goods	$119
2. Decreased net farm income	49
3. Movement of decreased production through channels of trade	36
4. Decreased land values	260
5. Taxes gained from increased land values	3

As can be seen from the above values, all levels of the economy would be affected by the lack of water in the demonstration area. The lack of these funds would affect all facilities and services offered the public.

Also, the irrigation function will create a tremendous demand for goods and services in the local service area, the State and the Nation as a whole. Many studies have been completed which indicate the multiplier effect that increased agricultural production has on the economy. As an illustration, a study showing the current impacts of irrigated agriculture on the Nebraska economy was completed. This study indicates that each dollar of net increase of agricultural output will have an impact of $6.68. The following tabulation gives the various categories of impacts considered.

Current Impacts

Direct	Induced-by	Stemming-from	Total
1.0	1.29	4.39	6.68

With the agriculturally oriented economy of Tulare County, any reduction in the production of agriculture raw products will directly affect the growth of the county. Some of this effect can be illustrated with the 1970 Tulare County per capita values.

Item	Per capita values
1. Personal income	$3,370
2. Assessed value of tangible property	2,520
3. Property tax	228

In addition to the items already discussed, the water supply would have many other socioeconomic effects on not only the area of water use but also the surrounding area. These effects were not quantified and are listed below.

a. The added tax base will make it possible for new and improved community services, i.e., schools, fire protection, sewage disposal, public libraries, and police protection.

b. The added job opportunities would assist in the population dispersion from overcrowded areas.

c. Income redistribution will benefit the economy.

d. Increased production of goods and services will benefit many areas of the Nation and the world.

C. SAN FELIPE DIVISION

1. General. One of the motivating forces behind the San Felipe Division was the deterioration of environmental conditions in the San Felipe service area. The service area has changed from an area of abundant ground-water supply with artesian wells to one of ground-water supplies depleted to such an extent as to cause land subsidence. This subsidence is the result of pumping more ground water than natural forces can replenish, resulting in a decline in ground-water levels. This decline causes an increase in the intergranular effective stresses in the water yielding deposits which results in the compaction of these deposits. Subsidence in the San Jose metropolitan area alone has caused millions of dollars worth of damage.

   The San Felipe Division will provide enough water in order to reduce the ground-water pumping in the confined area of fine soils and very slow water movement. Reducing the pumping in this confined area will allow the hydrostatic head to return to normal, preventing further compaction and subsidence of the soil. The return to normal hydraulic gradients in the ground-water basin will also prevent any salt water intrusion from San Francisco Bay.

   The Watsonville area at the mouth of the Pajaro River has an existing ground-water trough inland from the ocean where some wells have been capped because of high salinity content. Delivery of San Felipe water along the Pajaro River flood plains and plateaus along the coast is expected to bring the ground-water gradient back to normal and thus eliminate this undesirable salt-water intrusion.

   The Hollister Basin has an area of approximately 4,000 acres where concentrations of boron in the ground water are greater than 2 p.p.m. The use of this water for irrigation has caused a considerable buildup of boron in the soils, with corresponding losses to agricultural crops. Since 1935, 3,000 acres of irrigated agricultural land have been reduced to native pasture or dry farming grain. The exact monetary damage to the farmer is difficult to document but one measure of the losses caused by boron is the $1,200/acre reduction in appraised value. By meeting the entire water requirement of the area with San Felipe water, the boron will leach out of the upper soils to lower strata and the land will return to its normal productivity. Return of this land to agricultural productivity will balance some of the losses to urbanization which have occurred in Santa Clara County.

The San Felipe water for the Hollister Basin will be delivered through canals and conduits. The number of faults, ground-water barriers and ground-water quality in this area made it infeasible to distribute water through percolation ponds to the ground-water basin. The construction of canals and conduits will have an effect on the environment of the area by reserving lands for these purposes rather than agricultural, urban or other uses.

San Felipe Division water requirements are estimated to be as follows:

Subarea	M&I	Irrigation (acre-feet)
North Santa Clara	161,300	5,700
South Santa Clara	27,800	15,500
Hollister	12,000	34,000
Watsonville	6,300	10,700
	207,400	65,900

2. Land use Patterns. Changes in land-use patterns have been major within the San Felipe Division's service area. Where a scant 20 years ago orchards and truck gardens occupied the area, these now have succumbed to urbanization, with acres of homes predominating. These changes in land use which are altering wildlife populations will occur with or without the additional water supplied by the division. The provision of an additional water supply may allow continued urban expansion in some areas. The growth trends and opportunities of the region, and location near the San Francisco Bay metropolitan area, show large increases in population can be expected in the San Felipe Division area. To accommodate this population growth, urban areas are expected to eventually occupy nearly all of the north Santa Clara subarea and some portions of the south Santa Clara subarea. Substantial expansions of urban areas are expected in the Hollister and Watsonville subareas.

About one-half of the agricultural land of the north Santa Clara subarea is already occupied by urban use, and this trend is expected to continue either with or without San Felipe Division water supply. Continued urban growth around the towns of Morgan Hill, Gilroy, Hollister, and Watsonville, and around smaller communities will take additional agricultural land out of production.

One effect of the San Felipe Division will be to sustain considerably more land in irrigation than would be possible

without the project. This is particularly true in the south Santa Clara subarea. Without the project, future urban growth would necessarily take place on the valley floor, as in the north Santa Clara subarea, to obtain the ground-water supply, or, if located in the foothills, would derive its water from the existing ground-water supply and eliminate irrigated agriculture. With project water supplies there will be opportunity for urban development on nonirrigable land in the foothills around the valley areas. It is estimated that about 33,000 acres of land in the north and south Santa Clara subareas will be sustained in irrigation use by the San Felipe Division due to providing water for municipal and industrial use. This is irrigated land which would otherwise be taken for urban use.

In the Watsonville subarea there is the threat of loss of about 6,500 acres from irrigated agriculture due to the intrusion of salt water into the ground-water supply. The San Felipe Division project plan could prevent this loss by furnishing a substitute water supply.

In the Hollister subarea there are irrigable lands not presently irrigated due to lack of a satisfactory ground-water supply. Part of these lands are underlain by ground water containing boron in quantities too great for irrigating economical crops. In other areas, low well yields make the ground-water supply too expensive for economic irrigation use. About 16,000 acres can be brought under irrigation by providing a suitable water supply to such areas of need.

There are minor irrigable areas in the south Santa Clara subarea not presently irrigated or not fully irrigated due to difficulty in obtaining economical ground-water supplies. It will be possible to add about 7,000 acres to irrigation in this area; however, the amount lost from irrigation due to urban encroachment in other parts of the south Santa Clara subarea will exceed this amount.

3. Construction. Excavating the balance of the 10.3-mile-long Pacheco Tunnel would produce about 338,300 cubic yards of material which will have to be disposed of. An allowance of 50 percent is usually made for swelling and the required volume for a disposal area would be about 507,500 cubic yards.

Seven disposal areas were investigated by the Bureau of Reclamation. Each of the areas investigated would provide space for the entire 507,500 cubic yards of material because it is not known at this time whether all or part of the tunnel excavation would be wasted in any specific disposal area.

Pacheco Tunnel has been completed to station 199+17. The balance of the tunnel (8.6 miles) could be excavated from one or several headings depending on several factors such as type of excavating machines, distance of hauling material, and the right-of-way cost of disposal area.

Three disposal sites were investigated at an adit site near station 199+17, identified as Lakeside Adit. Sites No. 1 and 2 would provide a relative short haul for wasting material but the greater portion would extend onto private property. Site No. 3 extends eastward from the adit location and is entirely a Government right-of-way. The disposal site would be about 2,000 feet in length between contour elevations 560 and 621 feet. When disposal of materials in this area is completed, it could be used as a parking lot for the California State Beaches and Parks or some other recreation facility. The eastern end of this area is adjacent to old State Highway 152, which is now used by the public for entrance to the recreation area at Dinosaur Park for boat launching and fishing on San Luis Reservoir.

The South Fork of Pacheco Creek flows north across the tunnel centerline at station 486+45 and provides a reasonable location for a second adit. A disposal area for excavated tunnel material would be located south of the adit and on the east side of the creek between elevations 525 and 663 feet. The length of this spoil area would be about 1,200 feet and completely out of sight of highway traffic.

The tunnel would terminate near the eastern edge of Pacheco Creek Channel. Two sites were investigated at the outlet portal. Wasting tunnel material at this site could be used to support an old hillside slide which lies over the tunnel centerline in this vicinity. The disposal area would be between contour elevations 345 and 450 feet. This site would probably be visible from Pacheco Pass Highway.

Two additional sites were investigated which are located about 1 mile south of the outlet portal. Wasting material in either of these two areas would have a relatively low profile and be completely hidden from view by surrounding growth. Both sites are located on private property.

Excavating the Pacheco Tunnel from more than one heading would reduce the volume of the spoil areas discussed above.

4. Distribution System. In order to transport water to the four subareas, 104 miles of open and closed conveyance systems would be constructed. This system for the most part would be constructed on medium to steep side hills.

The 27-mile-long Santa Clara Canal lies adjacent to the Calaveras Fault. To prevent damaging effects from earthquake shocks the canal section in cross slopes steeper than 5:1 would be placed so that it is completely in undisturbed material with the top of the lining a minimum vertical distance of 3 feet below natural ground surface. In cross slopes greater than 2:1, a rectangular canal prism would be used. There are two potential slide areas along this canal alinement with a total distance of 50,000 feet. The preliminary design through these areas assumed the water would be conveyed through concrete pipe. Construction scars from construction of the open canal would be visible from the county road which parallels the foothills and also possibly from State Highway 101 some 2 to 4 miles to the west. The pipe sections could be buried and the natural slope of the hills retained. While construction scars could not be entirely eliminated, with time, natural grasses would cover the exposed slopes.

The conveyance system serving the Hollister and Watsonville area consists of 64 miles of open concrete pipelines. Except for the alinement through Chittenden Pass, the terrain is generally moderate and with smaller canal capacities, construction scars would be less severe than with the Santa Clara Canal. Here also slopes would soon be covered with native vegetation.

Conveyance of water from the main canals to the farms would be accomplished by buried concrete pipes and except for the initial construction, no adverse effects are anticipated. Exact delineation of the distribution system was not possible because individual irrigators must make the decision, considering cost and value of project water supply in comparison to their own ground-water supplies. It is estimated that there will be a considerable area that uses both ground water and project water on individual farms.

5. Recreation. The recreation facilities to be provided at Hudner Reservoir (as a Federal component) would be: Access and circulatory roads, 320 parking spaces, 2 launching ramps, 90 picnic units, 90 ramadas, a beach and a bathhouse, and 2 comfort stations. In addition, 3 miles of fencing, ground improvement, a water supply, and signs would be provided.

A new water-oriented recreation area accommodating 120,000 new days of recreation visitation will be created by Hudner Reservoir. Specific facilities that would be added are shown in the following tabulation:

	Units	Number
Land	acres	235
Water	acres	60
Family picnicking	sites	1
Family picnicking	tables	90
Boat launching	ramps	2

If additional recreation land could be made available adjoining existing non-Federal reservoirs, percolation ponds and some selected stream channels in Santa Clara County, a substantial recreation potential could be realized. As many as 400,000 additional recreation days could be realized. Because such land acquisition was not assured, the evaluation of the recreation aspects of the project was made without considering the potential of these lands. However, the Santa Clara County plans for countywide park development include, among other items, increasing the number of reservoir parks fourfold.

The import of water to the San Felipe Division would have the following significance:

a. Improve flow of water down Coyote Creek, Los Gatos Creek, Guadalupe River, and Pacheco Creek.

b. Will enhance recreation use and development of Anderson, Coyte, Calero, Lexington, Vasona Reservoirs and Camdon Percolation Pond by stabilization of water levels.

c. Will assist in maintenance of fishery in above areas by assuring adequate water levels for survival.

It was determined that although substantial benefits would accure and such recreation opportunities would be undoubtedly needed, the provision of land and recreation facilities at the non-Federal reservoirs and streams would be only of local significance and should not be the responsibility of the Federal Government. Credit is only claimed for that portion of the possible total recreation benefits that can be assigned to provision of a water supply for this purpose.

6. Fish and Wildlife. Recreation opportunities and fishery environment will be enhanced at seven existing Santa Clara County reservoirs and their connecting stream channels by providing greater water storage and live streams for a longer period. The imported San Felipe Division water will allow the Santa Clara County Flood Control and Water District to maintain permanent pools in these reservoirs, which periodically are dry, in addition to maintaining live streams. This will increase the opportunities for sports fishing for warm water species in the various county reservoirs, percolation ponds and streams.

There is a remote possibility of introducing undesirable fish species from the Delta into Calero Reservoir via the California Aqueduct, San Luis Reservoir, and Pacheco Tunnel. However, this possibility is not considered serious. Some adverse impact on fishery resources will continue as a result of increased pumping from the Delta at the Tracy Pumping Plant.

The canal and pipeline right-of-way runs generally along the toe of the hills. It effectively separates the dry land pasture and natural oak woodland from the irrigated and developed valley floors. In some instances, e.g., along Pacheco Creek in the canyon, the canal will cut off wildlife from its most readily available water source, e.g., Pacheco Creek. Other less dependable sources are available in the surrounding hills in the form of seeps, springs, and some small stock impoundments. The black-tailed deer is the most obvious mammal affected by this kind of impact although all other small mammals such as squirrels, rabbits, racoons, bobcats, coyotes, and skunks will also be affected. The very small mammals such as mice and wood rats have other sources of moisture and will not be affected.

There will be no large effect on birdlife except to improve the water opportunities for them. There is always the chance, however, that some species which are more terrestrial than others such as the California quail may fall into the canal and be unable to get out because of the steep sides.

The canal itself will not be a good fishing water and will probably be restricted because of safety reasons. However, recreation opportunities and fishery environment will be enhanced at seven existing Santa Clara County Flood Control and Water District reservoirs and their connecting stream

channels by providing greater water storage and permanent pools. Live streams can be maintained for a longer period. The natural waterways and reservoirs which will be benefited either directly or by return flows will provide better habitat for sport fish such as largemouth bass, catfish, and where appropriate conditions exist, trout, as well as native fish such as minnows and suckers. There will be increased opportunities for sports fishing for warm water species in the various county reservoirs, percolation ponds and streams.

It is quite possible that some of the Delta associated species such as the striped bass which are brought into the San Luis Reservoir via the California Aqueduct may find their way into the several reservoirs and provide sport fishing.

Three unique subspecies of fresh water fish occur in the streams tributary to Monterey Bay. The reintroduction of similar Central Valley species through water imports would result in hybridization. It is possible sanctuaries exist in other Monterey Bay streams and it is equally possible the Pajaro River stocks may have already disappeared due to introductions, water use, or other reasons.

Some reptiles will find the canal a barrier, but most species are nonmigratory except for a brief period in the spring and most lizards and snakes will be able to escape from the canal. Frogs will find it no barrier, but toads will not survive.

There will probably be secondary impacts on wildlife brought about by the land use changes made possible by the introduction of an adequate and firm surface water supply into the service area. In the portions where agriculture becomes more intensive, less natural habitat will be left for wildlife use accompanied by some loss of hunting opportunities. Nonconsumptive wildlife uses such as bird watching will be less affected but changes in the composition of birdlife will also cause changes in this form of use. In the instance of sections where urbanization or industrialization takes over, the movement of wildlife out of the area will be virtually complete except for resistant species such as squirrels, racoons, and opossums.

7. Archeological and Historic Sites. The richness of the early history of both the aboriginal and imposed cultures creates a potential for damage to archeological sites yet unknown.

8. Socioeconomic Factors. The irrigation, municipal and industrial, recreation, fish, and wildlife aspects of this division will improve the economic and social well-being of the basin residents by enhancing their health, leisure-time activities, and income levels.

San Felipe Division will provide a number of new jobs, ranging from 60 in the first year to 875 in the fifth year of construction. About 85 employees will be needed to operate the facilities. Unskilled construction workers' wages will total about $1,144,000 over the construction period of about 7 years. Unskilled and semiskilled operation and maintenance jobs in San Benito County, considered an economically depressed area, will be worth about $66,500 per year after the project goes into operation. Merchants and service industries will benefit from the increased purchasing power of these previously unemployed laborers.

Our latest information shows the increase in value of farm products made possible by project water deliveries amounts to about $19,200,000 annually under full irrigation development conditions. Crop and livestock production expenses, including interest and taxes, aggregate $12,700,000.

In addition to the increased income to farmers, contract operators engaged in such operations as picking, hauling, and packing vegetables, and digging and hauling sugar beets, receive substantial income benefits. The increased contribution to contract farming operators totals about $3,700,000, of which about 45 percent is paid out by contract operators in wages.

Local processors of the increased agricultural production made possible by the project will increase their volume of business by some $23,500,000. Of this amount, about $7,900,000, or 34 percent of all processing plant costs, will be in the form of wages paid, or in equivalent terms, for the employment of 1,580 full-time workers at an average salary of $5,000 annually. Interest on investment or paid to local lending institutions and business profits will amount to about $1,500,000 annually. The remainder of the $23.5 million of annual operating costs will be divided as follows: $8.7 million for supplies such as cans for apricots and cartons for vegetables; $1.8 million for depreciation and repairs of processing equipment; $0.6 million for taxes; and $3.0 million for utilities and miscellaneous expenses.

In addition to the onfarm and local processing sectors, the impact on local merchants, farm machinery and supply establishments, local truckers and other derivative businesses will be substantial. The difference between the farmers' gross and net farm income of $12.7 million is money largely spent among the local derivative businesses.

The Hollister subarea was chosen to demonstrate more specifically the effect of New Melones export water on the San Felipe Division.

Agriculture in the demonstration area would generally follow the distribution indicated by the San Benito County gross sales values. In 1971, vegetable and row crops lead the list with over one-third the total value, followed by fruit and nut crops and livestock sales. Tomatoes have the largest sales value of the individual crops. Feed grains are produced in small volume and are used to sustain the existing livestock and poultry enterprises. The following tabulation gives distribution of gross sales for San Benito County in 1971:

Item	Dollars (millions)	Percent
Fruit and nut crops	8.0	22.2
Vegetable and row crops	13.9	38.6
Livestock	6.3	17.5
Field crops	4.6	12.8
Livestock products	2.2	6.1
Poultry	1.0	2.8
Total	36.0	100.0

The Hollister study area will have a total average annual water requirement of 96,290 acre-feet. Of this total, 40,050 will be needed from an import source. The above data are based on year 2020 needs for municipal and industrial water. Irrigation water will be used about half for new lands and half for supplemental supplies. The irrigation use will build up over a 10-year period.

Hollister subarea is and will remain an agricultural center. The land resource is very good, the area climatic conditions and the market demands all lend themselves to maintaining the current economic makeup of the area. An indication of the quality of the land resource may be obtained from the following tabulation of land classification in the Hollister subarea:

Land class	Acres	Percent
Class 1	15,829	32.0
Class 2	17,812	36.0
Class 3	14,873	30.1
Class 4	961	1.9
Total	49,475	100.0

Historically, population growth within the Hollister study area has averaged around 2 percent annually since 1940. The study area includes the incorporated communities of Hollister and San Juan Bautista plus the unincorporated rural areas within the study area. The following tabulation illustrates the population growth within the Hollister study area, both historical and future, with adequate water supplies:

		Incorporated		
Year	Total	Hollister	San Juan Bautista	Unincorporated
1940	5,927	3,881	678	1,368
1950	7,714	4,903	1,031	1,780
1960	9,252	6,071	1,046	2,135
1970	11,856	8,000	1,120	2,736
1990	18,620	12,400	1,920	4,300
2020	31,100	20,700	3,200	7,200

Industrial development within the study area is oriented chiefly by the areas' agricultural economic base. An estimate of present and future municipal and industrial water requirements, on a gallon per capita per day annual basis, is illustrated by the following tabulation:

Year	Population	g.p.c.p.d.	Acre-foot annual factor	Total a.f. requirements
1970	11,856	291	0.3259	3,863
1990	18,620	344	0.3860	7,187
2020	31,100	346	0.3876	12,042

The future total water demand of 96,290 acre-feet is associated with an area population estimate of 31,100 or 3.096 acre-feet per person. Using this value, the 40,050 supplemental demand could be associated with about 12,900 people. With the 1970 San Benito County per capita figures, the following tabulation illustrates the general magnitude of such a population reduction in the Hollister subarea:

Item	Total	Per acre-foot
Personal income	$48,246.000	$1,200
Assessed tangible property valuation	53,535,000	1,340
Annual property tax	3,619,000	90

In the preceding demonstration, water was considered the limiting growth factor of the local economy. A supplemental supply is needed to maintain the current growth level and existing economic level.

Personal income, in the demonstration area, would be about $50 million less. This value was derived by applying the 1970 San Benito County per capita income ($3,740) to the reduced population.

The assessed tangible property valuation would be reduced by over $50 million using 1970 values. This in turn would lead to about $3,619,000 less in annual property tax.

As can be seen from the above values, all levels of the economy would be affected by the lack of water in the demonstration area. The lack of these funds would affect all facilities and services offered the public.

Also, the irrigation function will create a tremendous demand for goods and services in the local service area, the State and the Nation as a whole. Many studies have been completed which indicate the multiplier effect that increased agricultural production has on the economy. As an illustration, a study showing the current impacts of irrigated agriculture on the Nebraska economy was completed. This study indicates that each dollar of net increase of agricultural output will have an impact of $6.68. The following tabulation gives the various categories of impacts considered:

Current Impacts			
Direct	Induced-by	Stemming-from	Total
1.0	1.29	4.39	6.68

In addition to the items already discussed, the water supply would have many other socioeconomic effects on not only the area of water use but also the surrounding area. These effects were not quantified and are listed below.

a. The added tax base will make it possible for new and improved community services, i.e., schools, fire protection, sewage disposal, public libraries, police protection.

b. The added job opportunities would assist in the population dispersion from overcrowded areas.

c. Income redistribution will benefit the economy.

d. Increased production of goods and services will benefit many areas of the Nation and the world.

9. Water Quality. The water delivered to the San Felipe Project Service area from New Melones will be of the same quality as projected for the San Luis Reservoir. The quality of the import supply from the San Luis Reservoir will be about: (1) 200 to 250 mg/l TDS; (2) less than 5 mg/l nitrates; and (3) $<$ 0.5 mg/l boron.

The recommended drinking water limits by the U.S. Public Health Service is 45 mg/l nitrate and 500 mg/l TDS. The water supply from San Luis Reservoir will meet these standards, whereas several of the existing ground water sources in the San Felipe area do not.

The proposed open conveyance systems will include bypass facilities to exclude pollutants from adjacent land runoff.

The sea-water intrusion which is now polluting the ground water basins will be reduced with the importation of surface water supplies. The reduction of the ground water overdraft will serve to maintain and enhance the hydraulic barrier and, thus, restrict the intrusion of sea water.

The increase in irrigated agricultural lands (15,000 acres) projected for the project service area will increase the amount of agricultural return flows in the river. However, since the

project irrigation water has significantly less total dissolved solid concentration than the historical ground water supplies, the quality in terms of T.D.S. of the receiving waters will be improved under project conditions.

Both increased agriculture and M&I wastewater return flows could result in an increase in biostimulants in Pajaro River. However, the water quality objectives being considered by the California State Water Resources Control Board in their basin plan should limit the quality of discharges into the Pajaro River System. The Board is responsible for the implementation of these objectives through establishing water quality limits on individual discharges.

D. SAN LUIS UNIT

1. General. The assured irrigation water supply will tend to insure the expanded and continued use of the service area's land for agricultural purposes. The additional production will require either new agricultural suppliers of equipment and materials or expansion of present facilities. Some expansion of product processing and handling facilities either in the towns bordering the district or at points within easy transport will be needed. Additional land will be used for farmstead and farm access roads, but no extensive urban development is expected to occur since the district is within easy commuting of larger centers, the climate is unattractive, and the land is more valuable for irrigated agriculture.

Without additional water supplies, the existing irrigated farmlands will be forced to rely on overdrafting the ground water. As a consequence, ground-water levels will continue to lower and costs of pumping will continue to rise until many of the operators are economically forced out of production with consequent losses in food and fiber production, loss of investment, increased unemployment, and significantly curtailed economic activity. In addition, lowering ground-water levels will aggravate land subsidence.

The San Luis Canal and the Coalinga Canal present a barrier and a hazard which restrict the movement of man, livestock, and wildlife. Frequent canal crossings break the barrier. Fencing and escape devices in the canal are installed to reduce the hazard to children and animals.

The San Luis and Coalinga Canals and the Dos Amigos and Pleasant Valley Pumping Plants modify the natural surroundings. During construction, ground contours were rounded to blend with the natural terrain. Natural revegetation of the pumping plant areas and extensive seeding of canal banks has effectively achieved aesthetic harmony with the adjacent farmlands.

In the Westplains portion of the San Luis Division, the New Melones yield would be used for a supplemental irrigation supply. This would permit the area to irrigate all of its lands as needed rather than just some portion each year. This supplemental surface supply would also relieve the burden on ground-water pumping.

2. Vegetation. A marked change will occur with the introduction of domestic irrigated crops and a firm surface water supply. Dryland farming and the grasslands will almost completely disappear in the district, and the character of the landscape will change to irrigated orchards, pastures, and row crops. Class 6 land which is not suitable for irrigation can be expected to remain in its present use category of dry farming or grassland.

3. Fish and Wildlife. Dry grassland species of mammals will be replaced by those which tolerate man and irrigated lands. Beechy ground squirrels can be expected to increase in waste areas on the edge of cultivated fields. Botta pocket gophers and moles are not compatible with irrigated agriculture. Skunks, opossums, and racoons readily adapt to man's presence and will be favored by firm water supplies.

   No fisheries now exist in the service area. The source of water for the district, however, would be via the Sacramento-San Joaquin Delta and the San Luis Canal.

   Birdlife will be changed and the grassland species will largely be replaced by those tolerant of irrigated farmlands. Pheasants will become more important as game birds. Quail will be enhanced by the firm water supply, particularly if suitable cover is available. Doves may initially decline, but as orchards develop and their favorite foods such as turkey mullein (Eremocarpus setigerus) move into the waste areas, they will recover to at least their former level of abundance.

4. Endangered Species. The San Joaquin Kit Fox will lose more of its restricted range. It has not been observed in the area and is most likely confined to the westernmost portion if it is to be found anywhere in the district.

   The Blunt-nosed Leopard Lizard has a very specialized niche and is not found in grass or heavy vegetation. It prefers a sparse shrub habitat with open ground areas. The land in the district most suitable for this lizard is typified by class 6 type soils. The development will therefore have little impact on this species.

   The California Condor has not been observed in this portion of its range for many years and its feeding areas do not now include the area. The project will have no impact on this bird.

The Giant Garter Snake is an aquatic snake; the increased water supply to the service area should have a beneficial impact on the population of this snake.

5. Vectors. Additional irrigation and the potential for standing water will create conditions favorable for mosquitos. Since the wastelands adjacent to agricultural areas, canals, and roads are excellent habitat for the Beechy ground squirrel, this vector carrier is expected to increase. Rabbits of two kinds occur; the black-tail hare is a creature of open unirrigated fields and will decrease. The cottontail is expected to become more plentiful. Both species carry disease vectors of concern to man.

6. Recreation. Because open grasslands will be converted to intensive irrigated agriculture the freedom of movement of hunters will be restricted. More pheasants, quail, and after a few years doves will be available to the hunters.

7. Water Quality. Rising shallow saline ground-water tables are a consequence of continued and more intensive irrigation in the absence of underground drainage.

   All irrigation waters contain dissolved minerals or salts. The ground-water supplies in the service area have from 1,200 and 1,500 milligrams per liter of total dissolved solids and the import supplies have about 200 to 300 mg/l TDS. Growing crops concentrate these salts within the root zone until they exceed the plant's tolerance. Sufficient additional water must be applied to leach the salts out of the root zone. This process is impeded by impervious soils which underlie the permeable soils of the higher lands and occur at the surface in the lower lands, and shallow saline water tables are expected to gradually build up. Without irrigation water these lands would not be agriculturally productive. With agricultural water they are, but would eventually become unproductive even with irrigation water unless drainage is provided to maintain shallow, saline ground-water levels below the crop root zone.

   Therefore, a drainage collection system and a drainage disposal facility, the San Luis Drain, will be available so that individual irrigators can install field drainage systems to provide subsurface agricultural drainage. The complete description of the drain, its functions,

and impacts are found in the final environmental statement on the San Luis Unit CVP, California (INT. FES 72-36, October 4, 1972).

Irrigation return flows will be required to be recirculated on the lands where they originated, and thus will not affect adjacent landowners or streams. Since there will be no outflow of surface drainage from the district lands, the only possible outflow would be subsurface drainage. As indicated by data from tile drains in the San Joaquin Valley, herbicides and pesticides are normally broken down biologically as they move through the soil. Therefore, no adverse impact is expected from this source. Some increase in the total dissolved solids should be expected to be added to the ground water from those areas which change from dry farming to irrigated farming.

8. Air Quality. During construction, dust and noise can become a problem. After construction, noise will no longer be evident, but dust from agricultural activity and smoke from agricultural burning may be noticeable. However, on those areas now being dry farmed, the increased moisture in the soil from irrigation and the increased vegetative ground cover should decrease the amount of dust blown into the air.

9. Socioeconomic Factors. If export water were available from New Melones, the Westplains service area of Westlands Water District could receive a more firm supply. The service area lies along the foothills of the Coast Range on the western edge of the Westlands Water District.

   The service area has a highly intensive agricultural land use. With adequate water, the intensive land use will continue. The area has an excellent land resource, with most of land classified as class 1 or 2.

   Although the area does not produce the wide variety of crops that Fresno County does, the total county production can be used to reflect the highly intensive land use of the area. The tabulation following shows the gross sale value of various categories of agricultural production in Fresno County in 1970:

Item	Gross sales value in 1970 (millions--$)
Field crops	139.5
Seed crops	17.5
Vegetable crops	39.7
Fruit and nut crops	172.6
Nursery products	.7
Livestock and poultry	103.4
Apiary	.4
Total	473.8

The Westplains service area does not have a large livestock and poultry industry within its boundary. However, the area does produce feed for the livestock and poultry-oriented industry located in Fresno County and adjacent areas.

The area is sparsely populated with few people living on their farms. Many operators are moving to small towns or villages and commuting to their farming operations.

Although the demand for municipal and industrial water is small it is important. In the absence of any major prospective industrial development, future demand is likely to remain relatively small.

If import water were not available, much of the current supply would have to come from ground-water sources. The quality of the ground water varies throughout the service area, but much of it is of marginal potability. Large costs are incurred, without import water, to obtain the quantity and quality of municipal water required.

If the Westplains service area does not receive a firm supply of irrigation water, the agricultural economy will be limited to short-term grazing during years of exceptional winter rainfall. Based on this assumption, the following tabulation presents some of the per acre-foot values which would be foregone from not retaining the agricultural potential of the area:

Item	Per acre-foot
1. Increased production of farm goods	$170
2. Increased farm investment	414
3. Increased net farm income	66
4. Movement of increased production through channels of trade	55
5. Increased land values	223
6. Increased land taxes	6

All of the above items are annual values except items 2 and 5. In addition to the listed items, the irrigation function will create an increased demand for goods and services in the local service area, the State, and the Nation as a whole. Many studies have been completed which indicate the multiplier effect that increased agricultural production has on the economy. As an illustration, a study showing the current impacts of irrigated agriculture on the Nebraska economy was completed. This study indicates that each dollar of increase of agricultural output will have an impact of $6.68. The following tabulation gives the various categories of impacts considered:

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b. The added job opportunities would assist in the population dispersion from overcrowded areas.

c. Income redistribution will benefit the economy.

d. Increased production of goods and services will benefit many areas of the Nation and the world.

E. DELTA-MENDOTA CANAL SERVICE AREA

1. General. The Delta-Mendota service area as a whole has been intensively farmed for many years. The provision of supplemental water supplies will keep the lands in agriculture use.

   The irrigation water supply which might be obtained from New Melones would amount to about 113,000 acre-feet annually which can be apportioned as follows:

New irrigation - 32,000 acres at 3 acre-feet/acre =	96,000 acre-feet
Supplemental irrigation - 16,800 acres at 1 acre-foot/acre =	16,800 acre-feet
	112,800 acre-feet

   In addition, 1,330 acre-feet per year would be used by private duck clubs for wildlife habitat purposes. A supplemental municipal and industrial supply of 14,000 acre-feet annually would be provided for the Cities of Tracy, Firebaugh and Mendota.

   The remaining 157,000 acre-feet of New Melones yield could be used to meet other Central Valley Project requirements.

2. Vegetation. The service area will remain in cropland, orchards, or farmsteads. No new impact will be made on natural vegetation unless it would be to turn some grassland area from dryland grazing to irrigated pasture.

3. Fish and Wildlife. The Grasslands Water District is supplied water for waterfowl management and habitat purposes. This practice will continue with the additional opportunity for another 1,330 acre-feet per year to be used for habitat purposes by private duck clubs. No other impact will be made on fish or wildlife unless some grassland is turned to irrigated pasture.

4. Vectors. The application of additional water will create the potential for an increase in water associated insect vectors such as gnats and mosquitos unless control measures are applied. Sprinkler irrigation will tend to reduce this potential. There will be no increase in nonaquatic vectors.

5. Recreation. Impact on recreation will consist of greater hunting opportunities for waterfowl due to the use of new water on the grasslands for habitat development. Nonconsumptive use of waterfowl and other birds will be also increased by this new water. Some additional fishing will occur in drains and sloughs because of increased runoff.

6. Historical and Archeological Sites. No new construction is planned which would impact archeological sites.

7. Land Use. The service area is expected to remain in agricultural production. There will be, however, a change in that about 32,000 acres now dryfarmed or irrigated intermittently will receive a firm water supply and become permanently irrigated. An additional 16,800 acres now receiving only supplemental water will also be converted to permanent irrigation with the advent of a firm water supply.

8. Air Quality. There will be an increase seasonally in air pollution caused by agricultural burning and soil preparation. Further county restrictions on agricultural burning could reduce this potential impact.

9. Water Quality. The application of additional irrigation supply in the San Joaquin River drainage basin will increase the salt loads of the San Joaquin River. The contribution from these additional irrigated lands represent about 3 percent of the total irrigated land within the San Joaquin River Basin, exclusive of the San Luis service area. Assuming an equal contribution to the salt loads of the San Joaquin River at Vernalis, the increased TDS concentration resulting from the increased irrigated lands would be about 15 mg/l at 500 mg/l initial concentration. This increased concentration of TDS can be diluted by releases from the New Melones Project to maintain the 500 mg/l TDS water quality standards. The New Melones Project has the capability of maintaining the water quality standard at Vernalis with the increased irrigation return flows, assuming the maintenance of the existing flow-quality relationship in the San Joaquin River.

10. Aesthetic and Scenic Values. There will be no impact on aesthetic or scenic values since the area will remain in agriculture as before. Spring blossom displays may be increased by more orchard plantings.

11. Socioeconomic Factors. If export water were available from New Melones, ten districts now receiving a nonfirm project supply from the Delta-Mendota Canal could have a firm supply. These districts now receive 86,335 acre-feet in the nonfirm category.

    This area has a highly productive agricultural base which is expected to continue with an adequate water supply. A wide variety of agricultural products are produced in the area. Land use and intensity of productivity are similar

to those found in the Stockton-East Water District located in San Joaquin County. An indication of this diversity is given in the annual Agricultural Report of the San Joaquin County Agricultural Commissioner. The following tabulation shows the gross sale value of various categories of agricultural production in San Joaquin County in 1970:

Item	Gross sales value in 1970 (millions $)
Field crops	52.6
Vegetable crops	51.3
Fruit and nut crops	63.3
Seed crops	3.9
Nursery products	2.0
Livestock and poultry (animals)	15.8
Apiary products	.2
Livestock & poultry products (milk and eggs)	51.2
Total	240.3

The preceding distribution of crop sales indicates the large volume of crops which will have an effect on the general economy through direct employment. If the current level of land use can be maintained, agriculture will continue the important contribution to the overall socioeconomic well-being of the area.

Although there are no additional municipal and industrial water requirements per se within the various districts, the goods and services required in the area create a continued need for both quantity and quality water.

The effect of the use of New Melones water is demonstrated by the analysis of various facets of the Stockton-East Water District. These factors were projected to the year 2020 to help demonstrate the with and without adequate water supply situation within the S.E.W.D. Table 2 gives the with values and table 3 presents the without situation. The following tabulation shows the increase associated with adequate water supply:

Item	Increase per acre-foot
1. Population	1.18
2. Number employed	.46
3. Personal income	$4,696.72
4. Assessed tangible property valuation	$2,827.50
5. Annual property tax	$ 32.57
6. Taxable retail sales	$2,200.48

In the preceding demonstration, water was considered the limiting growth factor of the local economy. With the current overdrafting situation, a salvation supply is needed to maintain the existing economic level.

Using the assumption that the per capita consumption will be at a projected rate, and the indicated supply available in year 2020 without additional sources, the incremental population growth was determined. For the demonstration area, there would be 148,000 fewer people or about 1.180 per acre-foot of water not furnished.

In 1970, 39.2 percent of the total population in the Stockton standard metropolitan statistical area were employed. Based on this percentage, 58,100 fewer people would be employed in the demonstration area without a full supply of water.

Personal income, in the demonstration area, would be over 1/2 billion dollars less. This value was derived by applying the 1970 San Joaquin County per capita income ($3,970) to the reduced population.

The assessed tangible property valuation would be reduced by over $2,800 for each acre-foot of water lacking. This in turn would lead to over $32 less in annual property tax.

The State of California would receive tax from about $275,280,000 less taxable retail sales. Using a 5 percent sales tax rate, $13,764,000 less income from the demonstration area would be available to the State.

As can be seen from the above values, all levels of the economy would be affected by the lack of water in the demonstration area. The lack of these funds would affect all facilities and services offered the public.

Also, the irrigation function will create a tremendous demand for goods and services in the local service area, the State and the Nation as a whole. Many studies have been completed which indicate the multiplier effect that increased agricultural production has on the economy. As an illustration, a study showing the current impacts of irrigated agriculture on the Nebraska economy was completed. This study indicates that each dollar of net increase of agricultural output will have an impact of $6.68. The following tabulation gives the various categories of impacts considered.

Current Impacts

Direct	Induced-by	Stemming-from	Total
1.0	1.29	4.39	6.68

In addition to the items already discussed, the water supply would have many other socioeconomic effects on not only the area of water use but also the surrounding area. These effects were not quantified and are listed below.

a. The added tax base will make it possible for new and improved community services, i.e., schools, fire protection, sewage disposal, public libraries, police protection.

b. The added job opportunities would assist in the population dispersion from overcrowded areas.

c. Income redistribution will benefit ~~our~~ economy.

d. Increased production of goods and services will benefit many areas of the Nation and the world.

F. MONTEZUMA HILLS UNIT AND SUISUN MARSH

1. General. Since the proposed unit is being planned, in part, to provide a new water supply to the Suisun Marsh and since use of the marsh area will not be changed with the project, the impact on the environment of the marsh is considered to be highly beneficial over that which would exist under without project conditions. Maintenance of present waterfowl habitat and support levels in the marsh under future

conditions of upstream water demand and use would be a highly beneficial impact. In effect, provision of a new water supply would offset the detrimental effects of about 50 years of past upstream water development, and would afford the opportunity for enhancement of the marsh over existing conditions.

2. Fish and Wildlife. A warm water estuarine fishery is anticipated to develop in the proposed canal. Although an increase in wildlife numbers is foreseen along the canal because of the increase in streamside vegetation, hunting should be regulated as it could present a hazard to the public. Since the canal would connect the Delta with the Suisun Marsh, some utilization of the canal by resident and migrating waterfowl is expected and the Bureau of Sport Fisheries and Wildlife has indicated that the fresh water supplied through the canal would have a beneficial effect on the waterfowl population of Suisun Marsh.

   Effect of pumped diversions on fish resources in the channel would be minimized by screening of pump intakes. A new fish resource would be developed in the recreational lakes planned for development with the project which would mitigate to some extent any pump damage which might occur.

3. Endangered Species. The threat to the rare and endangered species in the area has come about largely through habitat restrictions and loss. These animals are all marsh associated and since one of the objectives is to protect the marsh by furnishing a dependable water supply the impact on endangered and rare species should be beneficial.

4. Vectors. Aquatic vectors in the marsh will change from those associated with a brackish water habitat to those more adapted to fresh water. The numbers will not be materially affected. Irrigation on the Montezuma Hills could produce an environment favorable to gnats.

5. Recreation. The Delta has two distinct and important features which attract visitors, the striped bass fishery and many miles on interconnected navigable rivers and sloughs. The Denverton Canal by virtue of its connection with the Delta waterways will benefit from this attraction.

The recreation capacity of the canal, with its 78± acres of water surface, would occur in year one of the project. This incidental anticipated use is 250,000 visitor days annually. The recreation opportunities would be enhanced by the acquisition of additional lands for recreational development and the transformation of several seasonal ponds into permanent lakes, ranging in size from 3 to 23 acres, would increase the visitation by 500,000 visitor days annually to 750,000 visitor days at the ultimate stage of development in year 14 of the project.

Since recreation in the Delta is not concentrated in the summer months, as with much water-oriented recreation in California, year-round use of the recreation facilities on Denverton Canal is expected. The greatest concentration of this use will occur in the spring and fall. Weekend use will predominate initially, but gradual shifting to midweek use will occur as the visitation approaches saturation capacity. Recreational impoundments, camping and picnic areas, riding and hiking trails would be provided along the channel. A sheltered waterway from Suisun Bay to the Sacramento River would be opened by a boat lift provided across the channel closure.

Fishing, picnicking, swimming, camping, cruising, sightseeing, and bird watching would account for most of the recreation use of the area. Fishing would be the prime attraction.

6. Historical and Archeological. No known archeological sites in the area would be affected by construction of the facility. An archeological survey will be made before construction.

7. Land Use. Land area used for the Denverton Channel would be committed as a waterway for recreational use and water supply. Since the water distribution works would be underground pipeline, land areas so occupied would be available for other uses. Drainage channels would be of the open-trench type and lands used for this purpose would require modification to accommodate other uses. This also would be the case after lands are developed for agricultural or municipal and industrial use.

The Montezuma Hills would be changed from dryland grain farming and grazing to irrigated field crops and orchards.

Lands committed to use for the main conveyance channel, located at low elevations, are of little economic importance and only marginal importance at present for wildlife support. Allowing the embankments of the channel to return to native vegetation after construction will provide significant future wildlife, recreational, and aesthetic potential for this area of the county. No change in use of the Suisun Marsh is planned.

8. Water Quality. With the unit, good quality water would be be conveyed from Lindsey Slough, a tributary of the Sacramento River, to Denverton Creek on the eastern edge of Suisun Marsh.

   The more saline water of Denverton Creek would be prevented from mixing with the project water supply by a tidal gated closure across the terminal end of Denverton Channel.

   By augmenting irrigation return flows with fresh water releases, both quantity and quality needs of the marsh will be met.

   A detailed evaluation has not been made of the quality and quantity of return flows from irrigation development in the unit service area. Such detailed investigation of waste return flows reaching the waterways of the Suisun Marsh would be made as required prior to developing the final plan for the Montezuma Hills Unit. This investigation would also include a study of drainage return flows from other existing areas which are disposed of in waterways draining to the marsh.

9. Aesthetics and Scenic Values. In order to provide suitable pressure for sprinkler irrigation and proper regulation of the pumping units, elevated regulating tanks were designed as part of the agricultural distribution system. These tanks would vary from 120 to 230 feet high and from 75,000 to 250,000 gallons in capacity. Three tanks would be required for the lands south of the canal, which rapidly increase in elevation to the south and would be conspicuous objects on the horizon.

10. Socioeconomic Factors. The proposed project features will meet the estimated year 2020 water requirement of 410,700 acre-feet. This water requirement will be used 37 percent for fish and wildlife, 36 percent for municipal and industrial, and 27 percent for irrigation development. The

immediate need is for a supply of fresh water to maintain Suisun Marsh as a vital segment of the Pacific Flyway. Water use for Montezuma Hills Unit is anticipated to build up as follows:

Year	Fish and wildlife	Municipal and industrial (acre-feet)	Irrigation	Total
1980	150,000	65,300	10,000	225,300
1990	150,000	83,400	98,900	332,300
1995	150,000	98,000	148,200	396,200
2000	150,000	112,500	148,200	410,700
2020	150,000	112,500	148,200	410,700

Although fish and wildlife benefits have not been quantified, the study area furnishes winter habitat for an estimated 20 percent of all waterfowl wintering in California or from 500,000 to 750,000 birds. If fresh water is not available, parts of the marsh will be covered with undesirable vegetation with little or no waterfowl food value. The California Department of Fish and Game estimates an ultimate loss of approximately 223,000 ducks through habitat degradation.

Municipal and industrial water requirements are primarily to satisfy industrial needs, about 98 percent of the total requirement. These industrial supplies would meet the requirements of a major steel processing facility, National Steel Corporation, and of a reactor-steam generator power-plant. Tentative sites for these plants have been located in the Collinsville area.

Municipal water use would be in the unincorporated Collinsville "Community Area." The area has a high growth rate projected with industrial buildup. Population growth and municipal and industrial water requirements are presented in the following tabulation:

Year	Population	Water requirement (annual acre-feet)
1980	1,415	65,300
1990	4,450	83,400
2000	5,620	112,500
2010	10,245	112,500
2020	11,100	112,500

The population of the unincorporated Collinsville "Community Area" in 1970 was 118. The State of California, Department of Finance, Population Research Unit projects a simple annual average growth for Solano County of 5.3 percent. Based on this growth rate the "Community Area" would have a population in 2020 of about 400 or about 10,700 less than if Montezuma Hills-Suisun Marsh Unit or other developments did not occur.

Based on the above population reduction and 1970 Solano County per capita values at least a portion of the effects of no project can be quantified. These financial losses are illustrated in the following tabulation:

Item	Per capita value	Total value
1. Personal income	$ 3,950	$42,265,000
2. Assessed value of tangible property	$ 2,180	$23,326,000
3. Average tax	$9.45/$100	$ 2,204,000
4. State income tax	$ 71	$ 760,000

In addition to the above financial losses, the civilian labor force in the area would be reduced about 7,760. Most of this group would be employed by the proposed industrial development and allied services.

Many intangible benefits cannot be quantified. The growth in population will create the need for many new services, which in turn can be financed through the additional tax income available. With the growth in the area many of the services offered can be upgraded.

The Montezuma Hills Unit would furnish a new water supply for about 54,500 acres of irrigable lands. These lands would be furnished a full supply of 148,200 acre-feet or about 2.7 acre-feet per irrigable acre. Most of the lands to be irrigated are in land class 3 and 4S, over 98 percent. The following tabulation shows the projected land use of the area to be irrigated:

Crop	Acres	Percent
Field crops	15,818	29.0
Sugar beets	7,909	14.5
Tomatoes	1,977	3.6
Alfalfa	2,206	4.0
Irrigated pasture	12,204	22.4
Vineyards	5,731	10.5
Orchards	8,698	16.0
Total	54,543	100.0

Many of the field crops to be grown would be included in the feed grain category, most of which would be used by local cattle feeders. California is a deficit-finished beef-producing state. It is estimated that 15 years will be required for full development of the agricultural base.

If the Montezuma Hills Unit is not developed it is expected that the agricultural economy will continue on the same basis. Based on this assumption, the following tabulation presents some of the benefits foregone due to the effect of not developing the agricultural potential of the area.

Item	Total	Per acre-foot
1. Increased production of farm goods	$19,949,000	$135.60
2. Increased farm investment	$56,779,000	$383.10
3. Increased real property taxes	$ 666,000	$ 4.50
4. Increased net farm income	$ 6,473,000	$ 43.70
5. Movement of increased production through channels of trade	$ 1,918,000	$ 12.90

All of the above items are annual values except item 2. In addition to the listed items, the irrigation function will create a tremendous demand for goods and services in the local service area, the State and the Nation as a whole. Many studies have been completed which indicate the multiplier effect that increased agricultural production has on the economy. As an illustration, a study showing the current impacts of irrigated agriculture on the Nebraska economy was completed. The following tabulation gives the impact

per dollar of net increase of agricultural output:

Current Impacts			
Direct	Induced-by	Stemming-from	Total
1.0	1.29	4.39	6.68

If this multiplier were applied to the projected increase in production of farm goods a tremendous impact would occur.

In addition to the items already discussed, the additional water supply would have many other socioeconomic effects on not only the area of water use but also the surrounding area. These effects were not quantified and are listed below:

a. The added tax base will make possible new and improved community services, i.e., schools, fire protection, sewage disposal, public libraries, police protection.

b. With the additional development, jobs would be created helping with unemployment and population dispersion problems.

c. Maintaining the Suisun Marsh will attract birds and fish which in turn will attract hunter and fisherman-oriented businesses.

d. The improved and sustained Suisun Marsh condition will offer additional varied recreational opportunities to users from a wide area.

e. More full-time farm units will help with population dispersion and income redistribution.

f. Increased food production will benefit all groups within the world's population.

G. SACRAMENTO-SAN JOAQUIN DELTA WATER QUALITY

1. Export All or Part of Yield.

Increased flows to the Sacramento-San Joaquin Delta during the dry season from the New Melones Project will have a beneficial environmental impact, primarily in the southern Delta. Increased flows will reduce salinity and increase water circulation in this area. Summertime salinity in Old River, Paradise Cut, and Tom Payne Slough presently can exceed 1,000 p.p.m. of total dissolved solids, which makes the water less usable. Maintenance of 500 p.p.m. TDS at Vernalis could significantly reduce salinity in this area, thus making the water more valuable.

In addition to reducing salinity, the dry season releases will have the benefit of reducing concentrations of nutrients, coliform bacteria, biochemical oxygen demanding substances, and toxic materials. Reduced nutrient concentrations will lead to less severe and less frequent algal blooms, which presently occur each summer in several southern Delta areas. Reduced algal levels and reduced biochemical oxygen demand concentrations will result in higher minimum dissolved oxygen concentrations in this area. This would be particularly significant in lessening the seasonal pollution block in the Stockton Ship Channel. Reductions in coliform bacteria and toxic substance concentrations would make water in the area safer from a public health standpoint, could reduce treatment costs for water withdrawn for municipal uses, and would reduce the water's toxicity to the fishery.

Dry season flow releases would maintain positive downstream flow patterns in more southern Delta channels over a greater period of time than is presently the case. This net downstream flow will aid returning salmon in migrating up the San Joaquin River, will aid young salmon in their journey through the Delta to the ocean, and will aid in dispersing the Stockton Ship Channel pollution block.

These environmental benefits will occur from the presently envisioned fishery and water quality enhancement releases from the New Melones Project. If all or part of the New Melones yield is routed through the Delta for export to other areas (such as San Felipe, San Luis, etc.), the magnitude of these environmental benefits will increase. Quantifications of these aspects are not now available, but more detailed information which will allow these quantifications to be made is being gathered by Federal and State agencies.

2. Full Yield to Delta Quality Control. **Utilizing the full amount or a large portion of the New Melones Project yield** to augment Delta outflows would provide the same type of environmental enhancement as described in Section III G of this report. The benefits would be greater and would occur over a larger area. However, utilizing the New Melones yield solely for Delta flow augmentation would forgo use of the water and the resulting benefits in any of the alternative service areas as authorized by Congress.

Present San Joaquin River flows (at Vernalis) are as low as 400-500 c.f.s. during the summer months. Approximately 80 percent of this flow goes to Old River, with the balance flowing down the San Joaquin River towards Stockton.

Consumptive use in the San Joaquin River below the Old River split often results in a near zero or a net upstream flow in the Stockton Ship Channel. Each summer a pollution block forms in the ship channel, caused primarily by waste discharges from the Stockton area. Provision of 1,000 c.f.s. to 1,500 c.f.s. to the ship channel throughout the summer and early fall months could aid in dispersing the pollution block, thus enabling the maintenance of the San Joaquin River fishery. A control structure at the Old River split would probably be necessary to regulate the available flow to Old River and to the San Joaquin River. Use of New Melones water to break up the pollution block would have the added benefit of providing natural, San Joaquin Basin water for the migration of salmon. This is contrasted by the present method of releasing Sacramento Basin water from the Delta-Mendota Canal to accomplish the removal of the pollution block.

The B-2 criteria for striped bass requires a salinity above Three Mile Slough on the Sacramento River and between Jersey Point and Venice Island on the San Joaquin River of less than 180 TDS p.p.m. for 35 days in April and May after the water temperature reaches 60° F. Under future conditions during a critical period without the B-2 criteria the salinity at Jersey Point, under State Water Resources Control Board Resolution 68-17, will average 2,150 TDS p.p.m. during this period.

The yield of 285,000 acre-feet from New Melones, while not sufficient to meet the B-2 criteria, could reduce the salinity from 2,150 TDS p.p.m. to about 700 TDS p.p.m.

Future CVP operations with a Peripheral Canal contemplate an overland agriculture supply to the western Delta islands and providing salinity control at Emmaton and Jersey Point of 1,000 p.p.m. cl. (2,150 TDS p.p.m.). In lieu of the overland supply it has been requested that the 1,000 p.p.m. cl. line be maintained at Blind Point August through December and 350 cl. p.p.m. (850 TDS p.p.m.) April through July. The additional agriculture protection would require about 700,000 acre-feet of yield which is more than twice the yield available from New Melones. However, the New Melones yield could maintain the 1,000 p.p.m. cl. line at Blind Point for the 6-month irrigation season April through September.

SECTION IV - ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

A. LOCAL AND FOLSOM SOUTH SERVICE AREAS

1. Conversion of some natural areas such as sloughs and marshes to cultivated agriculture will result in some loss of wildlife habitat. This primarily would affect big and upland game such as deer and California quail. There will be some loss to resident fish, quail population will be reduced moderately, and some migrant waterfowl will lose resting areas.

2. Loss of some archeological sites may occur due to change in land use; however, any discernible midden could be salvaged and a record of the site made prior to destruction of the site.

3. The change of some natural grassland areas to irrigated agriculture will replace the spring display of natural wildflowers with cultured plants and in some instances orchards which will produce another kind of spring display.

4. There will be removal of land from agricultural or other uses for canal and other water conveyance structure right-of-way.

B. SOUTHERN SAN JOAQUIN VALLEY

1. The Blunt-nosed Leopard Lizard, an endangered species, would lose a portion of its territory in the lowermost or western portion of the service area. The area is already cultivated as this water will be for a supplemental supply. This lizard's requirements of open space without grass interspersed with some rocky area and brush are not known to exist in this service area so the impact may well be more theoretical than real.

2. Importation of additional water to the locality may ultimately result in the need to collect some small increase in irrigation return flow, which has degraded beyond standards acceptable for agricultural use.

3. Additional water may cause a minor increase in mosquitos or other undesirable water related vectors.

4. Some agricultural lands will be dedicated to canal right-of-way.

C. SAN FELIPE DIVISION

1. Some loss of hunting opportunity will occur in the project service area because of changes in land use patterns.

2. There is the possibility of introduction of undesirable fish species from the Delta into the Monterey Bay drainage via the California Aqueduct, San Luis Reservoir, and Pacheco Tunnel.

3. Project canals would disrupt existing patterns of wildlife movement. This impact applies only to the movement of black-tailed deer from the generally undeveloped slopes above the canal into the irrigated agricultural areas below the canal. Losses of deer by drowning will occur with or without safety fences and crossings, fewer with the special measures than without.

4. Scars on the hillsides, due to canal construction, will be visible from county roads and highways; however, the earth slopes will be reseeded with native grasses, and rock cuts and fills will be shaped and left in a form compatible with the existing landscape. The 15 to 20 acres required for tunnel spoil will undoubtedly remain as bare rock but will be concealed, planted where possible, and shaped.

5. The application of irrigation water to an additional 14,700 acres will increase irrigation drainage containing concentrations of salts, but would not generally exceed 1,000 to 1,500 p.p.m. The nutrient concentration, higher than the applied water, could cause algae growth in the receiving streams during months of low flows.

6. Energy requirements for the several pumping plants in the San Felipe service area, referred to load center, are estimated to be 60.0 million kilowatt-hours during the first year of operation, and increasing to 255.0 million kilowatt-hours at year 2020. These figures include the loss of power regeneration at San Luis Pump-Generation Plant. The addition of San Felipe Division to the system will cause an additional decrease in power sales to preference agencies estimated to be 55 megawatts at full development.

D. SAN LUIS UNIT

1. Some land will be permanently allocated to project facilities such as service roads, and pumping stations. Relatively

speaking, however, the requirement for this purpose is small on this project as compared to a distribution system consisting of open ditches and canals.

2. The San Luis Unit will remove from the range of the San Joaquin Kit Fox something less than 5 percent of its present range of about 3,000 square miles. Similarly, something less than 1 percent of the 16,200 square-mile range of the Blunt-nosed Leopard Lizard will be adversely affected by the operations of this unit. A small portion of this impact can be assigned the Westplains area.

3. There may be some minor erosion of the land due to irrigation. However, erosion effects will be very minor since irrigation is proposed to be accomplished by sprinkler systems.

4. There will be a further reduction in the natural areas providing the spring display of wildflowers for which the west side of the San Joaquin Valley is noted.

E. DELTA-MENDOTA CANAL SERVICE AREA

1. The addition of new or previously intermittently irrigated lands to full irrigation may increase the salt load of the San Joaquin River unless another method such as a drain were used to dispose of the waste water.

2. Some upland game habitat may be lost or modified with moderate losses in quail and dove numbers.

F. SUISUN MARSH - MONTEZUMA HILLS UNIT

1. Without special measures the fumes, smoke, noise, activity and accidental spills of chemical wastes or processing materials from planned municipal and industrial developments in the Montezuma Hills Unit service area will have an adverse impact on the fish, wildlife, and waterfowl resources of the Suisun Marsh.

2. The quality of waste return flows from irrigation which are disposed of in waterways draining to the marsh may adversely affect the fish and wildlife values in the marsh.

3. Without adequate controls the increase of visitor use of the marsh could interfere with the waterfowl, fish and wildlife functions for which the marsh is to be managed.

4. There will be a change in the landscape of the Montezuma Hills from their apparently undisturbed grassland appearance to vistas of irrigated pasture, field crops and orchards. The large pressure tanks will be obvious intrusions on the landscape horizon.

G. SACRAMENTO-SAN JOAQUIN DELTA WATER QUALITY

No adverse environmental impacts are expected in the Delta should the whole New Melones conservation yield of 285,000 acre-feet available in the Delta be used. This amount includes the 35,000 acre-feet released for water quality requirements in the Stanislaus River downstream from the dam.

SECTION V. ALTERNATIVES

Including the release of the full conservation yield downstream into the Delta, seven alternative uses of New Melones water have been discussed, together with the expected impacts on the service areas. The impact of doing nothing by withholding supplemental or, in some instances, new water supplies, is briefly summarized for each alternative service area.

A. LOCAL AREA

Without adequate water supplies, the growth and enhancement of the local service area will be seriously restricted. In the lower basin, present water demands are met by overdrawing ground-water supplies, thereby causing progressive lowering of ground-water levels. Continuation of this type of operation will result in additional increased pumping costs and further threat, and most likely degradation of mineral quality of ground water in the area.

B. SOUTHERN SAN JOAQUIN VALLEY

The alternative of doing nothing is not desirable because of the falling water table with attendant increased costs of pumping, acceleration of the ground-water quality degradation, continued land subsidence and decreasing productivity of the presently irrigated acreages.

Because of the urgent need for a supplemental water supply in the very near future, the area cannot wait for the future development of the proposed East Side Division by the Bureau of Reclamation. An alternate source of a partial supply of water must be found if the present level of agricultural production is to be maintained.

C. SAN FELIPE DIVISION

The no-action alternative will require further development of local supplies, continued mining of the ground-water basin, or restriction of future area development and economic growth.

With the vigorous development of water already in the service area, enough additional supplies to meet the projected demands cannot be developed. To fully develop the inadequate local supplies will require the construction of numerous dams and reservoirs which would disturb the environment to a greater extent than the authorized plan. If additional water is not developed, the service area will continue to deplete the ground-water basin. Continued depletion of these supplies would

encourage intrusion of saline water, more land subsidence, and continued damage to the soils in the Hollister area by boron-rich ground water.

Currently, a waste water reclamation study is being made by a consulting engineer for the Santa Clara Flood Control and Water District. The final results of this study are not yet available.

The nature of raw sewage, a mixture of industrial and domestic wastes would make complete treatment expensive and difficult. Separation of the more easily treated wastes would require extensive modification of the existing collection and treatment systems. Unless complete removal of solids are obtained, the ground-water recharging facilities could become clogged. The removal of dissolved salt would be necessary to prevent the TDS level in the soil from building up. Waste water reclamation would be produced from plants on a continuous basis. Agricultural demands are on a 6-month basis beginning from zero demands early in the year, peaking in July and back to zero demands at the end of the irrigation season. For this reason, large storage facilities would be required to meet peaking demands of agriculture.

Despite these limitations, the potential for reclaiming waste water should continue to be studied. Should a practical plan to accomplish this prove feasible in the immediate future, it would delay the need for water imports into the north Santa Clara Valley by about 30 years.

Additionally, when water imports were required, the use of waste water as an additional source of ground-water recharge would make more high quality imported water available for other uses where quality is more critical.

D. SAN LUIS UNIT

The lands in the Westplains service area of the unit would not be developed to full irrigated agriculture unless other means to import a supplemental water supply could be found.

Underground water supplies are undesirable because of poor water quality in the shallow aquifer and limited amounts in the deep aquifer. Therefore, the present water supply system would continue in this district in its less than optimum condition and the production of crops would likewise be at less than optimum, both from the standpoint of yield and diversity.

Without full irrigation, the habitat for the endangered San Joaquin Kit Fox and the Blunt-nosed Leopard Lizard would remain the same, while habitat for the endangered Giant Garter Snake would become less favorable.

E. DELTA-MENDOTA CANAL SERVICE AREA

Approximately 32,000 acres of land, now dry farmed or intermittently irrigated, would remain in that condition. An additional 16,800 acres would continue receiving supplemental water on a nonfirm basis. An additional 1,330 acre-feet, which would have been used by duck clubs for wildlife enhancement purposes, would not be available.

F. MONTEZUMA HILLS UNIT AND SUISUN MARSH

The Montezuma Hills Unit service area would continue to be used for dry farming of grain, sheep and cattle raising, and some seasonal hunting of upland game birds. The potential for the proposed municipal and industrial areas to be served by the Collinsville Pipeline would not be achieved. Also, the potential which exists for increasing the productivity of the marsh for waterfowl and fish, through improved water and land management, would be lost.

G. SACRAMENTO-SAN JOAQUIN DELTA WATER QUALITY

Water quality conditions in the Southern Delta without the New Melones Project will degrade as water usage and return flows (municipal, industrial, and agricultural) increase in the San Joaquin River Drainage and in the Southern Delta. There will be an increase in salinity, biochemical oxygen demand, nutrient loadings, coliforms, heavy metals, and toxicants. (This is based on the assumption no change in present treatment methods and waste discharge requirements.)

Algal populations will be higher than present, the area, duration, and magnitude of the present pollution block (low dissolved oxygen) will increase, and the dangers to public health will increase.

SECTION VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The availability of supplemental water supplies from New Melones will stop a short-term use of the environment which has a potential long-term impact. Without supplemental surface supplies, existing irrigation operations would be forced to rely solely on overdrafting the ground water. Eventually, many of the operators would be economically forced out of production with consequent adverse long-term socioeconomic effects on the area and the region. Overdrafting of ground water would cause a resumption of land subsidence. In addition, excessively deep pumping of ground water poses the threat of contaminating the entire ground-water basin by disturbing deep-lying saline aquifers.

Recreation over much of the area has been largely short-term in character except in areas dedicated by local, state or national regulations to recreation purposes. Recreation where provided for in the planning for the use of water conservation yield adds more long-term areas by dedication and development.

The long-term trend in the Suisun Marsh since the early 1900's has been toward increased salinity conditions. This has resulted in a continuing degradation of water and soil salinity and an attendant decrease in waterfowl food production by the replacement of non-salt tolerant high value food plants by salt-resistant vegetation of little food value.

The release of new fresh water supplies of up to 150,000 acre-feet annually to Suisun Marsh would reverse this long-term trend in favor of a long-term trend which would maintain and enhance the marsh for waterfowl habitat. Without this reversal the California Department of Fish and Game projected an ultimate loss of 223,000 ducks due to habitat degradation.

The commitment of lands to canals and service-related structures is a long-term use.

In the instances where urbanization has been making inroads into agricultural lands the presence of a firm, competitive surface water supply should enhance the long-term opportunities for the lands to resist conversion to urban uses.

In the San Felipe Division-Hollister subarea the additional water will restore and maintain indefinitely the life of the boron-damaged soils around Hollister.

SECTION VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

In each of the alternative service areas the capital invested and the construction materials used (pipes, concrete, etc.), is seen as completely irreversible or irretrievable.

The construction of a tunnel from San Luis Reservoir under Pacheco Pass would be for all practical purposes an irreversible commitment. This would also be true of canal and conduit construction in all service areas. While it is conceivable that land acquired for canals and appurtenant structures could be returned to its original state, this would be highly unlikely and the structures would remain for many years.

Practically speaking, land dedicated to right-of-way for authorized project facilities will no longer be available for other uses. The commitment of the water resources for the proposed purposes from a practical standpoint would be irreversible; however, the allocation of the water supply could be modified between various functions if required to meet more critical human or natural resource needs.

The reliability of these expectations should be considered in the light of our collective capacity to foresee the national and regional priorities in resource management that will exist several generations hence.

SECTION VIII. CONSULTATION AND COORDINATION

In the course of preparing this summary of the impact from use of New Melones yield, basic data and information on need for water which had been received from interested water users as well as various available reports were utilized. This consultation and coordination for development of additional data will continue in the future as additional details of the planned use of New Melones water are finalized. **The following agencies have been active in this effort.**

A. LOCAL SERVICE AREA INCLUDING THE SAN JOAQUIN COUNTY PORTION OF THE FOLSOM SOUTH SERVICE AREA

Board of Supervisors, Stanislaus County
Calaveras County Water District
Tuolumne County Water District #2
City of Oakdale
City of Riverbank
Oakdale Irrigation District
Stockton-East Water District
Delta Water Users Association
Delta Water Agency
South San Joaquin Irrigation District
North San Joaquin Water Conservation District
Central San Joaquin Water Conservation District
San Joaquin County Flood Control and Water Conservation District
Woodbridge Irrigation District
Woodbridge Water Users Conservation District
Modesto Irrigation District
Waterford Irrigation District
Turlock Irrigation District

B. SOUTHERN SAN JOAQUIN VALLEY

Numerous water service organizations from Madera to Kern Counties
Central Valley East Side Project Association
State Department of Water Resources
Kern County Water Agency
Metropolitan Water District of Southern California
Cities of Fresno, Visalia, Hanford, Corcoran, Madera, Porterville, Exeter, Woodlake, Delano and Lindsay

C. SAN FELIPE DIVISION

Santa Clara County Flood Control and Water Conservation District
Santa Cruz County Flood Control and Water Conservation District
Monterey County Flood Control and Water Conservation District
San Benito County Water Conservation and Flood Control District
Pacheco Pass Water District

San Felipe Committee
State of California
Bureau of Sport Fisheries and Wildlife
National Park Service
Santa Clara Valley Water Conservation District
Corps of Engineers
Public Health Service

D. SAN LUIS UNIT, WESTPLAINS SERVICE AREA

Westlands Water District

E. DELTA-MENDOTA CANAL SERVICE AREA

Centinella Water District
City of Tracy
Del Puerto Water District
Foothill Water District
Hospital Water District
Landsdale Water District
Mustang Water District
Orestimba Water District
Pacheco Water District
Plainview Water District
Quinto Water District
Salado Water District
Sunflower Water District
The Westside Irrigation District
West Stanislaus Irrigation District
Laguna Water District
Mason Loundry
City of Firebaugh
City of Mendota

F. SUISUN MARSH-MONTEZUMA HILLS AREA

Solano, Contra Costa, Sacramento and San Joaquin Counties
Bureau of Outdoor Recreation
Bureau of Sport Fisheries and Wildlife
State of California
Suisun Soil Conservation District
Delta Water Agency
California Water Resources Association
California Wildlife Federation
California Duck Hunters Association
U.S. Soil Conservation Service
Audubon Society
Sierra Club

The Delta Fish and Wildlife Protection Study, a cooperative study of the California Departments of Fish and Game and Water Resources, begun in 1961, has sought to answer three problems pertaining to Suisun Marsh:

1) The relative waterfowl use of various plants now occurring in the marsh; 2) how these plants react, in terms of yield and competition, to various levels of soil-salt concentrations and other water-related environmental variables; and 3) the relationship between soil-salt concentrations and amounts and quality of the channel waters applied to the marsh.

Department of Fish and Game findings with respect to items 1 and 2 were published in study report number 6 dated June 1967. A report on findings relative to item 3 is expected in the near future.

The United States Bureau of Reclamation and Fish and Wildlife Service and the State of California Departments of Water Resources and Fish and Game under a July 13, 1970, Memorandum of Agreement are performing studies necessary to evaluate ecological effects of water development on the Sacramento-San Joaquin Estuary. Study number 13 of the four-agency agreement requires a water supply and management study of the Suisun Marsh which should: a) select a water supply and marsh management plan that will enable protection and enhancement of marsh waterfowl, and b) recommend a plan of action for its implementation. This reconnaissance report on the Montezuma Hills Unit represents an initial phase of the study under that agreement.

The U.S. Soil Conservation Service and Department of Fish and Game's Grizzly Island Refuge staff are working with local landowners to develop management plans for various land areas in the marsh.

The California Department of Fish and Game is providing technical services to the Suisun Soil Conservation District for development and maintenance of fish, game, and other wildlife resources through the district's land and water management program.

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SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence[1/] 1	2	3	4	5	6
Mammals							
Virginia oppossum	Didelphis marsupialis	X		X	X	X	X
Shrews	Sorex sp.				X		
Broad-handed mole	Scapanus latimanus				X		
Black-tailed jackrabbit	Lepus Californicus	X			X		X
Audubon cottontail	Sylvilagus audubonii	X		X	X	X	X
Brush rabbit	Sylvilagus bachmani	X			X		
Beechy ground squirrel	Otospermophilus beecheyi	X		X	X	X	
Botta pocket gopher	Thomomys bottae	X		X	X	X	
Beaver	Castor canadensis					X	X
Dusky footed woodrat	Neotoma fuscipes				X		
Muskrat	Ondatra zibethicus					X	
Coyote	Canis latrans	X		X	X	X	
Gray fox	Urocyon cinereoargenteus	X		X		X	X
Kit fox	Vulpes macrotis mutica				X		
Raccoon	Procyon lotor	X		X	X	X	X
Mink	Mustela vison					X	X
Long-tailed weasel	Mustela frenata						X
Striped skunk	Mephitis mephitis	X		X	X	X	X
Spotted skunk	Spilogale gracilis			X	X		X
River otter	Lutra canadensis					X	X
Bobcat	Lynx rufus	X		X	X		X
Black-tailed deer	Odocoileus hemionus columbianus	X		X	X	X	
Birds							
Anthony green heron	Butorides virescens anthonyi						X
Canada goose	Branta canadensis						X
White-fronted goose	Anser albifrons						X
Snow goose	Chen hyperborea						X

1/ See page for footnote.

SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence[1/]					
		1	2	3	4	5	6
Birds (continued)							
Mallard	Anas platyrhynchos			X			X
Gadwall	Anas strepera						X
Pintail	Anas acuta						X
Green winged teal	Anas carolinensis						X
American widgeon	Mareca americana						X
Shoveller	Spatula clypeata						X
Wood duck	Aix sponsa			X			
Canvasback duck	Aythya valisineria						X
Scaups	Aytha sp.						X
Buffle head	Bucephala albeola						X
Scoters	Melanitta sp.						X
Ruddy duck	Oxyura jamaicensis						X
Turkey vulture	Cathartes aura	X			X		
California condor	Gymnogyps californianus			X	X		
Red-tailed hawk	Buteo jamaicensis	X			X		
Swainson hawk	Buteo swainsoni	X					
Marsh hawk	Circees cyaneus						X
American osprey	Pandion haliaetus carolinensis						X
American Peregrine falcon	Falco peregrinus anatum						X
California (Valley) quail	Lophortyx californica	X	X	X	X	X	X
Mountain quail	Oreotyx picta	X		X			
Ring-necked pheasant	Phaisanus colchicus	X	X	X	X	X	X
Greater sandhill crane	Grus canadensis tabida						X
California clapper rail	Rallus longirostris						X
Virginia rail	Rallus linicola						X
Lora	Porzana carolina						X
Yellow rail	Coturnicops noveboracensis						X
Black rail	Laterallus jamaicensis						X
Gallinule	Gallinula chloropus						X

SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence[1/] 1	2	3	4	5	6
Birds (continued)							
Coot	Fulica americana	X		X			X
Killdeer	Charadrius vociferus	X					
Band-tailed pigeon	Columba fasciata	X		X			
Mourning dove	Zenaidura marcoura	X	X	X	X	X	X
Burrowing owl	Speotyto cunicularia				X		
Acorn (California) woodpecker	Melanerpes formicivorous	X					
Western Kingbird	Tyrannus verticalis				X		
Mockingbird	Mimus polyglottos	X			X		
Western bluebird	Sialia mexicana	X					
Western meadowlark	Sturnella neglecta				X		
Red-winged blackbird	Agelaius phoeniceus	X					
Bullock oriole	Icterus bullocki	X					
Brewers blackbird	Euphagus cyanocephalus				X		
Samuel's song sparrow	Melospiza melodia samuelis						X
Suisun song sparrow	Melospiza melodia maxillaris						X
Amphibians							
Western spadefoot toad	Scaphiopus hammondi				X	X	
California toad	Bufo boreas halophilus				X	X	
Bullfrog	Rana catesbeiana				X	X	
Reptiles							
Western pond turtle	Clemmys marmorata					X	
Blunt-nosed leopard lizard	Crotaphytus wislizenii silus		X		X		
Northwestern fence lizard	Sceloporus occidentalis occidentalis				X	X	
California horned lizard	Phrynosoma coronatum frontale				X	X	

SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence 1/					
		1	2	3	4	5	6
Reptiles (continued)							
Varigated skink	Eumeces gilberti cancellosus				X	X	
California striped racer	Masticophis lateralis lateralis					X	
San Joaquin whipsnake	Masticophis flagellum ruddocki					X	
Pacific gopher snake	Pituophis melanoleucas cantifer				X	X	
Valley garter snake	Thamnophis sirtalis fitchi				X		
Giant garter snake	Thamnophis couchi gigas		X		X		X
Northern Pacific rattlesnake	Crotalis viridis oreganus				X		
Fish							
White sturgeon	Acipenser transmontanus						X
American shad	Alosa sapidissma			X		X	X
Threadfin shad	Dorosoma petenense					X	
King salmon	Oncorhynchus tshawytscha	X				X	X
Brown trout	Salmo trutta	X					
Steelhead trout	Salmo gairdnerii gairdnerii	X				X	
Rainbow trout	Salmo gairdnerii	X					
Sacramento large-scaled sucker	Catostomus occidentalis					X	
Monterey sucker	Catostomus occidentalis mniotiltis			X			
Carp	Cyprinus carpio	X				X	X
Hard head	Mylopharodon conocephalus	X				X	
Hitch	Lavinia exilicauda	X					
Monterey hitch	Lavinia exilicauda harengus			X			
Sacramento squawfish	Ptychocheilus grandis	X				X	
Thicktailed chub	Gila crassicauda					X	X
Monterey western roach	Hesperoleucus symmetricus subditus			X			
Catfish	Ictalurus sp.			X			
Channel catfish	Ictalurus punctatus					X	

SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence[1/] 1	2	3	4	5	6
Fish (Continued)							
White catfish	Ictalurus catus	X				X	X
Brown bullhead	Ictalurus nebulosus					X	X
Striped bass	Roccus saxitilis	X				X	X
Smallmouth black bass	Micropterus dolomieui	X					
Largemouth black bass	Micropterus salmoides	X				X	
Sunfish	Lepomis sp.	X					X
Bluegill sunfish	Lepomis macrochirus					X	
Sacramento perch	Archoplites interruptus					X	X
Cottids	Cottus sp.	X					
Plants							
Digger Pine	Pinius sabiniana	X					
California bay	Umbellularici californica	X					
Black walnut	Juglaus californica	X					
Interior live oak	Quercus wislizenii	X					
Valley oak	Quercus lobata	X					
Blue oak	Quercus douglasii	X					
Sycamore	Platanus racemosa	X					
California buckeye	Aesculus californica	X					
Fremont cottonwood	Populus fremontii	X	X				
Red alder	Alnus oreganus	X					
Bulrush or Tule	Scirpus robustus	X					
Wild oat	Avena sp.				X		
Common reed	Phragmites communis						X
Cattail	Typha sp.						X
Olney bulrush	Scripus olneyi						X
Hardstem bulrush (tule)	Scirpus acutus						X

SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence[1/] 1	2	3	4	5	6
Plants (continued)							
Baltic rush	Juncus balticus						X
Dock	Rumex sp.						X
Smartweed	Polygonum sp.						X
Alkali bulrush	Scirpus robustus						X
Arrow grass	Triglochin maritima						X
Saltgrass	Distichlis spicata						X
Brass button	Cotula coronopifolia						X
Pickleweed	Salicornia ambigua						X
Pickleweed	Salicornia subterminalis						X
Sego pondweed	Potamogeton pectinatus						X
Horned pondweed	Zaunicheelia palustris						X
Ditch grass	Ruppia maritima						X
Land spurry	Spergularia sp.						X
Silverweed	Potentilla anserina						X
Gum plant	Grindella cuneifolia						X
Alkali heath	Frankenia grandiflora						X
Pigweed	Chenopodium sp.						X
Filaree	Erodium sp.				X		
Filaree	Erodium circutarium					X	
Filaree	Erodium moschatum					X	
Bur clover	Medicago hispida					X	
Fescue	Festca megalura					X	
Foxtail chess	Bromus rubins					X	
Poverty three-awn	Aristada divaricata				X		
Pine bluegrass	Poa scabrella				X		
Wild oat	Avena fatua				X		
Six weeks fescue	Festuca octoflora				X		

SCIENTIFIC NAMES OF ANIMALS AND PLANTS MENTIONED IN SUPPLEMENT

Common Name	Scientific Name	Area of Occurrence[1/] 1	2	3	4	5	6
Plants (continued)							
Soft cheat	Bromus mollis				X		
California needlegrass	Stipa pulchra				X		
Brome grass	Bromus sp.				X		
Cocklebur	Xanthium sp.				X		
Spikeweed	Hemizona sp.				X		
Thistle	Cenataurea sp.				X		
Bindweed	Convolvulus sp.				X		
Mustard	Brassica sp.				X		
California poppy	Eschscholtzia californica	X					
Lupine	Lupinus sp.	X					
Salt bush	Atriplex sp.		X			X	
Australian salt bush	Atriplex semibaccata						X
Fat-hen salt bush	Atriplex patula var. hastata						X
Buck brush	Ceanothus sp.	X					
Red bud	Cercis occidentalis	X					
Coyote bush	Baccharis pilularis						X
Sagebrush	Aertemisia californica					X	
Poison oak	Rhus diversiloba	X					
Cascara	Rhamnus purshiana	X					
Buttonbush (button willow)	Cephalanthus occidentalis	X	X				
Willows	Salix sp.	X	X				

1/ Areas of occurrence are as follows:

1. Local service area - Includes portions of Calaveras, Tuolumne, San Joaquin, and Stanislaus Counties; and Folsom South service area.

2. Southern San Joaquin Valley (Cross Valley Canal) area - Pixley Irrigation District.

3. San Felipe Division - Hollister subarea.

4. San Luis Unit - Westplains service area.

5. Delta-Mendota Canal service area.

6. Suisun Marsh-Montezuma Hills Unit.

NEW MELONES LAKE
ENVIRONMENTAL IMPACT STATEMENT

SUPPLEMENTAL DATA
ON USE OF CONSERVATION YIELD

APPENDIX B

COMMENTS AND RESPONSES

Prepared by
U. S. Army Engineer District, Sacramento, California
and
Bureau of Reclamation

APPENDIX B

COMMENTS AND RESPONSES

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APPENDIX B

COMMENTS AND RESPONSES

1. INTRODUCTION

Comments were requested from the following agencies and organizations:

Environmental Protection Agency
Department of Interior
Department of Agriculture - Soil Conservation Service
Department of Commerce
State of California
Calaveras County
Tuolumne County
Stanislaus County
San Joaquin County
Environmental Defense Fund
Sierra Club - Executive Director
Sierra Club - Northern California Regional Conservation Committee
Sierra Club - Yokut Wilderness Group
Stockton Audubon Society
National Speleological Society
Citizens Environmental Advisory Committee

Comments were received from the U. S. Department of Commerce, the Soil Conservation Service, the State of California, the Environmental Defense Fund, and the Yokut Wilderness Group of the Sierra Club. The comments of those agencies and organizations are discussed in this appendix. Responses were prepared jointly by the Corps of Engineers and the Bureau of Reclamation. The full text of all letters received is given in attachment A.

2. DEPARTMENT OF COMMERCE

(1) Comment: On page 80, it is stated that "the Tracy Fish Collecting Facility achieves an efficiency of up to 90 percent in salvaging salmon and striped bass over an inch in length by use of a louver-type fish diversion and collector." Since such fish, in order to reach the collector, must pass two sets of louvers, collection efficiency is actually closer to 80 percent for fish over one inch long. Also, since collection efficiency is related to fish size, which is quite variable, it would be more meaningful to give estimates for each species of the percentage of the total seaward migration passing the collection facility that reach the collectors.

Response: The Tracy Fish Collecting Facility does use two sets of louvers as indicated in the comment. However, the 90 percent figure was our best estimate of the net efficiency for the entire facility in "salvaging salmon and striped bass over an inch in length." This is based on operating experience and a testing program which was detailed in the report, "Efficiency Evaluation-Tracy Fish Collecting Facility" dated October 1960. The testing program was carried out and the report written by personnel from the U. S. Bureau of Commercial Fisheries and from the Bureau of Reclamation. The report concluded that, "From the data secured and observations made it may be concluded that the efficiency of the Tracy Fish Collecting Facility ranges from 65% to nearly 100% depending upon the species of fish, their size, the velocity of flow, the ratio of the velocity in the bypasses to that in the channels and upon accumulations of debris in the bypasses. Efficiency is nearer the upper limit most of the time under normal operating conditions."

While data on different fish species may be useful, we do not consider it to be necessary for the purposes of this statement.

(2) Comment: Although there are no fisheries in the San Luis service area (p. 116), the fishery-related impacts that result from return of irrigation water to the Delta will occur. Such impacts are described in other sections of the statement, but should be identified with respect to the San Luis Unit alternative.

Response: The 4th paragraph on page 81 of the "Supplemental Data" portions of the statement discusses the operational flexibility of the San Luis Drain provided by the reregulatory capabilities of Kesterson Reservoir together with the natural flows in the Delta. The paragraph concludes with the statement that, "Drain flow treatment facilities, as needed, will also be provided to prevent any adverse effects of drain discharge on the receiving waters."

The phrase "any adverse effects" includes the fishery resources of the Delta. It is intended that this treatment will be such that there will be no fishery-related adverse impacts in the Delta resulting from irrigation return flows from the San Luis Service Area.

(3) Comment: In section III, a variety of potential adverse impacts on fisheries resources are identified for each alternative area for distribution of New Melones conservation water. In section IV, page 134-137, many such impacts have been omitted in the summarization of adverse impacts. Changes in current patterns from increased pumping in the Delta, changes in water quality from return of irrigation water and loss of small fish at the Tracy pumping stations should be mentioned as having potential adverse effects on fisheries resources.

Response: Concur.

3. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

The Soil Conservation Service, by letter dated 1 December 1972, acknowledged receipt of the Environmental Impact Statement (EIS) supplement and stated that they have no comments on it.

4. STATE OF CALIFORNIA

1/5/73 letter to Colonel J.C. Donovan from N.B. Livermore, Secy for Resources Director Quotes

(1) Comment: It is recognized that the actual place of use of the project yield cannot be determined at this time because changes in demand and other factors are likely to occur between now and 1980, the earliest date when the yield would be available from New Melones Lake. A significant factor that could influence the area of use will be the decision on project water rights by the State Water Resources Control Board.

Until the decision of the State Water Resources Control Board is rendered, and water service contracts have been executed, the environmental impact of the use of the new conservation yield and related aspects of the project cannot be specifically evaluated.

Response: Concur.

(2) Comment: Page 23, paragraph 2. Coyotes and bobcats are both commonly found in this area. Neither animal can be considered as rare or uncommon.

Response: Concur.

(3) Comment: Page 24, paragraph 3. Two bird species that are classified as rare or endangered are known to inhabit this area: the southern bald eagle (endangered) and the California yellow-billed cuckoo (rare).

Response: Concur.

(4) Comment: Page 52, paragraph 6. The sparse and specialized grassland cover mentioned here has significant populations of quail, chukar, raptors, songbirds, kit fox, and coyotes, and cannot be considered as a "sparse wildlife fauna."

Response: Concur.

(5) Comment: Page 59, Fish and wildlife. Some mention should be made of the heron and egret rookery on the San Joaquin River, north of San Luis Island. This is the largest known rookery in the entire San Joaquin Valley (over 400 birds) and it provides birdwatching and nature study experience for hundreds of people annually.

Response: This would not be affected by the New Melones project or the use of its conservation yield.

(6) Comment: Page 84, Hydrology. The environmental impact statement presents a tabulation of average monthly flows which is called "at Ripon," in the text, and "below Knight's Ferry," in a tabular heading. Our examination during the period of 1941-70 for July-November shows the following average flow at Ripon:

Average flow at Ripon, 1941-70 (c.f.s.)	
July	378
August	184
September	203
October	261
November	474
December	1,027
Lowest daily mean flow, 1941-70	40 c.f.s.

(These flows were taken from USGS Surface Water Records of California, Vol. 2)

The assessment of the project impact of flows in the Stanislaus River should extend from Goodwin Dam to the San Joaquin River. We recommend that both "at Ripon" and "below Knight's Ferry" be included, as well as any other key flow points along the river.

Response: The reference in the supplement to the flows shown being at Ripon is incorrect. The indicated flows should be those just downstream from all the local diversions. If all diversions are assumed to occur upstream of Ripon, the average monthly flows at Ripon which would have occurred (based on 1921-46 period of study) under project operation and under existing conditions are as follows:

Month	Average monthly flows at Ripon with service to local area (c.f.s.)	Average existing monthly flows (c.f.s.)
Jan	312	485
Feb	574	1,389
Mar	574	1,804
Apr	310	1,757
May	412	2,539
Jun	522	1,145
Jul	347	245
Aug	285	155
Sep	307	175
Oct	350	160
Nov	304	110
Dec	313	177

The difference between the average existing monthly flows shown above and the flows which you reported is explained on the basis of a different time period and the fact that the flows for the period 1941-70 are not representative of the existing conditions of development. Flow data for Stanislaus River is not available for other points between Goodwin Dam and the San Joaquin River for similar project conditions; however, it is believed the data for the two points shown (Knights Ferry and Ripon) provide a good indication of the average situation along the Stanislaus River under project conditions. Flows below Ripon to the mouth will usually increase somewhat due to return flows and drainage, and the flow between Ripon and Knights Ferry may be roughly interpolated in proportion to distance.

(7) Comment: Page 85, Fish and wildlife. Experience has shown us that native habitat will not improve with the importation of extra water; land values are such that farmers will not retain native vegetation on land suitable for farming. It is common practice to fill in the small drainage channels containing riparian habitat and additional water will make it feasible to do this.

Response: We do not agree that added water will result in local filling of drainage channels, resulting in loss of wildlife habitat. The drainage channels will still be needed; in fact, additional drainage capacity will probably be needed with additional supply.

(8) Comment: Page 85, paragraph 4. The hunter harvest of rabbits will not increase with the importation of water and improvement of land. Trespassing is not normally tolerated for rabbit hunting on developed land, which will mean fewer hunters and a reduced harvest of animals.

Response: While we concur in the expert opinion regarding hunting in relation to privately owned lands, the information presented was directed primarily at pointing out that rabbit numbers will increase as a result of the added food available, due to the increased crops produced from the added water supply.

(9) Comment: Page 90, on table 2. An error appears in column 5. The income should be stated in thousands of dollars, not thousands of people.

Response: Concur.

(10) Comment: Page 116, Fish and wildlife. Raccoon and quail will not be favored by firm water supplies as indicated since the resultant "clean" farming practices will be detrimental to both species. Also, kit fox are found in the area described, and they will be detrimentally affected by future land development.

Response: Concur.

5. ENVIRONMENTAL DEFENSE FUND (EDF)

(1) Comment: (Condensed) EDF believes that the EIS supplement should include certain data arising out of the ongoing hearings before the California Water Resources Control Board. They make specific reference in this regard to requests for water by the California Department of Fish and Game which would like much or all of the project yield released downstream for preservation of the salmon fishery. They point out that if the Board were to condition water rights permits in such a way as to require meeting the Fish and Game request the ability of the project to meet its other predicted accomplishments would be impaired.

Response: The EIS supplement already discusses the alternative of releasing the entire project yield into the Delta. We do not believe that it is desirable for the environmental impact statement to evaluate the Department o Fish and Game's request since we do not know how the Water Resources Control Board will condition water rights in this respect. A discussion of the Department's request is, however, given in our response to EDF comment 24.

(2) Comment: (Condensed) EDF believes that the EIS supplement is misleading in that it infers that if New Melones water is not made available the potential service areas will fall into decline and that alternatives such as wastewater reclamation have not been evaluated.

Response: The EIS supplement is intended to imply that some additional source of water is needed in the various alternative service areas. This does not mean that New Melones must provide that source because, in fact, New Melones alone can only meet a portion of these needs. Some other source of water will have to be developed with or without New Melones.

(3) Comment: (Condensed) EDF would like the EIS supplement to address the question of present water supply in the Central Valley Project. They make specific reference to present contractual commitments and Water Quality Control Board Decisions 1379 and 1400.

Response: We believe this issue is adequately addressed in the EIS supplement on pages 2 and 3.

(4) Comment: (Condensed) EDF would like additional maps in the EIS supplement to show the location and features of the alternative service areas.

Response: We agree that additional maps would be useful, but not essential.

(5) Comment: We suggest that some mention should be made of the soil classifications of the various potential service areas. Since it seems most doubtful that soils of Class 4 or worse should be brought into production at this time, we belive that the need for water can only be evaluated in light of these facts.

Response: Under Bureau of Reclamation—policy Class 4 soils, while having some deficiencies, are still considered capable of being utilized for specific crops or specific farming practices, which under irrigation will maintain a profitable commercial agricultural enterprise. No soils of lesser quality than Class 4 have been included in the projected irrigation needs shown in the supplement.

(6) Comment: Finally, we suggest that a discussion of the problem of salt balance in the Central Valley should be integrated into the supplement, since most of the potential service areas discussed therein either contribute to or are the victims of the present salt imbalance in the Valley as a whole.

Response: The salt balance in the Central Valley has already been discussed in the basic "environmental impact statement" of May 1972. See page 46 of that statement.

(7) Comment: Page 2, Paragraph 1: The statement that approximately 285,000 acre feet of water would be available for pumping from the Delta appears to be factually inaccurate. The 98,000 acre-feet of water proposed to be released for fishery maintenance purposes would also be in part available for pumping from the Delta, depending on the release pattern.

Response: We concur. The 98,000 acre-feet of water dedicated for fishery maintenance purposes could at least in part, also be available for pumping from the Delta, or for meeting other CVP requirements. However, such possible use was not considered in computing New Melones project accomplishments.

(8) Comment: Page 2, Paragraph 4: We are unclear as to why it is impossible at the present time to assign priorities to the claimed needs of the potential service areas. If the needs genuinely exist now, then it would seem possible to order them in terms of urgency.

Response: In regard to assignment of use of New Melones water, first consideration will need to be given to the local service areas as provided by the authorizing legislation. The indicated needs for the various service areas used are based on full development requirements. In this instance we would consider that each would have an equal priority of need of additional water supply from some source which could include New Melones. On the basis of what we know today, it would appear that the east side of the San Joaquin Valley would have the most urgent need at the moment.

However, as indicated in the supplement, the priorities to be considered in selecting the areas in which the water will be marketed cannot and should not be made at this time because of changes which can and most likely will occur between now and about 1980 relative to both water needs and water supplies.

(9) Comment: Page 3, Paragraph 1: This would seem an appropriate point for a discussion of the need for water with and without compliance with the requirements of Decision 1379, and with and without the Peripheral Canal.

Response: The implications of Decision 1379 as it relates to the need for New Melones water are discussed in the basic environmental impact statement of May 1972 and, although repetition in the place suggested is not objectionable, we do not believe it is necessary.

(10) Comment: Page 4, Paragraph 1: The local service area now includes the entirety of the four counties named, by virtue of an amendment to the Bureau of Reclamation's water rights application now pending before the State Water Resources Control Board.

Response: Concur; however, the areas described are those portions that could be most readily served.

(11) Comment: Page 5, Paragraph 4: We suggest this paragraph be augmented to reflect that the Folsom-South service area could obviously be served by the Auburn-Folsom South Canal, and that the Folsom-South service area is by far the largest and most important portion of the area discussed in this paragraph.

Response: We agree that this same area could be served by the Auburn-Folsom South Canal. We note, however, the EDF is opposed to the Auburn-Folsom South Canal, having filed an action in United States District Court to halt that project. In their report sent by letter dated December 28, 1972 to the Office of Management and Budget, EDF uses the alternative of using New Melones water as an argument against the Auburn-Folsom South Canal. At any rate, if the southern portion of San Joaquin County were to be served by New Melones water, an equivalent amount of Auburn-Folsom South water could be used elsewhere.

(12) Comment: Page 6, Paragraph 2: We suggest a map of the proposed location or locations of the Cross Valley Canal would be useful here.

Response: Such a map might be useful, but we do not believe it is necessary.

(13) Comment: Page 13, Paragraph 2: We believe that the statements contained in this paragraph are inconsistent with those made by the Bureau of Reclamation on other occasions. That is, it is our understanding from previous Bureau statements that the Delta-Mendota Canal is presently at capacity during the irrigation season. Since the discussion here is primarily of the supply of irrigation water, this would seem to be the determining factor -- not how much capacity remains in the Delta-Mendota Canal during the winter.

Response: Under the present operation, the full capacity of Delta-Mendota Canal is utilized only in the month of July in the first 3 1/2 miles of the canal. Other than this there is additional capacity available in the canal for providing water service. Further, through exchange and the use of San Luis Reservoir, additional service could be provided even in the month of July.

(14) Comment: (Condensed) With reference to page 15, paragraph 2. EDF believes that the discussion should be augmented by reference to the recent report of the National Water Commission which comes to the conclusion that there is no present need for new reclamation projects. EDF also believes the work of Professor Richard Norgaard of the University of California should be discussed in this context. They think these reports are correct in their conclusions.

Response: The prediction of future economic trends is at best very problematic. All predictions are based on assumptions about how past and present market conditions will continue or change in the future. The predictions contained in the EIS supplement are based on different assumptions than are the studies of Professor Norgaard and also those of Dean and King. We believe that based on present information our assumptions are reasonable and that the conclusions derived from them are valid.

The major conclusion reached by Dean and King is that lower prices for products might result from higher production. These lower prices would be of great benefit to the consumer and certainly in line with government goals.

(15) Comment: Page 18, Table at the bottom (continued at the top of page 19): We believe that the statement should set out the source of these figures. Moreover, we suggest the term "water requirements" as it is used in respect of the tables should be defined. If, as is often true in Bureau parlance, the term "requirements" refers to ultimate possible development within a given area, this definition should be clearly spelled out.

This comment applies to all other assertions of need for additional water supply in all the other potential service areas discussed.

Response: The table at the bottom of page 18 represents water requirements, as indicated by the respective counties, for meeting ultimate needs of the respective areas. The Federal Government has not attempted to pass judgement on the validity of these requirements at this time. Prior to a "finding of the Secretary of Interior" as prescribed in the project authorization these requirements will be fully evaluated. The table at the top of page 19 represents the quantities of water to meet ultimate water requirements as indicated in water contract negotiations.

(16) Comment: Page 34, Paragraphs 2 & 5: We suggest that the discussion of ground-water depletion is better cast in numerical terms, and that rates of ground-water decline should be given in connection with assertions made.

Response: The following is a tabulation of average change in ground-water levels, by counties, within the East Side Division south of the Chowchilla River for the period 1960-1970; this period represented near normal precipitation. A much greater decline would have occurred if 14,800,000 acre-feet had not been delivered from Millerton Lake during the 1960-1970 period.

County (Area within E.S.D. only)	Spring 1960 to Spring 1970
Madera	-10.0
Fresno	- 8.8
Tulare	+ 7.5
Kings	0
Kern	-42.2

Madera County - A look at the 1960-1970 data shows an average decline of about 10 feet, although there are rather extensive areas of small rises. The most severe overdraft in the past 10 years has taken place east of Highway 99, near the town of Chowchilla, where water levels have declined up to 60 feet.

Fresno County - The period of 1960-1970 for this county showed an average decline of about 8.8 feet. Nearly all of the area east of a north-south line through Clovis and Fowler had a rise in ground-water levels, totaling as much as 30 feet in one area. In an area about 15 miles southwest of Fresno, an overdraft condition has existed since 1947 and has, in fact, worsened during the 1960-1970 period. Water levels have declined as much as 50 feet from 1960 to 1970 in this area.

Tulare County - Tulare County had the most significant general rise in ground-water levels of any county within the East Side Division, south of the Chowchilla River during the 1960-1970 period. The application of large quantities of Central Valley Project water in many irrigation districts has, no doubt, accounted for this trend. Despite the overall good condition of water levels, there are some alarming areas of severe overdraft. In an area near Highway 65 at White River, ground-water levels have dropped 100 feet in the 1960-1970 period. There has also been a general decline in water levels in the vicinity of Highway 99 between Tipton and Earlimart, ranging between 10 to 40 feet.

Kings County - Although earlier periods show a general decline in this area, the average water-level change between 1960-1970 was virtually nil. There are a few rises and declines, but they are of moderate magnitudes. Pine Flat Dam's effect and short-term contracts for Millerton Lake water probably account for the stabilized water levels. This analysis does not include aquifers in the Tulare Lake Basin due to a lack of data.

Kern County - Kern County has long sustained a severe overdraft condition. The importation of project water to Shafter-Wasco Irrigation District and the Arvin-Edison Water Storage District beginning in 1958 and 1966, respectively, has decreased the overdraft rate in these areas and, with substantial application, may eventually stabilize ground-water levels in these areas. Ground-water levels declined an average of 42.2 feet in Kern County from 1960 to 1970. Heavy overdraft occurred in the southern portion of the valley, west of Highway 99 and in the Semi-Tropic Ridge area west of the Shafter-Wasco Irrigation District. The only exception in the Kern County is the Southern San Joaquin Municipal Utility District where water levels have continued to rise due to the importation of Friant-Kern water since 1951.

It should be pointed out that Kern County is noted for its multi-aquifer systems with different piezometric levels. As different well control may have been used to construct the 1960 and 1970 ground-water elevation maps, some inaccuracies may be induced in the change map since it was derived from elevation maps; however, these do not affect the validity of the overall conclusions for the Kern County area.

(17) Comment: Page 36, Paragraph 3: What is the relationship of subsidence to the permanent loss of ground-water storage capacity? These relationships should also make it possible to measure the rate of ground-water loss.

Response: Subsidence results chiefly from the permanent compaction of the fine-grained beds of an acquifer system. Although the total storage capacity of the system is reduced by a volume equal to the subsidence, the loss of usable storage capacity commonly is insignificant, because the aquifers on the whale are not appreciably compacted.

Compaction recorders can measure the rate of change in thickness of deposits, which represents the rate at which water is squeezed out of the pore spaces of the silt and clay. These recorders also measure the elastic response of the aquifers to pumping stresses.

Subsidence can only be stopped in areas of ground-water overdraft by a reduction of ground-water pumpage or a supplemental import supply or both in an amount exceeding the overdraft.

(18) Comment: Page 39: We suggest that the source of the San Felipe Division water requirements figures be identified in the discussion. We are confused by the "percolation" allocations in the table of figures presented on this page. Is the percolation requirement designed to replace a groundwater overdraft situation?

The discussion also notes that some 40,000 acres of land would receive 1 1/3 acre-feet of supplemental irrigation water. This statement should set forth the reason that such supplemental water is needed. If it is designed to allow a change in cropping pattern, this should be clearly set forth.

Response: The water requirements shown were taken from "San Felipe Division, C.V.P., California, A Report on the Feasibility of Water Supply Development, March 1964 -- U.S. Bureau of Reclamation." The figures represent the projected needs for year 2020. In normal years, the water supply would be percolated to groundwater as the best means of getting it into the present distribution systems. Following a dry period, this percolation would also serve as a means of recharging the overdraft of groundwater. The supplemental water supply is needed to permit agriculture to continue in the face of urban development. Without such additional water supply, the urban development would utilize existing supplies and thus eliminate agriculture in the area.

(19) Comment: Page 48, "Air Quality": It is startling to see the city of San Jose characterized as a "possible exception" to the prevailing very good air quality. The filthy air of the city of San Jose should be forthrightly characterized as such. The provision of new water supplies from the San Felipe Division would allow further growth in the San Jose area, thereby exacerbating the air pollution problem.

Response: We agree that the San Jose area has serious air quality problems as do most major urban areas in California. It is not the policy of government to limit this problem by what could be termed "cutting off their water". While various drastic measures may be needed to curb air pollution, arbitrarily stopping further water supplies does not appear to be a viable solution.

(20) Comment: Page 50, Paragraph 2: To state that the entire West Plains service area -- rather than just a portion of it -- will be irrigated each year is to state that net irrigated acreage in California will increase. There should be some reference, therefore, at this point to the Dean and King studies.

Response: With the continual over drafting in the areas, the New Melones yield would be used to relieve some of the burden on ground-water supplies. Any increase in irrigated acreage would be offset by loss of irrigated acreage elsewhere in the State of California which is continually occurring due to the urbanization and other land use changes; therefore, net increases in irrigated acreage would not occur.

(21) Comment: Page 57, Paragraph 1: Once again, we believe the source of the tabular figures should be identified, and the phrase "projected additional water requirements" defined with precision.

Response: An explanation of what is meant by "projected additional water requirements" is as follows:

Irrigation - Water requirements under full development is the water needed to produce the crops expected to be grown in the area when all the irrigable lands are under production.

These requirements are derived from analysis of the land capability, climatic considerations, and economic constraints which indicate the type of crops best suited to area. Unit water requirements applied to these estimated crop acreages provide the estimated water requirements.

Municipal and Industrial - Water requirements under full development are projections of water needed for urban and industrial needs of the area up to fifty years in the future. These requirements are derived from estimates of population projections, and industrial use projections, and industrial use projections in combination with per capita water requirements.

The tabular figures on page 57 are based on existing water contracts and contract negotiations.

(22) Comment: Page 66, Paragraph 1: We do not understand how New Melones water could be used to service the Montezuma Hills area, as we believe this to be an hydraulic impossibility. Presumably an exchange of water is envisioned. This should be clearly stated.

In addition, we again ask for identification of the source of the tabular data presented.

Finally, the 54,500 new acres to be brought into production in the service area should be evaluated in light of the Dean and King and Norgaard studies. Some reference to these should be made at this point.

Response: The EDF comment is correct in that if New Melones water service were made to Montezuma Hills it would be accomplished by exchange. The indicated water requirements were taken from "Montezuma Hills Unit, C.V.P., California, a reconnaissance appraisal of a means of providing water service to Montezuma Hills area and Suisun Marsh, October 1971 -- U. S. Bureau of Reclamation." They represent the projected demand for year 2000. With regard to the Dean and King and Norgaard Studies, see the response to EDF comment 14 .

(23) Comment: Page 79, "Impacts on the Delta": This section omits to mention the harm that would result to the Delta if the yield of the New Melones Dam were diverted into the East Side Division at Knight's Ferry. In this connection, it should be noted that although the Bureau has repeatedly stated that the East Side Division is not likely to be constructed in the near future, it has nevertheless consistently refused in the course of the Water Rights Hearings before the Water Resources Control Board to delete from its applications a provision for diversion of the New Melones yield at Knights's Ferry. In view of this, we believe that some mention should be made of the effect on the Delta of total diversion out of the basin.

Response: Total diversion out of the basin is not contemplated even if East Side Division is eventually constructed. The guaranteed fish maintenance and water quality flows would be sufficient to avoid detrimental effects to existing Delta water quality conditions. In addition to this a significant portion of the New Melones yield would surely be used in the basin since such use is given first priority by congressional directive.

(24) Comment: Page 84, "Hydrology": We suggest that the gauge point at which the flows shown on the table are measured be identified and that these flows be compared with those requested by the California State Department of Fish and Game in the New Melones Water Rights Hearings.

Response: The tabulation is intended to represent the flows in the vicinity of Knights Ferry assuming the New Melones yield is used for service to the local area; these are the flows remaining in the river below the diversions. See also response to State of California comment 6.

The flows requested by the California Department of Fish and Game in the recent water rights hearings are as shown below. There is no indication at this time that the Water Resources Control Board will issue water rights for the project predicated on this request.

January 1 - February 28	150 c.f.s. throughout the river (Goodwin Dam to the mouth).
March 1 - March 31	700 c.f.s. from Ripon to the mouth. At least 83 percent of this flow to be in the river channel between Goodwin Dam and Ripon.
April 1 - April 30	900 c.f.s. from Ripon to the mouth. At least 83 percent of this flow to be in the river channel between Goodwin Dam and Ripon.
May 1 - May 31	1,200 c.f.s. from Ripon to the mouth. At least 83 percent of this flow to be in the river channel between Goodwin Dam and Ripon.
June 1 - June 30	1,000 c.f.s. from Ripon to the mouth. At least 83 percent of this flow to be in the river channel between Goodwin Dam and Ripon.
July 1 - September 30	100 c.f.s. throughout the river (Goodwin Dam to the mouth).
October 1 - December 31	200 c.f.s. throughout the river (Goodwin Dam to the mouth).

(25) Comment: Page 87, "Land-use": Some reference should be made to the Dean and King and Norgaard studies in connection with the discussion of 50,000 to 70,000 acres of irrigated land within the local service area.

Response: As previously stated, it is not deemed necessary to cite these references repeatedly, since they and their conclusions have already been discussed. See response to EDF comment 14.

(26) Comment: Page 87, "Water Quality": If New Melones yield is used in the local service area to irrigated 50,000 to 70,000 acres of presently dry land, the quality of the return flows will in fact be less than the quality of direct downstream flows. This fact should be clearly set forth in the statement.

Response: It is true that any additional irrigation return flows would be of lower quality than the receiving waters unless some as yet unutilized treatment is applied. The resulting quality of water in the river will still be better with the project than without because the flows would be higher during the critical summer and fall months than at present.

(27) Comment: Page 89, "Socio-economic Factors": We note, in connection with the discussion of the Folsom-South Service Area, that the area's annual overdraft is only 37,000 acre-feet. We accordingly suggest that the term "salvation supply" is somewhat wide of the mark. In addition, we suggest that the conclusions of Dean and King and Norgaard must be factored into the economic discussion found at this point in the supplement in order for it to make any sense.

Response: The Bureau's Folsom-South ground-water safe yield figures were derived on the basis of a storage change analysis in the early 1950's. Consequently, this was predicated on water level depths and gradients that prevailed at that time, thus providing a favorable ground-water condition for production and economic pumping lifts for project operation.

Throughout the ensuing years, water levels continued to progressively decline, thus inducing greater recharge at the expense of higher pumping lifts and ground-water storage depletion in and adjacent to the area; thus estimated pumpage in later years minus the original safe yield analysis show overdraft figures of greater magnitude than mere ground-water storage depletion.

A review of the historic ground-water level and storage depletion in Folsom-South discloses an irregular pattern, progressively down, but with some years actually showing an increase, depending upon pumpage, precipitation and runoff; storage depletion is therefore dependant upon which group of years or base period is considered.

Computations reveal that from 1952 to 1972, ground-water storage was depleted 1,176,000 a.f. or an average of 58,800 a.f.a. This contrasts with such erratic conditions as follows:

Year	Storage Depletion	
	Total a.f.	: Acre-feet annually
1959-1960	224,000	224,000
1966-1970	48,000	12,000
1970-1972	184,000	92,000

Again we wish to point out that storage changes without large quantities of the induced recharge now taking place would be much greater under a safe ground-water supply basis.

With regard to the Dean and King and Norgaard studies, see the response to EDF comment 14.

(28) Comment: Page 100: Once again, we believe the economic assertions made at this point must be tempered in an appropriate manner with discussion of the Dean and King and Norgaard conclusions. It is simply incorrect, as a conceptual matter, to assume as does this analysis that production foregone through lack of additional water would have been sold at a price identical to the goods that were in fact sold.

Response: Once again, we do not concur with the Dean and King and Norgaard conclusions. There are many factors to be considered when developing the supply and demand functions which influence prices. These changes in situations are difficult to predict yet have an impact on prices. As an example, the changing world political situation with regard to exports.

(29) Comment: Page 103, "Land-Use Patterns": In addition to omitting a clear discussion of feasibility of waste water reclamation for this potential service area, the Statement also fails to note that the Santa Clara Valley is an excellent place to regulate future growth via enforcement of limitations on incremental water supply. We suggest that this kind of policy is an alternative to importation of New Melones water to serve the San Felipe division which deserves discussion at this point.

Response: See response to EDF comment 19.

(30) Comment: Page 111, et seq.: Once again we observe that the analysis of the Hollister area assumes the wisdom of the most complete agricultural development possible, an assumption not consistent with the Dean and King and Norgaard studies. Moreover, the discussion of these pages appears to prove that it would be unfortunate for the Hollister area to grow at any rate less than the two percent per year it has experienced in the past. This is by no means apparent. Certainly the wisdom of unlimited growth is open to question. Moreover, it is impossible to justify continued linear growth on the simple basis that growth at a less rapid rate would result in a smaller total income and total tax figure. This is because it is impossible to predict, absent a careful analysis of the costs of growth, such as the increased need for public services, that each marginal population increment is matched by a similar marginal economic increment.

Response: Once again we do not agree with the conclusions reached in the Dean and King and Norgaard studies. Therefore, we feel there is likelihood and need for agricultural development in the Hollister area. We do concur that the wisdom of unlimited growth is open to question, both pro and con. No attempt is made to justify continued linear growth on the basis that less rapid rate would result in smaller total income and total tax figure. The analysis only demonstrates some of the effect the lack of a water supply would produce.

(31) Comment: Page 122, "Land-Use": Once again, there should be some mention of the Dean and King and Norgaard studies in connection with the 48,000 acres of land to be brought into irrigated production.

Response: See response to EDF comment 14.

(32) Comment: Page 125, "Montezuma Hills Unit and Suisun Marsh": The discussion of use of the New Melones conservation yield in this potential service area is seriously truncated. There is no substantial attempt to detail the impact on the Suisun Marsh and other areas of the Delta of the industrial development in the Montezuma area which would be facilitated by importation of fresh water supplies. These proposed units of industrial development include nuclear power facilities, oil refineries and other refineries. Their wastes would of course have a major impact on the local biota, and their presence would have a variety of other significant environmental consequences. We suggest that some attempt be made to assess the wisdom of utilizing Federal facilities and Federal water to stimulate this kind of industrial development in this particular area.

Response: It is true that a portion of the water provided to the Montezuma area would be utilized for municipal development. The extent of new development that would be attributable to a new water supply cannot be fully determined at this time because there are many factors besides water supply that affect new development potential. Any new development in this area would be subject to prevailing water and air quality and other environmental standards. More detailed environmental impact studies would be conducted before any such project were constructed.

(33) Comment: Page 133a: We question whether downstream releases from New Melones Dam would prove useful in overcoming the pollution block that presently exists in the Stockton area. We suggest, therefore, that the evidence upon which these assertions are based be identified.

Response: During recent years (1963, 1964, 1968, and 1972), water from the Delta-Mendota Canal has been released to the San Joaquin River during the fall months to assist in dispersing the pollution block. Although such releases alone have not been completely effective in dispersing the block, results of the program indicate that maintaining a positive downstream net flow in the Stockton Ship Channel throughout the summer and fall with high quality Stanislaus River water will greatly assist in preventing a pollution block to form. Also needed are the planned improvements to the Stockton Sewage Treatment Plant, and a control structure to prevent most of the San Joaquin River flow from going down Old River. The release of water from the New Melones Reservoir would have the added benefit of providing natural San Joaquin Basin water for the migration of salmon.

Studies are currently being considered as part of the Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary to provide detailed information on the factors affecting water quality in the Stockton Ship Channel and other parts of the Southern Delta. Results of these studies will show what is needed in terms of supplemental flows, water regulation facilities, and waste water treatment to maintain desirable water quality conditions throughout the year in these areas. These studies should be completed by 1975.

(34) Comment: Page 138, "Alternatives": As we have indicated at the beginning of our comments, we consider the treatment of alternatives in the supplement to be seriously deficient, principally because the "no action" alternative is quite clearly not the only alternative to utilization of New Melones yield in any or all prospective service areas. To cite but two examples, supplementary supplies in the local area could alternatively be derived from the Auburn-Folsom South Project, the Peripheral Canal or directly from the Delta. The most obvious alternative source of supply to the Southern San Joaquin Valley is to provide more water from the Bureau of Reclamation Central Valley Project Delta Reservation, to be transported through some as yet unauthorized facility.

We emphasize once again that it is impossible to assess the alternatives to utilization of the New Melones Project for one or more of these potential service areas without understanding the present facts of water supply in the Central Valley Project. These facts should be set forth, and should include present contractual commitments matched against present supplies, incremental supplies available to the Central Valley Project from other authorized projects (excluding New Melones), ultimate demands under present contracts and future calls on the entire system assuming the implementation of appropriate Delta water quality standards.

Response: We recognize that a no action alternative is not the only alternative to New Melones for supplying the potential service areas. As noted in response to EDF comment 11, New Melones can only meet a portion of these needs and other sources will have to be found to meet the total needs. The alternatives EDF mentions also have serious environmental problems associated with them. For example, as noted elsewhere EDF is opposing the Auburn-Folsom South Project because of what they consider overriding environmental considerations. Further pumping from the Delta which EDF suggests as an alternative to New Melones also has serious drawbacks because of the effect on fishery resources. The simple fact of water supply in the Central Valley Project area is that when all water needs including environmental needs are added up there is not enough water available and new water sources are needed.

(35) Comment: Page 138, "San Felipe Division": This section refers to a waste water reclamation study for this service area, the final results of which are not yet available. The final study is now public and shows waste water reclamation to be a viable alternative to the provision of Central Valley Project water. The supplement should be amended to reflect this.

Response: Assuming the projected water requirement shown in the Consoer-Bechtel waste water reclamation report, which is 60 percent of that projected in the Bureau's San Felipe Study, then the comment by EDF is correct in that the waste water reclamation study does show waste water reclamation to be alternative to the San Felipe Project. The supplement states that if a practical plan prove feasible, it would defer the necessity for water import. However, the Consoer-Bechtel report does indicate some reservations regarding cost of treatment and operational problems which were indicated in our supplement. In addition, there is still the matter of full acceptance by public health agencies of the use of such water for human consumption. This is touched on briefly on page 4-12 of the waste water reclamation report.

(36) Comment: Page 141: This portion of the supplement asserts that the Delta water quality conditions will worsen without the New Melones Project. Some attempt should be made to quantify these dire assertions. Moreover, as the Bureau has persistently refused to abandon its Knight's Ferry diversion from the water rights applications it has submitted to the State Water Resources Control Board, the impact of the New Melones Project on the Delta should be also analyzed on the assumption of complete projected East Side diversion, with only fish and water quality releases going downstream to the Delta. A similar analysis should be made based upon maximum expected local service area diversions.

Response: Data is not available to elaborate further. Questions raised by EDF have already been answered on page 133.

6. SIERRA CLUB-YOKUT WILDERNESS GROUP

The following comments were received from Mr. Neil Hudson, Chairman of the Yokut Wilderness Group's River Touring Section, Sierra Club.

(1) Comment: Briefly, I am impressed and quite satisfied with the report. I assume it satisfies necessary additions suggested in the San Francisco hearing.

(2) Comment: One thing not mentioned in the Southern San Joaquin section is saltation of the soil when irrigated farming is begun. This phenomena will impose a time limit on useful agriculture for that area. Research into the problem in Imperial Valley and in Israel is pointing toward salt-resistant strains--but no progress yet. This is a minor issue and I am not suggesting its inclusion.

Response: We recognize that salinity is a problem in this area but because of excellent quality water from New Melones, the new water supply will not add to the problem provided proper irrigation practices are followed.

NEW MELONES LAKE
ENVIRONMENTAL IMPACT STATEMENT

SUPPLEMENTAL DATA
ON USE OF CONSERVATION YIELD

ATTACHMENT A

CORRESPONDENCE RECEIVED

Prepared by
U. S. Army Engineer District, Sacramento, California
and
Bureau of Reclamation

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

December 27, 1972

Colonel James C. Donovan
District Engineer
Department of the Army
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel Donovan:

The "Supplemental Data on Use of Conservation Yield" to the environmental impact statement on New Melones Lake, Stanislaus River, California, which accompanied your letter of November 22, 1972, has been received by the Department of Commerce for review and comment.

The Department of Commerce has reviewed the supplementary data and has the following comments to offer for your consideration.

On page 80, it is stated that "the Tracy Fish Collecting Facility achieves an efficiency of up to 90 percent in salvaging salmon and striped bass over an inch in length by use of a louver-type fish diversion and collector." Since such fish, in order to reach the collector, must pass two sets of louvers, collection efficiency is actually closer to 80 percent for fish over one inch long. Also, since collection efficiency is related to fish size, which is quite variable, it would be more meaningful to give estimates for each species of the percentage of the total seaward migration passing the collection facility that reach the collectors.

Although there are no fisheries in the San Luis service area (p. 116), the fishery-related impacts that result from return of irrigation water to the Delta will occur. Such impacts are described in other sections of the statement, but should be identified with respect to the San Luis Unit alternative.

In section III, a variety of potential adverse impacts on fisheries resources are identified for each alternative area for distribution of New Melones conservation water. In section IV, Page 134 - 137, many such impacts have been omitted in the summarization of adverse impacts. Changes in current patterns from increased pumping in the Delta, changes in water quality from return of irrigation water and loss of small fish at the Tracy pumping stations should be mentioned as having potential adverse effects on fisheries resources.

Thank you for giving us an opportunity to review this supplementary data to the environmental impact statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
2020 Milvia Street, Berkeley, CA 94704

December 1, 1972

Colonel James C. Donovan
District Engineer
Dept. of the Army
Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel Donovan:

We acknowledge receipt of the supplement to the Environmental Impact Statement for New Melones Lake, Stanislaus River, sent to the Soil Conservation Service for review and comment.

We made review comments on the Draft Environmental Statement per this project on February 22, 1972. We have no further comments on the draft or the supplement thereto.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

G. H. STONE
State Conservationist

cc: A. D. Warnken, SCS, Sacramento

NORMAN B. LIVERMORE, JR.
SECRETARY

RONALD REAGAN
GOVERNOR OF
CALIFORNIA

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814

Department of Conservation
Department of Fish and Game
Department of Navigation and
Ocean Development
Department of Parks and Recreation
Department of Water Resources

Air Resources Board
Colorado River Board
San Francisco Bay Conservation and
Development Commission
State Lands Commission
State Reclamation Board
State Water Resources Control Board
Regional Water Quality Control Boards

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

JAN 5 1973

Colonel James C. Donovan
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel Donovan:

The State of California has reviewed the "Environmental Impact Statement, New Melones Lake, Stanislaus River, California" (Supplemental Data on Use of Conservation Yield) prepared by the U. S. Bureau of Reclamation, which was submitted to the Office of Intergovernmental Management (State Clearinghouse) within the Governor's Office. The review accomplished by the State fulfills the requirements under Part II of the U. S. Office of Management and Budget Circular A-95 and the National Environmental Policy Act of 1969.

The environmental impact statement was reviewed by the State Departments of Agriculture, Fish and Game, Parks and Recreation, Public Health, Conservation, Public Works (Division of Highways), Navigation and Ocean Development, and Water Resources; the State Lands Division; the State Reclamation Board; and the California Regional Water Quality Control Board, Central Valley Region.

On August 18, 1972, the State commented on the "Environmental Impact Statement, New Melones Lake, Stanislaus River, California", dated May 1972. Our comments on that statement are still valid. The comments on this letter are limited to the supplemental data statement.

It is recognized that the actual place of use of the project yield cannot be determined at this time because changes in demand and other factors are likely to occur between now and 1980, the earliest date when the yield would be available from New Melones Lake. A significant factor that could influence the area of use will be the decision on project water rights by the State Water Resources Control Board.

Until the decision of the State Water Resources Control Board is rendered, and water service contracts have been executed, the environmental impact of the use of the new conservation yield and related aspects of the project cannot be specifically evaluated.

Some specific comments that should be considered to improve the text of the statement are attached to this letter.

Thank you for the opportunity to comment on the environmental impact statement.

Sincerely yours,

N. B. LIVERMORE, JR.
Secretary for Resources

By N. B. Livermore Jr.

Attachment

cc: Mr. James A. R. Johnson
Executive Director
Office of Intergovernmental Management
State Clearinghouse
1400 - 10th Street
Sacramento, CA 95814
Attention: Mr. Mark Briggs
(SCH No. 72011720)

ATTACHMENT

Specific comments on the text of the "Environmental Impact Statement, New Melones Lake, Stanislaus River, California" (Supplemental Data on Use of Conservation Yield are as follows:)

Page 23, paragraph 2. Coyotes and bobcats are both commonly found in this area. Neither animal can be considered as rare or uncommon.

Page 24, paragraph 3. Two bird species that are classified as rare or endangered are known to inhabit this area: the southern bald eagle (endangered) and the California yellow-billed cuckoo (rare).

Page 52, paragraph 6. The sparse and specialized grassland cover mentioned here has significant populations of quail, chukar, raptors, songbirds, kit fox, and coyotes, and cannot be considered as a "sparse wildlife fauna."

Page 59, Fish and Wildlife. Some mention should be made of the heron and egret rookery on the San Joaquin River, north of San Luis Island. This is the largest known rookery in the entire San Joaquin Valley (over 400 birds) and it provides birdwatching and nature study experience for hundreds of people annually.

Page 84, Hydrology. The environmental impact statement presents a tabulation of average monthly flows which is called "at Ripon", in the text, and "below Knight's ferry", in a tabular heading. Our examination during the period of 1941-70 for July-November shows the following average flow at Ripon:

Average Flow at Ripon, 1941-70 (cfs)	
July	378
August	184
September	203
October	261
November	474
December	1027
Lowest daily mean flow, 1941-70	40 cfs

(These flows were taken from USGS Surface Water Records of California, Vol. 2)

The assessment of the project impact of flows in the Stanislaus River should extend from Goodwin Dam to the San Joaquin River. We recommend that both "at Ripon" and "below Knight's Ferry" be included, as well as any other key flow points along the river.

Page 85, Fish and Wildlife. Experience has shown us that native habitat will not improve with the importation of extra water; land values are such that farmers will not retain native vegetation on land suitable for farming. It is common practice to fill in the small drainage channels containing riparian habitat and additional water will make it feasible to do this.

Page 85, paragraph 4. The hunter harvest of rabbits will not increase with the importation of water and improvement of land. Tresspassing is not normally tolerated for rabbit hunting on developed land, which will mean fewer hunters and a reduced harvest of animals.

Page 90, on Table 2. An error appears in column 5. The income should be stated in thousands of dollars, not thousands of people.

Page 116, Fish and Wildlife. Raccoon and quail will not be favored by firm water supplies as indicated since the resultant "clean" farming practices will be detrimental to both species. Also, kit fox are found in the area described, and they will be detrimentally affected by future land development.

ENVIRONMENTAL
DEFENSE
FUND

2728 DURANT AVENUE, BERKELEY, CALIFORNIA 94704/415 548-8906

December 27, 1972

Colonel James Donovan
District Engineer
Sacramento District, United States Army
Corps of Engineers
650 Capitol Mall
Sacramento, California

Re: Comments on Supplement to New Melones Impact Statement

My dear Colonel Donovan:

Enclosed please find the comments of Environmental Defense Fund on the draft "Supplemental Data on Use of Conservation Yield," intended for ultimate incorporation into the New Melones Environmental Impact Statement.

Copies of our comments will be delivered under separate cover to the Bureau of Reclamation, Mid-Pacific Region, and counsel for all parties in the federal court litigation.

With my best wishes for a happy holiday season, I am

Yours truly,

Michael W. Palmer
Regional Counsel

ENVIRONMENTAL DEFENSE FUND

2728 DURANT AVENUE, BERKELEY, CALIFORNIA 94704/415 548-8306

COMMENTS OF ENVIRONMENTAL DEFENSE FUND ON THE NEW MELONES IMPACT STATEMENT, "SUPPLEMENTAL DATA ON USE OF CONSERVATION YIELD."

We wish to provide the following comments upon the "Supplemental Data on Use of Conservation Yield," a document presently being circulated for comment and destined for ultimate addition to the Environmental Impact Statement on the New Melones Project now on file.

As in the past, we have certain general comments to make in respect of the Supplement. First, we are surprised that no effort is made in the Impact Statement to set forth any of the pertinent data arising out of the hearings before the California State Water Resources Control Board. Specifically, we are aware that the California State Department of Fish and Game has requested that essentially the entire conservation yield of the dam be released downstream for preservation of the salmon fishery according to a release schedule which would not be entirely consistent with planned power and irrigation releases from the dam. We are also aware that the Bureau of Reclamation has made tentative estimates of the impacts on power generation and irrigation yield of the proposed Fish and Game releases. If the Board were to condition water rights permits in such a way as to require meeting the Fish and Game release pattern, the ability of New Melones to service the seven potential areas discussed in the Supplement would

be impaired. As the Supplement repeatedly claims that New Melones is sorely needed to satisfy the demands of these seven potential areas, or some of them, we believe that the potential impairment should be noted and analyzed in the Statement.

Second, we are greatly disappointed that the authors of the draft Supplement did not see fit to disclose the true facts of the present water supply situation within the Central Valley Project in order that the claims made in the Supplement for the great need for irrigation water from New Melones might be evaluated in a realistic perspective. For example, the "Alternatives" section of the Supplement states in essence that if the six irrigation service areas do not receive a supplemental water supply they will fall into decline. Surely, however, the question is not whether these several potential service areas will or will not receive a supplemental supply, but rather whether possible alternatives to the New Melones Project -- including doing nothing -- will have any effect on each of the potential service areas. New Melones could not, for example, possibly service the needs of all these several areas. In addition, virtually all the service areas have planned primary sources of supplemental water supply other than New Melones, such as the long-standing plans to serve the Auburn-Folsom South portion of the local service area from the Auburn-Folsom South Canal.

There is absent, moreover, any attempt to evaluate more innovative ways of obtaining water, such as wastewater reclamation or desalination. As we note in our specific comments below, a recent engineering study prepared in respect of one of the six potential service areas -- the San Felipe Division --concludes that waste-

water reclamation in that area is a viable alternative to the importation of new water supplies.

We suggest that the present tenor of the alternatives section must be radically altered. To imply, as the present draft clearly does, that the potential service areas will fall into decline if the New Melones Project is not built is affirmatively misleading and raises the question whether the authors of the draft statement do not have a congenital aversion to the truth.

We believe that some effort should be made in the Statement to address the question of present water supply in the Central Valley Project. There is, for example, no discussion of whether present contractual commitments can be met with the present supply, the amount of water available for irrigation service after compliance with Decisions 1379 and 1400 (with and without the Peripheral Canal, in each case), or the amount of augmented capacity to be added to the Central Valley Project by authorized projects other than New Melones. Claims for the need for New Melones water in the respective service areas should at least be tempered by the facts of present supply and demand, and re-analyzed in the light of the augmented supplies to be made available in the future by such projects as Auburn, Marysville and Cottonwood Creek. Only by setting forth these facts is it possible for the otherwise uninformed reader of the Statement to determine whether environmental detriments are balanced by economic benefits.

We believe that additional maps should be provided in various places in the Supplement in order to show the location and features of the various alternative service areas, both in respect of geography and water supply.

We suggest that some mention should be made of the soil classifications of the various potential service areas. Since it seems most doubtful that soils of Class 4 or worse should be brought into production at this time, we believe that the need for water can only be evaluated in light of these facts.

Finally, we suggest that a discussion of the problem of salt balance in the Central Valley should be integrated into the Supplement, since most of the potential service areas discussed therein either contribute to or are the victims of the present salt imbalance in the Valley as a whole.

SPECIFIC COMMENTS

Page 2, Paragraph 1: The statement that approximately 285,000 acre feet of water would be available for pumping from the Delta appears to be factually inaccurate. The 98,000 acre feet of water proposed to be released for fishery maintenance purposes would also be in part available for pumping from the Delta, depending on the release pattern.

Page 2, Paragraph 4: We are unclear as to why it is impossible at the present time to assign priorities to the claimed needs of the potential service areas. If the needs genuinely exist now, then it would seem possible to order them in terms of urgency.

Page 3, Paragraph 1: This would seem an appropriate point for a discussion of the need for water with and without compliance with the requirements of Decision 1379, and with and without the Peripheral Canal.

Page 4, Paragraph 1: The local service area now includes the entirety of the four counties named, by virtue of an amendment to

the Bureau of Reclamation's water rights application now pending before the State Water Resources Control Board.

Page 5, Paragraph 4: We suggest this paragraph be augmented to reflect that the Folsom-South service area could obviously be served by the Auburn-Folsom South Canal, and that the Folsom-South service area is by far the largest and most important portion of the area discussed in this paragraph.

Page 6. Paragraph 2: We suggest a map of the proposed location or locations of the Cross Valley Canal would be useful here.

Page 13, Paragraph 2: We believe that the statements contained in this paragraph are inconsistent with those made by the Bureau of Reclamation on other occasions. That is, it is our understanding from previous Bureau statements that the Delta Mendota Canal is presently at capacity during the irrigation season. Since the discussion here is primarily of the supply of irrigation water, this would seem to be the determining factor -- not how much capacity remains in the Delta Mendota Canal during the winter.

Page 15, Paragraph 2: We believe that this discussion should be augmented by reference to the recent report of the National Water Commission which likewise comes to the conclusion that there is no present need for new reclamation projects in the United States. In addition, we believe that the work of Professor Richard Norgaard, of the University of California at Berkeley, should be mentioned in this section since it relates specifically to the New Melones Project and is more recent than the Deane and King work. Professor Norgaard's study is well-known to the Bureau.

We should also note that the discussion of the Deane and King work makes great efforts to undermine that work by pointing out that

is based on certain assumptions. We would only note that the continued declining trend of certain of the parameters critical to their study renders their conclusions even more conservative than when first reached. The most important of these continuing trends is of course population. The Deane and King study assumes C ring population growth, whereas in fact the United States as a whole is now on the D ring; this represents a substantial decline in population growth projections which has occurred since the Deane and King studies.

Finally, we are unable to square the discussion in this section with the bland assertions, repeatedly made elsewhere in the Supplement, of the increased value to the state which would be provided by the augmented irrigation yield of the New Melones Project.

Page 18, Table at the bottom (continued at the top of page 19): We believe that the Statement should set out the source of these figures. Moreover, we suggest the term "water requirements" as it is used in respect of the tables should be defined. If, as is often true in Bureau parlance, the term "requirements" refers to ultimate possible development within a given area, this definition should be clearly spelled out.

This comment applies to all other assertions of need for additional water supply in all the other potential service areas discussed.

Page 34, Paragraphs 2 & 5: We suggest that the discussion of groundwater depletion is better cast in numerical terms, and that rates of groundwater decline should be given in connection with the assertions made.

Page 36, Paragraph 3: What is the relationship of subsidence to the permanent loss of groundwater storage capacity? These

relationships should also make it possible to measure the rate of groundwater loss.

Page 39: We suggest that the source of the San Felipe Division water requirements figures be identified in the discussion. We are confused by the "percolation" allocations in the table of figures presented on this page. Is the precolation requirement designed to replace a groundwater overdraft situation?

The discussion also notes that some 40,000 acres of land would receive 1 1/3 acre feet of supplemental irrigation water. This tatement should set forth the reason that such supplemental water is needed. If it is designed to allow a change in cropping pattern, this should be clearly set forth.

Page 48, "Air Quality": It is startling to see the city of San Jose characterized as a "possible exception" to the prevailing very good air quality. The filthy air of the city of San Jose should be forthrightly characterized as such. The provision of new water supplies from the San Felipe Division would allow further growth in the San Jose area, thereby exacerbating the air pollution problem.

Page 50, Paragraph 2: To state that the entire West Plains service area -- rather than just a portion of it -- will be irrigated each year is to state that net irrigated acreage in California will increase. There should be some reference, therefore, at this point to the Deane and King studies.

Page 57, Paragraph 1: Once again, we believe the source of the tabular figures should be identified, and the phrase "projected additional water requirements" defined with precision.

Page 66, Paragraph 1: We do not understand how New Melones water could be used to service the Montezuma Hills area, as we believe this to be an hydraulic impossibility. Presumably an exchange of

water is envisioned. This should be clearly stated.

In addition, we again ask for identification of the source of the tabular data presented.

Finally, the 54,500 new acres to be brought into production in the service area should be evaluated in light of the Deane and King and Norgaard studies. Some reference to these should be made at this point.

Page 79, "Impacts on the Delta": This section omits to mention the harm that would result to the Delta if the yield of the New Melones Dam were diverted into the East Side Division at Knight's Ferry. In this connection, it should be noted that although the Bureau has repeatedly stated that the East Side Division is not likely to be constructed in the near future, it has nevertheless consistently refused in the course of the Water Rights Hearings before the Water Resources Control Board to delete from its applications a provision for diversion of the New Melones yield at Knight's Ferry. In view of this, we believe that some mention should be made of the effect on the Delta of total diversion out of the basin.

Page 84, "Hydrology": We suggest that the gauge point at which the flows shown on the table are measured be identified and that these flows be compared with those requested by the California State Department of Fish and Game in the New Melones Water Rights Hearings.

Page 87, "Land-use": Some reference should be made to the Deane and King and Norgaard studies in connection with the discussion of 50,000 to 70,000 acres of irrigated land within the local service area.

Page 87, "Water Quality": If New Melones yield is used in the local service area to irrigate 50,000 to 70,000 acres of

presently dry land, the quality of the return flows will in fact be less than the quality of direct downstream flows. This fact should be clearly set forth in the Statement.

Page 89, "Socio-economic Factors": We note, in connection with the discussion of the Folsom-South Service Area, that the area's annual overdraft is only 37,000 acre feet. We accordingly suggest that the term "salvation supply" is somewhat wide of the mark. In addition, we suggest that the conclusions of Deane and King and Norgaard must be factored into the economic discussion found at this point in the Supplement in order for it to make any sense.

Page 100: Once again, we believe the economic assertions made at this point must be tempered in an appropriate manner with discussion of the Deane and King and Norgaard conclusions. It is simply incorrect, as a conceptual matter, to assume as does this analysis that production foregone through lack of additional water would have been sold at a price identical to the goods that were in fact sold.

Page 103, "Land-use Patterns": In addition to omitting a clear discussion of feasibility of wastewater reclamation for this potential service area, the Statement also fails to note that the Santa Clara Valley is an excellent place to regulate future growth via enforcement of limitations on incremental water supply. We suggest that this kind of policy is an alternative to importation of New Melones water to serve the San Felipe division which deserves discussion at this point.

Page 111, et seq.: Once again we observe that the analysis of the Hollister area assumes the wisdom of the most complete agricultural development possible, an assumption not consistent with

the Deane and King and Norgaard studies. Moreover, the discussion of these pages appears to prove that it would be unfortunate for the Hollister area to grow at any rate less than the two percent per year it has experienced in the past. This is by no means apparent. Certainly the wisdom of unlimited growth is open to question. Moreover, it is impossible to justify continued linear growth on the simple basis that growth at a less rapid rate would result in a smaller total income and total tax figure. This is because it is impossible to predict, absent a careful analysis of the costs of growth, such as the increased need for public services, that each marginal population increment is matched by a similar marginal economic increment.

Page 122, "Land-use": Once again, there should be some mention of the Deane and King and Norgaard studies in connection with the 48,000 acres of land to be brought into irrigated production.

Page 125, "Montezuma Hills Unit and Suisun Marsh": The discussion of use of the New Melones conservation yield in this potential service area is seriously truncated. There is no substantial attempt to detail the impact on the Suisun Marsh and other areas of the Delta of the industrial development in the Montezuma area which would be facilitated by importation of fresh water supplies. These proposed units of industrial development include nuclear power facilities, oil refineries and other refineries. Their wastes would of course have a major impact on the local biota, and their presence would have a variety of other significant environmental consequences. We suggest that some attempt be made to assess the wisdom of utilizing federal facilities and federal water to stimulate this kind of industrial development in this particular area.

Page 133a: We question whether downstream releases from New Melones Dam would prove useful in overcoming the pollution block that presently exists in the Stockton area. We suggest, therefore, that the evidence upon which these assertions are based be identified.

Page 138, "Alternatives": As we have indicated at the beginning of our comments, we consider the treatment of alternatives in the Supplement to be seriously deficient, principally because the "no action" alternative is quite clearly not the only alternative to utilization of New Melones yield in any or all prospective service areas. To cite but two examples, supplementary supplies in the local area could alternatively be derived from the Auburn-Folsom South Project, the Peripheral Canal or directly from the Delta. The most obvious alternative source of supply to the Southern San Joaquin Valley is to provide more water from the Bureau of Reclamation Central Valley Project Delta Reservation, to be transported through some as yet unauthorized facility.

We emphasize once again that it is impossible to assess the alternatives to utilization of the New Melones Project for one or more of these potential service areas without understanding the present facts of water supply in the Central Valley Project. These facts should be set forth, and should include present contractual commitments matched against present supplies, incremental supplies available to the Central Valley Project from other authorized projects (excluding New Melones), ultimate demands under present contracts and future calls on the entire system sssuming the implementation of appropriate Delta water quality standards.

Page 138, "San Felipe Division": This section refers to a wastewater reclamation study for this service area, the final results

of which are not yet available. The final study is now public and shows wastewater reclamation to be a viable alternative to the provision of Central Valley Project water. The Supplement should be amended to reflect this.

Page 141: This portion of the Supplement asserts that the Delta water quality conditions will worsen without the New Melones Project. Some attempt should be made to quantify these dire assertions Moreover, as the Bureau has persistently refused to abandon its Knight's Ferry diversion from the water rights applications it has submitted to the State Water Resources Control Board, the impact of the New Melones Project on the Delta should be also analyzed on the assumption of complete projected East Side diversion, with only fish and water quality releases going downstream to the Delta. A similar analysis should be made based upon maximum expected local service area diversions.

235 Bardo
Oakdale, California 95361
December 26, 1972

Dear Colonel Donovan,

Thank you very much for sending me copies of EIS supplement to the New Melones Project. I forwarded the extra copy to Roger and you'll hear from him shortly.

Briefly, I am impressed and quite satisfied with the report. I assume it satisfies necessary additions suggested in the San Francisco hearing.

One thing not mentioned in the Southern San Joaquin section is saltation of the soil when irrigated farming is begun. This phenomena will impose a time limit on useful agriculture for that area. Research into the problem in Imperial Valley and in Israel is pointing toward salt-resistant strains--but no progress yet. This is a minor issue and I am not suggesting its inclusion.

Best wishes for the New Year,

Yours truly,

Neil Hudson

Neil Hudson