

CACHE CREEK BASIN

California

DATA FOR TECHNICAL CONFERENCE

JULY 1975



CACHE CREEK BASIN, CALIFORNIA
DATA FOR TECHNICAL CONFERENCE

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SECTION A
THE STUDY AND REPORT

Purpose and Authority

Purpose.

The purpose of this report is to describe flood and related water resource problems and needs of the Cache Creek Basin and present various alternatives under consideration. The information presented herein is in accordance with requirements for a Technical Conference.

Authority.

The House of Representatives Flood Control Committee and Public Works Committee adopted resolutions regarding Cache Creek flood problems and the settling basin on 29 May 1946 and 19 June 1963 respectively. These resolutions are quoted below.

"Resolved by the Committee on Flood Control of the House of Representatives, that the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbors Act approved June 13, 1902, be and is hereby requested to review the report on the Sacramento River and tributaries, California, from Collinsville to Shasta Dam, published in House Document Numbered 649, 78th Congress, 2nd Session, and subsequent reports, with a view of determining whether previously considered plans for the control of floods in the Cache Creek Basin should be modified in any way and particularly with a view to determining the most practicable method of providing protection against floods in the Clear Lake area."

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on Sacramento-San Joaquin Basin Streams, California, Published as House Document Numbered 367, Eighty-first Congress, First Session and other reports, with a view to determining whether the existing project should be modified in any way at the present time, with particular reference to the Cache Creek Settling Basin."

Prior Studies and Report

Many studies have been conducted by various agencies to determine a plan of development for the Cache Creek Basin. These studies have ranged from cursory examinations through reconnaissance evaluations to detailed estimates and projects.

Corps of Engineers

The Corps of Engineers investigated the Clear Lake - Cache Creek Basin during the latter 1940's to determine methods of solving water problems, particularly the flood problems, for the basin. In a document entitled "Review Report on Cache Creek Basin California," July 1950, the Corps of Engineers proposed a 250,000 acre-foot reservoir at the Indian Valley site on the North Fork of Cache Creek, a 40,000 acre-foot reservoir at the Kelseyville site on Kelsey Creek, channel improvement on Middle and lower Scotts Creeks, a new channel for diverting floodflows of Clover Creek and enlargement of the Clear Lake outlet channel. Other sites such as the Blue Ridge and Wilson Valley sites on Cache Creek, and several small reservoirs on tributaries to Clear Lake, were also studied.

The Corps proposed that the Clear Lake outlet channel be enlarged to a capacity of 8,000 c.f.s. to allow improved operation of Clear Lake for flood control purposes. All of the proposed reservoirs were to provide flood control and conservation of water primarily for irrigation. In addition, all of the proposed facilities, but primarily the enlarged Clear Lake outlet and Indian Valley Reservoir, were to enhance recreation.

In the mid 1960's the Corps conducted studies of the Settling Basin. No action was recommended as a result of these studies.

U. S. Bureau of Reclamation.

The Bureau of Reclamation has studied plans for development of the water resources of the Clear Lake - Cache Creek Basin as a part of "The Comprehensive Plan for Central Valley Basin California," dated May 1947. The Bureau contemplated that the runoff from Cache Creek, other than that from Clear Lake, would be regulated in Indian Valley Reservoir on North Fork Cache Creek and Wilson Valley Reservoir on the main stream, utilizing capacities of 250,000 and 210,000 acre-feet, respectively. These reservoirs were to be operated for flood control, but their primary use was to be for irrigation. Irrigation water supply was to be used for lands lying just west of Woodland. Development of Kelsey Creek was also proposed, as was the Yolo-Zamora Canal.

The Bureau's primary interest was to develop new irrigation and municipal and industrial water supply. This would be accomplished by transmountain diversion of water from the Eel River by means of the English Ridge project on the main fork of the Eel and the Garrett tunnel from English Ridge to Middle Creek, a tributary to Clear Lake. The service area for the English Ridge Unit extends beyond the Cache Creek Basin. The major area to be served within the basin is the region around Clear Lake. The Bureau has indicated that the English Ridge project is economically infeasible at this time.

The Bureau of Reclamation is presently studying the Lake and Yolo counties area to develop a comprehensive plan to meet the water need and provide for water quality, fishery, and recreation.

Soil Conservation Service.

There are four U.S. Soil Conservation Service watershed projects, currently in final feasibility stages of planning, that could affect Cache Creek floodflows.

The Cottonwood - Willow Slough Watershed Project area is adjacent to the Cache Creek Basin, south of Capay. The Lamb Valley Diversion feature of this project would divert floodflows into Cache Creek near Capay. The timing of peaks and relatively small flows of this diversion will cause only slight additions to the peak flows on Cache Creek. The major feature of this project is a proposed reservoir on Cottonwood Slough, in the upper portion of the watershed. This feature would reduce the floodflows into Willow Slough.

The Dry Slough - Davis Area Watershed Project area is adjacent to the south boundary of the Cottonwood - Willow Slough watershed. Features of this project, which include a diversion of Chickahominy Slough floodflows into Putah Creek, would reduce the floodflows into Willow Slough. The combined features of these two projects would reduce the floodflows into Willow Slough.

The Hungry Hollow Watershed Project area is adjacent to Cache Creek, north of Esparto. Diversion channels and improvement of existing channels would reduce damage from floodflows in Goodnow Slough. The project would, however, increase inflow to Cache Creek by as much as 2,000 c.f.s.

The Capay Valley Water Project area is located south and adjacent to Cache Creek between the towns of Rumsey and Capay. Current plans are to construct a diversion dam on Cache Creek just upstream of Rumsey and a distribution system along Cache Creek to service 8,400 acres of agricultural land. Additionally, a small reservoir is proposed on Palmes Canyon. It will store irrigation water and provide recreational benefits. The project as proposed does not have a significant effect on flood flows of Cache Creek.

State of California.

The Department of Water Resources is also primarily interested in the transmountain diversion of Eel River water. The water thus developed would be integrated into the State Water Project. Of the possible 670,000 to 1,230,000 acre-feet diverted from the Eel River, about 60,000 acre-feet is expected to be utilized in the Cache Creek Basin. The remainder would be for export. The State has developed 12 alternative diversion schemes, a portion of which are via Cache Creek Basin. The most promising route includes the Cache Creek Basin. Following completion of the DWR studies, the State established in December 1972, the California Wild and Scenic Rivers System, of which portions of the Eel River are a part. A report and five appendixes were originally scheduled to be published as DWR Bulletin 175. A report was, however, published in December 1972 presenting alternative plans considered.

The Department of Water Resources has been directed by the Reclamation Board to develop an interim plan for the operation of the Cache Creek Settling Basin. Two reports prepared in 1968 and 1972 by the DWR indicate that the settling basin storage capacity has been nearly depleted. These reports also discuss both short and long term solutions to the sediment deposition problem. A third report presently being prepared presents an interim maintenance plan that will suffice until a long range solution can be developed.

Lake County.

Tudor Engineering Company under contract to Lake County Flood Control and Water Conservation District has prepared two reports in January and November 1973 concerning the Kelsey Creek Water Supply Project. This project would essentially consist of construction of the Pomo Reservoir (Kelseyville Reservoir) on Kelsey Creek to provide for irrigation, domestic water supply, and recreation. The reports have been prepared in compliance with the requirements for a Small Reclamation Project (P.L. 984) Federal loan.

Yolo County.

Reports have been prepared for the Yolo County Flood Control and Water Conservation District to meet the requirements for a Small Reclamation Project (P.L. 984) Federal loan for construction of the Indian Valley Reservoir.

SECTION B
RESOURCES AND ECONOMY OF THE STUDY AREA

Environmental Setting and Natural Resources

General Basin Description.

The Clear Lake-Cache Creek Basin lies on the eastern slope of the Coast Range immediately south of the Eel River and Stony Creek Basins and north of the Putah Creek Basin. The basin drains 1150 square miles which primarily includes portions of Colusa, Lake, and Yolo Counties. The basin is naturally divided into two areas; the Clear Lake area (Lake County), including tributaries to the lake, and the Cache Creek area comprised of Cache Creek (Yolo County) and its tributaries. Clear Lake is a shallow natural lake having a capacity of about 315,000 acre-feet at an elevation of 1318.65 USGS (at 0' Rumsey gage) situated approximately 110 miles north of San Francisco and 110 miles northwest of Sacramento. The lake covers an area of 63 square miles, drains approximately 465 square miles in addition to its own surface area, has a shoreline of some 100 miles, a maximum depth of about 60 feet, and winter and summer temperatures of 40 and 76 degrees Fahrenheit respectively. Its principal tributaries are Scotts, Middle, and Clover Creeks entering from the north, and Kelsey and Adobe Creeks entering from the south. Presented in table B-1 is pertinent data relative to these tributaries and on chart 1 is a general map showing the basin.

Clear Lake discharges via Cache Creek outlet channel and through Grigsby Riffle, which is a natural geological obstruction, and then out the Clear Lake Dam into Cache Creek. Below Clear Lake Dam, Cache Creek descends through the rugged, 30 mile long Cache Creek Canyon. The two major tributaries of Cache Creek, the North Fork Cache Creek and Bear Creek, enter the Main Stream 9 and 24 miles respectively downstream of the dam. Cache Creek emerges from the canyon into Capay Valley, and during the wet season flows in a meandering pattern through the productive agricultural lands of Yolo County and into the Yolo Bypass. Prior to discharging into the Yolo Bypass, a portion of Cache Creek's heavy sediment load is deposited in the Cache Creek Settling Basin at the mouth of the creek.

Historical and Archeological Values

Indian sites identified by A. L. Kroeber in his classic book on California Indians, as well as sites identified by Patti Johnson, an archeologist and an expert on Cache Creek, and Henry Mauldin, Lake County Historian, are shown on chart 2.

Clear Lake has been established as the site of human life at least 8,000 years ago. Before the coming of the white man, it is estimated that Lake County was inhabited by about 5,000 Indians, making it the most densely populated area in the State. As a general classification, the Indians were of the Pomo family, related members of the Hoken family. The Pomos lived in three principal belts; the coast, the Russian River Valley, and the lake district. Clear Lake, due to its climate and bountiful resources, offered one of the finest environments for the Indians in the State.

Table B-1
BASIN PHYSICAL DATA

	Scotts Creek	Middle Creek	Clover Creek	Kelsey Creek	Adobe Creek (b)	Entire Clear Lake Basin	NORTH FORK		
							Cashe Creek	Bear Creek	
1.) Drainage Area, Square Miles	107	54	27	48	19	528	225	102	
2.) Main Channel Length, Miles	27 1/2	14 1/2	3	21	13	-	34	25 1/2	
3.) Maximum Basin Width- Length, Miles	10-17	6-11	4.5-10	3-13	6-10	16-40	15-25	6-24	
4.) Maximum-Minimum Elev- ation, Ft. Above U.S.L.	3950- 1326	4700- 1326	4200- 1326	4720- 1326	3940- 1326	4700- 1326	3030- 950	1560- 630	
5.) Average Annual Runoff, 1000 Acre Feet (a)	47.7 (1921-70)	33.2 (1921-70)	3.5 (1921-66)	43.7 (1921-71)	25.4 (1955-70)	253.6 (1921-70)	141.3 (1930-70)	37.6 (1959-70)	
6.) Maximum-Minimum Annual Runoff, 1000 Acre Feet (a)	140.8-4.5 (1921-70)	97.4-17.3 (1963-70)	12.9-3.9 (1961-66)	119-3.0 (1921-71)	17.0-2.9 (1955-70)		422.8-15.1 (1921-70)	89.9-6.7 (1959-70)	

(a) At Gaging Station
(b) Includes Highland Creek

B-2

On the upper and main bodies of the lake, the main Indian communities were not so much near the shore as near the streams, within easy reach of the lake. All Pomo settlements are on the north or east side of the streams. Only in Lower Lake where the surrounding hills were arid or excessively mineralized, was there a true lake population.

The Lake Miwok held the drainage areas of several small streams flowing into the very lowest mile or two of Clear Lake, and the southern bank of Cache Creek and the lake outlet for a short distance beyond. They occupied several settlements where Lower Lake now stands.

The Indians along Cache Creek and in the remainder of the lower basin were known as Patwin, a segment of the Wintun family, which occupied most of the Sacramento Valley. Kroeber cites eight known Wintun village sites on Cache Creek.

Archeological surveys in the Clear Lake-Cache Creek Basin have been very limited, despite the fact that all evidence points to rich and varied archeological resources. The sites shown along Clear Lake outlet channel have not been excavated. However, a Patwin site, 6 miles northwest of Clear Lake Oaks is on the National Register of Historic Places. The Anthropology Department of University of California, Davis, under the direction of Patti Johnson, has conducted limited test excavations in the foothill portions of the Capay Valley. Three of the sites are set back from the creek and one is an aboriginal site of the Patwins. The second, on the south bank of Cache Creek is the largest foothill site recorded. The third, an open village site, is the oldest evidence of human occupation in the east-central Coast Range Mountains found to date. A small portion of this site has been excavated. Only very preliminary work has been done in the lower reaches of Cache Creek. The known sites are shown on chart 2.

In the period from 1850 to 1855 white settlers began to populate the Clear Lake area, and in the process exterminated a great number of Lake County's Indians. In a short time large portions of the valley were privately owned and agriculture flourished. Mining and lumbering became important. Resort business also began around the numerous mineral springs. In 1861, Lake County was officially organized from a portion of Napa and Mendocino Counties and Lakeport was made the county seat.

Yolo was one of the original 27 counties created in 1850. Cache Creek is rich in historical lore and played a crucial role in the settlement and development of the region. One of the earliest uses by the white man was for fur trapping. French Camp, one mile east of Yolo on the north side of Cache Creek, was the campsite of Hudson Bay trappers. The first fur brigade in the Sacramento Valley, arriving in 1829, camped here. The name Cache Creek came from the fact that trappers cached their fur along the stream. The earliest permanent settlements were also established along Cache Creek. The town of Yolo, originally called Cacheville, began on the north bank of Cache Creek and was to become the first county seat in 1857. Although the county was not in the gold mining area, it shared in its prosperity because several of the towns were located

favorably as supply centers for the miners. However, from its inception to the present, the dominant factor in the history and expansion of the county has been it's rich agricultural resources.

Climate.

The climate is characterized by warm summers and mild winters typical of California's Central Valley area. About 95 percent of the annual precipitation occurs during the period October through April. The normal seasonal precipitation varies from 17 to above 60 inches from the lower reaches to the upper reaches of the basin and has a basin mean of about 32 inches. Winter temperatures seldom fall much below freezing and temperatures of the warm dry summers frequently exceed 100 degrees fahrenheit. The average frost-free periods in areas of agricultural development are about 250 days in the Cache Creek area and about 217 days in the Clear Creek area.

Geology.

The Clear Lake area is underlain by metamorphic, igneous, and sedimentary rocks ranging in age from Jurassic to Recent. The highland areas are composed of consolidated sandstone, shale, and serpentized basin intrusive rocks. The valleys are relatively flat alluviated areas underlain by sands and gravels of the Cache formation, Pleistocene volcanics, and terrace and alluvial deposits.

The Cache Creek area below Clear Lake Dam is underlain by folded and faulted sedimentary rocks of Cretaceous and Tertiary age. These older consolidated rocks are overlain by semiconsolidated Tehama and related continental deposits of Plio-Pleistocene age and Recent alluvial deposits. There is little residual soil in the mountainous portions of the basin, but the valley area downstream from the town of Runsey is underlain by stream channel, terrace, and flood plain deposits.

Transportation.

Development of Lake County has been hampered by lack of adequate transportation facilities and services. The nearest railroad is the Southern Pacific, 20 miles south of Middletown at Calistoga. Four State Highways, all two lanes wide and winding, and with summit elevations from 1,521 to 2,400 feet, connect the county to major urban centers. Secondary roads radiate into the surrounding countryside. Portions of old Highway 29 have been replaced by a freeway.

Through vehicular traffic across Cache Creek outlet channel is afforded by the Highway 53 bridge. The old Highway 53 bridge, a single span structure located about 1/2 mile downstream of the new highway 53 bridge also remains in use. A wooden trestle bridge, about 1/4 mile downstream of the lake connects the north side of the channel to the Anderson Marsh area.

Two private airports, one near Lakeport and the other at Lower Lake, provide private and charter flight service.

In the lower portion of the basin there is an excellent transportation system. Two railroads serve Yolo County. The Watts Woodland Municipal Airport, located 4 miles west of Woodland and near Cache Creek, provides facilities for executive aircraft and air cargo. The Sacramento Metropolitan Jet Airport is located 8 miles east of Woodland. Interstate 5 connects with State Route 13 for direct connection with Interstate 80, 8 miles south of Woodland. Interstate 880 and 505 border Woodland to the east and west and State Route 16 is the major east-west road through the basin, paralleling portions of Cache Creek. Cache Creek is bridged by Interstates 5 and 505, a number of county roads, and a spur of the Southern Pacific Railroad.

Natural Resources.

Much of the land adjacent to Clear Lake is used for agricultural purposes. It is primarily devoted to production of pears, walnuts, alfalfa, and pasture. Most of the population in the upper basin lives in proximity to Clear Lake.

The upland areas of the upper basin are steep and generally unsuitable for agricultural purposes because of poor soils and/or lack of water. However, this zone has sufficient natural growth, including chamise, manzanita and scrub oak, and stands of blue oak and Digger pine, to support many species of game and non-game animals such as black-tailed deer, quail, mourning doves, band-tailed pigeons, gray foxes, bobcats, skunks, and raccoons. The heron is an important wildlife species around Clear Lake. In addition, rare species such as the bald eagle, peregrine falcon, ring tailed cat, and osprey have been observed in the upper basin.

Clear Lake itself is far from what its name implies. Early records indicate that algae growth in Clear Lake has been an objectional problem for many years. The algal blooms are a result of the natural eco-system of the lake; however, the effects of increased population and agricultural development have aggravated the problem and increased the proportion of pollutants in the lake. Although the condition of the lake is objectionable, it produces one of the best warm-water fisheries in the State. The most important species that inhabit the lake are black crappie, hitch, bluegills, largemouth black bass, and brown bullheads. The ephemeral flow of most of the tributaries cannot support a stream fishery, although these streams are important spawning grounds for the hitch.

Vegetative cover of the Cache Creek Canyon area and higher elevations in this area varies a great deal with slope exposure and elevation. A dense chaparral cover type, dominated by chamise, manzanita and scrub oak occupies more of the drainage area than any other cover type. Blue oak and Digger pine woodland occur on many of the lower slopes. Grasses occur as an understory in much of the woodland area and occasionally as a pure type of patchy distribution. Sheltered north and east slopes at the higher

elevations often have pure stands of Douglas-fir or yellow pine. Canyons and river bottoms contain a large assortment of tree and shrub species. The "flats" along Cache Creek in the canyon are the most productive deer forage areas in this reach.

Species of wildlife present in the canyon area are the same as those found in the Clear Lake area except that a herd of Tule elk, numbering about 170, ranges throughout the Cache Creek Canyon area. The elk were transplanted from the Tule elk herd of the San Joaquin Valley. These elk, known as the Colusa herd, are an endangered species and are perhaps the one environmental factor more important than any other in the basin. The size of the Colusa herd has been stable for several years. The marshy areas along Bear Creek and, to a lesser extent, along Cache Creek, provide the main source of summer forage for the elk.

In the lower part of the basin below the town of Rumsey, the major game animals consist of various species of wild fowl. Some small game and fur bearing animals inhabit the area but their natural habitat is limited. The fishery in this reach is of minor significance since the channel is dry most of the year and the adjacent land is in private ownership.

The major portion of the irrigable land is under intensive cultivation of row crops, field crops, and orchards. The principal row crops are sugar beets and tomatoes with a wide variety of other row crops of lesser importance. Alfalfa is the most important field crop. Almonds, English walnuts, and apricots are the major orchard crops. The most important agricultural use of the non-irrigated land is for production of barley and range.

Human Resources

Population Characteristics

Lake County, with a total 1974 population of 23,600, ranks 43rd in county population in the State. From 1940 to 1970, the resident population increased at a rate of about 3 percent on the average annually. The State average for the same period was 3.6 percent annually. The current rate of growth is about 4.5 percent annually, with the majority being in a retirement group of 65 years or older. Historical populations and densities for Lake County are summarized below:

<u>Year</u>	<u>Resident Population</u>	<u>Density In Persons Per Square Mile</u>
1930	7,166	5.4
1940	8,069	6.1
1950	11,481	8.7
1960	13,786	10.4
1970	19,548	14.7

Source: U. S. Department of Commerce, Bureau of the Census

The seasonal population exceeds the number of permanent residents during the Memorial Day to Labor Day vacation period. An increase of 80,000 persons during the months of June through August is estimated by the local Chamber of Commerce based on reports of resorts, motels, restaurants, and records of Chamber offices.

There are no large urban developments in Lake County. However, most of the urbanized areas are located around Clear Lake Rim, and two-thirds of the county population live in these urban centers. Lakeport, the county seat, has the largest population with 3,400, while Clear Lake Highlands-Clear Lake Park has the heaviest population concentration with 5,800 permanent residents.

Natural increases are a minus factor in Lake County population growth.

<u>1 July 1960 to 1 July 1970</u>	<u>Change in Numbers</u>	<u>Natural Increases</u>	<u>Net Migration</u>	<u>Migration as % of Population Change</u>
13,900 - 19,700	5,800	-700	6,500	112

Source: California State Department of Finance

The birth rates in Lake County are lower than the statewide averages, as is the percentage of young adults in the population. The latter phenomena is common among rural counties, where limited employment and educational opportunities encourage out-migration of young adults to the metropolitan areas. Lake is the number one county in California in percentage of population over 65 and number six in the United States in county rankings. The median age in the county is 47.0 years.

The racial-ethnic distribution of Lake County in 1970 is presented in the following tabulation.

Racial-Ethnic Distribution - 1970

	<u>White 1/</u>	<u>Black</u>	<u>Spanish Language or Surname</u>	<u>Other</u>
Lake County	92.4%	.2%	4.5%	2.9%

1/ Excluding Spanish language or surname

Source: Derived from 1970 Census of Population and Housing

The population of Lake County is comprised predominately of whites with 92.4 percent as compared with 74.0 percent for the State. The next largest racial or ethnic group is composed of those residents with a Spanish heritage, representing 4.5 percent of the county population as compared with 15.5 percent for the State. Approximately .2 percent of Lake County's population is black which is significantly less than 7 percent that is representative for California.

Yolo County had an estimated 1974 population of 104,400 and ranked 27th in the state. Much of the recent population growth has been the result of net in-migration and has centered in the incorporated areas of Woodland and Davis. Woodland is the only major population center partly in the basin with an estimated population of 25,150 in 1974.

The following tabulation shows historical population growth for Yolo County.

<u>Year</u>	<u>Resident Population</u>	<u>Density in Persons Per Square Mile</u>
1930	23,644	22.8
1940	27,243	26.3
1950	40,640	39.3
1960	64,727	62.6
1970	91,788	88.8

Source: U. S. Dept. of Commerce, Bureau of Census

The following tabulation described population change by source.

<u>Year</u>	<u>Average Annual Change</u>	<u>Average Annual Natural Increase</u>	<u>Average Annual Net Migration</u>	<u>Migration as % of Population Change</u>
1950-1960	+2,509	+876	+1,633	65.1
1960-1970	+2,606	+1,008	+1,598	61.3

Source: Central Valley Report 1973

The county birth rate is now below 2.1 children per family. The median age in the county is young at 24.5 as compared with 28.1 for the State.

As shown below, nearly 78 percent of the population of Yolo County is white while for the State, it is 74 percent. Those persons with a Spanish heritage account for 16.7 percent of the county's population as compared with 15.5 percent for California. About 1.2 percent of the county population is black while 7 percent is representative for the State.

Racial-Ethnic Distribution - 1970

	<u>White 1/</u>	<u>Black</u>	<u>Spanish Language or Surname</u>	<u>Other</u>
Yolo County	77.9%	1.2%	16.7%	4.2%

1/ Excluding Spanish language or surname.

Source: Derived from 1970 Census of Population and Housing.

Education. There are differences in the educational attainment levels of the upper and lower subbasins as the following tabulation shows.

	<u>% of Males 25 Yrs. or Older H.S. Graduates</u>	<u>% of Females 25 Yrs. or Older H.S. Graduates</u>	<u>% of Total 25 Yrs. or Older College Graduates</u>
Lake County	48.2	52.5	1
Yolo County	60.7	62.5	18

Source: 1970 Census of Population, General, Social and Economic Characteristics.

One of the most serious problems in Lake County resulting from the relatively low levels of educational attainment, particularly as regards to the high school dropout rate, is the lack of a skilled labor force. It should be noted that part of the extreme variation between the two counties in number of college graduates is due to the location of the University of California at Davis in Yolo County.

Education statistics for primary and secondary systems in both counties are shown in Table B-2.

There is no official use of Clear Lake by local schools in Lake County. Limited experimentation related to water quality is periodically carried out, but this is not part of the formal curriculum. Portions of Cache Creek are widely used for study by local schools and youth organizations. A field trip guide for elementary school teachers identifies five sites along or within the creek which have special merit as "natural laboratories." The sites are on private land, and access ranges from unrestricted to access subject to owner's permission.

Housing.

Over 55% of the total housing units in Lake County are summer homes or cabins. A study by the Lake County Coordinating Council for Overall Economic Development indicates that of a net increase in housing from 1961-1970 of 2,279 units, one-half were second homes and not used for permanent housing. Subdivisions created primarily for the building of seasonal homes have been in existence for many years in the Clear Lake area. However, growth of both recreational and residential subdivisions has slowed in recent years. The following data taken from the 1970 Census of Housing indicate the predominance of second homes.

<u>Total Owner Occupied</u>	<u>Total Renter Occupied</u>	<u>For Rent</u>	<u>For Sale</u>	<u>Other Year Around</u>	<u>Vacant Seasonal Migratory</u>	<u>Total Dwelling Unit Inventory</u>
5,638	2,041	233	176	3,748	325	12,161

In addition, there are approximately 4,000 trailer and mobile homes, and mobile home development leads all new forms of housing.

TABLE B-2
 EDUCATIONAL STATISTICS
 Fall 1971 to Fall 1972

School District	: Elementary Enrollment	: Secondary Enrollment	: % Increase or Decrease	: Median School Yrs. Completed	: No. Teachers	: Teacher-Pupil Ratio	: Avg. Ann. Salary	: Avg. Ann. Expenditure Per Student
Yolo County:								
Esparto Unified	608	224			40	1:21	\$ 9,870	\$924
Woodland Unified	5,003	2,812			329	1:24	\$11,746	\$920
County-wide	13,662	5,403	- .5%	12.4	889	1:21	\$10,727	Not Known
Lake County	2,941	1,434	+ 3%	11.9	215	1:17	\$10,532	\$200
State Averages				12.3		1:28	\$11,431	\$937

Source: California Schools Selected Statistics.

Housing type is distributed as follows:

<u>Singles</u>	<u>Multiples</u>	<u>Mobile Homes 1/</u>	<u>Vacant Seasonal Migratory</u>	<u>Total Dwelling Unit Inventory</u>
9,905	587	1,344	325	12,161

1/ The low number indicated excludes mobile homes and trailers if vacant or used only for business or vacation purposes.

Source: Detailed Housing Characteristics, California, 1970.

Quality, condition, and price of housing in Lake County varies from very low to high. The lack of zoning restrictions has resulted in lower quality homes, interspersed with expensive, high quality homes and mobile homes, and semi-permanent and vacation trailers. This is particularly evident along Clear Lake rim and the Clear Lake outlet channel.

In Lake County Basin, 10% of the dwelling units are substandard. In 1970, the number of dwelling units in urbanized areas identified as substandard was about 5%. The estimated population living in substandard housing structures was 1,172. The median number of persons per all occupied units is low at 2.1, which indicates that overcrowding is not one of the critical factors in the problem of substandard housing. Substandard housing is scattered throughout the county, but is more concentrated in portions of the towns of Clear Lake Highlands, Clear Lake Oaks, and to a lesser extent in Lucerne and Lakeport. Many of the older resorts have been converted into apartments for elderly and retired persons on low fixed incomes and often suffer from lack of repairs and maintenance. Substandard housing is randomly distributed along Clear Lake outlet channel.

The greatest percentage of homes in Lake County were built prior to 1960 according to the 1970 census. The following tabulation summarizes the distribution of Lake County housing by year of construction.

Year Structure Built	Prior to 1940	1940-1949	1950-1959	1960-March 1970
Percent of Total Structures	20.3	16.0	26.4	37.3

Source: 1970 Census of Housing

Rentals and real estate prices are of a similar range throughout the county, with the exception of the City of Lakeport which runs about 5% higher than all the other unincorporated towns in the county. The median price of a home for sale in 1970 was \$13,400. The cost of new homes has increased drastically, as in the rest of the state.

The overriding housing problem in this portion of the basin is the gap between new housing constructed and population increases. The average

rate of available housing has increased 2% per year, considerably lower than the population growth rate. Also, the large number of second homes has done nothing to replace substandard housing. The high cost of new housing eliminates much of the low income population. Furthermore, private investors have shown no interest in construction of housing for low and moderate income families.

The following provides a count of dwelling units in Yolo County as of 1 April 1970.

<u>Total Owner Occupied</u>	<u>Total Renter Occupied</u>	<u>For Rent</u>	<u>For Sale</u>	<u>Other Year Around</u>	<u>Vacant Seasonal Migratory</u>	<u>Total Dwelling Units Inventory</u>
15,936	12,936	709	170	411	127	29,728

Source: Detailed Housing Characteristics, California, 1970.

The predominant housing type is single-family residential, as shown below:

<u>Singles</u>	<u>Multiples</u>	<u>Mobile Homes</u>	<u>Vacant Seasonal Migratory</u>	<u>Total Dwelling Unit Inventory</u>
20,629	7,506	1,466	127	29,728

Source: Detailed Housing Characteristics, California, 1970.

Multiple units, as percentage of the total housing stock are increasing.

The major concentration of housing within the lower part of the basin is found in Woodland. The median price asked for a home in this area was \$25,600 with prices typically higher in Woodland. There are marked differences in the quality and adequacy of housing throughout the lower basin. With the exception of Woodland, communities within the lower basin exceed the countywide average for percentages of substandard housing. Substandard units range as high as 53% of the total housing stock. It is estimated that 382 houses within the lower basin designated townsites are substandard.

As with Lake County, a majority of Yolo County housing units were constructed prior to 1960. The following tabulation summarizes the 1970 distribution of Yolo County housing units by year of construction.

Year structure built	Prior to 1940	1940- 1949	1950- 1959	1959- March 1970
Percent of Total Structures	18.8	11.3	30.3	39.6

Development and Economy

Land Use.

Less than 45% of the land in Lake County is in private ownership. The remainder is held by the Federal government, chiefly within the Mendocino National Forest, by the State, which has developed only a small portion of its holdings, and by local governments.

The upland areas are steep and generally unsuitable for development or agriculture due to poor soils and lack of water. Mining and lumbering in the upland areas has decreased substantially.

Irrigated agriculture and urban development, which comprise less than 10% of the land use, are generally concentrated in the areas near Clear Lake. Urban development is concentrated along the approximately 100 miles of lake shoreline. About 39 miles of this is developed for water associated recreation and permanent or summer homes.

Along the Clear Lake outlet channel, scattered residential and resort development occurs on the north side of the creek from Clear Lake to approximately $\frac{1}{2}$ mile east of the Highway 53 bridge. Two residential pockets are found on the south side of the channel, one extending from the Highway 53 bridge downstream for approximately $\frac{1}{2}$ mile, and the other located approximately $\frac{3}{4}$ mile downstream of this first development. Marshland and pastureland constitute the remaining land uses along the outlet channel.

Other than the relatively fertile lands along the tributaries in Long Valley, Indian Valley, and Bear Valley, the land downstream of Clear Lake is generally mountainous and economically unproductive.

Lands downstream of Clear Lake outlet dam and adjacent to and within Cache Creek channel are for the most part privately owned. The Bureau of Land Management does control some 23,000 acres of public land in the mountainous Cache Creek Canyon portion of the basin.

In the Capay Valley, primary land use is agricultural, with a preponderance of orchards. The small rural towns of Rumsey, Guinda, Brooks, and Capay are located along Highway 16 which extends through the Capay Valley. There is growing residential development scattered through the foothill areas of this valley.

As one descends to the flat lands in the lower portion of the basin, the major portion of irrigable land is under intensive cultivation of row crops, field crops, and orchards. Non-irrigated land is used for grain production and grazing land. In this sector of the basin are the small towns of Esparto and Yolo, and the largest city in the Clear Lake-Cache Creek Basin, Woodland.

Gravel extraction is the most significant land use within the creek channel, with nine plants currently in operation from the Madison Bridge to Yolo.

Of the 3,600 acres within the Cache Creek Settling Basin, 80% is used solely for agriculture. The remainder is covered with native vegetation and provides valuable wildlife habitat. Flowage easements which permit passage of floodflows have been purchased from landowners within the settling basin by the State Reclamation Board.

Property Values.

Property values in the Clear Lake area have been the result of demand and local governmental policy. Local government has been reluctant to apply controls to land use. Although zoning is currently underway, to date only a small portion of the land has been zoned for specific residential, commercial, or agricultural uses. Therefore, property values are extremely sensitive to the inflationary pressures of speculation and the deflationary dangers of non-directed development.

Lake frontage is the most desirable in the area and the highest priced. Lake frontage sells for \$200 to \$350 a front foot. Property values around Lakeport and the southern side of the lake tend to be higher than in the rest of the basin. Along Clear Lake outlet channel lots sell for about \$250 a front foot.

Agricultural land values are comparatively high. Pear land is considered to be the prime land in the county and ranges from \$1,200 to \$1,300 per acre. Dry farm land sells from \$800 to \$1,000 per acre. This value seems high as dry land farming is generally no longer economically feasible in this area. It, therefore, can be assumed that buyers either intend to improve the land for intensive agriculture or develop it for recreational or residential use. Pasture land sells for about \$150 to \$300 per acre.

Industrial properties range from \$350 to \$2,500 per acre.

Property is generally in great demand in the lower Cache Creek area and values are consequently relatively high. The exceptions are the small rural towns, where lots are not generally as desirable and supply exceeds demand. Highest property values for all categories of land use are found in the Woodland area.

There is a high demand for rural-residential sites outside established urban areas. There has been an especially dramatic increase in property values in the Capay Valley area since 1970. Most of this has resulted from parcelling of pasture and foothill lands into ranchette type development. There is no land in the Capay Valley, other than steep rangeland, which sells for less than \$750 an acre and land suitable for homesites would generally run at least \$2,000 per acre.

The highest priced agricultural land in the basin is found north and south of Woodland, and averages \$2,000 per acre and up. Agricultural land within the settling basin has been valued at \$1,000 per acre, with native vegetation valued at \$300 per acre. Agricultural land throughout the remainder of the basin averages \$1,500 an acre for Class I and II soils. Acreage suitable for dry land farming and field crops will range

from \$600 to \$800 per acre. Rangeland averages about \$125 per acre. Agricultural land along Cache Creek with gravel rights averages about \$2,000 per acre. Several gravel plants have been actively buying up sand and gravel reserves which will provide extractable material for the next 30 years. Bottom lands within the creek, without gravel rights, are valued at about \$200 per acre.

Industrial properties in Woodland have been sold in ranges from \$6,500 to \$18,000 per acre.

Personal Income.

At the close of 1973 it was estimated that median family income in the Clear Lake area would reach 65% of the statewide average. However, there have been substantial gains in personal income during the last two decades. The median income of all families within the basin in 1970 was \$6,551, as compared to the California average of \$10,732. Per capita income in 1970 was \$2,772. Personal income by source in 1970 was as follows: (in thousands of dollars)

<u>Wages & Salary</u>	<u>Other Labor Income</u>	<u>Proprietors Income</u>	<u>Property Income</u>	<u>Transfer Payments</u>	<u>Total</u>
\$20,995	\$945	\$9,331	\$12,621	\$13,909	\$57,801

Source: 1970 Census of Population, Social and Economic Characteristics.

An unusually high percentage of income is derived from transfer payments. Social Security payments represent the largest portion of this source. In 1972, 6,773 persons collected \$819,000 monthly or \$9,828,000 annually. However, 35% of social security recipients are below the poverty level. The second largest allocation of transfer payments is for public assistance. In 1972, there were 2,392 public aid recipients.

Rural non-farm income per family is lower than the countywide average, although rural farm is substantially higher than the average. Median family income is highest in the Lakeport area and lowest at Clear Lake Highlands.

The median income of all families of Yolo County in 1970 was \$9,482 as compared to the California average of \$10,732. Per capita income in 1970 was \$2,990. Personal income by source was as follows in 1970: (in thousands of dollars)

<u>Wages & Salaries</u>	<u>Other Labor Income</u>	<u>Proprietors Income</u>	<u>Property Income</u>	<u>Transfer Payments</u>	<u>Total</u>
\$242,016	\$10,111	\$49,064	\$40,966	\$38,923	\$381,080

Source: 1970 Census of Population, Social and Economic Characteristics.

Wages for all non-agricultural occupations are below State averages. However, farm managers and farm laborers receive annual wages higher than

the California average. Despite this, agricultural employees are second only to women as the lowest income group in the area. Self-employed farm income is also considerably lower than the average family income in the area.

In contrast to the Clear Lake area, transfer payments make up only about 10% of personal income distribution. Among social security recipients, 8.3% are below the poverty level. Public aid recipients receive a large share of the transfer payments, and in 1973 there were 4,207 recipients in the county.

Income levels are depressed in the rural communities of the basin, with welfare recipients numbering up to 72% of the community. Average income levels per family in 1970 ranged from \$9,635 in Woodland to \$3,000 in Capay.

Employment and Labor Force.

Lake County employment has been characterized by relatively slow growth in numbers of new jobs and by a general lack of employment opportunities. The rate of unemployment for the past two decades has been substantially higher than state or national averages for the same period. The average rate of unemployment in 1972 was 11.4%, compared to 12.6% in 1971. There is also a high degree of seasonal variation in this rate. During winter months, it is not uncommon for unemployment rates to reach 16 to 17 percent, compared to 4 to 5 percent in the peak employment summer months. This reflects the dependence of the regional economy on agriculture and trade and service jobs relating to summer recreation.

Commercial trade and services represent the largest source of employment. This sector has become increasingly important in the total employment picture, although the growth rate has been slow. Relative employment in agriculture and food processing shows a general decline from 1950 to the present.

Employment characteristics, based on the 1970 census, are shown in Table B-3. About 85% of the total work force is employed within Lake County.

TABLE B-3
Employment Characteristics for Lake County: 1970

Employment status

Total labor force	6,365
Civilian labor force	6,350
Civilian employment	5,793
Percent unemployed	8.8

<u>Industry of employed persons</u>	<u>Number</u>	<u>% Distribution</u>
Agriculture, forestry, & fisheries	685	11.8
Mining	62	1.1
Construction	665	11.5
Manufacturing	295	5.1
Durable goods	(169)	(2.9)
Nondurable goods	(126)	(2.2)
Transportation, communications, & sanitary services	403	6.9
Wholesale and retail trade	1,245	21.5
Finance, insurance, business, & repair services	479	8.3
Professional and related services	1,617	27.9
Public administration	<u>342</u>	<u>5.9</u>
 Total employed	 5,793	 100.0%

Source: 1970 Census of Population, General Social and Economic Characteristics.

In Yolo County there has been considerable industrial expansion and diversification in basin employment in the past five years. However, agriculture remains the most important influence on the labor market. Employment is consequently seasonal but less so than in prior years. The most serious unemployment problems occur in the rural areas during the winter months. Unskilled workers generally are in surplus throughout the year.

Employment in agriculture is declining, while employment in manufacturing, government, and service and trade categories are increasing. Employment characteristics for 1970 are shown in Table B-4.

TABLE B-4

Employment Status

Total labor force	36,517
Civilian labor force	36,334
Civilian Employment	33,786
Percent Unemployed	6.3

<u>Industry of employed persons</u>	<u>Number</u>	<u>% Distribution</u>
Agriculture, forestry, & fisheries	2,652	7.9
Mining	145	.4
Construction	1,797	5.3
Manufacturing	2,914	8.6
Durable goods	(902)	(2.7)
Non-durable goods	(2,012)	(5.9)
Transportation, communications, & sanitary services	2,421	7.2
Wholesale and retail trade	6,152	18.2
Finance, insurance, business, & repair services	1,950	5.8
Professional and related services	12,910	38.3
Public administration	<u>2,845</u>	<u>8.4</u>
Total employed	33,786	100.0

Source: 1970 Census of Population, General Social and Economic Characteristics.

Approximately 67 percent of the work force is employed within Yolo County. The second largest center of employment is the Sacramento Metropolitan Area. The majority of all industrial workers are unionized with lesser representation among the retail service and trade categories. Agricultural workers are generally non-union. Skilled labor is in good supply. There are also a large number of professionals due to the presence of the University of California at Davis.

Business and Industrial Activity.

Business in Lake County is typically small, owner-operated, and employs a limited number of outside employees, with an increase in part-time help during the peak summer months. Large chain stores are almost nonexistent and the nationally franchised restaurants typical of many resort areas are not represented. In the resort areas around the lake rim, strip development is the rule. Lakeport is the business center of the basin, with a marketing area population of 12,000.

There is little industry in the basin; the largest plants are associated with the processing and packing of pears and walnuts. There are a total of 40 small manufacturing firms in the county; the average employs 1 to

2 persons. There are approximately 6,500 acres of potential industrial land zoned unclassified, open to unlimited uses and privately owned.

Business has grown gradually, with no big peak periods. The two major commercial enterprises in the basin are recreation and agriculture. Other major types of business and industry in 1973 were real estate (\$10,000,000), construction (\$6,000,000), and aggregates and materials (\$1,500,000). Total taxable sales in 1973 were \$48,929,000.

Woodland is the business and industrial hub in the vicinity of the lower part of the basin. It provides goods and services for its own population as well as for the surrounding rural areas. The main street of Woodland has traditionally been the central business district, and consists of a number of relatively small businesses of the services and trade type, as well as a number of major banking branches. There are three major shopping centers within the city limits and they are absorbing an increasingly large share of the area's retail sales.

Although there are a growing number of larger discount stores locating in the shopping centers, the average business remains small, is generally owner-operated, and retains a small number of permanent employees.

The other rural communities in the lower portion of the basin have only very limited business establishments, which are farm related or provide such essentials as gas and groceries. Of these communities, Esparto has the greatest number of business and service facilities, while the others have generally shown a decline in the number of business establishments.

Taxable retail sales in Yolo County in 1973 were \$260,534,000 with \$72,751,000 reported for the City of Woodland.

Manufacturing is rapidly advancing in the Woodland area. There are 481 acres zoned industrial within the city limits. The bulk of this development radiates north and east of Woodland. Measured by employment and payrolls, food processing accounts for two-thirds of all manufacturing. There is, however, a growing number of non-agriculturally oriented industries. These establishments are in the small to medium size range. There is no industrial activity in the rural areas.

Mineral production, although not important in comparison to statewide averages, is on the increase. Gas production in 1972 was 8,011,216 mcf, valued at \$2,519,274 compared to 5,741,234 mcf in 1971, valued at \$1,837,200. Cache Creek supplies the bulk of the sand and gravel for construction in the county. In 1970, sand and gravel production was valued at \$4,050,276. There are nine organizations currently operating in Cache Creek.

Agriculture.

In the Clear Lake area, agriculture is exceeded only by recreation in its contribution to the area's economy. In 1973, the gross value of agricultural production was \$22,155,000.

Lake County, which contains virtually all the agricultural land in the Clear Lake area, has only about 18% fertile agricultural land, the rest ranges from marginal to non-productive. Intensive farming is generally restricted to the level valley lands surrounding Clear Lake. Agriculture in the rest of the area is limited to dry pasture with only minor amounts of irrigated cropland. The mountain lands are suitable mainly for rangeland.

Today over half the area under cultivation is in orchards, the main crops being pears and walnuts. These two crops account for over 70% of the total value of agricultural output. Pear orchards, due to their much higher economic return, are replacing many of the marginal walnut orchards. A major addition to the agricultural scene has been the introduction of wine grapes.

Agricultural Preserves under the Williamson Act are now in excess of 33,000 acres. In 1971 there were a total of 804 farms, and land in farm totals 180,905 acres. Total cropland harvested was 26,105 acres, and irrigated land totaled 19,744 acres.

In the lower part of the basin, Yolo County is the leading county in terms of gross revenue from agriculture in the Sacramento Valley. In 1974, the value of all Yolo County crops was \$214,436,150. Much of the western portion of the area is composed of rolling terraces and steep uplands which are used for dry farmed grain or range depending on slope. The remainder of the basin consists of nearly level alluvial fans, flood plains, and basins which are intensely cultivated. Farm lands within the settling basin are level and extremely rich silty river bottom land. Total irrigated acreage in the Cache Creek area is estimated to be about 98,000 acres. Principal crops are orchards, alfalfa, sugar beets, and tomatoes. Rice has declined in importance, but is still extensively grown in the Cache Creek Settling Basin. Field crops and truck crops are also grown within the settling basin.

Recreation.

Recreation is the key component in the social and economic vitality of the Clear Lake subbasin. Recreation use is estimated at 2.5 million visitor days annually, with an estimated gross expenditure of 30 million dollars. The excellent warm water fishery is the chief attraction.

The recreation industry does face a number of problems, however. Many of the resort units along the lake shoreline were built in the 1930's in a totally different recreation era. A resort typically consisted of a small number of utilitarian cabins where a family would commonly spend their entire annual summer vacation. These resorts no longer fit the recreational preferences of a more affluent and mobile population. Recreation vehicles are the new order of the day, and the visitor is likely to spend a few days at most at the lake before moving on to new areas. These older resorts are now more typically permanent rentals occupied by pensioners and single persons. The few "deluxe" motels with full facilities are in demand for the entire season. The more abundant supply of motels

with only a few units and limited amenities frequently are marginal operations. Overnight parks for recreational vehicles and camping are increasing.

There are a total of 197 resorts containing 2,427 sleeping units, 91 trailer parks with 2,009 sites and 64 campgrounds with 1,404 sites in the Clear Lake area. There are also 125 facilities supplying gasoline for boats, 1348 private docks and piers, 40 boat ramps, 15 beaches, 7 boat repair shops, and 26 marina supply stores.

As it related to water dependent uses, recreation is divided about equally between the north and south halves of the lake.

Clear Lake outlet channel receives heavy recreational use during all months when there is good fishing. The 5½ mile channel is reputed to be the best stretch of black bass fishing in California. The resorts along the channel are generally full during these months. The carrying capacity of the channel based on boating use is about 264 persons.

It is estimated that algae is presently causing a loss of about one million activity days of recreation yearly in the Clear Lake area. The lower Clear Lake Highlands area is most eutrophic, with massive algae blooms occurring throughout much of the recreation season. The upper arm also has a significant summer and fall bloom, and the productivity of the Oaks arm falls between that of the other two arms.

Recreation is not a significant economic factor in the lower Cache Creek area. There is a general shortage of all recreational facilities throughout the area. The deficiency is most severe in the unincorporated areas. There are no State or National Parks and no privately owned public recreation facilities. A private country club is located just south of Cache Creek, below Airport Road. County and city facilities include a park system in Woodland and a 22 acre park with overnight camping adjacent to Cache Creek near Guinda. The Bureau of Land Management controls some 23,000 acres which are open for public use. This area is rugged and is used primarily by hikers, hunters, and those with off road vehicles.

Access to the Cache Creek Canyon between Clear Lake Dam and State Highway 16 at the Colusa-Yolo County line is very limited. Where Highway 16 parallels the creek to Rumsey Bridge, considerable recreation use occurs; primarily fishing, camping, and picnicking. Below Rumsey, access is limited to several locations where public roads cross or reach the creek. Most of the land is private and posted.

In the past five years, "white water" boating on the North Fork and the main stem has grown enormously in popularity. The North Fork is runnable in late March in wet years. Downstream from the North Fork, Cache Creek is boatable all summer due to irrigation water released from Clear Lake. The reach from Highway 16 to the Rumsey Bridge is a favorite for kayakers and canoeists. Many local people float this section on inner tubes and rafts. Boating use in the lower North Fork and Cache Creek from the North Fork to Rumsey is estimated at 2,000 to 5,000 recreation days annually.

An important recreational activity throughout the basin below Clear Lake Dam is hunting for deer and upland game birds. A number of private hunting clubs maintain blinds in the Cache Creek Settling Basin.

Projected Population.

As projected by the California State Department of Finance and shown in Table B5, the population of Lake County is expected to increase from 19,548 in 1970 to 58,800 by 2035. This represents a compound growth rate of about 1.71 percent per year, which is less than the historical rate of about 2.5 percent per year for the last forty years. Concurrently, the population of Yolo County is expected to increase from 91,788 in 1970 to 273,900 by 2035. This represents a compound growth rate of about 1.70 percent per year, which is much less than the historical rate of about 3.4 percent per year for the last forty years. Population growth in the urbanized and urbanizing areas of both counties is expected to take place at rates differing from rates applicable to the counties as a whole. Population growth along the perimeter of Clear Lake will be limited by availability of space and basic service facilities. It is estimated that the perimeter will support less than twice the present population. Increased levels in population on the urban fringe of Woodland are expected to follow countywide trends since the main thrust of residential expansion in the vicinity is away from the flood plain.

TABLE B-5

Population Projections for California and Lake and Yolo Counties (1985-2035)

	1985	1995	2005	2015	2025	2035
Lake County	31,600	36,500	40,700	46,100	52,000	58,800
Yolo County	133,000	161,100	187,600	213,900	241,500	273,900
California	24,363,000	27,726,000	30,948,000	34,705,000	38,670,000	43,226,000

Source: Population projections for 1985-2015 by the California State Department of Finance; projections for 2025 and 2035 by the Sacramento District, Corps of Engineers.

Projected Income.

Future income estimates for Lake and Yolo Counties are based on the 1972 OBERS Projections made for the Water Resources Council by the U. S. Department of Commerce. It was assumed that those projections made for the non-SMSA portion of the Sacramento Water Resources subarea would be generally valid for Lake County, while the Sacramento Standard Metropolitan Statistical Area would be applicable to Yolo County.

Income projections released by OBERS indicate that per capita personal income for Lake County is expected to increase in terms of 1967 constant dollars

from \$2,820 in 1972 to \$16,435 by 2035. This level of increase represents an average annual growth rate of about 2.3 percent, which is greater than the historical rate of about 1.9 percent per year for the 22 year period from 1950 to 1972.

During this same 22 year period, Yolo County experienced an average annual rate of growth of 1.4 percent. Projections by OBERS indicate, however, that per capita personal income for the county is expected to increase on a 1967 constant dollar basis from \$3,400 in 1972 to \$18,180 by 2035, or at an average annual growth rate of about 2.7 percent. For comparison, per capita personal income projections for Lake and Yolo Counties and California are shown in Table B-6.

TABLE B-6

Per Capita Personal Income Projection
For Lake and Yolo Counties and California
(1985-2035) (1967 Dollars)

	1972(a)	1985	1995	2005	2015	2025	2035
Lake County	2,820	4,150	5,545	7,410	9,635	12,525	16,435
Yolo County	3,400	4,920	6,445	8,450	10,870	13,980	18,180
California	3,970	5,925	7,730	10,100	12,740	16,100	20,275

Source: Growth rates for 1985-2035 adopted from 1972 OBERS Projections.
(a) Per capita income for 1972 from California Statistical Abstract.

Employment Projection.

Recent OBERS projections indicate that the ratio of the civilian labor force to population will increase slightly in the future. The rising participation rates are expected to result primarily from rising employment in the female segment of the population. This increase is expected to more than compensate for the declining rates of participation by men in the younger age groups due to continuing education and by older age groups due to earlier retirement.

Table B-7 shows projected civilian employment for Lake and Yolo Counties with allowances made for anticipated changes in relative labor participation rates and in relative employment rates.

TABLE B-7

Projected Civilian Employment In
Lake and Yolo Counties for 1985-2035

	1985	1995	2005	2015	2025	2035
<u>Lake County</u>						
Population	31,600	36,500	40,700	46,100	52,000	58,800
Participation Rate, %	38	38	40	40	40	41
Civilian Employment	12,008	13,870	16,280	18,440	20,800	24,100
Manufacturing Employment, %	5.50	5.40	5.40	5.35	5.35	5.35
Manufacturing Employment	660	740	870	987	1,115	1,290
<u>Yolo County</u>						
Population	133,000	161,100	187,600	213,900	241,500	273,900
Participation Rate, %	40	40	42	42	42	42
Civilian Employment	53,200	64,440	78,792	89,838	101,430	115,038
Manufacturing Employment, %	20.1	19.3	18.7	18.1	17.6	17.1
Manufacturing Employment	10,693	12,436	14,734	16,261	17,851	19,672

Source: Population projections by the California State Department of Finance; participation ratios adopted from projection by the Bureau of Economic Analysis.

In future years total employment in Lake County is expected to be more dependent on commercial trade and services than it is at present. There should also be a substantial increase in government employment as more public education services are offered by the county. A reduction in the amount of seasonal unemployment and a reduction in the annual average rate of unemployment is anticipated as the economy becomes less dependent on agriculture.

Civilian employment categories in Yolo County which can be expected to increase most are local government, finance, services, trade, construction, manufacturing, and State government. Future civilian employment in Yolo County will rely to a lesser extent on agriculture which traditionally has had high seasonal unemployment rates.

SECTION C
PROBLEMS AND NEEDS

Status of Existing Improvements

Corps of Engineers

In the upper portion of the basin the Lakeport Lake Project on Scotts Creek was authorized for construction by the Flood Control Act of 1965. The first phase preconstruction studies were completed in July 1973. The proposed lake would have a storage capacity of 55,000 acre-feet. The facility would be operated to provide flood control to downstream areas along Scotts Creek and a degree of flood control to Clear Lake, a municipal and industrial water supply of 8,400 acre-feet annually, an irrigation water supply of 9,100 acre-feet annually, water oriented recreation, and fish and wildlife enhancement. Adjacent to the Scotts Creek Basin is the Middle Creek Basin where the Corps of Engineers has constructed levees for flood control. The Middle Creek Improvement Project was authorized by the Flood Control Act of 1954 and includes levees and incidental channel improvements on Middle Creek, a channel for diversion of Clover Creek overflows to Middle Creek above the town of Upper Lake, levees on lower Scotts Creek, and pumps for discharge of drainage water entrapped by project levees.

In the lower Cache Creek Basin the Corps of Engineers completed construction of levees along Cache Creek in 1943 as a part of the Sacramento River Flood Control Project. The Corps also completed the initial phase of construction of the settling basin in 1937 under the same authorization. The levee project provided for a 20,000 c.f.s. channel capacity. In 1961 the levees were raised and extended about 3 miles upstream of the town of Yolo. The leveed channel currently has a design capacity of 30,000 c.f.s. with 3 feet freeboard. Since 1937, additional work has been completed on the settling basin. In 1940 a southern levee was completed followed by construction of Cobble Weir in 1944. Throughout the project life there have been many readjustments of the training levees to make optimum use of the basin storage. The most recent work, completed by the State in 1973, was heightening of the Cobble Weir to provide interim sediment storage.

Soil Conservation Service

The Soil Conservation Service has constructed two small dams, one on Adobe Creek and the other on its tributary, Highland Creek. These reservoirs provide flood protection to the flood plain containing about 4,000 acres along lower Adobe Creek.

Lake County

Nonstructural measures have been taken along the Clear Lake Rim as enabled by the National Flood Insurance Act of 1968. A flood insurance study for the unincorporated areas of Lake County, California, was prepared for the Federal Insurance Administration by the Corps' Sacramento District, dated December 1971, followed by a flood insurance study for Lakeport, California, dated May 1972. As a result of these studies, steps have been taken to restrict future construction in flood-prone areas so as to minimize possible damages caused by flooding by building above a recommended level; approximately that level reached by that flood whose magnitude has about a one percent chance of being equalled or exceeded in any year.

Yolo County

The Yolo County Flood Control and Water Conservation District (YCFC & WCD) has completed construction of the Indian Valley Reservoir on North Fork Cache Creek. The reservoir controls a drainage area of 121 square miles and has a storage capacity of 300,000 acre-feet of which 40,000 acre-feet is for flood control storage. Irrigation water from Indian Valley Reservoir in addition to that from Clear Lake is provided to agricultural lands of Yolo County.

Currently 20,000 acres of agricultural land are provided with water from Clear Lake by an irrigation system owned and operated by YCFC & WCD. The District acquired the water rights to the canals and other facilities comprising the irrigation system from the Clear Lake Water Company on 1 October 1967. Included in the system are the Clear Lake Dam and the Capay and Moore diversion dams located in the lower reaches of Cache Creek. An extensive network of canals and ditches distributes the irrigation water diverted by the Capay and Moore Dams as shown on chart 6.

Flood Problem

Flood characteristics

Floods in the basin occur principally from runoff of high-intensity rainstorms during winter and spring months. The pattern of storms contributing to flood conditions often causes a number of peaks within a short period of time and, often, large quantities of water are produced. As reaches of the streams are relatively short and channel gradients are steep, peak floodflows usually pass completely through the basin within a 24-hour period. The effects of such floods are different for the upper and lower areas of the basin.

The shoreline of Clear Lake has been subject to flooding throughout its history. The flood problem is caused primarily by the restricted outlet channel of the lake, which has a discharge capacity of about 2,500 c.f.s. at elevation 7.56 feet on the Rumsey Gage, and a maximum of about 8,000

c.f.s. at extreme flood stage. Since historical flood inflows into the lake exceed 40,000 c.f.s., a considerable volume of flood water must be stored temporarily in the lake. Although the Clear Lake outlet dam was constructed in 1915, it has not affected the channel discharge capacity, as the impairment to flow is caused by a natural upstream restriction, the Grigsby Riffle. Water supply records indicate that the outflow capacity of the channel was less before the dam was built than at present, because of channel dredging operations. These dredging operations were halted before completion by a court suit which resulted in the Gopcevic Decree. Although the Gopcevic Decree (appendix A) set the maximum flood water storage elevation in Clear Lake at 9.0 feet on the Rumsey Gage, it is not physically possible to operate within this limit with the existing restricted outlet channel. Records of water surface elevations in Clear Lake since 1874 show that elevation 7.56 has been exceeded 48 times, and that elevation 9.0 has been exceeded 24 times.

Floods of record

All floods of record in the Cache Creek Basin have been of the rain-flood type and are characterized by relatively high peaks of short duration and relatively small total volume. However, these characteristics are modified somewhat in the lower Cache Creek area by Clear Lake which acts as a regulating reservoir. As indicated the outflow from the lake is limited by the existing outlet channel. Nevertheless, the area below Clear Lake along Cache Creek is subject to flooding. Listed in table C-1 is data related to some of the larger historical floods of Clear Lake and Cache Creek.

Table C-1
Floods of Records

Year	Month of Peak	Peak Stage (Rumsey Gage Ft)	Exceedence Interval (Years)
------	---------------	-----------------------------	-----------------------------

CLEAR LAKE

1956	February	9.53	12
1958	February	10.88	45
1965	December	9.10	8
1970	January	10.47	30

Year	Month of Peak	Peak Flow (c.f.s.)	Exceedence With Indian Valley Reservoir (Years)
------	---------------	--------------------	---

CACHE CREEK ABOVE RUMSEY

1965	January	59,000*	-
1970	January	43,400	150

CACHE CREEK NEAR CAPAY

1955	December	31,800	10
1958	February	51,600	250
1965	January	44,500	70
1970	January	36,200	20

CACHE CREEK AT YOLO

1956	February	27,400	15
1958	February	41,400	130
1965	January	37,800	70
1970	January	36,600	60

* Estimated.

Recent flood damages

In February, March, and April of 1958, the elevation of Clear Lake reached a maximum of 10.88 feet and exceeded 9.0 feet for a total of 44 days. During all of this time the maximum possible release was being made from the lake. In 1958 about 4,000 acres of residential, commercial, and agricultural lands were flooded. The depth of flooding averaged about 2 feet, and water was standing in many homes and business establishments for as long as two months. Damage adjacent to Clear Lake caused by the flood of 1958 was estimated to be \$878,000. In January 1970, Clear Lake reached a stage of 10.47 on the Rumsey Gage. About 1,600 acres were flooded around the rim and damages amounted to \$485,000. The following tabulation summarizes the damages reported from these two floods:

Table C-2
Clear Lake Flood Damages
1958 and 1970

Category	1958 Flood	1970 Flood
	(\$1,000)	(\$1,000)
Residential	440	186
Commercial	312	125
Public Facility	74	115
Agricultural	<u>52</u>	<u>59</u>
Total	878	485
Total in 1974 prices	1,713	660

Prior to 1961 the design capacity of the levees downstream of Yolo was 20,000 c.f.s. A levee break in this area occurred during February 1956, flooding about 700 acres. In February 1958, the levees successfully held a peak flow of 41,400 c.f.s. However, the levees were under constant surveillance, and sand bagging in critical areas prevented major flooding. At the same time Cache Creek overflowed its banks upstream from the levees, flooding farm lands and roads. Flood damage along the lower reaches of Cache Creek during the 1958 flood was estimated to be about \$520,000 as summarized in the following tabulation.

Table C-3
Cache Creek Flood Damages
1958

Category	:	Damages (\$1,000)
Residential	:	5
Commercial	:	5
Industrial and utilities	:	10
Public facilities	:	276
Agricultural	:	<u>221</u>
Total	:	517
Total in 1974 prices	:	1,036

In 1970 very limited flooding occurred in the lower basin adjacent to Cache Creek. Approximately \$50,000 (\$76,500 in 1974 prices) of primarily agricultural damages occurred.

Existing flood hazard

It is estimated that damages to existing development along the Clear Lake Rim would equal approximately \$1,973,000 and \$672,000, respectively from flooding under similar hydrologic and climatic conditions as occurred in 1958 and 1970. As previously noted, flood damages along the Clear Lake Rim are dependent upon wind conditions prevailing during the period of high lake levels. Waves of up to four feet in height on the main lake area and three feet on the lower arm could occur under severe wind conditions, with a substantial impact on potential flood damages. During the 1970 flood, wind velocities were not of sufficient magnitude to create significant wave action. However, if wind velocities sufficient to create average wave heights of 2 feet occurred simultaneously with the peak lake levels reported in the 1970 flood, damages under present economic conditions would be expected to exceed \$1.5 million.

There has been extensive channel excavation by gravel operators in the reach of Cache Creek between Capay and just upstream of the Cache Creek project levees.

This excavation work has consisted of primarily channel deepening and some widening. The effect of this has been a considerable reduction in the overbank flood damage potential in this reach. It is believed by local interests that channel deepening has allowed degradation at bridge crossings and corresponding damage to bridges.

The recently completed Indian Valley Reservoir will reduce peak flood flows along Cache Creek downstream of the junction of the creek with North Fork Cache Creek and thereby result in reduced flood damage potential.

Description of flood plain area

The flood plains within the study area lie in two different, noncontiguous sectors of the Cache Creek Basin (Clear Lake - lower Cache Creek). For study purposes the flood plain of lower Cache Creek was divided into three reaches consistent with physical and economic characteristics innately common within each subarea. Acreages within the Standard Project Flood Plain of each reach are presented in the following tabulation:

Table C-4
Standard Project Flood Plain Area

Reach	Acres
Clear Lake Rim	4,135 ^{1/}
1	2,475
2	2,650
3	10,880

1/ For Clear Lake Rim agricultural acreage only.

The Clear Lake Rim flood plain consists of that area adjoining the lake at an elevation above 1,326.2 feet and ranges up to an elevation of approximately 1,331.5 feet at the Standard Project Flood stage. Homes and commercial developments encircle much of the lake with agricultural crops in production on many land areas both level and fertile enough for this type of usage. Crops grown include pears, grapes, walnuts, barley, and alfalfa. Some of these lands are used for pasture.

Reach 1 extends through the Capay Valley from the town of Rumsey to just above Capay Weir. The creek in this reach flows through a gently rolling terrain which is comprised of land used predominately for such agricultural purposes as orchards and field crops with much of the land in native forage. Farmsteads occupy approximately 15 of the 2,475 acres within this reach. None of the flood plain land is devoted to urban land uses at the present time, nor is there any reason that any will be urbanized within the study period. The Capay Valley itself does contain some scenic values to those traveling through since it does have hills on both sides which afford visual interest to the area.

Reach 2 lies between Capay Weir and Airport Road located west of the town of Yolo in the Sacramento Valley. Farmsteads within the flood plain occupy

approximately 10 acres with an additional 10 acres devoted to urban uses. The remainder of the land is used for agriculture. The major features of the terrain are those common to other wide-spreading alluvial fans; that is, mainly flat but with a slight slope and somewhat deep soils with enough natural drainage to be good for crop production. No significant urban development is expected within this reach during the study period.

Reach 3 is downstream of Airport Road and terminates at the Cache Creek Settling Basin. About 98 percent of this flood plain is placed in agricultural crops while about 2 percent (about 185 acres) is in urban-type land use. That land in agricultural production is intensively used for a broad spectrum of crops which vary from sugar beets to pasturage and includes some walnuts and other orchard crops. The city of Woodland is adjacent to the flood plain with some fringe areas being flooded by infrequently high flows from Cache Creek. This fringe area includes much of the industrial sector of Woodland. Terrain in Reach 3 on both the north bank and the south bank of Cache Creek is generally flat with deep sediment soils.

Present property values

An inventory of the damageable units currently occupying the Standard Project Flood Plains including structural and content values is presented in the following tabulations. This inventory does not include land values or such public facilities as roads, bridges, or water and sewage treatment facilities. Flood damages, however, are estimated for these facilities, based on historic data and interviews of local officials.

Table C-5

Clear Lake Rim Damageable
Property Values in 1974

	:	:	Average	:	Total	
	:	Units	:	Value	:	Value
Residential Structures <u>1/</u>		575		\$17,600		\$10,120,000
Residential Contents <u>1/</u>		575		6,160		3,542,000
Mobile Home Structures		325		6,600		2,145,000
Mobile Home Contents		325		2,310		750,750
Commercial Structures		2,305		-		12,866,500
Motel (units)		2,000		4,400		(8,800,000)
Stores		180		19,800		(3,564,000)
Marina gas facilities		125		3,300		(412,500)
Commercial contents		2,305		-		4,656,300
Motel (units)		2,000		1,320		2,640,000
Stores		180		8,910		1,603,800
Marina gas facilities		125		3,300		<u>412,500</u>
Total						\$36,675,550

1/ Excluding mobile homes.

Table C-6

Cache Creek Damageable
Property Values in 1974

	:	:	Average	:	Total
	:	Units	Value	:	Value
<u>Reach 1</u>					
Farmsteads:					
Residential structures		19	\$17,000		\$323,000
Residential contents		19	6,000		114,000
Farm buildings		11	5,600		<u>61,600</u>
Total					\$498,600
<u>Reach 2</u>					
Residential structures		11	\$17,300		\$190,300
Residential contents		11	6,100		67,100
Commercial structures		1	30,000		30,000
Commercial contents		1	15,000		15,000
Industrial structures		3	25,000		75,000
Industrial contents		3	37,300		<u>111,900</u>
Total					\$489,300
<u>Reach 3</u>					
Residential structures		81	\$17,200		\$ 1,393,200
Residential contents		81	6,000		486,000
Commercial structures		18	43,500		783,000
Commercial contents		18	57,850		1,041,300
Industrial structures		22	425,000		9,350,000
Industrial contents		22	635,000		<u>13,970,000</u>
Total					\$27,023,500

Future development - Clear Lake Rim

Residential and commercial development in the Clear Lake Rim Reach will be restricted more by a limitation of space and basic service facilities such as water and sewage treatment facilities than by a lack of demand by retirees, recreational visitors, and others desiring lake side home sites. Investigation of local zoning and parcel maps and general plans indicates that the lake perimeter will support less than twice the current development if agricultural and other open space areas described in the Open Space Element of the Lake County General Plan are to be preserved (see page 18). Projections of future residential and commercial units within the flood plain area based on these limitations are presented in table C-7. It is assumed that all such structures will be constructed with the ground floor above the 11.56 feet elevation level as measured at the Rumsey Gage in conformance with present flood plain management regulations.

It is assumed that future industrial and major public facility buildings would continue to locate outside of the flood plain areas because of the premium in land prices for lake side development for residential and commercial purposes. Damageable public facilities such as roads, parks, and water and sewage treatment facilities are expected to increase at a rate commensurable to the increase in residential and commercial units, or approximately 1.15 percent per annum during the study period.

Table C-7

Clear Lake Rim Existing and
Projected Units Standard Project Flood Plain

	1974	: 1985	: 1995	: 2005	: 2015	: 2025	: 2035	: -	: 2085
Residential									
Homes	575	658	735	825	920	1,030	1,150		1,150
Mobile homes	325	372	415	465	520	580	650		650
Commercial	2,035	2,497	2,668	2,860	3,062	3,274	3,506		3,506
Private piers	1,348	1,391	1,433	1,476	1,521	1,570	1,622		1,622
Agriculture (acres)	4,135	4,135	4,135	4,135	4,135	4,135	4,135		4,135

Although no major changes in total agricultural acreage is projected for the flood plain, changes in crop distributions and yields per acre are projected based on projections contained in the California Framework studies. The following tabulation summarizes the existing and ultimate cropping distribution and yield projected for the flood plain area.

Table C-8

Existing and Projected
Crop Distribution and Yield
Clear Lake

Crop	1974		:	2035	
	Acres	Yield (Ton/acre)		Acres	Yield (Ton/acre)
Alfalfa	155	5.60	:	200	8.40
Grain	495	1.80	:	600	3.80
Pasture	785	8.70	:	900	11.0
Orchards	805	5.84	:	1200	11.4
Native Pasture	<u>1895</u>	<u>-</u>	:	<u>1235</u>	<u>-</u>
Total	4135			4135	








Source: 1974 estimates based on field surveys and Lake County Agricultural Crop Reports. 2035 projections adapted from California Framework Studies.





OPEN SPACE ELEMENT

LEGEND




OPEN SPACE: (Existing and Proposed)

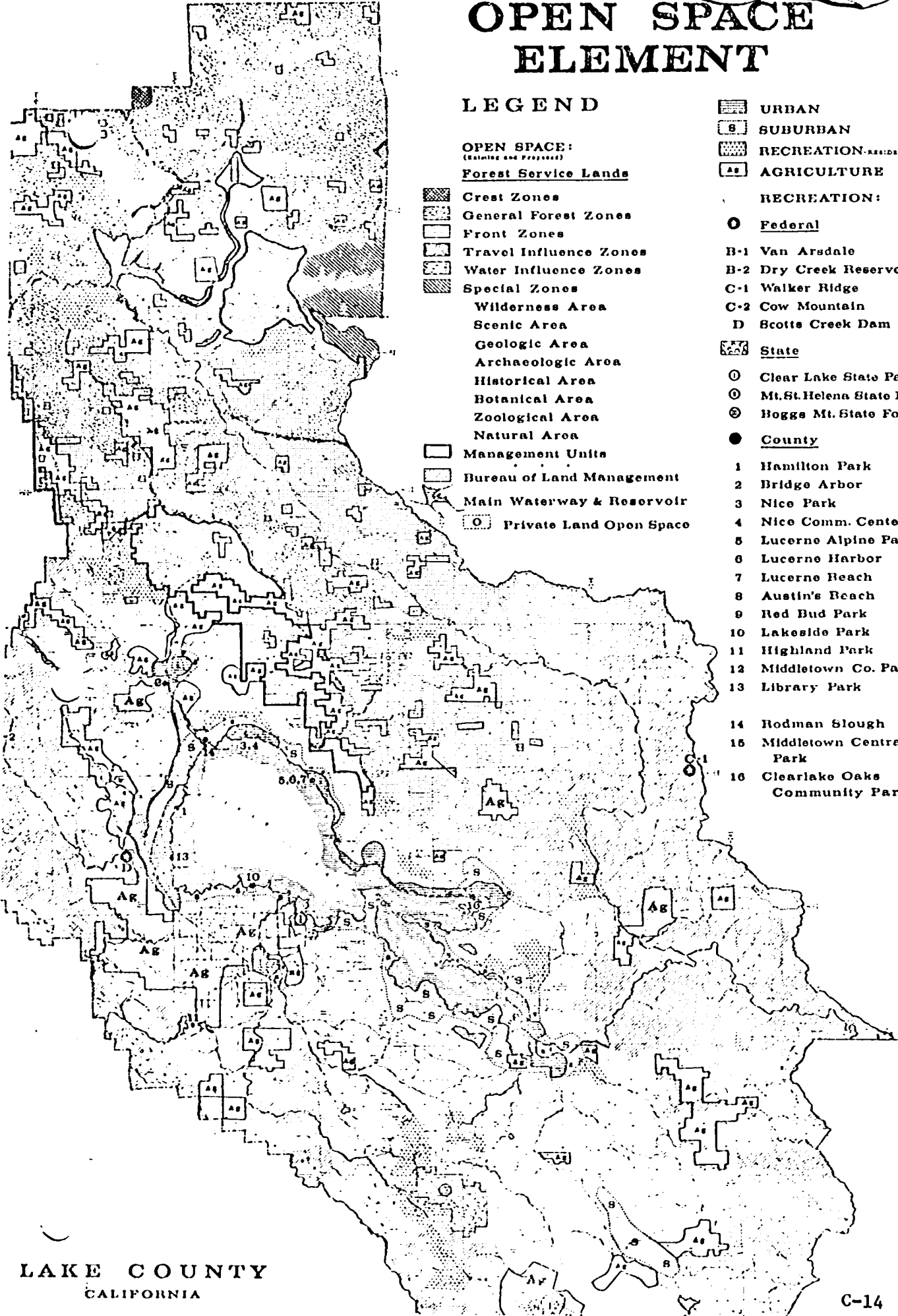
Forest Service Lands

-  Crest Zones
-  General Forest Zones
-  Front Zones
-  Travel Influence Zones
-  Water Influence Zones
-  Special Zones
 - Wilderness Area
 - Scenic Area
 - Geologic Area
 - Archaeologic Area
 - Historical Area
 - Botanical Area
 - Zoological Area
 - Natural Area
-  Management Units
 - Bureau of Land Management
 - Main Waterway & Reservoir
 - Private Land Open Space

-  URBAN
-  SUBURBAN
-  RECREATION-RESIDENTIAL
-  AGRICULTURE

RECREATION:

-  Federal
 - B-1 Van Arsdale
 - B-2 Dry Creek Reservoir
 - C-1 Walker Ridge
 - C-2 Cow Mountain
 - D Scotts Creek Dam
-  State
 - ① Clear Lake State Park
 - ② Mt. St. Helena State Park
 - ③ Boggs Mt. State For.
-  County
 - 1 Hamilton Park
 - 2 Bridge Arbor
 - 3 Nice Park
 - 4 Nice Comm. Center
 - 5 Lucerne Alpine Park
 - 6 Lucerne Harbor
 - 7 Lucerne Beach
 - 8 Austin's Beach
 - 9 Red Bud Park
 - 10 Lakeside Park
 - 11 Highland Park
 - 12 Middletown Co. Park
 - 13 Library Park
 - 14 Rodman Slough
 - 15 Middletown Central Park
 - 16 Clearlake Oaks Community Park



Future development - Cache Creek

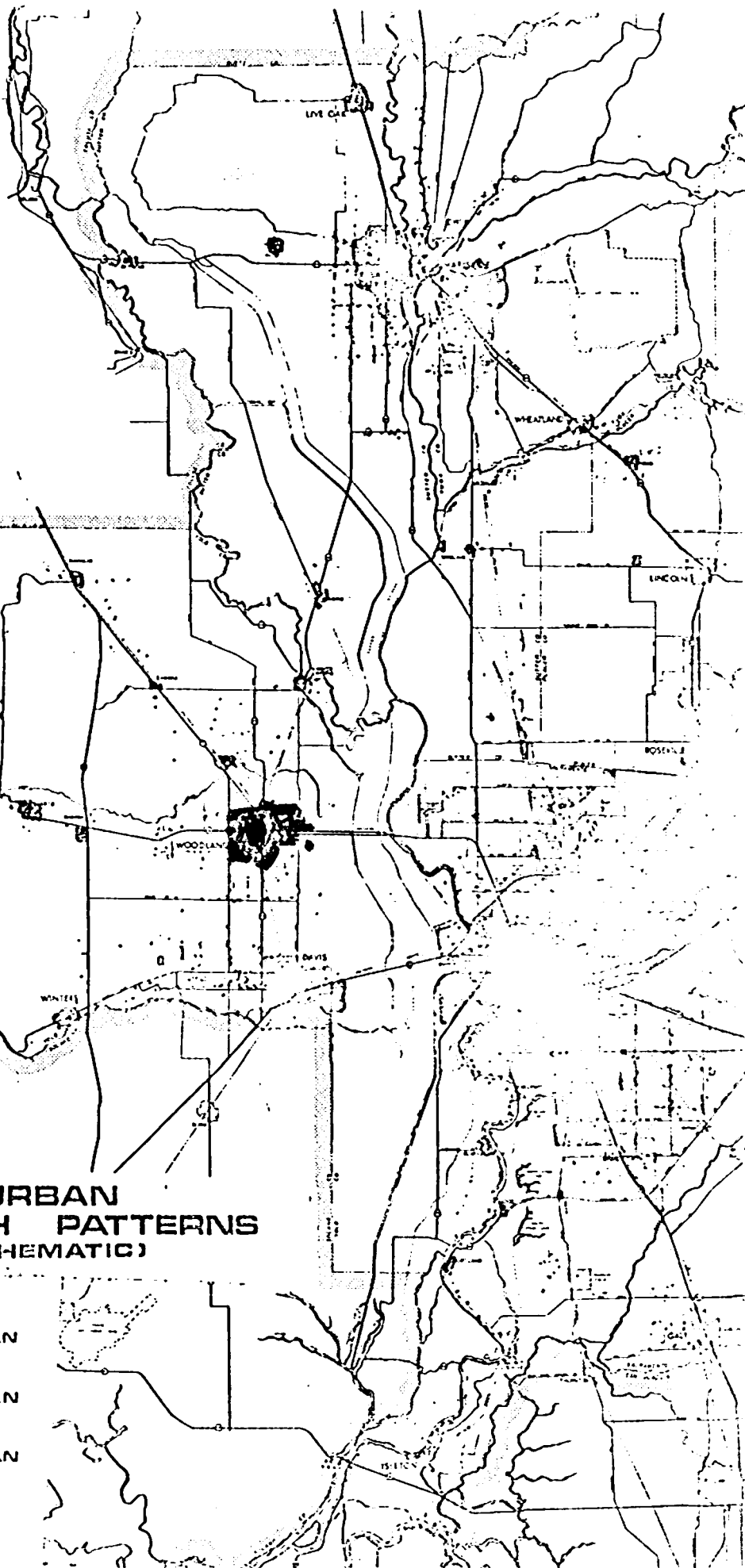
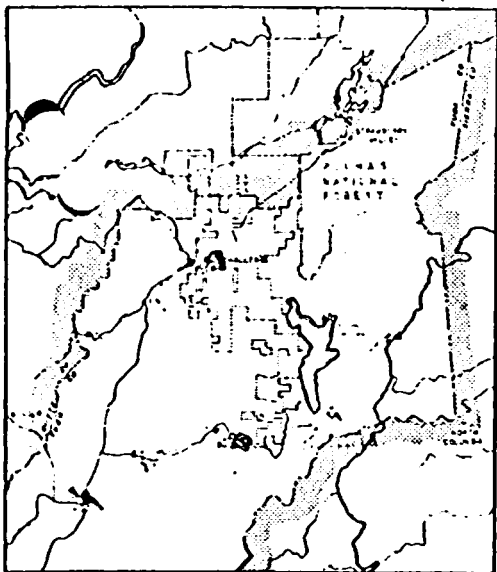
No significant increase in residential, commercial, or industrial units is projected for Reaches 1 and 2 during the study period. These reaches are located in a rural portion of Yolo County with agriculture being the predominate land use. The Open Space Element of the Yolo County General Plan indicates a majority of this acreage is classified in agricultural preserve status under the California Land Conservation Act (Williamson Act) of 1965. The Sacramento Regional Area Planning Commission (SRAPC) Regional General Plan, Physical Development Element, August 1973, indicates that future urban development projected for this portion of Yolo County can be readily accomodated in existing rural communities such as Madison, Esparto, and Guinda in areas outside of the flood hazard area.

Future residential, commercial, and industrial development projected for Reach 3 is presented in table C-9. These projections were based on 1974 Department of Finance Population projections modified by present trends to fewer persons per housing unit, and the general growth patterns projected for urban development in the Woodland area presented in the SRAPC General Plan (page 21). The major movement in residential and associated commercial development in the Woodland area is expected to be in a southerly direction towards the City of Davis and away from the flood plain area. However, some residential development is expected in the northwestern portion of Woodland as extensions of current developments in areas subject to moderate flooding from the standard project flood event. The growth

Table C-9

Cache Creek - Reach 3 Existing
and Projected Units, Standard Project Flood Plain

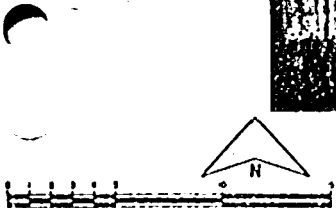
	1974	:	1985	:	1995	:	2005	:	2015	:	2025	:	2035	:	-	:	2085
Residential	81		106		136		174		223		285		365		-		365
Commercial	18		24		30		39		49		63		81		-		81
Industrial	22		30		39		52		69		91		120		-		120
Agriculture (acres)	10,695		10,620		10,550		10,440		10,300		10,120		9,870		-		9,870



**URBAN
GROWTH PATTERNS
(SCHEMATIC)**



- 1840 URBAN AREA
- 1870 URBAN AREA
- PROPOSED 1980 URBAN AREA



in housing units in the flood plain area is estimated to average 2.5 percent per annum during the study period. This is higher than the projected 1.65 percent per annum increase in population for Yolo County for the same period because of the present trend to fewer persons per housing unit and the small base of units currently occupying the flood plain area.

Based on 1972 OBERS projections for the Sacramento SMSA, wholesale and retail trade activities are projected to increase at an average rate of approximately 3.1 percent per year during the study period. Commercial development within the flood plain area is expected to be primarily of a neighborhood retail type and its growth rate would be less than anticipated for the entire SMSA. Growth of commercial units is therefore projected to average approximately 2.5 percent per annum.

Based on the previously mentioned SRAPC Regional Plan and recent construction activities, future industrial development in Woodland will occur primarily in the north eastern portion of the urban area. Much of this area is included in the standard project flood plain of Reach 3. Current industrial activities located in the flood plain include food processing and plastics production plants. Transportation facilities directly serving the area include the recently completed Interstate Highway 5 and Southern Pacific Railroad lines.

Industrial growth in Reach 3 is estimated to average 2.8 percent per annum during the study period. This rate of growth is slightly higher than the 1972 OBERS projection of 2.65 percent per annum for manufacturing activities in the Sacramento SMSA for a similar period. The higher rate of growth is assumed because of the small base of industrial facilities currently located in the immediate flood plain area and the locational advantages for future industrial development created by the recently completed highway system.

There are currently no major public buildings within Reaches 1-3 and none are projected for the study period. Future development of such neighborhood facilities as schools and fire houses in the Woodland area are expected to follow the major urban movement to the South away from the flood damage reaches. Damageable public facilities such as roads, bridges, and water and sewerage facilities in Reach 3 are expected to increase at a rate commensurable to the increases projected in residential, commercial, and industrial development on approximately 2.25 percent per annum. This same growth rate is assumed for the public facilities in Reaches 1 and 2 which service such rural communities as Madison, Esparto, and Guinda.

As with the Clear Lake Rim Reach no significant reductions in the total acreage devoted to agricultural production is projected for Reaches 1 and 2, while urban development in Reach 3 is expected to remove approximately

825 acres from agricultural production during the study period. The following tabulation summarizes the existing and projected crop distributions and yields for the combined agricultural acreages in Reaches 1-3.

Table C-10
Existing and Projected Crop Distributions
Reaches 1-3

Crop	1974		2035	
	Acres	Yield (Tons/acre)	Acres	Yield (Tons/acre)
Rice	550	2.8	400	4.6
Field	2,970	1.0	3,535	2.2
Truck	2,570	25.0	2,685	52.0
Grain	1,605	2.0	1,580	4.2
Pasture	2,075	3.0	1,560	3.8
Orchard	1,510	1.8	1,700	3.5
Native pasture	<u>4,505</u>	-	<u>3,500</u>	-
Subtotal	15,785		14,960	
Farmsteads and urban	<u>220</u>		<u>1,045</u>	
Total	16,005		16,005	

Source: 1974 estimates based on field surveys and Yolo County Agricultural Crop Reports. 2035 projections adapted from California Framework Studies.

Future property values

For damage and benefit analysis existing structures are evaluated on the basis of their current market values. New and replacement units are evaluated on the basis of 1974 construction prices and conditions. No increases in value per structure is projected during the study period either for existing or new or replacement units or for the content value of commercial or industrial units. Residential content values, however, are expected to increase over time with increases in affluence (increases in per capita income in real terms).

Residential content values for the flood plain areas are currently estimated at 35 percent of structural values. Increases in content values during the study period are projected on the basis of anticipated growth in the

resident per capita income . Based on the per capita income projections previously presented for Lake and Yolo Counties, residential content values in the Clear Lake and Cache Creek areas are projected to increase at an average rate of 2.84 percent and 2.7 percent per annum, respectively, until content values reach a maximum of 75 percent of structural values. For both areas the 75 percent limit would be reached before the year 2005. Additional increases in residential content value are not projected beyond the 75 percent limit. The effect of the affluence factor on future residential content values is summarized in tables C-11 and C-12.

Table C-11

Clear Lake Rim - Residential
Structure and Content Values, 1974 Prices

	: 1974	: 1985	: 1995	: 2005	: 2015	: 2025	: 2035	: -	: 2085
<u>Residential Structures</u> ^{1/}									
Number of units	575	658	735	825	920	1,020	1,140	-	1,140
Average value of structures (\$1,000) ^{2/}	17.6	18.3	18.9	19.3	19.7	20.0	20.0	-	20.0
Without affluence									
Average value of contents (\$1,000)	6.2	6.4	6.6	6.8	6.9	7.0	7.0	-	7.0
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents (\$1,000)	6.2	8.7	11.9	14.5	14.8	15.0	15.0	-	15.0
Percent of structural value	35	48	63	75	75	75	75	-	75
<u>Mobile Homes</u>									
Number of units	325	372	415	465	520	580	650	-	650
Average value of structure (\$1,000) ^{2/}	6.6	8.3	9.5	10.5	11.3	12.0	12.0	-	12.0
Without affluence									
Average value of contents (\$1,000)	2.3	2.9	3.3	3.7	4.0	4.2	4.2	-	4.2
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents (\$1,000)	2.3	3.9	6.0	7.9	8.5	9.0	9.0	-	9.0
Percent of structural value	35	47	63	75	75	75	75	-	75

^{1/} Excluding mobile homes.

^{2/} No increase in value is projected for existing units. New and replacement units are evaluated at average 1974 construction prices of \$20,000 per home and \$12,000 per mobile home. Replacement is based on an average replacement cycle of 45 years.

Table C-12

Cache Creek - Residential Structure And
Content Values, 1974 Prices

	: 1974	: 1985	: 1995	: 2005	: 2015	: 2025	: 2035	: -	: 2085
<u>Reach 1</u>									
Number of units	19	19	19	19	19	19	19	-	19
Average value of structures (\$1,000)	17.0	17.0	17.0	17.0	17.0	17.0	17.0	-	17.0
Without affluence									
Average value of contents (\$1,000)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	-	6.0
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents (\$1,000)	6.0	8.0	10.5	12.8	12.8	12.8	12.8	-	12.8
Percent of structural value	35	47	62	75	75	75	75	-	75
<u>Reach 2</u>									
Number of units	11	11	11	11	11	11	11	-	11
Average value of structures (\$1,000)	17.3	17.3	17.3	17.3	17.3	17.3	17.3	-	17.3
Without affluence									
Average value of contents (\$1,000)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	-	6.1
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents (\$1,000)	6.1	8.2	10.7	13.0	13.0	13.0	13.0	-	13.0
Percent of structural value	35	47	62	75	75	75	75	-	75
<u>Reach 3</u>									
Number of units	81	106	136	174	223	285	365	-	365
Average value of structures (\$1,000)	17.2	17.2	17.2	17.2	17.2	17.2	17.2	-	17.2
Without affluence									
Average value of contents (\$1,000)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	-	6.0
Percent of structural value	35	35	35	35	35	35	35	-	35
With affluence									
Average value of contents (\$1,000)	6.0	8.0	10.5	12.9	12.9	12.9	12.9	-	12.9

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS

CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS

	ENLARGE CLEAR LAKE OUTLET CHANNEL	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS	FLOOD PLAIN ZONING	NO DEVELOPMENT - SEDIMENT CONTROL ALTERNATIVES
1. Plan Data	<p>Enlarge 5.0 miles of outlet channel from a capacity of 2,500 to 8,000 cfs at 7.56' on Rumsey Gage at Lakeport.</p> <p>Flood operation criteria function of non-damaging flow of 21,000 cfs at downstream Capay and control stage of lake to 7.56 on Rumsey Gage at Lakeport.</p> <p>Relocate numerous residences, docks and two bridges.</p> <p>Modification of Bemmerly and Gopcevic Decrees necessary prior to project implementation.</p>	<p>Enlarge 3.6 miles of outlet channel from a capacity of 2,500 to 8,000 cfs at 7.56' on Rumsey Gage at Lakeport and construct 1.4 mile new channel and a weir and control structure.</p> <p>Flood operation criteria function of non-damaging flow of 21,000 cfs at downstream Capay and control stage of lake to 7.56' on Rumsey Gage at Lakeport.</p> <p>Construct two new bridges. Minimal impact on riparian development.</p> <p>Modification of Bemmerly and Gopcevic Decrees necessary prior to plan implementation.</p>	<p>Local flood regulatory authority applied to insure proper utilization of activity within the flood zone.</p> <p>Floodproof future development within Standard Project Flood plain (once in 500 years on the average), but above 100 year flood zone due to Lake County participation in the National Flood Insurance Program.</p> <p>Expenses borne by individual property owners.</p>	<p>No action undertaken by Federal Government for flood damage reduction through either structural or non-structural measures.</p>
2. National Economic Development				No Federal or non-Federal costs and no benefits.
Annual Costs	\$320,300	\$248,300	\$20,000	
Annual Benefits	303,900	320,900	57,200	
Net Annual Benefits	-16,400	72,600	37,200	
Benefit-Cost Ratio	0.95 to 1.0	1.3 to 1.0	2.9 to 1.0	
3. Environmental Quality				
(a) Vegetation	7 acres of riparian lands along 2 miles of the existing outlet channel lost due to channel widening. These lands support vegetation such as hardwoods, pines, willows, vines, and brush species. Vegetation would be replanted along disturbed banks.	20 acres of grassland lost to bypass channel construction; of that 16 acres are west of State Highway 53. 3 acres of riparian land along 1.3 mile reach of existing channel would be lost to channel widening. This land supports vegetation such as hardwoods, pines, willows, vines, and brush species. 1.4 mile long bypass channel would create new riparian vegetation along its banks. Vegetation would be replanted along disturbed banks.	Potential reduction in development in the Clear Lake flood plain area would reduce loss of shoreline vegetation. However the opposite effect may occur outside the flood plain due to potentially increased development in that area.	Long term decrease in vegetation along lake periphery and outlet channel due to replacement of open space and agricultural land with urban development.
(b) Wildlife	5 miles of existing channel deepened and intermittently widened, would reduce riparian vegetation providing fish and wildlife habitat. 400 feet (9%) of the total 4,500 lineal feet of aquatic oxbow habitat would be lost. Blasting during construction in a 0.9 mile reach of the existing channel would affect the existing fishery. Channel meander would be maintained and as riparian vegetation re-establishes, fishery should also re-establish.	3.6 miles of existing channel deepened and intermittently widened, would reduce riparian vegetation providing fish and wildlife habitat. Aquatic oxbow habitat would not be affected. 1.4 miles of new channel capable of supporting aquatic life would be created. Blasting during construction in a 0.3 mile of the existing channel would affect the existing fishery. Channel meander would be maintained and as riparian vegetation re-establishes fishery should also re-establish.	Potential reduction in development in the Clear Lake flood plain area would reduce the loss of shoreline wildlife habitat. However, the opposite effect may occur outside the flood plain due to potentially increased development in that area.	Sport and commercial fishery on Clear Lake would continue to grow. Limited fishery in outlet channel will remain stable. Wildlife populations would remain stable, population growth dependent on rate of human intrusion upon wildlife habitat.
(c) Water Quality	Increased turbidity during the 1 construction season within the outlet channel and downstream of the Clear Lake outlet dam. Little or no effect on the algal growth problem in Clear Lake.		NO EFFECT	Algal growth problem on Clear Lake would continue to be researched. Continued development could cause a long-term reduction in water quality in Clear Lake and Cache Creek.
(d) Air Quality	Minor effect by construction equipment exhaust during 1 construction season.		NO EFFECT	No significant change.
4. Regional Development				
(a) Land Use	7 acres of riparian land lost by channel widening. 48 acres of pasture land used for spoil area to be located outside of flood plain to prevent induced development.	20 acres of grassland and 3 acres of riparian land lost by channel construction and widening. 4.8 acres of pasture land used for spoil area to be located outside of flood plain to prevent induced development.	Additional cost of flood proofing may discourage development in flood prone areas around lake. Currently undeveloped flood plain may remain or develop to use compatible to flood proofing, such as open space recreation, parking areas, etc. Future development not directly related to recreation may locate outside the Standard Project flood plain due to increased cost.	Urban development would tend to replace agricultural use of land. Recreation oriented development will grow along lake periphery and along outlet channel, but would be restricted due to a perennial flood threat.
(b) Local Government Finance	112 acres of land removed from tax rolls, reducing tax revenues by about \$ 3,300 annually. Flood plain property values increased and in turn local tax revenues. Reduced emergency flood fighting cost.	118 acres of land removed from tax rolls, reducing tax revenues by about \$ 2,600 annually. Flood plain property values would increase and in turn local tax revenues.	Damage reduction to future structural development may increase assessed valuation around the lake. However, administration and enforcement of non-structural regulations would be local government costs.	Riparian property values would tend to increase, providing additional tax revenue. The exception would be where frequent flooding makes agricultural or residential development untenable.
(c) Employment/Labor Force	Reduced flood threat would tend to stabilize existing and promote future development, resulting in a similar stabilizing effect on the local labor force. 28 local workers provided with employment during 1 construction season. Maintenance work required intermittently after construction employing local labor.		NO EFFECT	Changes expected to follow the rate of population growth. Employment would be more dependent on commercial trade and services than at present.
(d) Business, industrial, agricultural activity	During construction period recreation oriented business along outlet channel would be adversely effected; however, long-term benefits by business realized. Retail sales of about \$ 219,000 would benefit local business during the construction period.	During construction period recreation oriented business along outlet channel would be adversely effected; however, long-term benefits by business realized. Retail sales of about \$ 372,000 would benefit local business during the construction period.	Flood proofing would raise costs of 1,000 new commercial structures in Standard Project flood plain between 1985 and 2035 and replacement of additional 2,370. Should not effect rate of development, but possibly the location. Continued damages to existing facilities.	Recreation would continue to be major economic force in area. Commercial and agricultural development would continue to suffer periodic flood damage. Agricultural development would be highly dependent upon development of new water supplies.

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS

CLEAR LAKE FLOOD CONTROL ALTERNATIVE PLANS

	ENLARGE CLEAR LAKE OUTLET CHANNEL	ENLARGE CLEAR LAKE OUTLET CHANNEL AND BYPASS	FLOOD PLAIN ZONING	NO DEVELOPMENT - SEDIMENT CONTROL ALTERNATIVES
5. Social Well Being				
(a) Noise	Minor effect due to construction equipment during 1 construction season. However blasting would create periodic localized high noise levels.	Minor effect due to construction equipment during 1 construction season. Due to the bypassing of the developed portion of the reach, high noise levels with blasting would not be significant.	NO EFFECT	Increased urban development and recreation use would increase noise levels, but not to unacceptable levels.
(b) Population/Housing	3 residences relocated. Dislocation of persons due to flooding would be reduced. A long-term stabilizing effect on housing around lake and along the outlet channel would occur.		Estimated 770 new housing units, 1,030 replacements within Standard Project flood plain between 1985 and 2035. Higher construction costs with flood proofing would result in a more uniform cost and better quality home within the flood plain. This would have a positive effect on the long-term quality of housing within the flood plain but would increase the problem of a shortage of low to moderate income housing in the area.	Lake County population predicted to increase to 60,700 by 2020. Immigration of retired persons is expected to be primary element in basin growth. Mobile homes and second home development would dominate. Major flood damage to existing structure along lake rim and outlet channel would continue to occur, with this effect minimized on new housing due to flood plain zoning requirements.
(c) Aesthetics	Although natural channel meander would be maintained, loss of riparian vegetation to widening would cause a decrease in the aesthetic value of the area. Approximately 1 channel mile of aesthetically pleasing oxbow habitat would be decreased 9% with a decrease in flow in the remainder. Spoil areas would be unsightly until replanted vegetation was re-established. Additional vegetation native to the area would be planted adjacent to the channel.	Aesthetic losses would be minimized by use of the bypass channel, thereby permitting the scenic oxbow areas to remain unaffected, and reducing the loss of riparian vegetation along the existing channel. Weir and control structure would detract from the "natural" beauty of the area, but a potentially scenic source of new riparian vegetation would be created along the 1.4 mile long bypass. Areas used as spoil disposal sites would be unsightly until replanted vegetation was re-established in these areas. Additional vegetation native to the area would be planted adjacent to channels.	Land use regulations would help to preserve any "natural" appearance that remains on the lake periphery in restraining development of the shoreline and minimizing landscape alterations.	Tendency towards urbanization would further decrease the "natural" appearance of riparian areas.
(d) Transportation	Removal and reconstruction of State Highway 53 bridge, old Highway 53 bridge, and Garner Island bridge would be necessary, thereby temporarily decreasing transportation efficiency on these routes. However, a long term benefit due to reduced flood damage to roads around Clear Lake would exist. Outlet channel navigation, especially in the vicinity of the Grigsby Riffle, would be significantly improved.	Reconstruction of the Garner Island bridge as well as the construction of 2 new additional bridges on State Highway 53 and Old Highway 53, would temporarily affect transportation efficiency at these sites. However, a long term benefit would be realized to roads along Clear Lake rim by reducing the flood threat.	Continued flood threat to existing roads and utilities around Clear Lake periphery. However, effective planning and management would minimize this threat to yet-to-be constructed facilities.	Traffic volume in area predicted to increase 10% annually. Two new State Highway routes are proposed for future construction. Roads, particularly Highway 20 would continue to suffer periodic flood damage.
(e) Recreation	Fishing in outlet channel essentially eliminated during 1 construction season. Small craft navigation ultimately improved, but adversity affected during construction. Increase of 31,000 recreation user days annually with proposed campground and fishing access facilities.	Effect on riparian recreation oriented development minimized with bypass channel. Minor fishery would be supported in bypass channel. Increase of 48,000 recreation user days annually with proposed campground and fishing access facilities.	4,740,000 annual user days predicted for Clear Lake by year 2020. Flooding would continue to cause damage to recreation oriented business and facilities along lake rim and outlet channel.	Future recreation use of Lake largely dependent upon water quality.
(f) Health	Potential safety hazard during construction due to blasting and heavy equipment operation in close proximity to residential areas. However, would decrease health hazards associated with flooding along the lake rim and outlet channel.	Safety hazard during construction minimized due to the bypassing of the most densely populated areas by the bypass channel. Project would decrease health hazards associated with flooding along the lake rim and outlet channel.	Although flood proofing would tend to increase protection to future residential and commercial development from the public safety hazards associated with flooding, flooding will continue to pose a public health hazard.	Newly planned sanitation and water supply systems will reduce public health threat posed by flooding. Flooding of main highways will continue to threaten life and property. Residential flooding along lake rim and outlet channel would continue to pose physical and psychological health problems.
(g) Historic and Archeologic	Wintun and Pomo indian villages and campsites line the periphery of Clear Lake and the outlet channel. Construction works could disturb such sites should they exist.		NO EFFECT	Continued urbanization and agricultural improvements would progressively diminish the rich archeological resources available.
(h) Institutional Relationships	Modification of Gopcevic (1920) and Bemmerly (1940) Decrees would be necessary prior to any alteration of the outlet channel.		NO EFFECT	NO EFFECT

Flood damage

Average annual flood damages were computed for the Clear Lake Rim and lower Cache Creek area based on 1974 conditions. This data is presented in table C-13.

Table C-13

Average Annual Damages
1974

Location	:	Average Annual Damage
Clear Lake Rim	:	\$369,700
Reach 1	:	27,300
Reach 2	:	24,300
Reach 3	:	51,800

Erosion and Sediment Problem

The erosion and sedimentation problems are primarily confined to the area of Cache Creek below Rumsey. For many years, erosion and sedimentation have been a problem in this area and numerous acres of land have been washed away. Between Capay and the settling basin the channel has been gradually degrading which has had a damaging effect on bridges crossing Cache Creek.

Bank erosion

Bank erosion along Cache Creek takes place between the towns of Rumsey and Yolo. Downstream of Yolo, bank protection has been placed by the Corps of Engineers in conjunction with the constructed levee project. Between the towns of Rumsey and Capay the damaging effects of erosion are primarily evident along the right bank where agricultural development has taken place. In the reach between the towns of Capay and Yolo loss of banks has been caused by both erosion and mining of sand and gravel from the channel and bordering lands. In particular, gravel mining operations downstream of Stevens Bridge have significantly widened the channel. The land use types along the channel that have been and are subjected to erosion are presented in table C-14.

Table C-14

Land Use along Cache Creek

Reach	: Cultivated: : Lands	: Orchards	: Pasture	: Hillside
MILES				
Rumsey to Capay (Reach 1)	11.6	10.8	4.7	17.1
Capay to Stevens Bridge (Reach 2)	11.8	1.7	8.9	0

There are also numerous structures crossing the creek and adjacent to the creek in addition to farmsteads that have been damaged or are susceptible to erosion damage. These facilities are listed in table C-15 from downstream to upstream.

Table C-15

Structures Crossing Cache Creek

Miles Upstream From Settling Basin	:	Type Facilities	:	Name
7.0		Road Bridge		Stevens Bridge
8.0		Irrigation Canal		Moore Canal
9.4		Diversion Dam		Moore Dam
9.5		Irrigation Canal		Alder Canal
10.0		Power Trans- mission lines		
12.2		Power Trans- mission lines		
12.8		Power Trans- mission lines		(3 lines)
12.9		Road Bridge		Interstate 505
13.4		Road Bridge		Madison Bridge
16.3		Road Bridge		Esparto Bridge
18.5		Road Bridge		Capay Bridge
20.6		Diversion Dam		Capay Dam
39.7		Road Bridge		Rumsey Bridge

Analysis of the erosion and land loss along Cache Creek is presented in table C-16. This data was developed from intermittent aerial photos that were available for the period from 1939 to 1972.

Table C-16
SUMMARY OF LOWER CACHE CREEK SEDIMENT EROSION AND DEPOSITION ANALYSIS

REACH -Subreach	Length of Reach (Miles)	Date of Aerial Photo	Total Area Within Banks (Acres)	Difference In Acreage (Acres)	Average Difference (Acres/Year/Mile)	Total Period Average (Acres/Year/Mile)
REACH ONE: Rumsey to Capay Dam						
	17.9	Jun 1953	1261			
		Jun 1969	1382	121	0.42	0.87
		Mar 1972	1556	174	3.24	
REACH TWO: Capay Dam to Airport Rd (Stevens Br.)						
	12.3	Aug 1939	1022			
		Jun 1970	1410	388	1.02	1.02
-Capay Dam to Esparto Bridge						
	4.1	Aug 1939	360			
		Apr 1953	386	26	0.45	0.64
		Jun 1970	441	55	0.79	
-Esparto Bridge to Madison Bridge						
	2.7	Aug 1939	308			
		Jul 1957	235	-23	-0.47	1.15
		Jun 1970	404	119	3.39	
-Madison Bridge to Moore Dam						
	3.4	Aug 1939	239			
		Jul 1957	199	-40	-0.65	0.87
		Jun 1970	331	132	2.99	
-Moore Dam to Airport Road (Stevens Bridge)						
	2.1	Aug 1939	115			
		Jul 1957	147	32	0.85	1.83
		Jun 1970	234	87	3.19	
REACH THREE: Airport Rd To Settling Basin						
-Airport Road to Yolo Bridge (Mostly Excavation)						
	4.4	Aug 1939	539			
		Jul 1957	592	53	0.67	1.03
		Jun 1970	680	88	1.54	

C-26

Review of this data shows that the channel has generally become progressively wider. This is considered unusual since a channel will typically maintain its size. However, during the critical dry period of the 1930's sediment deposition most likely took place. After that period, major flood flows occurred in the valley in 1937, 1940, 1956, 1958, 1964, and 1970. This probably provides a tendency for channel widening coupled with sand and gravel mining.

Source of sediment

Below the gage on Cache Creek above Rumsey the stream flows through sedimentary rock formations before entering the Capay Valley. The channel widens considerably in this area since it is not confined by the steep rock canyon predominant between Clear Lake Outlet Dam and Rumsey. In this area a considerable amount of sediment inflow to the creek is generated. The sediment yield of Capay Valley between Rumsey and Capay is approximately 3.5 times higher than in the upstream portions of Cache Creek Basin. The sediment yield of Cache Creek at Capay is considered very high. A comparison of the unit sediment yield of Cache Creek to other streams is presented in table C-17.

Table C-17

Stream	Location	Drainage Area (1,000 sq. mi.)	Average Water Discharged (1,000 cfs)	Average Annual Suspended Load (ton/sq. mi.)
Cache Creek	Capay, CA	0.5	0.6	1,584
San Joaquin	Vernalis, CA	14.0	4.7	25
Eel	Scotia, CA	3.1	7.0	5,846
Colorado	Grand Canyon, AZ	137.8	6	1,082
Columbia	Rasco, WA	102.6	256	100
Missouri	Hermann, MO	528.2	69	454

Source: "The Sediment Yield of Major Rivers of the World" by John N. Holeman. August 1968 issue of Water Resources Research, published by American Geophysical Union.

The high sediment inflow to the creek in this reach is dependent on a number of factors. One prime factor is the low amount of precipitation in such a relatively steep mountainous area. Because of the low precipitation there is a limited amount of vegetative cover and when precipitation does occur a large amount of sediment is washed from the hills into the stream.

The Capay Hills, located to each side of the stream and forming the Capay Valley, are broken at numerous places by step-like topography where surficial slump and soil creep have gradually created gullies. The hills to the northeast form the left bank of the creek, allowing hillside sediment flow to discharge directly into the stream. Along the right bank of the creek is the Capay Valley floor that has been extensively cultivated for agriculture. This cultivation tends to increase the susceptibility to erosion.

Sediment transport

The cross section of Cache Creek in the reach between Capay and the settling basin is typically very wide and shallow. Width to depth ratios are commonly 50 or greater. A low flow channel meanders within the confines of the main channel, occasionally attacking the banks.

The stream transports an extremely wide range of grain size with a large proportion of fines (<0.2 mm) moving as wash load. Although the banks in this reach are composed of easily erodible material they are probably not a major source of the sediments that deposit in the settling basin.

As stated previously, the major source appears to be hillside and sheet erosion in the Capay Valley, above Capay.

The sediment transport increases from Capay to Yolo, 10 miles downstream, because of flow diversions for irrigation and a decreasing energy slope. The average annual total transport at Capay is about 2,115,000 tons, and at Yolo 1,297,000 tons. Calculated average annual capacity for transport of bed material is 263,000 tons at Capay and 165,000 tons at Yolo. For the present flow-duration characteristics of Cache Creek, approximately 90% of the average annual bed material transport occurs during flows between 1,500 and 11,000 cfs. Transport rates of bed material at Capay and Yolo as functions of discharge, and other pertinent sediment information, are presented in table C-18. The movement of bed material, as opposed to wash load, is important in determining channel stability.

Table C-18

SEDIMENT TRANSPORT
BED MATERIAL TRANSPORT RATES, CACHE CREEK

Discharge (cfs)	Transport Rate (Tons/Day)	
	Near Capay	Near Yolo
50,000	160,000	125,000
30,000	69,000	54,000
20,000	39,000	29,000
15,000	30,000	19,000
10,000	22,000	11,500
5,000	9,600	5,100
3,000	4,300	2,400
1,500	930	700
1,000	400	320
500	115	77

AVERAGE ANNUAL TRANSPORT RATES IN TONS

	Bed Material (0.2 - 20mm)	Wash Load (<0.2mm)	Total
Cache Creek	263,000	1,852,000	2,115,000
Cache Creek at Yolo	165,000	1,132,000	1,297,000

As the transport capacity at Capay is greater than that at Yolo, deposition within this reach is expected. Gravel operations, however, are presently removing in excess of 4,000,000 tons of material each year. This material is being mined since the rate at which it is being removed is nearly three times greater than the ability of the stream to replace bed material from upstream. It appears that this removal of material has resulted in a substantial increase in the channel width.

The amount of sediment transported to the Cache Creek Settling Basin amounts to 675 acre-feet annually on the average.

Sediment deposition in the settling basin

A survey of the settling basin was made by the Corps of Engineers in 1933 and 1934 and subsequent topographic surveys were made by the State in 1958, 1968, and 1971. The following tabulation shows the volume of sediment deposited during these periods based on these surveys.

Table C-19

<u>Period</u>	<u>: Deposition : In Settling Basin (Acre-feet)</u>
1934 to 1958	9,700
1958 to 1968	1,900
1968 to 1971	<u>1,035</u>
Total	12,635

The average annual sediment deposition in the settling basin during this period amounts to about 340 acre-feet.

Gradation analysis of the soils of the settling basin and Yolo Bypass were made in March 1972 by the State of California Department of Water Resources. The results of these analyses are shown in the following tabulation.

Table C-20

Location	Sand (larger than .074 mm)	Silt (.005 to .074 mm)	Clay (smaller than .005 mm)
PERCENT			
Cache Creek at Yolo (inflow)	16	36	48
Settling Basin mouth of training basin	69	23	8
Settling Basin near Cobble Weir	15	62	23
Yolo Bypass	22	42	36

Source: "Cache Creek Settling Basin Interim Plan," by State of California Department of Water Resources, October 1972.

The density of the deposited material in the settling basin is as follows:

Table C-21

CHARACTERISTICS OF DEPOSITS

	Specific Weight (Lbs/Cu.Ft.)	Size Range (mm)
Settling Basin	88.9	0.005 - 0.5

Sediment Deposition in the Yolo Bypass

Sedimentation of the Yolo Bypass by Cache Creek has again become a problem. In 1937 the Cache Creek Settling Basin was constructed as a unit of the Sacramento River Flood Control Project to control deposition of sediments in Yolo Bypass and thus maintain the flood flow capacity of the bypass. However, the settling basin's storage capacity is now almost depleted. As previously stated, the State of California has in recent years done some work on Cache Creek Settling Basin to provide interim storage capacity

until a long range solution can be developed. The recent raising of the Cobble Weir at the outlet of the settling basin, to increase the storage capacity has, however, caused encroachment into the freeboard of perimeter levees under design flow conditions.

Based on an analysis of the gradation of sediment flowing into the settling basin (675 acre-feet) and the sediment that has deposited in the Yolo Bypass, it was determined that an average of about 100 acre-feet per year would deposit when the trap efficiency of the settling basin reached zero. A zero trap efficiency was expected to occur in 1975; however, the interim measure of raising the Cobble Weir has provided some prolonged efficiency.

Deposition Below Yolo Bypass

Depletion of the sediment storage in the settling basin is allowing the heavy sediment load carried by Cache Creek to be carried into the Yolo Bypass unimpaired. This, as indicated, is effecting the Yolo Bypass flood flow capacity. Also, additional sediment is now being permitted to flow on downstream further compounding the sediment deposition problems in navigation channels and flood control channels. To maintain the effectiveness of the Sacramento River and downstream San Francisco Bay System, it has been necessary to continually dredge deposited sediments. Significant deposition problem areas that are presently evident below Yolo Bypass are the Sacramento River Shallow Draft Channel, Sacramento River Deep Water Ship Channel, and San Francisco Bay System. These problem areas are discussed in the following paragraphs.

a. The Sacramento River Shallow Draft Channel provides a 10 foot deep channel from Suisun Bay to Sacramento, a 6 foot deep channel from Sacramento to Colusa, and a 5 foot deep channel from Colusa to Chico Landing. Each year the Corps of Engineers has this channel dredged of deposited sediment to maintain its depth for navigation. Based on 8 years of recent records of dredging, there has been an average of 325,000 cubic yards per year dredged. This dredging is costing in excess of \$400,000 per year.

b. The Sacramento River Deep Water Ship channel provides a 30 foot deep channel for 43 miles from Suisun Bay to the Port of Sacramento. Portions of the channel are dredged an average of every two years. The average annual dredging of sediment amounts to 240,000 cubic yards based on 8 years of recent records. The dredging is costing in excess of \$300,000 per year.

c. The San Francisco Bay System contains a number of small bays, public ports, naval ports, and ship channels that are effected by the deposition of sediment carried into the bays from the Sacramento River and other areas. The Corps of Engineers in 1967 used sediment flow data collected by the U. S. Geological Survey and determined that there is a sediment flow into the system of 9.56 million cubic yards per year

on the average. Of this about 8.13 million cubic yards per year is estimated to come from the Sacramento-San Joaquin Delta and principally from the Sacramento River Basin. Approximately 10 million cubic yards of Bay sediment are dredged annually by the Federal Government and private concerns in the Bay System. The majority of this material is disposed of in the Bay water at one of five disposal sites and it is estimated that about 1.4 million cubic yards leaves the Bay annually from overboard dredge disposal practices.

Just from these critical problem areas there is an estimated average annual dredging requirement of about 11 million cubic yards and this costs in excess of \$1.00 per cubic yard to remove.

If no action is taken it is estimated that 240 acre-feet (387,000 cubic yards) on the average per year of sediment that was depositing in the settling basin will flow into this navigation system and a portion deposited. This extra sediment amounts to about 5 percent of the sediment flow into the San Francisco Bay System from the Sacramento-San Joaquin Delta.

Municipal and Industrial Water Supply Needs

Lake County

The primary source of M & I water in the vicinity of Clear Lake is groundwater supplies. Some M & I water supply is also provided from the lake.

The Corp's authorized Lakeport Lake project is planned to supplement the M & I water supply by providing an additional 8,400 acre-feet annually to the Lakeport area. Pomo Reservoir site on Kelsey Creek, being studied by Lake County, is planned to also supplement M & I water supply of the Clear Lake area.

Yolo County

The larger cities in Yolo County, such as Woodland, Davis, and Winters, obtain their entire water supply from groundwater sources. It is predicted that wells will continue to be used for M & I water supply in the future. The following tabulation presents data relative to water supply.

Irrigation Needs

Lake County

Even though Clear Lake lies within Lake County, the lake provides a limited source of irrigation water for the county since Yolo County Flood Control

Table C-22

URBAN AREAS IN YOLO COUNTY AND THEIR RESPECTIVE WATER SUPPLIES

Urban Area	Water Supply		Average Annual Consumption (mgd)	Quality of Water Supply	
	Source	Treatment		Total Dissolved Solids as mg/l	Hardness mg/l as CaCO ₃
City of Woodland	Wells	none	6.3	368-737	167-331
City of Davis, incl. El Macero	Wells	none	4.2	574-942	261-466
City of Winters	Wells	none	0.7	236-407	144-310

Source: "Preliminary Water and Waste Management Plan" for Sacramento Regional Area Planning Commission; Metcalf and Eddy Engineers, November 1969.

and Water Conservation District owns the water rights of water stored in the lake. Irrigation water supplies can, however, be developed on the streams flowing into the lake. On Scotts Creek, the Corp's authorized Lakeport Lake will provide 9,100 acre-feet annually of irrigation water. On Kelsey Creek, Lake County is studying construction of the Pomo Reservoir (Kelseyville Reservoir) which will furnish irrigation water to the Big Valley area adjacent to Kelsey and Adobe Creeks.

The Bureau of Reclamation in their January 1969 English Ridge Unit feasibility report stated that future demand of irrigation water supply for the Clear Lake area amounted to 38,400 acre-feet annually. Of this total, about 10,300 acre-feet would be required for the Big Valley area. The Bureau has, however, indicated that the English Ridge Unit is economically infeasible at the present time. There is also a potential to store additional water in Clear Lake to meet Lake County demands.

Yolo County

Studies of providing additional water to Lake and other nearby counties have recently been resumed by the Bureau of Reclamation.

Yolo is primarily an agricultural county. Agricultural water is obtained from groundwater and surface water supplies. Clear Lake, Cache Creek, and the Sacramento River constitute the primary sources of surface water. Local interests indicate the combined sources of surface and groundwater are not sufficient to meet demands allowing an overdraft of the groundwater by an estimated 60,000 to 80,000 acre-feet per year.

Accepting the existence of a significant overdraft of the groundwater basin, an additional source of supply is needed by Yolo County. More water is also needed to irrigate land which is not now used for agricultural purposes. Indian Valley Reservoir, located on North Fork Cache Creek, will provide an additional irrigation yield. Other possible sources of surface water include the West Sacramento Valley Canal studied by the Bureau of Reclamation. Studies show this project to be economically infeasible.

Studies have been conducted by the Bureau of Reclamation in 1964 regarding irrigation water supply for the lower Cache Creek service area. This service area extends in a west to east direction from Rumsey to the vicinity of Yolo and in a north to south direction from just north of Cache Creek to Putah Creek. The service area contains 160,800 acres of arable land. Of this area 52,058 acres are served by groundwater sources providing about 222,000 acre-feet of water annually. Groundwater safe yield is, however, estimated at 200,000 acre-feet. Total surface water source irrigation consumption from Cache Creek is about 96,000

acre-feet annually. Present firm yield is estimated at 45,000 acre-feet. With the development of Indian Valley Reservoir a new source of water will be provided. Even with Indian Valley Reservoir, Yolo County agricultural interests indicate a need for future irrigation water supply.

Water Quality Problem

Clear Lake

Clear Lake has a significant water quality problem, caused by excessive algal growths. Clear Lake has become an eutrophic lake, in that its nutrient content allows for massive algal blooms during certain times of the year. This interferes with one of its beneficial uses, which is recreation. The other major beneficial use of Clear Lake, that of an irrigation water supply for downstream users, is satisfactorily met for the crop types grown.

The nutrients of major concern for algal growth in any water body are nitrogen and phosphorus. These nutrients enter Clear Lake from stream inflows and overland runoff. Nutrients already in the lake become recycled as death and biological oxidation releases them from their organic bonds, and play an important role in the seasonal algal growth cycles.

The algal blooms of Clear Lake cause a "pea-soup" appearance and when wind-swept to the shoreline the algae die and produce an unsightly appearance and an unpleasant odor detrimentally effecting recreation use. The blue-green algae in the lake are the most obnoxious of all the algal family, in that, in addition to the above, they also release by-products which are toxic in the higher concentrations. Certain blue-green algal species are able to maintain their dominant position in Clear Lake because they possess gas vacuoles which allow them to remain in the lighted (euphotic) zone of the lake waters. Thus, they get the light needed for their growth, while shading other genera of algae such as the greens and diatoms.

Rigorous studies on the causes and control of the algal blooms of Clear Lake have been underway for the past three years by the Clear Lake Algal Research Unit (CLARU). This unit is supported by both the California Department of Water Resources and by the Lake County Flood Control and Water Conservation District. The main aim of CLARU is to find a means of "tipping the ecological balance" so that the growth of nonobnoxious green algae is favored over the growth of the obnoxious blue-green algae. One of the two control methods tried is artificial aeration of the Oaks Arm, causing vertical mixing. This is to keep the green algae in the lighted euphotic zone along with the blue-green algae, where the green algae with their faster growth rate will be the dominant algal group, thereby utilizing most of the available dissolved nutrients for their growth. The second control method, for possible use in the upper arm, which is too large for

artificial aeration, is to apply an algicide that can inhibit fixation of atmospheric nitrogen by the blue-green algae. Artificial aeration for blue-green algal growth control in Lower Arm was tried in the summer of 1973, but the results are not yet published. Nutrient studies of Clear Lake, in support of CLARU's efforts, have been recently conducted by the California Department of Water Resources.

Cache Creek

Currently, the water of Cache Creek, as it leaves Lower Arm of Clear Lake, is of a suitable quality to satisfy its downstream beneficial uses. The major beneficial use of Cache Creek is irrigation water supply. Downstream of the Clear Lake Outlet, Bear Creek flows into Cache Creek and has a relatively high boron content. Higher boron concentrations have a deleterious effect on plant growth, with different plant types having different sensitivities to it. Crops irrigated with lower Cache Creek waters have to be of the types insensitive to the usual boron concentrations present. Other quality parameters important in irrigation (total dissolved solids, chlorides, sodium absorption ratio, etc.) are satisfactory.

The other beneficial uses of Cache Creek, such as fishery and recreational uses, are satisfactorily met by the present qualities.

Fish and Wildlife Needs

Clear Lake is widely known as a good fishery for warmwater species of fish. The lake contains large numbers of largemouth bass, catfish, perch, crappie, bluegill, and sunfish. Many nongame species also inhabit the lake. Some of these rough fish, such as squawfish, suckers, splittail and hitch, are stream spawners. These fish ascend the streams from the lake to spawn during the spring. The young usually migrate to the lake by early summer. For many years the hitch was considered as one of the most important forage species for game fish in Clear Lake. However, currently the hitch is of relatively minor importance to game fish production or to the economy of the Clear Lake fishery.

The Clear Lake area is inhabited by many species of wildlife including black-tail deer, black bear, ring-necked pheasant, mourning dove, valley quail, and rabbits. Waterfowl visit the area during migration periods. Fur-bearing animals include gray fox, bobcat, mink, raccoon, ring-tail, spotted skunk, and muskrat. Many of these fur-bearers live along or in stream courses.

The Department of Fish and Game has been attempting to preserve a wildlife area adjacent to the lake in the vicinity of the upstream end of the Clear Lake outlet channel. Their proposal is to purchase the Anderson Ranch, a portion of which is a natural marsh area, and develop a wildlife refuge.

The main stream of Cache Creek and its tributaries provide minor fisheries for smallmouth bass and white catfish. Other warmwater game species are present in limited numbers, but contribute very little to the total sport catch. In addition, other nongame species, principally of the minnow family, squawfish, carp, and roach, are found throughout the drainage basin. Rainbow trout are present in the head waters of North Fork of Cache Creek and its tributaries where suitable year-round water temperatures exist. The heavy sediment-carrying characteristic of Cache Creek is the limiting factor on the production of game fish in the creek. Cache Creek is fed by many mineralized streams, which further degrade productivity of the fishery.

At the mouth of Cache Creek, the settling basin currently contains some lands that are not used for agricultural purposes, thereby allowing optimum use for wildlife. However, the amount of unused land has been continually diminishing and this is of concern to the U.S. Fish and Wildlife Service and Department of Fish and Game.

General Recreation

The Clear Lake area has been intensively developed for water-associated recreation. The lake has a shore line of about 100 miles, of which 39 are presently developed for water-associated recreation facilities, including public and private beaches, wharfs, and lakeside residences.

Most of the desirable shore line locations around Clear Lake have been developed with facilities; at Clear Lake Highlands, the shore line is virtually saturated with recreational developments. Most of the shore line areas having access to deep waters are developed to some extent. The largest areas of undeveloped shore line exist southeast and northeast of Lakeport along shallow and marshy reaches of lake shore where, during periods of low water, the lake recedes, leaving large areas of lake bottom exposed. At the Clear Lake State Park, located at the base of Mt. Konocti on Soda Bay, an area of public access to Clear Lake has been developed by dredging channels and lagoons for small boats. The State campgrounds attract over 100,000 recreationists annually. In the past few years additional facilities have been added for camping and boating.

A number of recreational facilities have been developed in the hills surrounding Clear Lake and along the tributary streams. However, the most popular resorts are those which can offer water-associated recreation. There is little flow during summer months in streams tributary to Clear Lake. Many Lake County interests have indicated a desire to develop additional recreational reservoirs on these streams to maintain flow during summer months.

Because the Clear Lake Water Company operates Clear Lake to obtain a water supply for agricultural purposes, the lake is drawn down during the late summer months. During years of low inflow to the lake, this lowering of the lake level is considered to be a detriment by recreational interests. Consequently, any operation of the lake that would tend to stabilize its water surface would enhance the recreational potential of Clear Lake. Another detriment to recreation is the blooms of blue-green algae that often occur in Clear Lake and produce unsightly scums and foul odors.

At present, little recreational use is made of the main stem of Cache Creek or of its tributaries. The adjacent lands are used principally for hunting deer and quail. Even this activity is somewhat limited, owing to limited access to the lands. In the past 5 years, whitewater boating on the North Fork of Cache Creek and Cache Creek has grown in popularity. Boating use in the lower reaches of North Fork Cache Creek and Cache Creek from their confluence to Rumsey is estimated between 2,000 and 5,000 recreation days annually. Future consideration of trails along Cache Creek would provide additional water oriented recreation opportunity in this area.

Improvements Desired

There are two local agencies in the Cache Creek Basin which qualify as project sponsors. They are Lake County and Yolo County. These two counties have been actively interested in the survey study.

Improvements desired by local interests were expressed at the public meeting held in Woodland on 2 July 1969. The improvements desired vary from channel stabilization to multipurpose storage reservoirs. Local interests also desire to restrict the mining of aggregates from portions of Cache Creek. Removal of these aggregates increases channel velocities, thereby causing erosion and silting of existing groundwater recharge areas which may reduce the groundwater recharge ability of Cache Creek flows. The California State Reclamation Board, which maintains and operates the Sacramento River Flood Control Project, desires a long-range solution to the settling basin problem to prevent sediment deposition in the Yolo Bypass, thereby reducing its flood-carrying capacity.

The two local water agencies indicate that additional irrigation water supply will be needed in both the upper and lower basins to supplement diminishing groundwater supplies. Recession of groundwater levels is a significant problem throughout Big Valley south and west of Clear Lake, and in the Sacramento Valley portion of the basin.

The water quality of Clear Lake has been declining for many years. Also, the surface level of Clear Lake fluctuates throughout the year and from

season to season because of irrigation releases during the summer and fall months and variation in inflow during the winter and spring months. Lake County officials would like to have the water quality improved and the lake level stabilized to enhance the recreation potential of the lake. However, any change in the present conditions of Clear Lake could have ecological implications which would require detailed study and evaluation.

SECTION D

FORMULATING A PLAN

The formulation portion of the study involved the exploration of alternative measures of resolving the problems and fulfilling the needs that have been defined in the study area. Such alternatives were then screened to arrive at a plan that best responds to the problems and needs of the area. Plans were formulated with due regard to all pertinent benefits and costs, both tangible and intangible.

The procedures used in formulating plans for the management of water and land resources are consistent with the Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources," (Principles and Standards), the National Environmental Policy Act of 1969, (NEPA), the River and Harbor and Flood Control Act of 1970, the Water Pollution Control Act Amendments of 1972, and the Water Resources Development Act of 1974. Together, these policies establish and define the national objectives for water resource planning and specify the range of impacts that must be applied when evaluating plans.

The Principles and Standards require that Federal and Federally assisted water and land activities be evaluated considering achievement of National Economic Development (NED) and Environmental Quality (EQ) as co-equal national objectives. NED is achieved by increasing the value of the national output of goods and services and improving national economic efficiency; EQ is achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems. Achievement of these two national objectives is the basis for establishing the "Federal Interest" in alternative plans prepared for and presented to decision makers.

The additional consideration of Regional Development (RD) and Social Well-Being (SWB) is specified in the River and Harbor and Flood Control Act of 1970. The contributions to the RD account are determined by establishing the effect of a proposal on regional income, employment, economic base, land use, and other factors. Contributions to the SWB account are determined by establishing the effects of a proposal on security of life, health and safety, education, cultural and recreational opportunities, and emergency preparedness.

The Federal Water Pollution Control Act Amendments of 1972 reaffirms the National goal to achieve clean water in a timely manner. Among other things, the Act provides for linking water quality concerns to the more traditional aspects of resource management when preparing alternative plans.

Formulation and Evaluation Criteria

Formulation and evaluation of the plans of improvement for the study area, including all possible alternatives, were based on technical, economic, and intangible criteria, including beneficial and detrimental effects on the area's environment. Such criteria will lead to the selection of the plan of improvement which represents the solution that best responds to the problems and needs of the area and is justifiable.

Technical Criteria

The following important technical criteria were adopted for use in developing a plan:

- a. The plans should be consistent with the California Water Plan and the Lake and Yolo Counties' General Plans.
- b. Historical sediment flow and deposition should be used as a basis for future storage requirements.
- c. The flood season control stage at Clear Lake should be in the area of 7.56 on the Rumsey Gage at Lakeport.
- d. Dam, channel, levee, and weir design criteria, such as freeboard requirements and cross section selection were established on the basis of existing site conditions, available materials, and type structure selected.
- e. A minimum of 50-year sediment control should be provided with a trap efficiency of at least 50 percent.

Economic Criteria

The following economic criteria for formulation of the plan are summarized as follows:

- a. Benefits and costs of the alternatives should include consideration of beneficial and adverse externalities stemming from normal economic production and consumption.
- b. The benefits and costs should be expressed in comparable terms to the fullest extent possible. All evaluations of alternatives are based on July 1974 prices and an interest rate of 5-7/8 percent, and 100-year and 50-year project lives for flood control and sediment control alternatives respectively.

c. A plan must have net national economic development benefits unless the deficiency in net benefits for the national economic development objective is the result of benefits foregone or additional costs incurred to serve the environmental quality.

d. Each separable unit of a possible plan should provide benefits at least equal to cost unless benefits are foregone or additional are incurred to serve the environmental quality.

Environmental Quality and Other Criteria

The following environmental criteria and intangibles were considered in formulating a plan:

a. Public health, safety, and social well being including possible loss of life should be carefully considered.

b. General public acceptance of possible plans should be determined by coordination with interested Federal and non-Federal agencies, various groups, and individuals by means of public meetings, field inspections, meetings with several groups, letters, and other public involvement procedures.

c. The plan should be workable within the constraints of present and potential governmental structure function, relationships, and associations in the study area.

d. Detrimental environmental effects should be avoided where possible, and feasible mitigation features for such unavoidable effects should be included.

e. The relationship of the proposed action to land use plans should be considered; the environmental impact of any proposed action should be evaluated; any adverse environmental effects which could not be avoided if a proposal were implemented, should be delineated; alternatives to such proposed action should be identified; the relationship between local short-term uses and the maintenance or enhancement of long-term productivity should be determined; and any irreversible and irretrievable commitments of resources involved if a proposed action were implemented should be identified.

f. A systematic interdisciplinary approach should be used to analyze a plan, based on the integrated use of natural and social sciences and environmental design arts.

Possible Solutions

In developing an array of possible alternatives, consideration was given to all known reasonable alternatives that would solve the major water resource problems of the study area. These include:

- a. Consideration was given to flood plain zoning around Clear Lake Rim and areas adjacent to Cache Creek in Yolo County.
- b. Single and multiple purpose reservoir storage was examined on Cache Creek and certain tributaries.
- c. Studies were made of new construction and enlargement of levees along lower Cache Creek. Channel enlargement and a bypass channel have been studied for the Clear Lake outlet channel.
- d. Consideration was given to various methods of controlling the sediment problems of Cache Creek to prevent sedimentation in the Yolo Bypass. Also bank protection measures were considered.

Nonstructural alternatives

Reduction of future flood damages by nonstructural land management has been investigated during preliminary studies. The major portion of the flood plain in the lower basin is presently in agricultural use and is expected to remain so. Around Clear Lake there is residential, commercial, and agricultural development. The Corps has completed flood plain insurance studies of the perimeter of the lake and currently a Flood Plain Information report is being prepared for the Big Valley area consisting of the lower reaches of Adobe, Cole, Kelsey, and Manning Creeks. The lands around the rim of the lake have been flood plain zoned to the 100-year on the average lake level by inactment of the Flood Insurance Program. Future study of this area was considered warranted and results of these studies which consider flood proofing of future development above the 100-year level is discussed later in this section.

In the lower basin along Cache Creek studies were conducted of nonstructural flood plain management alternatives which can be taken to reduce flood damage. It, however, does not appear that flood damages can be prevented by nonstructural measures since lands are primarily used for agricultural purposes, and there is a limited flood threat.

Presently weather conditions and lake and stream stages are monitored by the joint Federal - State River Forecast Center in Sacramento. When

flooding becomes imminent, the State Flood Operations Center is activated and operates on a 24-hour basis in conjunction with the River Forecast Center. The Flood Operations and Forecast Centers furnish flood information to agencies for dissemination to the public. The Flood Operation Center coordinates flood fighting activities throughout the State and is authorized to receive requests from local public agencies for assistance during floods.

Reservoir storage. - Reconnaissance studies of potential reservoirs in the Clear Lake - Cache Creek Basin consisted of review of past studies by the Corps, Bureau of Reclamation, State of California, and local interests. Reservoirs which were reviewed are shown on chart 4.

Reservoir sites on Cache Creek from upstream to downstream are Wilson Valley (upper & lower), Kennedy Flats, Blue Ridge, Esparto, Guinda, and Brooks. The upstream three sites are in the steep canyon area between Clear Lake Outlet Dam and Rumsey. The canyon provides good dam sites from a topographic standpoint; however, there are geologic problems and a lack of good reservoir and spillway sites.

The three downstream dam sites are less attractive from a topographic standpoint than the three upstream ones; however, in other respects are superior. The limiting factor of the Esparto, Guinda, and Brooks sites is their locations in the Capay Valley. Capay Valley is a scenic picturesque agricultural valley in Yolo County. Proposal of a dam in this type of setting would be strongly opposed.

Many of the sites on Cache Creek have been recently studied by the Bureau of Reclamation and Department of Water Resources in respect to diversion of Eel River water into Cache Creek. These studies, however, have been deferred due to the Eel River being classified by California as a Wild and Scenic River.

In the future, as demand for water increases, California may be dependent on the north coast for a source of new water supply. So as not to hamper formulation of an optimum plan for development of the resources of both the Eel River and Cache Creek Basins in the future, current studies of storage facilities on Cache Creek have been discontinued. Additionally, flood control only reservoirs on main stem Cache Creek are not presently economically feasible.

In the Clear Lake portion of the basin recent Corps studies have been made of the Kelseyville Reservoir site on Kelsey Creek to provide flood control, recreation, and irrigation water supply. Studies of this site have been discontinued since Lake County initiated studies to obtain a Small Reclamation Project Federal loan (P.L. 984) to construct the reservoir. As previously indicated, an engineering firm retained by Lake County has completed two of three proposed reports to fulfill the requirements for a Federal loan.

Levee and channel improvement

Clear Lake. - Reconnaissance investigation of Clear Lake flood problem consisted of reanalysis of the Corps' proposed 1950 plan for channelization of the Clear Lake outlet channel. This initial study consisted of enlarging the channel capacity from 2,500 to 8,000 cfs to provide flood relief to the rim of Clear Lake. Further studies of this plan were presented in the data for the Phase I conference that indicated an economically feasible solution. Therefore, future study was considered warranted.

Cache Creek levees. - Evaluation of levees on Cache Creek were made from the Settling Basin to Airport Road as shown on chart 5.

These evaluations indicated an economically infeasible project. Also, additional studies were conducted on the feasibility of providing protection along the right bank of Cache Creek from the Settling Basin to Airport Road and this also was determined to be economically infeasible. Further detailed analyses were not considered necessary.

Yolo Bypass Flood Control and Cache Creek Sediment Control. - The sediment flow from Cache Creek, as previously stated, is partly depositing in the Yolo Bypass causing a reduction in flood capacity of the bypass and in turn producing a flood threat. To control only the flood threat caused by the deposition would require the raising of the Yolo Bypass levees. Levee enlargement would generally be required from about 2 miles downstream of Interstate 5 upstream to the Fremont Weir. The Knights Landing Ridge Cut which discharges Colusa Basin high flow, would also be effected by the backwater condition caused by the sediment deposition. If sediment were allowed to pass into the Yolo Bypass, a certain amount of sediment would be washed further downstream into the ship channel where it would have to be removed.

Because the heavy sediment flow from Cache Creek has a significant effect on the area further downstream, a more comprehensive approach was considered necessary to help solve the flood and deposition problems. The comprehensive approach involves primarily storing sediment within the Cache Creek Basin. The following alternatives were studied to provide this comprehensive type solution.

- Raise Settling Basin Levees
- Excavate Settling Basin
- New North Settling Basin
- New South Settling Basin
- Upstream Channel Storage and Bank Protection
- Upstream Sediment Reservoir

Raise Settling Basin Levees. - This plan would entail enlargement of the settling basin perimeter levees and reconstruction and heightening Cobble Weir about 9-1/2 feet. This plan would provide an additional 17,000 acre-feet of storage and require enlargement of the Cache Creek project levees for a distance upstream.

Excavate Settling Basin. - This plan would consist of periodic removal of sediment from the basin to a disposal site, thereby continually restoring the capacity of the existing basin. The deposited soils are of good quality suitable for agricultural purposes and could be used on poor quality lands surrounding the basin for the purpose of upgrading them for agricultural use. They could be used for road construction fill or top soil for urban areas. The cost of sediment removal is a prime factor in consideration of this alternative since hauling cost would be high; however, this cost could be counter balanced if material excavated was used for beneficial purposes. The State of California has easements on the settling basin lands; however, it does not have legal right to remove deposited material. Therefore, further easements would be necessary.

New North Settling Basin. - This plan would require diversion of Cache Creek flows north into a new settling basin, construction of perimeter levees abutting the existing settling basin and Yolo Bypass levees, construction of a new weir, and removal of the existing weir. Lands within the new basin would be purchased in fee to assure optimum operation. However, there is only limited storage available in this area and a long term solution could not be provided.

New South Settling Basin. - This plan would require diversion of Cache Creek flows south under Interstate 5 and into a new settling basin, construction of perimeter levees abutting the Yolo Bypass, construction of a new weir, and removal of the existing weir. Limiting factors of this plan are Interstate 5, which limits storage capacity available, and the potential for development of a long term solution.

Upstream Channel Storage and Bank Protection. - This plan consists of using the wide Cache Creek channel between Airport Road and Capay for sediment storage along the banks. This plan would also provide bank protection to adjacent agricultural lands.

The method that would be used to store the sediment involves a system of jetties (Kellner Jetty System) made up of jacks tied together with steel cable and anchored to the streambank as shown on chart 7. The Kellner Jetty System is particularly adapted to heavy silt-laden streams, such as Cache Creek, subject to considerable variation in channel scour during periods of high flow. Heavy sediment-laden flows are permitted to penetrate the jetty and in turn velocity and energy are reduced causing sediment to be deposited behind the jetty. Vegetation would eventually be established, further increasing the retarding effect and providing an

additional wildlife habitat. This plan would, therefore, provide bank protection, sediment storage, and additional wildlife habitat if operated in the stated manner. However, there is only a limited amount of storage available along the stream, and the jetty field would encroach into gravel mining areas of about nine operators in the channel. Modification of the operation of the jetty system could be made to allow gravel companies to extract from half the field area closest to the center of the channel. This would be done by excavating deposited sediment between the 250 foot spaced jetty rows. This method of operation would prolong the useful life of the field at the sacrifice of about half of the potential wildlife area that could be provided.

Upstream Sediment Reservoir. - Consideration was given to an upstream reservoir at Brooks site in Capay Valley. This site was chosen since almost the total sediment load of the stream enters above this point. From an environmental standpoint this plan would not be acceptable due to its location in the Capay Valley. A reservoir would prevent almost total sediment flow; however, it could increase the downstream erosion and channel degradation problem.

Analysis. - Each of the alternatives were economically analyzed on a reconnaissance level to determine which offered the greatest potential. The alternative plans were evaluated on the basis of 50-year useful life where practical. From this analysis and discussion of alternatives above, it was determined that the following alternatives warranted further study: Raise settling basin levees, excavate settling basin, upstream channel storage bank protection, and upstream sediment reservoir. The results of these detailed studies are presented in following paragraphs of this section.

Alternatives Considered Further

The following discussion briefly summarizes the alternative plans that were developed as a result of preliminary analysis of the array of possible plans that were presented previously. Several of the plans previously discussed have been eliminated from future consideration for one or more of the following reasons: very limited economic feasibility, significant environmental problems, limited potential for providing a long-term solution, or serious consideration of that solution by other agencies. A summary of the economic, environmental, and social effects of each of these plans is presented at the end of this section.

Flood Control Alternatives

Significant flood problems in the Cache Creek Basin are generally confined to the northern portion of the basin, namely, around the perimeter of Clear Lake. Extensive channel enlargement by gravel mining operations and upstream flood control facilities on tributary streams such as the recently constructed

Indian Valley Reservoir have significantly reduced flood damage potential in the lower basin. Periphery flooding on Clear Lake is generally attributed to a constricted outlet channel which prohibits outflow from the lake from keeping pace with large inflows, thereby causing temporary storage of floodwater and inundation of shoreline development as the water level rises. The flood control alternatives discussed below would help to alleviate this flood hazard.

Clear Lake outlet channel enlargement. - Investigations have been made of enlarging the Clear Lake outlet channel from Clear Lake downstream to the Clear Lake outlet dam as shown on chart 8. The present capacity of the channel is 2,500 cfs at an estimated non-damaging Clear Lake flood stage of 7.56 on the Rumsey Gage at Lakeport. Preliminary design and cost estimates were made of 5,000, 8,000, and 11,000 cfs enlargement plans. An economic analysis of these plans shows that the 8,000 cfs channel provides the greatest net benefits.

The alternative consists of deepening and/or widening about 5.1 miles of the 5.5 mile long existing outlet channel, relocation of residences, numerous docks, two bridges, and provision for recreational facilities adjacent to the channel. These recreation facilities would consist of improved access for fishing and a 50 unit campground along the lower reach of the channel.

The flood operation goal is to control Clear Lake water surface elevations to 7.56 feet on the Rumsey Gage. However, releases would be governed by a downstream Cache Creek flow at Capay of 21,000 cfs. When Clear Lake stages reach 7.56 feet on the Rumsey Gage and flows at Capay exceed 21,000 cfs, releases from the lake would be based on the existing rating curve as shown on chart 9. Conversely, when flows at Capay are less than 21,000 cfs, and Clear Lake stages exceed 7.56 feet, lake releases would be based on the project rating curve, also shown on chart 9. This criteria was established since a flow of 21,000 cfs was determined to be the non-damaging flow at Capay. However, Yolo County interests downstream are concerned that a sustained flow of 21,000 cfs would increase the erosion problem along Cache Creek downstream of Rumsey. Additional studies are being conducted relative to this potential problem.

Enlargement of the outlet channel as proposed is currently prohibited by the Gopcevic and Bemmerly Decrees. The Gopcevic Decree was issued in 1920 by the Mendocino County Superior Court as a result of a suit between certain property owners bordering Clear Lake and the Yolo Water and Power Company, predecessor to the Clear Lake Water Company. The decree prescribes certain maximum and minimum stages of the lake and orders damages to be paid in case of violations. It also prohibits any widening, deepening, or other enlargement of the outlet channel except as necessary to carry out the decree. This decree is critical from the standpoint of flood and irrigation problems

in the basin, and would require modification for an effective Clear Lake flood control operation to be put in effect. The two most important provisions of the Gopcevic Decree with respect to operation of the lake are given below. Details of the provisions of the decree are given in appendix A.

a. The maximum stage of Clear Lake cannot exceed 9.00 feet on the Rumsey Gage at any time. Stages between 7.56 and 9.00 feet are permitted for up to 10 successive days for the temporary storage of flood waters.

b. The minimum stage of the lake is set at zero on the Rumsey Gage and in making releases from the lake, irrigation, evaporation, and other losses for the ensuing season must be considered.

Since the lake could not be controlled to the flood control provisions of the Gopcevic Decree, subsequent to the February 1938 flood which caused extensive damage around the rim of Clear Lake, the State of California, in response to requests of lake interests, undertook the enlargement of the Clear Lake outlet channel to permit reduction of flood stages on the lake. Property owners along Cache Creek in Yolo County obtained an injunction restraining the State from widening or deepening this outlet, on the grounds that such construction would result in higher flood flows with consequent increased damages in the lower reaches of Cache Creek. This injunction was issued by the Yolo County Superior Court and upheld by the District Court of Appeals, and is known as the Bemmerly Decree. Detailed provisions of this decree are also presented in appendix A.

Flood control benefits are due to a reduction in lake flood stage and for this plan require maintaining the Flood Insurance Program construction elevation to the existing level and permit a reduction because of structural improvements. In addition to flood control benefits, enlarging the outlet channel would improve local navigation. During low stages, boating is critically affected in the vicinity of the Grigsby Riffle. The reduction in flood stage of the lake for various stage frequencies is shown on chart 10. Enlargement of the outlet channel could also result in more effective use of the stored water for irrigation uses. Examination is being made to determine if the controlled lake stage can be increased to provide increased water supply without reducing flood control.

Clear Lake outlet channel enlargement and bypass . - This alternative is similar to Clear Lake outlet channel enlargement alternative in that it involves alteration of the outlet channel to increase Clear Lake outflows. However, in order to lessen the impact of the plan on streamside development, a 1.4 mile long bypass channel would be constructed as shown on chart 8, bypassing the highly developed portion of the reach. The remainder of the existing channel both upstream and downstream of the bypass channel would be enlarged as in the previous alternative. An economic analysis of this alternative shows than an 8,000 cfs capacity, which includes flow through both the proposed bypass channel and the existing outlet channel, provides maximum net benefits.

The bypass channel, as proposed, would have side slopes of 1/2H to 1V through the portion underlain by rock, and 2H to 1V through the portion of the reach consisting of earth base. It would have a weir at its upstream end, and a control structure in outlet channel adjacent to the weir to control flow into the bypass channel. It would be designed so that positive flow would continuously occur so as to preclude any stagnant water conditions or entrapment of aquatic organisms. New additional structures would be required at State Highway 53 and old Highway 53. Recreation features are generally the same as the previous alternative.

The flood operation criteria established for this alternative and resultant flood control benefits are the same as for the previously discussed flood control alternative. This alternative is also subject to restrictions imposed by the Gopcevic and Bemmerly Decrees. Modification of the decrees would be required prior to implementation of this alternative.

Clear Lake Flood Plain Zoning. - Zoning involves the application of local regulatory authority to insure the general welfare through proper utilization of land resources. For the purpose of flood damage reduction around Clear Lake, it would consist of a flood zone extending from the edge of Clear Lake at low stages to the ground location corresponding to the elevation of the regulatory flood. Any land use or development compatible with the flood hazard could be permitted in this zone.

This alternative would consist of flood proofing future development within the Standard Project Flood Plain. Lake County is participating in the National Flood Insurance Program, which requires adoption of ordinances or other controls that will regulate land use and construction within the 100-year flood plain (land area inundated once per hundred years, on the average). Rate studies have been completed for the City of Lakeport and flood insurance rate maps have been issued. Rate maps for the Clear Lake periphery will be issued on completion of a county-wide study that is in progress and scheduled for completion late in 1975. For this reason, this alternative is limited to flood proofing future development above the 100-year level.

Flood proofing, in this sense, would consist of elevating future buildings on pads or piles, constructing dikes, providing water tight closures and anchorage systems, waterproofing, or any other such method designed to resist inundation. Expenses would be borne by individual property owners.

Sediment Control Alternatives

Studies indicate that well over one million cubic yards of sediment annually are transported by Cache Creek downstream to its mouth. The primary function of the sediment control alternatives discussed herein is the elimination or

alleviation of an adverse impact on the Yolo Bypass capacity from deposition of these sediments in the bypass. Sediment allowed into the Yolo Bypass poses the additional threat of continuing downstream to the Sacramento River Ship Channels and San Francisco Bay where it would have to be removed by dredging.

The Yolo Bypass is a part of the Sacramento River Flood Control Project, its function being to convey excess waters of the Sacramento River and the Sutter Bypass safely past Sacramento, other downstream communities, and thousands of acres of agricultural land. As shown on chart 11, Cache Creek discharges into the Yolo Bypass via the Cobble Weir about 6 miles downstream of the Sacramento River. At this location the bypass is about 1-1/2 miles wide with a design flow capacity of 377,000 cfs.

As previously mentioned, it is predicted that the Cache Creek Settling Basin will fill in 1975 (approach zero percent trap efficiency). At that time, about 675 acre-feet of sediment annually would pass the Cobble Weir into the Yolo Bypass and a portion would deposit. So as to maintain its flow capacity, this would require raising the existing levees along the bypass, as well as those along the Knights Landing Ridge Cut. Backwater conditions caused by sediment deposition over 50-years would require raising the levees a maximum of 2.6 feet in the reach from the Fremont Weir downstream to about the Sacramento Bypass. This is based on studies showing that approximately 100 acre-feet of the total 675 that enter the bypass will settle in the bypass. The remainder will be carried downstream, settling out at various locations. A portion will eventually reach the Sacramento River Ship Channel and San Francisco Bay, where it will have to be removed by dredging.

The following alternatives were evaluated in greater detail to provide a comprehensive solution to the sediment deposition problem and are shown on chart 11.

Raise Settling Basin Levees. - This would restore the settling basin trap efficiency to 50 percent. At this rate, about 340 acre-feet of sediment per year on the average would be trapped in the settling basin, with the remaining 335 acre-feet being washed into the Yolo Bypass and downstream. With the present zero trap efficiency in the settling basin an estimated 575 acre-feet per year is transported downstream of the Yolo Bypass. With this alternative, therefore, a reduction of 240 acre-feet annually to downstream deposition sites is realized. This would result in reduced dredging in the Sacramento River Ship Channel and San Francisco Bay System.

The planned life is 50 years, requiring 17,000 acre-feet of storage capacity. To accomplish this, the existing perimeter levees would be raised an average of 12 feet, and in the process, the existing 12' crown width

would be increased to 20', with 5' of freeboard provided. The existing 1580' long Cobble Weir, raised 2' in 1974 by the State of California as an interim measure for additional storage capacity, is mainly composed of structurally unsound bagged concrete. With this alternative, the weir would be rebuilt to a new length of 1740 feet, and would have the capability of being raised in 2' increments by stop logs a total of 10 feet, providing a measure of control over the ponded water behind the weir. The existing training levees, as shown on chart 11, are located about 1/2 mile east of the west perimeter levee. They serve to regulate the location of the sediment deposition by directing the flow of incoming sediment laden water. Since the general slope of the settling basin is to the east, the portion of land between these training levees and the west perimeter levee is not being utilized to its potential. For this reason, the existing training levees would be degraded and material used to construct new ones adjacent to the west perimeter levee.

About 250 acres of agricultural land would be acquired in fee for project improvements. An additional 260 acres would be acquired in fee to serve as borrow areas for the enlarged levees. Following proposed project completion, these borrow areas would be returned to agricultural use. The current flowage easements over the settling basin owned by the State of California would have to be maintained over the 50-year project life.

Excavate settling basin. - This alternative would control the Cache Creek sedimentation problem by allowing periodic excavation of the existing settling basin thus restoring its trap efficiency. As previously mentioned, the State of California has flowage easements over the settling basin lands, but does not have legal rights to remove deposited material. Therefore, the 3,600 acres comprising the basin would be purchased in fee and for optimum use converted to use as a national or state wildlife refuge.

In order to efficiently utilize the storage capacity of the total acreage within the basin, the existing training levees would be degraded and rebuilt adjacent to the west perimeter levee as discussed in the previous alternative. It would not be necessary to enlarge other than the west perimeter levee, but some alteration of the Cobble Weir would be necessary. When the Cobble Weir was raised 2' in 1974, the freeboard on a portion of the perimeter levees was decreased to 3'. In order to re-establish the necessary 5' of freeboard, it would be necessary to lower the weir a maximum of 2'.

The preliminary operation scheme for of the settling basin under this alternative is as follows:

a. Initially excavate 2 to 3 million cubic yards to establish a sufficient trap efficiency. Thereafter, an average annual volume of 650,000 cubic yards would require removal.

b. Partition the settling basin into 6 "cells" by construction of low levees 3 to 4 feet in height. Degrade the existing training levees and construct a new one adjacent to the west perimeter levee to allow direction of incoming flows into the various cells.

c. Annually remove sediment from the cell adjacent to the Cobble Weir at the settling basin outlet. The remaining 5 cells would be excavated on a rotational basis dependent upon the rate of deposition. The rotation cycle is expected to be at least 5 years. In any one year, approximately 2,500 acres would be available to grow crops such as rice or millet for wildlife. Millet appears to be adaptable to this rotational operation since it is replanted about every 5 years.

With this alternative, because of the annual replenishment of the storage capacity, about 60 percent or 400 acre-feet annually of that amount of sediment currently discharging into the Yolo Bypass would be trapped in the settling basin. This would reduce by about 300 acre-feet annually the amount of sediment that would reach downstream navigation works, and have to be removed by dredging. This alternative is environmentally attractive due to the establishment of the wildlife refuge.

Kellner Jetty System. - This alternative would decrease the amount of sediment reaching the Yolo Bypass by causing deposition upstream within a Kellner Jetty System made up of iron jacks tied together with steel cable and anchored to the streambank as shown on chart 7. Eighty-three thousand lineal feet of jettys would be distributed among 13 locations between Capay and Yolo as shown on chart 11 protecting approximately 28,000 feet of channel bank. The system would function to decrease flow velocities, thereby causing deposition at that location. Over time, established vegetation within the jetty field would aid in the entrapment process.

It is estimated that about 35 percent, or about 230 acre-feet per year of sediment would be deposited within the jetty fields. At present, an average of 575 acre-feet of sediment per year to the Sacramento River Ship Channel and beyond is attributable to Cache Creek. With this alternative, this figure would be reduced to about 445 acre-feet, which indicates about 130 acre-feet per year is prevented from reaching downstream navigation channels by the Kellner Jetty System. Since this trap efficiency is somewhat less than the 50 percent desired, this alternative may be used in conjunction with others. In this way, benefits could be derived from bank protection and sediment control works at the jetty locations, while supplemental trap efficiency would be provided downstream. However, benefits shown in the tabulation at the end of this section for this alternative would be reduced if this alternative was combined with a downstream alternative. Therefore, only a few of the most feasible jetty fields, could potentially be developed.

In order to maintain the 35 percent trap efficiency through the jetty fields, periodic excavation of a portion of the trapped sediment would be necessary. As shown on chart 7, the 250' span between retard lines would allow ample space for excavation in these areas. Similar prototype installations indicate a deposition of 1 to 3 feet per year can be expected. At this rate of deposition, excavation should occur every few years to maintain trap efficiency. It is estimated that the individual jacks may last 25 years or longer before repair or replacement becomes necessary. With this type of periodic maintenance program, an extremely long life can be expected from a given jetty field.

Brooks Sediment Reservoir. - This alternative, as the previously discussed alternative, would help to alleviate the Cache Creek sedimentation problem by trapping sediment at an upstream location, thus preventing it from reaching the settling basin and Yolo Bypass. This would be accomplished by means of a sediment reservoir located about 3 miles upstream of the Capay Diversion Dam in the lower end of the Capay Valley. This location was chosen since studies have shown that nearly the entire sediment load enters the stream upstream of this point. It would function as a large detention basin, causing deposition as water ponded and flow velocities decreased.

The total average annual sediment load at this location is about 1,100 acre-feet. In order to provide a 50-year capacity at about 100 percent trap efficiency, 55,000 acre-feet of storage would be required. The dam itself would be earthfill, composed of approximately 350,000 cubic yards of material that would be acquired from excavation of the spillway. The crest elevation would be 332' (M.S.L. Datum), with a 20' crown width and 20' of freeboard provided. The dam would be 92 feet high.

Assuming 100 percent trap efficiency through the reservoir, this alternative would decrease the amount of sediment reaching downstream navigation channels by about 575 acre-feet annually. However, a natural consequence of intercepting sediment at this location would be possible bank erosion and streambed degradation between Capay and the settling basin due to the tendency of the stream to attempt to regain the sediment load it had lost.

Economic - Environmental - Social Effects of Alternatives

Presented in the following tabulation is a summary of the economic, environmental, and social effects of the alternative plans considered further. This data is presented in a form required by the "Principles and Standards."

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS SEDIMENT CONTROL ALTERNATIVE PLANS

	RAISE SETTLING BASIN LEVEES	EXCAVATE SETTLING BASIN	KELLNER JETTY SYSTEM	BROOKS SEDIMENT RESERVOIR	NO DEVELOPMENT-SEDIMENT CONTROL ALTERNATIVES
1. Plan Data	<p>Raise existing settling basin perimeter levees an average of 12' to provide 17,000 acre feet storage.</p> <p>Reconstruct and enlarge Cobble Weir. Raise weir crest in 2' increments with stop logs to maintain 50% trap efficiency.</p> <p>Degrade training levees. Reconstruct adjacent to west perimeter levee to allow maximum utilization of all land within the basin.</p> <p>Maintain existing flowage easement across settling basin lands.</p> <p>50 year useful life.</p>	<p>Purchase in fee the 3,600 acres within the settling basin, and establish a wildlife refuge.</p> <p>Operate basin in a dual capacity of sediment control and wildlife enhancement.</p> <p>Separate basin into 6 "cells" of about 600 acres each by means of 4' high levees.</p> <p>Annually excavate cell adjacent to Cobble Weir. Excavate the remaining 5 on a rotational basis, dependent upon the rate of deposition.</p> <p>Degrade training levees. Reconstruct adjacent to west perimeter levee and use to direct flow into various cells.</p> <p>60% trap efficiency thru Cobble Weir.</p> <p>50 year economic life.</p>	<p>Install 83,000 lineal feet of jettys at 13 locations between Capay and Airport Road.</p> <p>Excavate as needed over 1/2 area between 250' spaced rows to maintain trap efficiency of 33%.</p> <p>Bank protection provided to agricultural land, highways, irrigation canals, bridges, and rural residences.</p> <p>A portion of the 13 jetty fields could be used in combination with other downstream sediment control alternatives.</p> <p>Replace 25% of jacks and all cables after 30 years of 50 year useful life.</p>	<p>Construct a sediment reservoir with a 50 year capacity of 55,000 acre-feet near Brooks.</p> <p>Earthfill dam 92' high, approaching 100% trap efficiency.</p> <p>Reservoir would inundate 2,950 acres. About 3 miles of State Route 16.5 miles of utility lines, and 46 residences would be relocated.</p> <p>Provide minimal recreation and irrigation benefits on a decreasing basis during its 50 year useful life.</p>	<p>No action undertaken by Federal Government for sediment control on erosion reduction through other structural or non-structural measures.</p>
2. National Economic Development (NED)	<p>Annual Costs \$421,000</p> <p>Annual Benefits 469,000</p> <p>Net Annual Costs/Benefits 48,000</p> <p>Benefit Cost Ratio 1.1 to 1.0</p>	<p>\$395,000</p> <p>755,000</p> <p>360,000</p> <p>1.9 to 1.0</p>	<p>\$305,000</p> <p>385,000</p> <p>80,000</p> <p>1.3 to 1.0</p>	<p>\$1,995,000</p> <p>780,000</p> <p>1,215,000</p> <p>0.4 to 1.0</p>	<p>No Federal or non-Federal costs and no benefits.</p>
3. Environmental Quality (E.Q.)	<p>(a) Vegetation 250 acres of rice land permanently sacrificed to right-of-way. Additional 260 acres temporarily out of production for use as a borrow site. Levees will be seeded with grasses to restore original condition. Erosion would continue to riparian vegetation in upstream areas.</p> <p>(b) Wildlife Insignificant disruption of local wildlife population during 1 season construction period.</p> <p>(c) Water Quality Decrease by 240 acre-feet annually the amount of sediment allowed into the Yolo Bypass and downstream ship channels, thereby decreasing turbidity.</p> <p>(d) Air Quality Minor effect of construction equipment exhaust during 1 season construction period.</p>	<p>3,600 acres of agricultural land, 3,200 of which is currently growing rice and tomatoes would be provided for natural vegetative growth and/or agricultural crops, although 13 acres permanently sacrificed to right-of-way requirements. About 1,000 acres per year excavated, causing temporary loss of vegetation on those lands. Sediment supply would reduce demand in other areas, thereby limiting vegetative loss to a central area, and reducing the amount of land scarring. Erosion would continue to claim riparian vegetation in upstream areas.</p> <p>3,600 acres of wildlife refuge would significantly enhance wildlife production in lower Cache Creek. Annual sediment removal operations would periodically disrupt local wildlife populations.</p> <p>Decrease by 300 acre feet annually the amount of sediment allowed into the Yolo Bypass and downstream ship channels, thereby decreasing turbidity.</p> <p>Minor effect of construction equipment exhaust during 1 season construction period and periodic sediment removal and maintenance operations thereafter.</p>	<p>Bank protection provided at 13 locations along 5.3 miles of channel would protect agricultural crops. Over time, native vegetation would be established within the 166 acres of jetty fields. Periodic excavation of about 80 acres would temporarily destroy a portion of this. Increased velocities downstream of jetty fields may cause increased erosion and loss of associated riparian vegetation.</p> <p>5.3 miles of channel bank would be stabilized, aiding in establishment of riparian habitat. About 1/2 of the 166 acres of jetty fields would support native grasses, thereby providing additional habitat. Periodic maintenance and excavation operations would disrupt local wildlife populations.</p> <p>Decreased turbidity in Cache Creek between jetty fields and settling basin. However, increased velocities and associated erosion in this reach may partially offset this. Decrease by 130 acre feet annually the amount of sediment allowed into the Yolo Bypass and downstream ship channels, thereby decreasing turbidity.</p>	<p>2,950 acres of agricultural land inundated contains orchard, row and field crops, and pasture. 7.3 channel miles of stream with associated riparian vegetation would also be lost to inundation. Increased velocities downstream of the reservoir site may cause increased erosion and loss of associated riparian vegetation.</p> <p>7.3 miles of stream which supports a minor fishery would be lost. A portion of the 2,950 acres inundated supports deer, as well as other mammals and birds. However, 15 miles of shoreline would be created, and a limited fishery could be established in the reservoir until it filled with sediment.</p> <p>Decreased turbidity in Cache Creek between reservoir and settling basin. However, increased velocities and associated erosion in this reach may partially offset this. Decrease by 570 acre feet annually the amount of sediment allowed into the Yolo Bypass and downstream ship channels, thereby decreasing turbidity.</p> <p>Minor effect of construction equipment exhaust during 2 season construction period.</p>	<p>Would remain stable, with the exception of continued loss of riparian vegetation to erosion and gravel mining operations.</p> <p>Continued lack of a fishery in Lower Cache Creek. Wildlife populations would remain stable. Continued loss of riparian habitat to erosion and gravel mining operations.</p> <p>Would remain as it is at present, with relatively high boron levels. Continued turbidity due to erosion.</p> <p>No significant change.</p>
4. Regional Development	<p>(a) Land Use About 250 acres of agricultural land used for growing rice would be lost to levee construction. An additional 260 acres would be temporarily taken from rice production to serve as a borrow area.</p> <p>(b) Local Government Finance 250 acres taken from county tax rolls would decrease county revenues by about \$6,200 annually. Increased retail sales during one year construction period would increase local tax revenue by about \$8,100.</p>	<p>3,200 acres currently used for growing rice and tomatoes, in addition to 400 acres in their natural state, would be diverted to use as a wildlife refuge. However several hundred acres per year could be leased to farmers, returning a portion of the settling basin to agricultural use.</p> <p>3,600 acres taken from county tax rolls would decrease county revenues by \$85,000 annually. \$8,000 to \$10,000 annually rebated under revenue sharing agreement when lands are taken for national wildlife refuge. Increased retail sales during 1 year construction period would increase local tax revenue by about \$4,300. Additional retail sales expected due to activity associated with annual sediment removal operations and refuge management.</p>	<p>166 acres acquired for jetty fields are within the channel section, thereby affecting gravel extraction operations in the area. Decreased threat of land lost to erosion would stabilize land use and productivity adjacent to the bank protection works.</p> <p>166 acres taken from county tax rolls would decrease county revenues by \$4,200 annually. Increased retail sales during 1 year construction period would increase local tax revenue by \$5,500. Erosion protection to adjacent agricultural lands will increase productivity, and thereby tax revenues. Additional retail sales expected due to activity associated with maintenance and sediment removal operations within the jetty fields.</p>	<p>2,950 acres of agricultural land used to grow orchard, row and field crops, and pasture would be diverted to reservoir use. Limited recreation potential during 50 year project life could attract typical tourist oriented land use immediately adjacent to the reservoir. Irrigation water stored during winter months could be partially offset by increased local agricultural production due to irrigation.</p> <p>2,950 acres taken from county tax rolls would decrease county revenues by about \$71,000 annually. Increased retail sales during 2 year construction period would increase local tax revenue by about \$27,400. Local tax revenues could increase due to limited recreation potential and increased agricultural productivity with irrigation.</p>	<p>Would remain stable, with conversion from non-irrigable crops to irrigable ones where feasible. Native vegetation would continue to be converted to agricultural use, with urban development absorbing some agricultural land, especially in vicinity of Woodland. Grazing on pasture land would continue to be subdivided into "ranchette" housing developments.</p> <p>Higher developed land uses would raise property values, and thus tax revenues. Lands sacrificed to continued erosion will be lost to county tax rolls.</p>

SUMMARY OF ECONOMIC-ENVIRONMENTAL-SOCIAL EFFECTS SEDIMENT CONTROL ALTERNATIVE PLANS

	RAISE SETTLING BASIN LEVEES	EXCAVATE SETTLING BASIN	KELLNER JETTY SYSTEM	BROOKS SEDIMENT RESERVOIR	NO DEVELOPMENT-SEDIMENT CONTROL ALTERNATIVES
(c) Employment/Labor Force	Estimated 76 workers would be acquired from the local labor force during the 1 year construction period.	Estimated 41 workers acquired from the local labor force during the 1 year construction period. Annual sediment removal operations would favorably affect local mining operators. Increased activity associated with outdoor recreation could favorably affect local employment.	Estimated 51 workers acquired from the local labor force during the 1 year construction period. Periodic maintenance and sediment removal from jetty fields would favorably affect local labor associated with those activities.	Estimated 128 workers acquired from the local labor force during the 2 year construction period. Local employment associated with limited recreation or increased agricultural activity due to irrigation potential may be favorably improved.	Employment in agriculture is expected to decline, with high growth rate in local government, finance, services, trade, construction, and manufacturing.
(d) Business, Agricultural, Industrial Activity	Estimated \$810,000 in increased retail sales in marketing area due to project construction.	Local retail sales increased \$494,000 during construction. Agricultural production within the settling basin reduced in favor of wildlife enhancement. Commercial soil mining operations effectively serviced by soil trapped within the basin. Local recreation oriented business should increase. Reduction in crop depredation on lands outside settling basin.	Local retail sales increased \$546,000 during construction. Local agricultural production increase. Commercial sand and gravel mining operations would periodically remove trapped sediment.	Local retail sales increased \$2,744,000 during construction. Agricultural production in Lower Capay Valley would be significantly reduced due to the loss of 2,950 acres of productive land. The limited recreation potential would not significantly affect recreation oriented business.	Greatest growth expected in non-agricultural oriented industry. Based on current water available, maximum irrigable average possible in sub-basin is 58,000 acres. New agricultural development would be subject to this restriction. Continued erosion in Cache Creek would cause further loss of agricultural land. Ultimately existing irrigation canals will also be threatened by erosion.
5. Social Well Being					
(a) Noise	Minor effect due to construction equipment during 1 season construction period.	Minor effect due to construction equipment during 1 season construction period and periodic sediment removal operations thereafter.		Minor effect due to construction equipment during 2 season construction period.	Would increase corresponding to population, industrial, and commercial development to a still insignificant level.
(b) Population/Housing	Reduce potential failure of Yolo Bypass levees that would cause widespread flood damage and possible loss of life.		Stabilizing effect on local population due to increased erosion protection to agricultural lands.	Estimated 46 residences removed with reservoir construction. Limited recreation and irrigation water potential may stabilize remaining local population.	Yolo County population estimated at 289,400 by 2020, with most growth in Woodland area. Lands adjacent to Cache Creek which are zoned suburban have potential for low to moderate income housing. No new housing would be subject to flood proofing or flooding. With continued erosion, several existing residences would ultimately be threatened.
(c) Aesthetics	Temporary aesthetic loss due to construction scars. Native vegetation would be replanted on borrow areas and new levees.	Short-term aesthetic loss during construction. Sediment removal operations could scar up to 1,000 acres annually. Refuge establishment would restore area to relatively natural state, resulting in a long term aesthetic increase. Available sediment would reduce need for unsightly borrow areas in other areas.	Iron jacks would be initially unsightly. Riparian vegetation would be established in jetty fields as sediment was built up. Periodic sediment removal over portions of the field would make this improvement temporary. Increased velocities downstream of jetty fields may cause increased erosion and unsightly scarring.	2,950 acres of picturesque Capay Valley would be inundated. Lake views would be offered on a decreasing basis over 50 year life. End product of a full sediment reservoir would be unsightly.	Increased residential development would destroy some "natural" aesthetic value. Continued channel erosion and gravel mining operations would continue to deteriorate the riparian appearance of Cache Creek.
(d) Transportation	Decrease of 120 acre-feet of sediment annually depositing downstream Sacramento River shipping channels and San Francisco Bay.	Potentially decrease road construction costs by making available inexpensive fill material. Decrease of 150 acre feet of sediment annually depositing in downstream Sacramento River shipping channels and San Francisco Bay.	Potential increased erosion at highway bridge abutments downstream of jetty fields due to increased velocities. Decrease of 75 acre-feet annually depositing in downstream Sacramento River shipping channels and San Francisco Bay.	3 miles of State Route 16, and 5 miles of utility lines require relocation. Increased velocities downstream of dam may increase erosion at highway bridge abutments. Decrease of 285 acre-feet annually depositing in downstream Sacramento River shipping channels and San Francisco Bay.	Future plans call for rapid transit link from Woodland to Sacramento, and ultimately San Francisco. Channel meander and continued erosion would threaten existing and future transportation systems by undermining bridge piers and abutments, as well as travel ways themselves.
(e) Recreation	NO EFFECT	Existing private hunting clubs in settling basin would be abolished with refuge establishment. However, an estimated 12,000 recreation user days annually for hunting, fishing, hiking, camping, and wildlife observation would be realized.	NO EFFECT	Existing plans for riding and hiking trail through proposed reservoir site would require modification. Minor water oriented recreation benefits would be provided on a decreasing basis until reservoir filled with sediment.	Cache Creek "white water" boating use would increase. Recreation facilities will be developed to handle future use.
(f) Health	Increased levee height would increase the threat of loss of life and property should the levee fail.	NO EFFECT	NO EFFECT	Vector problem could pose a health hazard as water is ponded.	Lack of a serious threat will continue.
(g) Historic and Archeologic					Known archeologic resources in lower basin may be lost to continued erosion and development such as land leveling and urban buildup.

SECTION E
ECONOMICS OF ALTERNATIVES

Flood Control

In the flood control portion of this section the purpose is to furnish flood damage data and to set forth information on the assumptions made and the procedures used in estimating flood damages expected to occur annually, under both current and projected future conditions of development along both the Clear Lake Rim in Lake County and Cache Creek floodplain in Yolo County with existing flood control measures, and Lakeport Lake in operation and both alternative levels of project protection. Tangible damages have been evaluated while intangible damages have not. Tangible damages are those which accrue as a direct result of the flooding and are readily ascertainable on a basis of monetary losses, or increased costs, to individuals or groups while intangible damages are losses such as loss of life, impairment of health and living conditions, and psychological problems resulting from floods that are not readily subject to monetary evaluation. Assumptions, and methodology used in developing average annual damages under preproject conditions are described in the following paragraphs.

Types of flood damages.

Damages caused by flooding within the standard project flood plains were delineated by classes and types of damages and were developed in accordance with terminology contained in paragraph 1-72, EM 1120-2-101, Survey Investigations and Reports, General Procedure. In conformity with these guidelines, tangible damages considered included physical damages resulting from inundation; flood emergency losses or costs incurred in fighting or preparing for flooding; and financial losses resulting from decreased production and increased living and operating costs within the flood plains.

Residential damages analyzed include those physical damages caused by flooding to residential structures and secondary adjoining buildings and grounds. Costs of emergency measures taken pursuant to flooding is also included. Separated into a separate category from residential structures for purposes of flood damage determination were residential contents including household items and personal property.

Commercial damages were computed so as to include physical flood damages to land, buildings, equipment, supplies, merchandise, and other items used in the conduct of commerce, business, trade, services, or entertainment. Also included are costs of emergency actions.

Industrial-utilities damages were analyzed so as to include losses and destruction to industrial and public utilities properties as a result of inundation. Facilities used in extracting, producing, manufacturing, and processing of commodities and heavy warehousing and those involved in distribution are generally classified as industrial. Flood damages to

industry are substantially of the same type as those sustained by commercial establishments. Damages to public utilities include losses to all utilities such as railroads, electric and telephone plants, transmission lines, and facilities of like nature.

Public facilities damages include tangible damages resulting from inundation of public roads and bridges, streets, sidewalks, highway structures, parks, and other facilities, including equipment and furnishing owned or operated by Federal, State, County, or local governmental units. These damages do not include intangible damages which would occur to the whole community as a result of the concentration of governmental concern on the smaller area of the flood plain.

Other losses to the public include the additional costs incurred during flood emergencies such as evacuation and reoccupation, flood fighting, disaster relief, and extra duty for police, fire, and military units.

Agricultural damages include inundation losses to crops, agricultural machinery, fences, wells, and farm buildings. Also included are such other tangible damages as costs of emergency actions.

Flood damage computations.

Probable flood damages under existing and the previously described future conditions for the Clear Lake Rim Reach were computed on a Control Data Corporation 7600 computer located at the Lawrence Berkeley Laboratory in Berkeley, California, using the "DAMAGES" program developed by the Economics Section of the Los Angeles District Office, U.S. Army Corps of Engineers. Probable flood damages under existing conditions for the three downstream reaches of the Cache Creek Basin were computed on a G.E. 200 Computer at the Sacramento District Office. Probable future damages for these reaches were projected on the basis of development factors derived from the growth projections described under future development. The following paragraphs more fully describe the relationships and assumptions which provide the basis for the computational process.

Depth-damage relationships.

Depth-damage relationships describe the probable damages that will occur under different depth of flooding conditions, either as a percentage of the total value of damageable property or in the probable loss expected. In addition to the depth of inundation other variables which may have a significant impact on the economic damages sustained include the velocity of the water, duration of flooding and wind-set. Under differing conditions of inundation, these variables will change in relative importance. Depth of inundation and velocity are major variables governing damages occurring in the lower, Yolo County, reaches, while depth of inundation, wind-set, and duration govern damages which would occur to properties along the rim of Clear Lake in any given event.

Buildings, contents and piers.

The depth-damage relationships for buildings, contents and piers used in this analysis are presented in Table E-1. These depth damage relationships were derived from depth-damage curves prepared by the Federal Insurance Administration, historic flood surveys and recent interviews with local officials.

TABLE E-1
DEPTH DAMAGE

Damage Category	Depth of Flooding From Ground Floor in Feet.				
	: -1.0	: 0.1	: 1.0	: 2.0	: 3.0
	: Percent Damages				
<u>Clear Lake Rim Reach</u>					
Residential structures	0.0	12.0	28.0	39.0	45.0
Residential contents	0.0	12.0	46.0	65.0	78.0
Mobile home structures	0.0	15.0	66.0	89.0	92.0
Mobile home contents	0.0	12.0	46.0	65.0	78.0
Commercial structures	0.0	12.0	28.0	39.0	45.0
Commercial contents	0.0	12.0	46.0	65.0	78.0
Piers	0.0	2.0	16.0	25.0	52.0
Marina gas facility structures	0.0	2.0	6.0	15.0	31.0
Marina gas facility contents	0.0	2.0	7.0	23.0	40.0
<u>Cache Creek-Reaches 1-3</u>					
Structures	0.0	9.0	20.0	27.0	32.0
Contents	0.0	7.5	32.0	44.0	50.0

Source: Piers and marina facilities developed from interviews of local marina operators. Remaining categories adopted from Federal Insurance Administrations Curves on the basis of local interviews and historic surveys.

Public facilities. Depth-damage relationships for public facilities such as roads and bridges and for emergency costs are derived from historical survey data and interviews of local officials. Total damage relationships associated with a given hypothetical level of flooding (see following discussion on flow -and stage-damage relationships) are developed for these damage categories rather than specific depth-damage relationships.

Agriculture. Agricultural damage relationships are also developed for given hypothetical flood events on the basis of historical flood data from the study and similar areas. Both crop and non-crop damages are estimated. Non-crop damages include debris clean-up, leveling, and damages to improvements such as roads, fences, irrigation systems and other equipment that could not be removed prior to flooding. Non-crop damages are more dependent on the level of improvements common to the area than the particular crops planted.

Non-crop damages for improved acreage in the Clear Lake Rim Reach are estimated to average \$82, \$100 and \$118 per acre, respectively from flooding from the 50-year 100-year and SPF events. Non-crop damages to native pasture are estimated to average \$10 per acre in this reach. In the downstream portion of the study area, Reaches 1-3, non-crop damages, to all agricultural lands are estimated to average \$94, \$110 and \$132 per acre respectively, for the three flood events.

Crop damages used in this analysis are summarized in the following tabulation. Differences in crop damage between the Clear Lake Rim and the downstream reaches result from the type of flooding expected (e.g., Clear Lake Rim would be of longer duration while the downstream reaches

TABLE E-2
AVERAGE CROP DAMAGES IN DOLLARS PER ACRE

Crop	<u>Clear Lake Rim</u>			<u>Reaches 1-3</u>		
	<u>50-Year</u>	<u>100-Year</u>	<u>SPF</u>	<u>50-Year</u>	<u>100-Year</u>	<u>SPF</u>
Orchards	342	369	445	88	110	143
Alfalfa	166 ^{1/}	166 ^{1/}	166 ^{1/}	50	66	77
Truck	-	-	-	100	104	126
Grain	69	69	69	44	55	83
Rice	-	-	-	22	28	33
Native Pasture	Neg. ^{1/}	Neg. ^{1/}	Neg. ^{1/}	13	17	22
Pasture	111 ^{1/}	111 ^{1/}	111 ^{1/}	56	66	82

^{1/} Includes one half of the cost for re-establishing stand.

would be of higher velocities) and the composition of particular crop categorie (e.g., barley is the primary grain crop in the Clear Lake Rim area while grain crops in the downstream reaches include barley, wheat and safflower).

In determining average crop damages consideration is given to planting times and probable timing of flooding as well as the impact of duration and velocity on crop yields. For example the primary grain crop in the Clear Lake Rim area is barley which is normally planted in late fall or early winter. The expected flooding of agricultural areas from high lake levels would primarily occur in late winter or early spring, after planting had occurred. During a 50-year flood event the lake level would be expected to exceed 9.00 feet at the Rumsey Gage for more than 45 days. Such long term duration of flooding would be expected to result in complete loss of the barley crop; and the average crop damage would, therefore, be the gross return per acre less any cultural costs that would no longer be incurred. The 1974 normalized yield for dry farmed barley in Lake County is 1.4 tons per acre and the 1974 normalized price is \$55.36 per ton for a gross return of approximately \$78 per acre. Harvesting costs of approximately \$9 per acre, based on a University of California Extension Service Study, "Sample Costs of Production," would be the only cultural cost that the farm operator would have not already incurred. Therefore the average crop damage to barley would be \$78-\$9 or \$69 per acre. Similar analysis were used to determine the remaining average crop damages within the study area.

Stage-damage and flow-damage relationships.

Stage-damage and flow-damage relationships describe the probable flood damages expected under varying stage elevations (Clear Lake Rim) or stream flows (Reaches 1-3). They are derived by estimating the probable flood damages for several hypothetical floods of given stage elevations on stream flows. Intermediate damage points are interpolated from these estimates on the basis of the proportionate change in stage elevation or stream flow.

The probable flood damages for the hypothetical floods are estimated by identifying the associated flood plain area, inventorying this area by damage category and depth of flooding, and applying the appropriate depth-damage relationship. Probable damages for the 25-year, 50-year, 100-year and SPF flood events under existing conditions are summarized in tables E-3 and E-4 for the study areas.

Stage- and flow-frequency relationships.

Stage- and flow-frequency relationships describe the probable frequency of occurrence of varying stage elevations or stream flows. These relationships

TABLE E-3

CLEAR LAKE RIM
PROBABLE 25-YEAR, 50-YEAR, 100-YEAR AND
STANDARD PROJECT FLOOD DAMAGES 1974 CONDITIONS
AND PRICES
(In Thousands)

Damage Category	25-Year	50-Year	100-Year	SPF
Residential structures ^{1/}	\$ 236	\$ 281	\$ 554	\$1,555
Residential contents ^{1/}	105	125	217	659
Mobile home structures	98	116	311	798
Mobile home contents	40	47	81	215
Commercial	537	638	1,247	3,388
Public facilities	153	181	289	652
Private piers	220	261	371	842
Agriculture	356	423	580	789
<u>Emergency costs</u>	<u>2</u>	<u>2</u>	<u>4</u>	<u>50</u>
Total	\$1,746	\$2,075	\$3,655	\$8,950

^{1/} Excluding mobile homes.

TABLE E-4

CACHE CREEK BASIN: PROBABLE 25-YEAR, 50-YEAR, 100-YEAR
AND STANDARD PROJECT FLOOD DAMAGES, 1974 CONDITIONS AND PRICES
(In Thousands)

Damage Category	25-Year	50-Year	100-Year	SPF
<u>Reach 1</u>				
Residential structures ^{1/}	\$ 6.9	\$ 8.1	\$ 9.3	\$ 40.9
Residential contents	0.0	0.0	0.0	16.7
Public facilities	18.4	22.6	28.0	58.2
<u>Agriculture</u>	<u>115.8</u>	<u>149.2</u>	<u>185.3</u>	<u>421.5</u>
Total	\$141.1	\$179.9	\$222.6	\$537.3
<u>Reach 2</u>				
Residential structures	\$ 0.3	\$ 1.2	\$ 5.0	\$ 38.0
Residential contents	0.2	0.9	3.0	20.0
Commercial	0.2	0.5	0.9	11.0
Industrial	5.0	12.0	50.0	61.0
Public facilities	104.0	126.0	135.0	154.0
<u>Agriculture</u>	<u>127.0</u>	<u>218.6</u>	<u>307.7</u>	<u>478.0</u>
Total	\$236.7	\$359.2	\$501.6	\$762.0
<u>Reach 3</u>				
Residential structures	\$ 0.0	\$ 0.0	\$103.0	\$251.0
Residential contents	0.0	0.0	51.0	132.0
Commercial	0.0	0.0	39.0	425.0
Industrial	17.5	55.0	71.0	2,107.0
Public facilities	5.3	24.0	60.0	240.0
<u>Agriculture</u>	<u>21.5</u>	<u>107.5</u>	<u>1,429.3</u>	<u>2,279.6</u>
Total	\$ 44.3	\$186.5	\$1,753.3	\$5,434.6

^{1/}Includes farmstead buildings.

are estimated for both with and without project conditions under present and future hydrologic conditions. The stage frequency and flow frequency relationships used in this analysis are presented in Chart 10 and Cache Creek Basin "Standard Project Floods" office report dated May 1974.

Damage-frequency relationships.

Damage-frequency relationships describe the probable frequency of occurrence of flood damages of varying magnitudes and are derived by combining the stage- or flow-damage and the stage- or flow-frequency relationships.

Summarized in Tables E-5 and E-6 are selected points from the above relationships under preproject conditions. In these tables columns a and b represent the stage- or flow-frequency relationships, columns b and c represent the stage- or flow-damage relationships, while columns a and c represent the damage-frequency relationships.

TABLE E-5

CLEAR LAKE RIM STAGE AND
DAMAGE FREQUENCY RELATIONSHIPS
1974 CONDITIONS AND PRICES

<u>Frequency as percent chance elevations and damages are equalled or exceeded</u> (a)	<u>Elevation at Runsey Gage</u> (b)	<u>Probable damages^{1/} (\$1,000)</u> (c)
.1	13.40 feet	9,296
.2	12.90	8,950
.5	12.10	5,691
.7	11.90	4,877
1.0	11.60	3,655
2.0	10.97	2,075
3.0	10.67	1,895
4.0	10.42	1,746
10.0	9.41	1,142
<u>38.0</u>	7.56	0

^{1/}Damages computed assuming an average increase of one foot in lake elevation resulting from wave action.

TABLE E-6

CACHE CREEK BASIN-FLOW AND DAMAGE
FREQUENCY RELATIONSHIPS-1974 CONDITIONS AND PRICES

Frequency as percent chance flows and damages are equalled or exceeded (a)	Flow (1,000 c.f.s)			Probable damages (\$1,000)		
	Reach 1 (b1)	Reach 2 (b2)	Reach 3 (b3)	Reach 1 (c1)	Reach 2 (c2)	Reach 3 (c3)
.1	54.5	66.2	50.0	551	871	6202
.2	50.5	59.0	47.0	537	762	5434
.5	45.0	52.0	43.3	391	610	3763
.7	42.5	49.5	42.7	316	560	2959
1.0	40.5	47.5	40.0	223	502	1743
2.0	36.5	42.5	35.5	180	359	187
4.0	31.8	37.5	31.5	141	237	92
5.0	31.0	36.3	30.0	127	196	0
10.0	27.2	30.8	25.5	91	25	0
30.0	21.0	21.0	19.0	0	0	0

Average annual damages and benefits.

Average annual damages are the expected value of damages for a given economic condition and point in time. They are determined by weighting the estimated damages from varying degrees of flooding by their probability of occurrence and may be approximated by measuring the area under the damage-frequency curve. Average annual damages are computed for both preproject and project (residual damages) conditions with the difference being an estimate of preventable damages (project benefits). Discounting of the future flows of damages and benefits during the project life, in constant prices, with the appropriate interest rate and standard discounting procedures yields average annual equivalent values for project evaluation.

Average annual and average annual equivalent damages and benefits are summarized for the study areas under alternative levels of project protection in tables E-7 to E-13. Average annual values are presented for the study year (1974), the base year (1985) and the project study period (1985-2085). Average annual equivalent values are presented for the project study period based on a 5-7/8 percent interest rate.

Reduction in flood proofing costs.

When a plan would negate the need for flood proofing that would be expected without the plan, the cost of such flood proofing less any increase in residual damages is a project benefit. It was assumed as a preproject condition that all new and replacement structures would be constructed with their first floor above the 11.56 foot elevation (Rumsey Gauge) in compliance with the current Lake County zoning ordinances. The estimates of average annual equivalent residual damages previously presented (\$123,600) were estimated assuming the continuation of this ordinance for the following economic reason. If the ordinance was discontinued with project construction average annual equivalent residual damages are estimated to be \$190,600 an increase of \$67,000. The average annual equivalent cost associated with providing the flood proofing is estimated to be \$6,400. Since the increase in residual damages exceeds the cost of compliance with the present ordinance it is economically rational to assume continuation of the ordinance.

Area redevelopment benefits.

The Area Redevelopment Act, Public Law 87-27, 87th Congress, 1st Session and its successor, the Public Works and Economic Development Act of 1965, Public Law 89-136, 89th Congress, provide for the Federal Government to cooperate with the states to help areas of substantial and persistent unemployment and underemployment, and to take effective steps in planning and financing their economic development. Federal assistance should enable such areas to enhance the domestic prosperity by creation of new employment opportunities through development and expansion of new and existing facilities and resources. The role of the Corps of Engineers in the program is set forth in ER 1165-2-6, dated 1 February 1966, which also specifies the criteria to be used for project formulation and evaluation. It states that in addition to the criteria now in use, estimates of benefits may include an amount equivalent to that part of the construction costs which

TABLE E-7

CLEAR LAKE RIM - PREPROJECT DAMAGES, 1974 PRICES
(In Thousands)

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	<u>Average Annual Equiv. 1985-2085 @ 5-7/8</u>
Residential Structures ^{1/}	\$ 52.2	\$ 48.2	\$ 45.6	\$ 43.0	\$ 41.3	\$ 38.1	\$ 42.9	-	\$ 42.9	\$ 44.5
Residential Contents ^{1/}										
Without affluence	22.9	18.7	15.4	12.1	8.9	4.9	5.5	-	5.5	13.4
(With affluence)	(22.9)	(25.4)	(27.7)	(25.9)	(19.1)	(10.5)	(11.8)	-	(11.8)	(23.7)
Mobile Home Structures	23.1	21.6	20.7	19.8	19.3	18.2	20.5	-	20.5	20.4
Mobile Home Contents										
Without affluence	8.4	7.0	5.9	4.8	3.8	2.4	2.8	-	2.8	5.2
(With affluence)	(8.4)	(9.5)	(10.6)	(10.3)	(8.1)	(5.2)	(5.9)	-	(5.9)	(9.4)
Commercial	117.8	106.6	96.4	86.2	76.1	65.4	69.5	-	69.5	90.4
Public Facilities	31.4	35.2	39.5	44.3	49.7	55.7	62.4	-	62.4	43.3
Private Piers	44.4	48.4	52.2	56.2	60.3	64.9	69.7	-	69.7	55.2
Agriculture	68.9	78.0	88.3	100.0	113.2	128.2	145.1	-	145.1	97.7
<u>Emergency costs</u>	.6	.7	.8	.9	1.0	1.1	1.2	-	1.2	.9
Total										
Without Affluence	\$369.7	\$364.4	\$364.8	\$367.3	\$373.6	\$378.9	\$419.6	-	\$419.6	\$371.0
With affluence	\$369.7	\$373.6	\$381.8	\$386.6	\$368.1	\$397.3	\$429.0	-	\$429.0	\$385.5

^{1/}Excluding mobile homes.

TABLE E-8

CLEAR LAKE RIM - RESIDUAL DAMAGES 1974 PRICES
(In Thousands)

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	<u>Average Annual Equiv. 1985-2085 @ 5-7/8</u>
<u>8000 cfs Channel</u>										
Residential Structures ^{1/}	\$ 16.7	\$ 15.3	\$ 14.4	\$ 13.5	\$ 12.9	\$ 11.8	\$ 13.2	-	\$ 13.2	\$ 14.0
Residential Contents/ without affluence	7.4	6.0	4.9	3.9	2.8	1.6	1.8	-	1.8	4.3
(with affluence)	(7.4)	(8.2)	(8.9)	(6.3)	(6.0)	(3.4)	(3.8)	-	(3.8)	(7.6)
Mobile Home Structures	7.3	6.8	6.4	6.1	6.0	5.6	6.3	-	6.3	6.3
Mobile Home Contents without affluence	2.7	2.3	1.9	1.5	1.2	.8	.9	-	.9	1.7
(with affluence)	(2.7)	(3.1)	(3.4)	(3.3)	(2.5)	(1.7)	(1.9)	-	(1.9)	(3.0)
Commercial	37.7	34.0	30.6	27.2	23.8	20.2	21.5	-	21.5	28.6
Public Facilities	10.2	11.4	12.8	14.3	16.1	16.0	20.2	-	20.2	14.0
Private Piers	14.4	15.7	17.0	18.3	19.6	21.1	22.6	-	22.6	17.9
Agriculture	22.4	25.4	28.8	32.6	36.9	41.8	47.3	-	47.3	31.9
Emergency Costs	.2	.2	.3	.3	.3	.4	.4	-	.4	.3
Total: Without affluence	\$119.0	\$117.1	\$117.1	\$117.7	\$119.6	\$121.3	\$134.2	-	\$134.2	\$119.0
with affluence	\$119.0	\$120.1	\$122.6	\$123.9	\$124.1	\$124.0	\$137.2	-	\$137.2	\$123.6
<u>5000 cfs Channel</u>										
without affluence	\$192.0	\$188.4	\$187.9	\$188.3	\$190.7	\$193.0	\$213.9	-	\$213.9	\$190.6
with affluence	\$192.0	\$193.2	\$196.5	\$197.9	\$197.6	\$197.2	\$218.6	-	\$218.6	\$197.8
<u>11000 cfs Channel</u>										
without affluence	\$ 96.0	\$ 94.9	\$ 95.2	\$ 96.1	\$ 98.0	\$ 99.7	\$110.4	-	\$110.4	\$ 97.0
with affluence	\$ 96.0	\$ 97.3	\$100.0	\$101.3	\$102.0	\$102.4	\$113.4	-	\$113.4	\$101.0

1/ Excluding Mobile Homes

TABLE E-9

CLEAR LAKE RIM - BENEFITS 1974 PRICES
(In Thousands)

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	<u>Average Annual Equiv. 1985-2085 G 5-7/8</u>
<u>8000 cfs Channel</u>										
Residential Structures ^{1/}	\$ 35.5	\$ 32.9	\$ 31.2	\$ 29.5	\$ 28.4	\$ 26.3	\$ 29.7	-	\$ 29.7	\$ 30.5
Residential Contents ^{1/}										
without affluence	15.5	12.7	10.5	8.2	6.1	3.3	3.7	-	3.7	9.1
with affluence	(15.5)	(17.2)	(18.8)	(17.6)	(13.1)	(7.1)	(8.0)	-	(6.0)	(15.1)
Mobile Home Structures	15.8	14.8	14.3	13.7	13.3	12.6	14.2	-	14.2	14.1
Mobile Home Contents										
without affluence	5.7	4.7	4.0	3.3	2.6	1.6	1.9	-	1.9	3.5
with affluence	(5.7)	(6.4)	(7.2)	(7.0)	(5.6)	(3.5)	(4.0)	-	(4.0)	(6.4)
Commercial	80.1	72.6	65.8	59.0	52.3	45.2	48.0	-	48.0	61.8
Public Facilities	21.2	23.8	26.7	30.0	33.6	37.7	42.2	-	42.2	29.3
Private Piers	30.0	32.7	35.2	37.9	40.7	43.8	47.1	-	47.1	37.3
Agriculture	46.5	52.6	59.5	67.4	76.3	86.4	97.8	-	97.8	65.8
Emergency Costs	.4	.5	.5	.6	.7	.7	.8	-	.8	.6
Total: Without affluence	\$250.7	\$247.3	\$247.7	\$249.6	\$254.0	\$257.6	\$285.4	-	\$285.4	\$252.0
With affluence	\$250.7	\$253.5	\$259.2	\$262.7	\$264.0	\$263.3	\$291.8	-	\$291.8	\$261.9
<u>5000 cfs Channel</u>										
without affluence	\$177.7	\$176.0	\$176.9	\$171.0	\$182.9	\$185.9	\$205.7	-	\$205.7	\$180.4
with affluence	\$177.7	\$180.4	\$185.3	\$188.7	\$190.5	\$190.1	\$210.4	-	\$210.4	\$187.7
<u>11000 cfs Channel</u>										
without affluence	\$273.7	\$269.5	\$269.6	\$271.2	\$275.6	\$279.2	\$309.2	-	\$309.2	\$274.0
with affluence	\$273.7	\$276.3	\$281.8	\$285.3	\$286.1	\$284.9	\$315.6	-	\$315.6	\$284.5

^{1/} Excluding Mobile Homes

TABLE E-10

FLOOD PLAN ZONING ALTERNATIVE
 CLEAR LAKE RIM - DAMAGES AND BENEFITS, 1974 PRICES
 (In Thousands)

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	<u>Average Annual Equivalents @ 5-7/8</u>
<u>Preproject Damages</u>										
Without affluence	\$369.7	\$364.4	\$364.8	\$367.3	\$373.6	\$378.9	\$419.6	-	\$419.6	\$371.0
With affluence	369.7	373.6	381.8	386.6	388.1	387.3	429.0	-	429.0	385.5
<u>Residual Damages</u>										
Without affluence	369.7	343.4	324.6	307.9	293.6	276.5	306.4	-	306.4	317.5
With affluence	369.7	352.2	339.4	322.5	301.6	276.5	306.4	-	306.4	329.3
<u>Benefits</u>										
Without affluence	0	21.0	40.2	59.4	80.0	102.4	113.2	-	113.2	53.5
With affluence	0	21.4	42.4	64.1	86.5	110.8	122.6	-	122.6	57.2

E-10

TABLE E-11

CACHE CREEK BASIN - REACH 1 DAMAGES AND BENEFITS 1974 PRICES

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	Average Annual Equiv. <u>1955-2085 @ 5-7/8</u>
	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	-	(\$1000)	(\$1000)
<u>Preproject Damages</u>										
Residential Structures ^{1/}	1.4	1.4	1.4	1.4	1.4	1.4	1.4	-	1.4	1.4
Residential Contents										
without affluence	.1	.1	.1	.1	.1	.1	.1	-	.1	.1
(with affluence)	(.1)	(.1)	(.2)	(.2)	(.2)	(.2)	(.2)	-	(.2)	(.2)
Public Facilities	3.5	4.5	5.6	7.1	8.8	11.1	13.9	-	13.9	7.0
Agriculture	22.3	29.4	34.1	37.2	40.2	41.8	43.9	-	43.9	35.6
Total: without affluence	27.3	35.4	41.2	45.8	50.5	54.4	59.3	-	59.3	44.1
with affluence	27.3	35.4	41.3	45.9	50.6	54.5	59.4	-	59.4	44.2
<u>Residual Damages</u>										
SFF Project										
without affluence	.7	.9	1.1	1.1	1.3	1.3	1.5	-	1.5	1.1
with affluence	.7	.9	1.1	1.2	1.4	1.4	1.6	-	1.6	1.2
100-Year Project										
without affluence	3.4	4.3	5.0	5.5	6.1	6.6	7.1	-	7.1	5.3
with affluence	3.4	4.3	5.1	5.6	6.2	6.7	7.2	-	7.2	5.4
50-Year Project										
without affluence	5.2	6.7	7.8	8.6	9.5	10.2	11.1	-	11.1	9.3
with affluence	5.2	6.7	7.9	8.7	9.6	10.3	11.2	-	11.2	8.4
<u>Benefits</u>										
SFF Project										
without affluence	26.6	34.5	40.1	44.7	49.2	53.1	57.8	-	57.8	43.0
with affluence	26.6	34.5	40.2	44.7	49.2	53.1	57.8	-	57.8	43.0
100-Year Project										
without affluence	23.9	31.1	36.2	40.3	44.4	47.8	52.2	-	52.2	38.8
with affluence	23.9	31.1	36.2	40.3	44.4	47.8	52.2	-	52.2	38.8
50-Year Project										
without affluence	22.1	28.7	33.4	37.2	41.0	44.2	48.2	-	48.2	35.8
with affluence	22.1	28.7	33.4	37.2	41.0	44.2	48.2	-	48.2	35.8

^{1/} Includes Farmstead Buildings

TABLE E-12

CACHE CREEK BASIN - REACH 2 DAMAGES AND BENEFITS, 1974 PRICES

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	<u>Average Annual Equiv.</u> <u>1985-2085 @ S-7/8</u>
	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)		(\$1000)	(\$1000)
<u>Preproject Damages</u>										
Residential Structures	.3	.3	.3	.3	.3	.3	.3	-	.3	.3
Residential Contents										
Without affluence	.2	.2	.2	.2	.2	.2	.2	-	.2	.2
(With affluence)	(.2)	(.3)	(.4)	(.4)	(.4)	(.4)	(.4)	-	(.4)	(.4)
Commercial	.1	.1	.1	.1	.1	.1	.1	-	.1	.1
Industrial	1.2	1.2	1.2	1.2	1.2	1.2	1.2	-	1.2	1.2
Public facilities	9.4	12.0	15.1	18.9	23.6	29.7	37.2	-	37.2	18.7
Agriculture	13.1	17.3	20.0	22.0	23.7	24.7	25.9	-	25.9	20.9
Total:										
Without affluence	24.3	31.1	36.9	42.7	49.0	56.2	64.9	-	64.9	41.4
With affluence	24.3	31.2	37.1	42.9	49.2	56.4	65.1	-	65.1	41.6
<u>Residual Damages</u>										
<u>SPF Projects:</u>										
Without affluence	1.7	2.2	2.5	2.7	3.1	3.4	3.7	-	3.7	2.7
With affluence	1.7	2.2	2.5	2.7	3.1	3.4	3.7	-	3.7	2.7
<u>100-Year Projects:</u>										
Without affluence	6.4	8.1	9.4	10.5	11.7	12.9	14.5	-	14.5	10.2
With affluence	6.4	8.2	9.5	10.7	11.9	13.1	14.7	-	14.7	10.3
<u>50-Year Projects:</u>										
Without affluence	9.2	11.6	13.5	15.2	17.1	19.0	21.2	-	21.2	14.8
With affluence	9.2	11.7	13.6	15.4	17.3	19.2	21.4	-	21.4	14.9
<u>Benefits</u>										
<u>SPF Projects:</u>										
Without affluence	22.6	28.9	34.4	40.0	45.9	52.8	61.2	-	61.2	38.7
With affluence	22.6	29.0	34.6	40.2	46.1	53.0	61.4	-	61.4	38.9
<u>100-Year Projects:</u>										
Without affluence	17.9	23.0	27.5	32.2	37.3	43.3	50.4	-	50.4	31.2
With affluence	17.9	23.0	27.6	32.2	37.3	43.3	50.4	-	50.4	31.3
<u>50-Year Projects:</u>										
Without affluence	15.1	19.5	23.4	27.5	31.9	37.2	43.7	-	43.7	26.6
With affluence	15.1	19.5	23.5	27.5	31.9	37.2	43.7	-	43.7	26.7

TABLE E-13

CACHE CREEK BASIN - REACH 3 DAMAGES AND BENEFITS 1974 PRICES

	<u>1974</u>	<u>1985</u>	<u>1995</u>	<u>2005</u>	<u>2015</u>	<u>2025</u>	<u>2035</u>	-	<u>2085</u>	<u>Average Annual Equiv.</u> <u>1985-2085 @ 5-7/8</u>
	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	(\$1000)	-	(\$1000)	(\$1000)
<u>Preproject Damages</u>										
Residential Structures	2.5	3.2	3.5	3.8	4.0	4.3	5.4	-	5.4	3.7
Residential Contents										
without affluence	1.3	1.7	1.8	1.9	2.1	2.2	2.8	-	2.8	2.0
(with affluence)	(1.3)	(2.3)	(3.2)	(4.1)	(4.4)	(4.7)	(5.9)	-	(5.9)	(3.6)
Commercial	2.8	3.6	4.7	5.9	7.5	9.7	12.4	-	12.4	5.9
Industrial	14.5	19.8	25.9	33.8	44.5	61.7	81.9	-	81.9	34.7
Public Facilities	2.3	2.9	3.7	4.6	5.7	7.2	9.0	-	9.0	4.5
Agriculture	29.4	37.5	43.4	47.6	51.3	53.6	56.2	-	56.2	45.4
Total: without affluence	51.8	68.7	83.0	97.6	115.1	138.7	167.7	-	167.7	96.2
with affluence	51.8	69.3	84.4	99.8	117.4	141.2	170.8	-	170.8	97.8
<u>Residual Damages</u>										
<u>SPF Project</u>										
without affluence	12.5	16.7	20.5	24.8	30.6	37.1	46.0	-	46.0	24.6
with affluence	12.5	16.8	20.9	25.4	31.1	37.7	46.8	-	46.8	25.0
<u>100-Year Project</u>										
without affluence	39.0	51.8	63.4	75.5	90.9	108.6	132.8	-	132.8	74.3
with affluence	39.0	52.3	64.5	77.2	92.7	110.6	135.2	-	135.2	75.7
<u>50-Year Project</u>										
without affluence	48.7	64.6	78.2	92.0	109.0	128.0	154.3	-	154.3	90.2
with affluence	48.7	65.2	79.5	94.2	111.3	130.5	157.4	-	157.4	91.8
<u>Benefits</u>										
<u>SPF Project</u>										
without affluence	39.3	52.0	62.5	72.8	84.5	101.6	121.7	-	121.7	71.6
with affluence	39.3	52.5	63.5	74.4	86.3	103.5	124.0	-	124.0	72.8
<u>100-Year Project</u>										
without affluence	12.8	16.9	19.6	22.1	24.2	30.1	34.9	-	34.9	21.9
with affluence	12.8	17.0	19.9	22.6	24.7	30.6	35.6	-	35.6	22.1
<u>50-Year Project</u>										
without affluence	3.1	4.1	4.8	5.6	6.1	10.7	13.4	-	13.4	6.0
with affluence	3.1	4.1	4.8	5.6	6.1	10.7	13.4	-	13.4	6.0

represents wages to workers who, in the absence of the project, would be unemployed. Lake County has been designated as eligible for assistance under the administration of the U.S. Department of Commerce.

The estimation of area redevelopment benefits for the two alternatives involving Clear Lake outlet channel enlargement are summarized in the following paragraphs. No ARA benefits have been computed for downstream alternatives. The ARA benefits have not been included in the benefit to cost rates analysis presented in Section D.

Area redevelopment benefits attributable to a project are equal to wages paid to local workers during construction who, during the absence of the project, would most likely be unemployed. Evaluation of construction costs of projects in California similar to the proposed plan indicates that about 35 percent of the Federal construction costs represent labor costs with about 45 percent of the labor provided by local workers, primarily from unskilled and semi-skilled labor pools.

Based on Federal construction costs of \$1,567,000 for the enlarge Clear Lake outlet channel alternative and the above assumptions, the total labor costs would be about \$548,500 and local labor costs about \$247,000. Assuming an average salary of \$12,000, the project would provide employment for about 21 local workers which would be readily provided by the local unemployed labor force. Based on a 5-7/8 percent interest rate and a 100 year discounting period, the average annual equivalent value of the area redevelopment benefit would be \$14,560 ($0.05895 \times \$247,000$) for this alternative.

Based on Federal construction costs of \$2,655,000 for the enlarge Clear Lake outlet channel and bypass alternative and the above assumptions, the total labor costs would be about \$929,300 and local labor costs about \$418,000. Assuming an average salary of \$12,000, the project would provide employment for about 35 local workers which would be readily provided by the local unemployed labor force. Based on a 5-7/8 percent interest rate and a 100 year discounting period the average annual equivalent value of the area redevelopment benefit would be \$24,640 ($.05895 \times \$418,000$) for this alternative.

Summary of Benefits.

Clear Lake Rim and Downstream Reaches. Physical inundation reduction benefits and the reduction of emergency costs where appropriate have been presented for alternative levels of protection for the four damage reaches. Area redevelopment benefits have been presented for the 8,000 cfs outlet and bypass channel alternative for the Clear Lake Rim Reach. None of the alternatives would be expected to induce additional development or result in intensified land use in the study areas. Location and intensification benefits have therefore not been estimated. These benefits for various flood control alternatives are presented in Tables 9 thru 13.

Residual damages SPF - event. Probable residual damages under SPF conditions with varying degrees of project protection are presented in Tables 14 and 15 along with probable preproject damages for comparative purposes.

TABLE E-14

CLEAR LAKE RIM STANDARD PROJECT FLOOD
PREPROJECT AND RESIDUAL DAMAGES, EXISTING
AND FUTURE CONDITIONS - 1974 PRICES
(In Thousands)

<u>Year</u>	<u>Preproject Damages</u>	<u>Residual Damages</u>	
		<u>5000 cfs Channel</u>	<u>8000 and 11000 cfs Channel</u>
1974	\$ 8,950	\$ 6,098	\$4,469
1985	10,475	6,806	4,710
1995	12,180	7,615	5,007
2005	13,928	8,421	5,274
2015	15,541	9,154	5,504
2025	17,140	9,860	5,701
2035	18,915	10,885	6,296
-	-	-	-
2085	18,915	10,885	6,296

TABLE E-15

CACHE CREEK BASIN - PREPROJECT DAMAGES
STANDARD PROJECT FLOOD EXISTING AND
FUTURE CONDITIONS - 1974 PRICES
(In Thousands)

	<u>Reach 1</u>	<u>Reach 2</u>	<u>Reach 3</u>
1974	\$ 537.3	\$ 762.0	\$ 5,434.6
1985	688.5	958.1	7,302.4
1995	796.9	1,110.3	9,055.8
2005	878.4	1,238.3	10,983.7
2015	964.1	1,379.7	13,364.7
2025	1,032.6	1,515.1	16,138.4
2035	1,118.3	1,682.1	19,972.0
-	-	-	-
2085	1,118.3	1,682.1	19,972.0

Note: The SPF-projects would provide complete protection from the SPF event while the 25-year, 50-year and 100-year projects would provide negligible protection.

Incidence of benefits.

Except for public facilities, the benefits from the reduction of physical inundation damages and emergency costs would accrue primarily to the owners and occupants of the land and developments within the flood plain areas. Historically, flood damages to public facilities and emergency costs have been borne primarily by city, special district (e.g. school districts) and county taxpayers. These taxpayers would therefore be the primary beneficiaries of the estimated reductions in public facility inundation damages. State and Federal taxpayers would benefit from the reduction of damages to such State and Federal facilities as interstate highways and in the reduction of emergency costs that would otherwise be borne by these entities. Area redevelopment benefits would accrue to the local workers that would be unemployed without project construction.

Sediment Control

The total cost of alternative construction and dredging strategies for the control of sediment from Cache Creek have been presented in Section "Formulating a Plan". The no development alternative would result in sediment deposition in both the Yolo bypass and downstream navigation channels. Such deposition would endanger the integrity of the bypass levees and the navigability of the downstream channels.

The Yolo bypass is an integral unit of the Sacramento River Flood Control Project. A failure of this unit would result in catastrophic damages including the possibility of the loss of life. In addition the Federal government is committed to maintaining the navigability of the downstream channels. The no development alternative is, therefore, assumed to be unacceptable. The benefits of the alternative plans presented are the maintenance of the integrity of the Yolo Bypass levees and the navigability of the downstream channels.

Sediment control benefits are derived from two sources as follows:

(1) If there was no sediment control development on Cache Creek the Yolo Bypass levees would need to be raised to maintain the design flow capacity in the bypass. To control sediment within the Cache Creek basin would eliminate the need for expending an average annual cost of \$246,000 to raise the Yolo Bypass levees and the Knights Landing Ridge Cut levees.

(2) Currently, a portion of the sediment leaving the settling basin via the Cobble Weir deposits in the Yolo Bypass; a much larger portion is carried downstream, with a percentage of this settling out in the Sacramento River channels and San Francisco Bay System, where it must be removed by dredging. When Cache Creek sediment control alternatives are introduced into the system, the amount of sediment entering the Yolo Bypass is reduced, the amount of sediment depositing in the Yolo Bypass is reduced to negligible amounts, and the amount of sediment being swept downstream is reduced, thereby decreasing dredging requirements, and providing project benefits. Benefits are calculated on the basis that 50% of the sediment

TABLE E-16

AVERAGE ANNUAL BENEFITS FROM
REDUCTION IN DREDGING

<u>Alternative</u>	Without Alternative		With Alternative		<u>Decrease in Dredging Requirement (Acre-feet)</u>	<u>Benefit (\$)</u>
	<u>Deposit Yolo Bypass (Acre-feet)</u>	<u>Sediment Flow Downstream Yolo Bypass (Acre-feet)</u>	<u>Deposit Yolo Bypass (Acre-feet)</u>	<u>Sediment Flow Downstream Yolo Bypass (Acre-feet)</u>		
Raise Settling Basin Levees	100	575	0	335	120	223,000
Excavate Settling Basin Levees	100	575	0	275	150	278,000
Kellner Jetty System	100	575	0	445	65	121,000
Brooks Sediment Reservoir	100	575	0	Small Amount	288	534,000

carried downstream of the Yolo Bypass settles out in areas requiring dredging, and said dredging is accomplished at a cost of \$1.15 per cubic yard. A tabularized accounting of reduced dredging requirements with each alternative is presented in Table E-16.

Bank Protection

Bank protection benefits were based upon the protection and preservation of land, rural residences and farm structures, highways, irrigation canals, and highway bridges across Cache Creek afforded by the stabilization effect of 83,000 lineal feet of jetties within the 13 jetty fields. Land protected was classified as orchard, farmland, or unimproved. Annual benefits were based upon an erosion rate assumed constant across the portion of land predicted to be lost during the 50 year project life. Residences, farm buildings, highways, and irrigation canals were assumed lost at some future date during the life of the project based upon the forementioned erosion rate. Using a zero rate of development, the value of these items at the time of loss is the same as at present. The annual benefit was derived by discounting the value of the structure at its time of loss over the entire 50 year project life. Annual benefits attributable to erosion protection to highway bridge abutments were based upon predicted annual maintenance costs at these sites without the project. A tabularized presentation of the annual bank protection benefits at each of the 13 jetty fields is shown in table E-17.

TABLE E-17

BANK PROTECTION BENEFITS

<u>Site #</u> (From upstream to downstream)	<u>Annual Bank Protection Benefit</u>
1	\$ 2,800
2	1,600
3	2,300
4	800
5	400
6	500
7	1,900
8	700
9	600
10	1,100
11	2,600
12	1,300
13	<u>1,800</u>
Total	\$18,400

Sediment Excavation

There were no benefits taken for sediment excavated from either the settling basin or the Kellner jetty fields. There, however, has been data gathered on the need of these sediment materials for useful purposes. Information was obtained regarding the need from sand and gravel operators and top soil contractors in the immediate area of the settling basin and Cache Creek. The three principle gravel operators indicated a potential average annual need of about 100,000 cubic yards per operator. The top soil contractor indicated a need of about 50,000 cubic yards annually. It was stated by the top soil operator that to obtain the rights to remove soils from borrow areas is costing about \$.20 per cubic yard at present. All of the contractors stated that it is becoming progressively more difficult to locate and make use of soil borrow areas. This is because of the environmental factor that must now be considered before selecting a site.

Further studies of the potential uses of the sediment material and continued demand for such materials are currently being evaluated by the University of California at Davis under Contract to the Corps of Engineers.

Crop Depredation

For the Excavate Settling Basin alternative Crop depredation benefits were estimated for the wildlife refuge feature of this alternative. The benefits were derived using data obtained from the U.S. Fish and Wildlife Service concerning other National Wildlife Refuges in the Sacramento Valley of the same approximate acreage as the alternative. The average annual benefit due to a reduction in crop depredation is estimated to be \$191,000.

Recreation

Recreation was considered for those alternatives that offered the greatest potential. These alternatives are Enlarge Clear Lake Outlet Channel, Enlarge Clear Lake Outlet Channel and Bypass, and Excavate Settling Basin. The estimated average annual use and benefit for these alternatives is shown in table E-18.

TABLE E-18

AVERAGE ANNUAL USE AND BENEFITS

<u>Alternative</u>	<u>Average Annual Use (User Days)</u>	<u>Average Annual Benefits (\$)</u>
Enlarge Clear Lake Outlet Channel	31,000	42,000
Enlarge Clear Lake Outlet Channel & Bypass	48,000	59,000
Excavate Settling Basin	7,000 to 12,000	40,000

The recreation uses in the Clear Lake area are due to increase in fishing access and camping. The respective unit benefits per user day are \$1.00 and \$1.50. For the settling basin benefits were due to general recreation and hunting and per unit benefits used were \$1.50 and \$6.00 respectively.

Cost of Alternatives

The cost of alternatives evaluated were based on 5-7/8 percent interest rate, 1 July 1974 prices levels, and 100 year and 50 year project lives for the Clear Lake and lower Cache Creek alternatives respectively. The first cost and average annual cost of alternatives is presented in table E-19.

TABLE E-19

ALTERNATIVES FIRST AND AVERAGE ANNUAL COST

Alternatives	First Cost	Average Annual
		Cost
		\$1,000
Clear Lake Flood Control		
Enlarge Clear Lake Outlet Channel	5,174	320.3
Enlarge Clear Lake Outlet Channel and Bypass	3,779	248.3
Clear Lake Flood Plain Zoning	343*	20
Sediment Control		
Raise Settling Basin Levees	6,608	421
Excavate Settling Basin	5,222	395
Kellner Jetty System	4,076	305
Brooks Sediment Reservoir	29,933	1,995

*Present worth at 5-7/8% interest rate, 100 year project life.

SECTION F
COORDINATION

Public Participation

Close coordination with the general public and local, County, State, and Federal agencies will continue throughout the investigation period. A public participation plan has been established which will serve as a guideline for the remainder of the investigation.

Completed Public Participation Activities.

- (1) 2 July 1969, Notice of Initiation and Public Meeting were held in Woodland.
- (2) January 1970, letters were sent to conservation groups announcing the study and requesting their comments.
- (3) September through December 1970, a class in Environmental Planning and Management, College of Agriculture and Environmental Sciences, at the University of California, Davis, made a study of the recreational potential of middle Cache Creek Basin. The instructor, an employee of the Environmental Resources Section, Sacramento District, reports that several interesting and practical plans were developed by the students.
- (4) 14 December 1971, a meeting was held with a special interest group.
- (5) 1 October 1973, a meeting was held with representatives of the U.S. Fish and Wildlife Service and Department of Fish and Game regarding the status of the investigation and to discuss measures which could be taken in the project design to preserve the fish and wildlife attributes of the area and discuss mitigation measures.
- (6) 19 October 1973, two separate meetings were held with Yolo County Public Works Department and Yolo County Flood Control and Water Conservation District to discuss and view bank protection needs.
- (7) 20 March 1974, a meeting was held with representatives of the Reclamation Board and the Department of Water Resources concerning coordination of the Cache Creek Settling Basin studies.
- (8) 3 April 1974, a meeting was held in Lakeport with Lake County officials regarding the Clear Lake Outlet Channel alternative plans.
- (9) 17 April 1974, a meeting was held in Woodland with Yolo County Planning Department and sand and gravel operators along Cache Creek to discuss sedimentation problems.
- (10) 7 May 1974, a meeting was held with representatives of the U.S. Fish and Wildlife Service and Department of Fish and Game regarding the status of the investigation.

- (11) 4 June 1974, a meeting was held with representatives of Yolo County to discuss the status of the studies.
- (12) 27 June 1974, a field inspection was made with Yolo County Flood Control and Water Conservation District Manager.
- (13) 15 August 1974, a meeting was held with Yolo County Flood Control and Water Conservation District Manager relative to the operation of Indian Valley Reservoir and the Clear Lake Outlet Channel enlargement.
- (14) 26 August 1974, a presentation was made to the Board of Supervisors of Lake County relative to the Clear Lake Outlet Channel enlargement alternatives. They indicated their support of the plans being considered and requested consideration be given to the water supply needs of Lake County in coordination with U.S.B.R.
- (15) 28 September 1974, a meeting was held with the Reclamation Board to discuss studies concerning the sediment problem in Cache Creek.
- (16) 8 April 1975, a meeting was held with representatives of the Reclamation Board and Department of Water Resources to discuss Federal and State studies relative to sediment control on Cache Creek. The Reclamation Board staff wished to integrate Corps studies with DWR studies to develop short range plans for the settling basin that would correspond with future Federal action.
- (17) 30 April 1975, a meeting was held with Yolo County Flood Control and Water Conservation District Manager to discuss Cache Creek alternatives. Yolo County interests are concerned about possible erosion along lower Cache Creek caused by enlarged Clear Lake outlet channel alternatives requiring sustained high flows on Cache Creek for flood operations. Yolo County was in support of bank protection alternatives.
- (18) 27 May 1975, a presentation was made to the Yolo County Water Resources Board on all Cache Creek alternatives that will be presented at the public meeting.

Continuing and Future Public Participation Activities.

Activities between Technical Conference and Special Public Meeting.

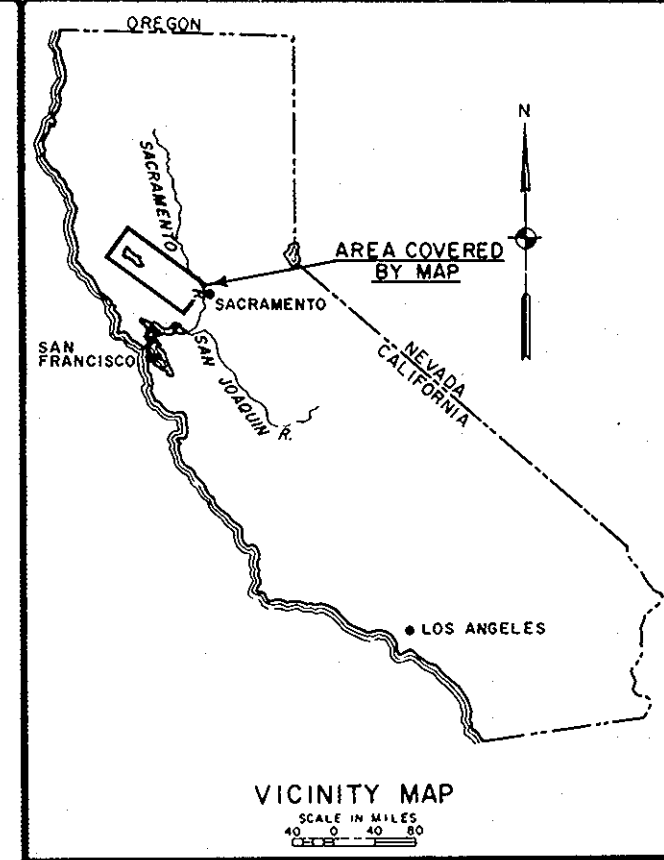
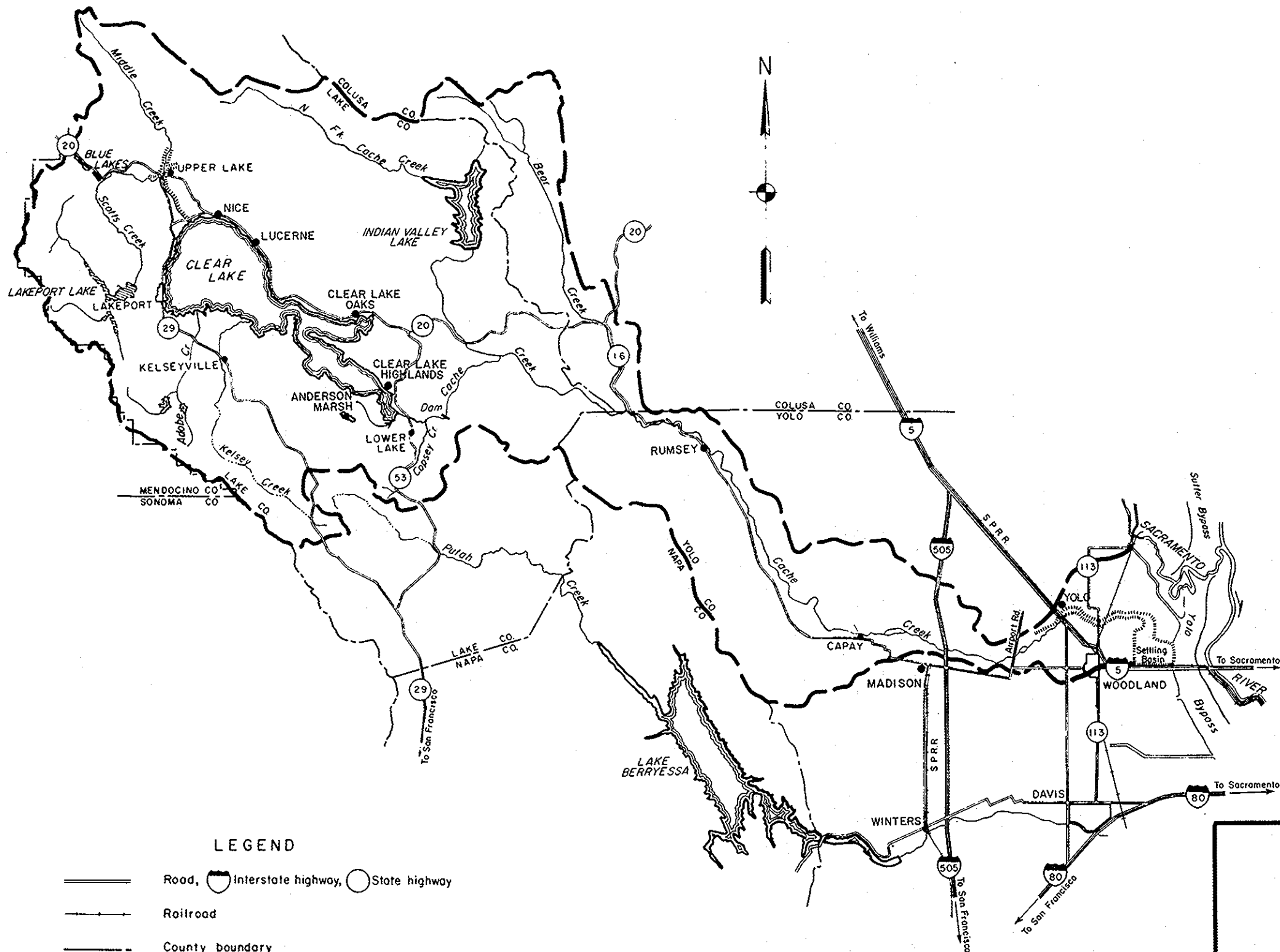
- (1) Informal meetings with both environmental groups and local, County, State, and Federal agencies will be held to inform these parties of the study progress and to solicit their views.
- (2) A notice of the Special Public meeting, currently scheduled for August 1975, will be mailed to interested parties 30 days in advance of the meeting. Included in this mailing will be a brochure generally describing the area, problems, and alternative plans which have been studied.
- (3) About 30 days prior to the Special Public Meeting an informal meeting will be held with fish and wildlife agencies to solicit their comments.

Activities between Special Public Meeting and Phase II Conference.

- (1) Meeting to be held with local officials soon after the Special Public Meeting, for the purpose of obtaining feedback in regard to the alternative plans suggested.
- (2) Continue coordination meetings with Federal, State, County, and local agencies, environmental groups, and local individuals as required.
- (3) The public is to be briefed intermittently by information bulletins or news releases as necessary.

Activities between Phase II Conference and Final Public Meeting.

- (1) Continue informal meetings and dissemination of information.
- (2) At least a month prior to the final public meeting, a group meeting with representatives of local government and various environmental groups will be held for the purpose of preparing for the final public meeting. This will insure that only pertinent information of interest to local people is presented at the meeting.



LEGEND

- Road, Interstate highway, State highway
- Railroad
- County boundary
- Drainage basin boundary
- Existing major levees
- Existing reservoir or lake
- Authorized reservoir



**CACHE CREEK BASIN
CALIFORNIA**

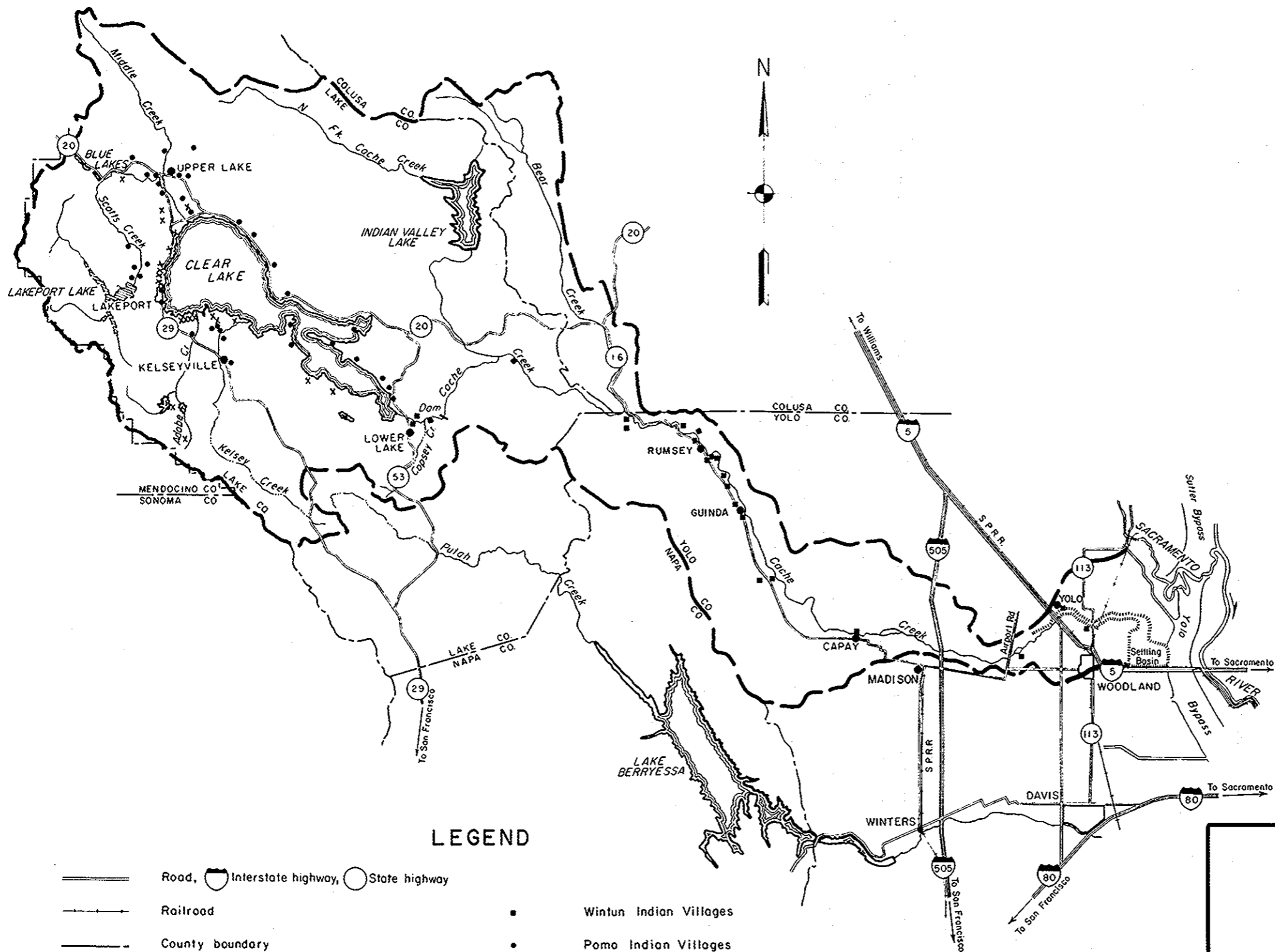
GENERAL MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J. P. S.

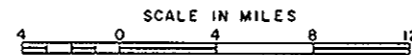
Date: March 1974

Drawn: D. J. E.



LEGEND

- | | | | |
|--|---|--|------------------------|
| | Road, Interstate highway, State highway | | Wintun Indian Villages |
| | Railroad | | Pomo Indian Villages |
| | County boundary | | Pomo Indian Campsites |
| | Drainage basin boundary | | |
| | Existing major levees | | |
| | Existing reservoir or lake | | |
| | Authorized reservoir | | |



**CACHE CREEK BASIN
CALIFORNIA**

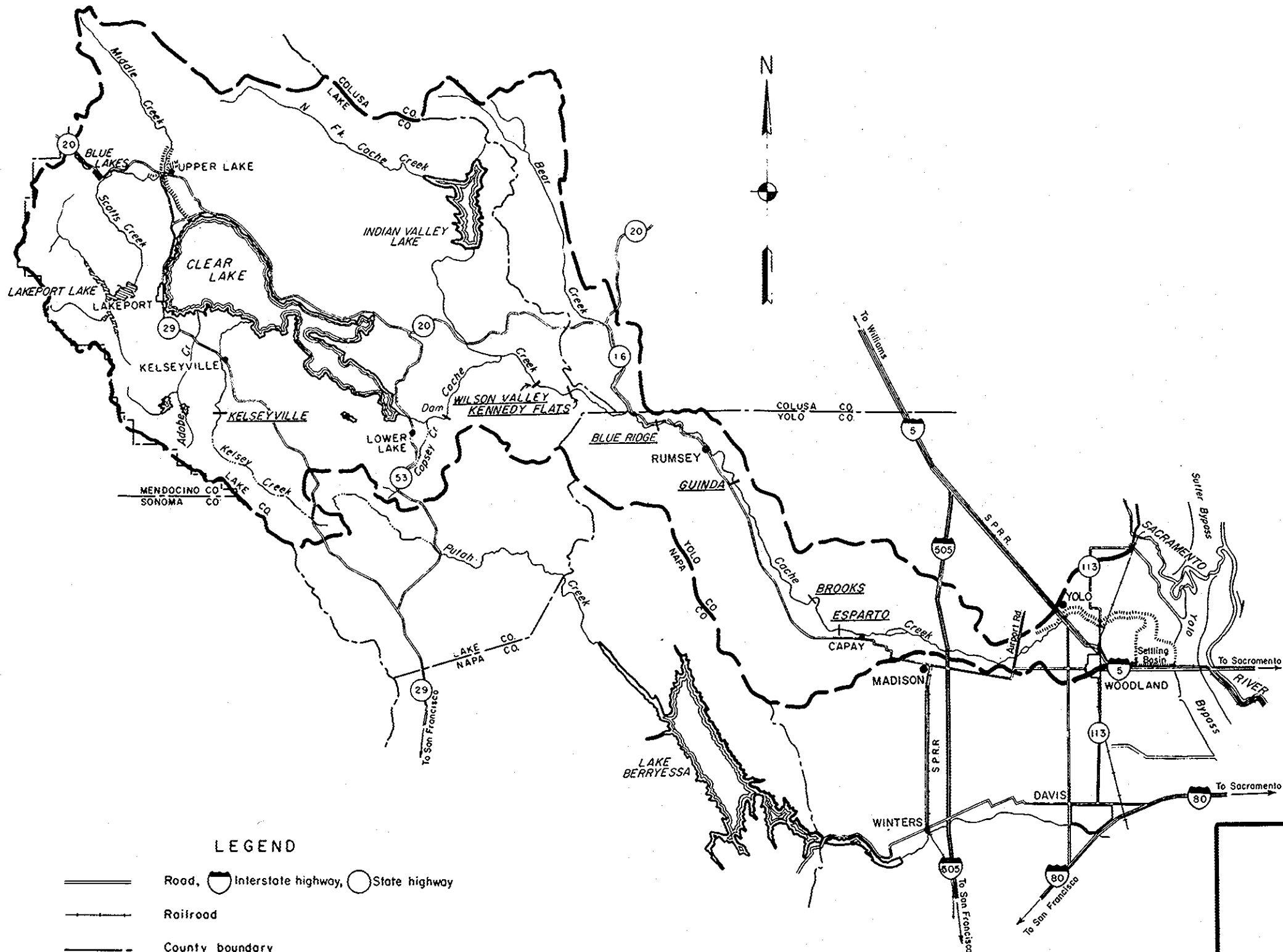
ARCHEOLOGICAL MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: S. T. I.

Date: March 1974

Drawn: D. J. E.



LEGEND

- Road, Interstate highway, State highway
- Railroad
- County boundary
- Drainage basin boundary
- Existing major levees
- Existing reservoir or lake
- Authorized reservoir
- Damsite

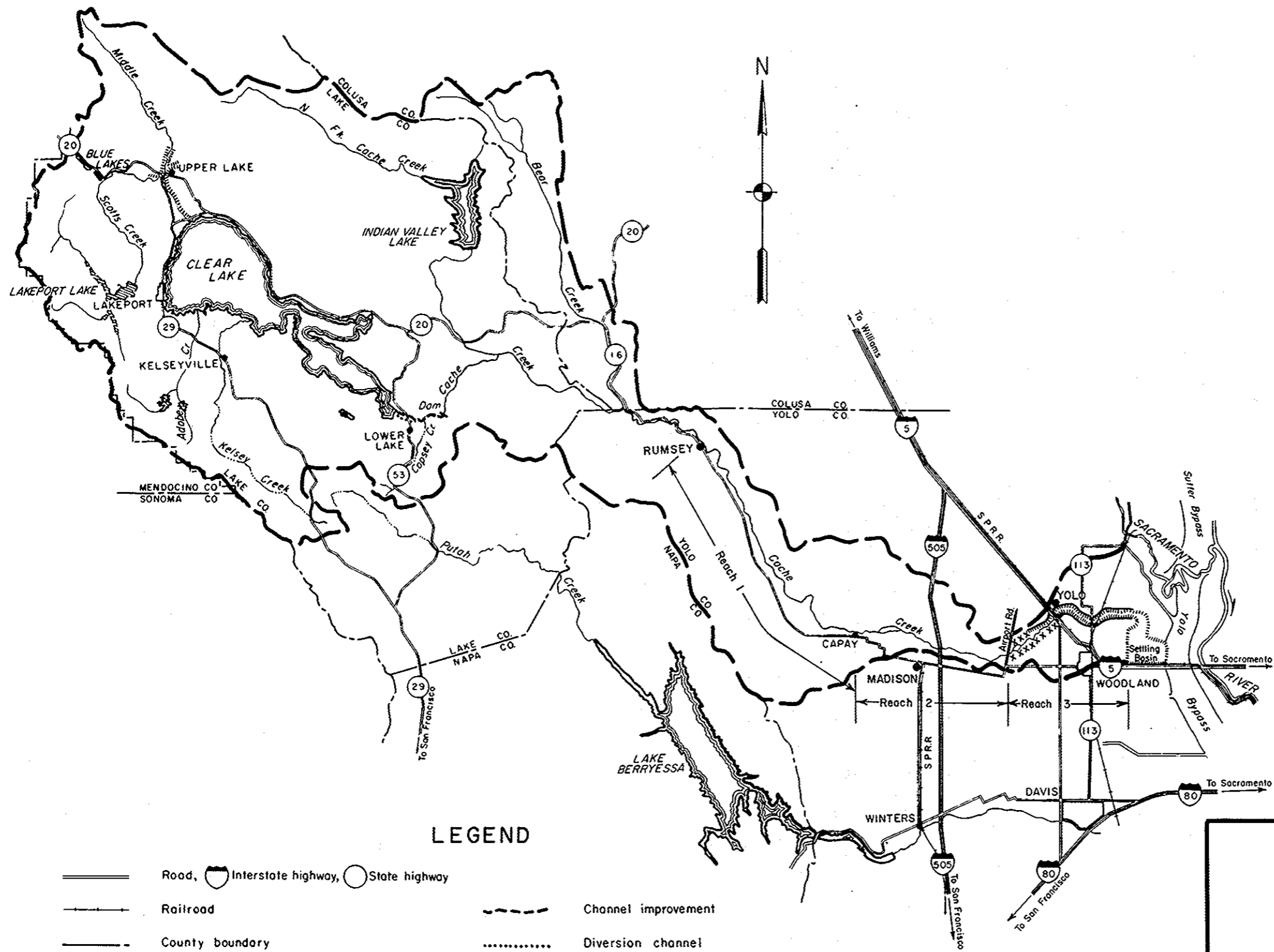


CACHE CREEK BASIN
CALIFORNIA

POSSIBLE RESERVOIR SITES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J. P. S. Date: March 1974
 Drawn: D. J. E.



LEGEND

- | | | | |
|-----------|---|-----------|-------------------------|
| — | Road, (I) Interstate highway, (S) State highway | - - - - - | Channel improvement |
| —+—+—+— | Railroad | | Diversion channel |
| - - - - - | County boundary | xxxxxxx | New levee |
| — | Drainage basin boundary | | Enlarged existing levee |
| | Existing major levees | | |
| 🏞️ | Existing reservoir or lake | | |
| 🏞️ | Authorized reservoir | | |

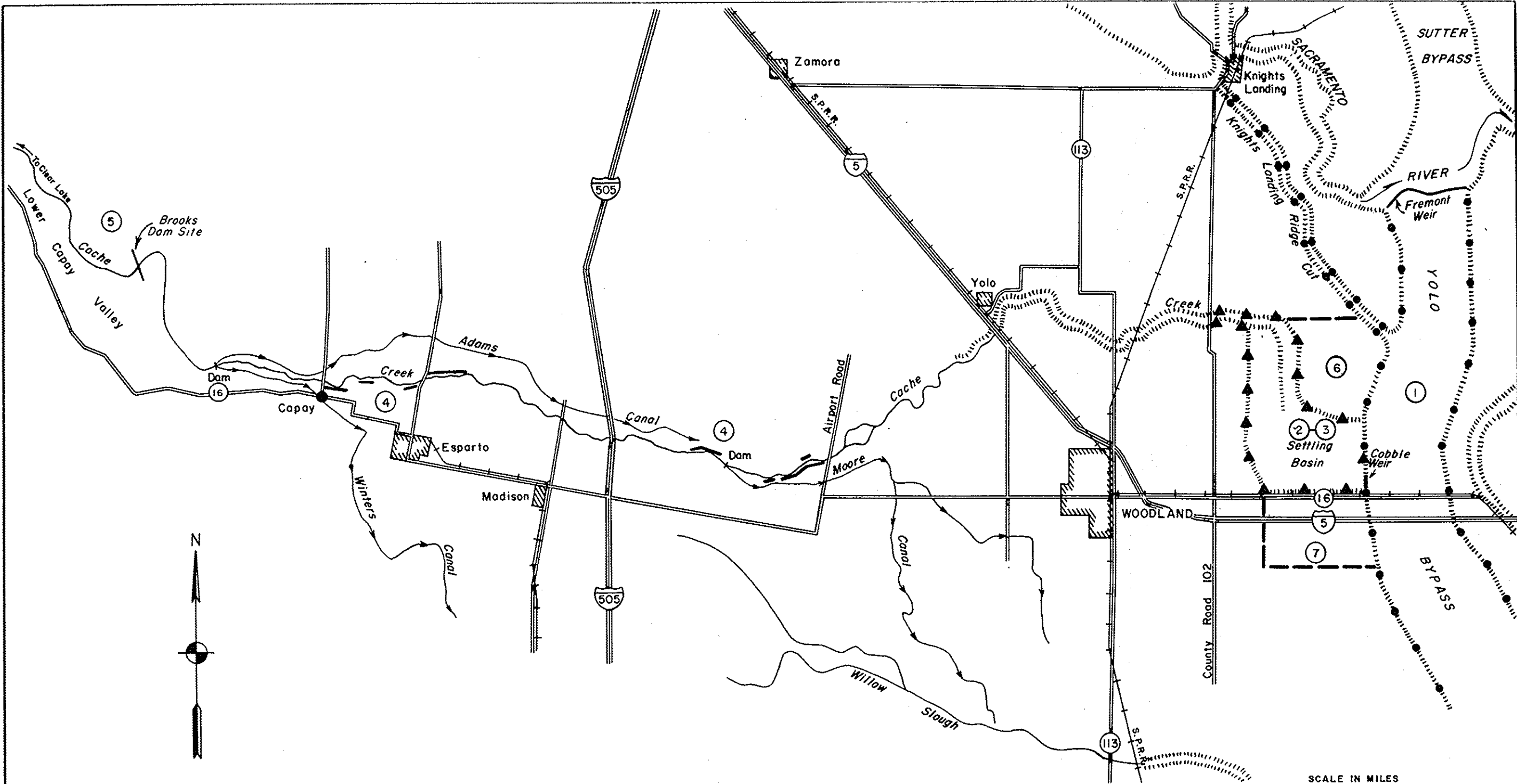


**CACHE CREEK BASIN
CALIFORNIA**

**POSSIBLE
LEVEE AND CHANNEL
IMPROVEMENTS**

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J. P. S. Date: March 1974
 Drawn: D. J. E.



- LEGEND**
- Sediment Control and Bank Protection
 - Raise Yolo Bypass Levees (Flood Control only)
 - ▲▲▲▲▲▲▲▲▲▲ Raise Settling Basin Levees
 - - - - - Limits of New Settling Basin Improvements

- POSSIBLE IMPROVEMENTS**
- ① Raise Yolo Bypass Levees
 - ② Raise Settling Basin Levees
 - ③ Excavate Settling Basin
 - ④ Kelliner Jetty System
 - ⑤ Brooks Sediment Reservoir
 - ⑥ New North Settling Basin
 - ⑦ New South Settling Basin

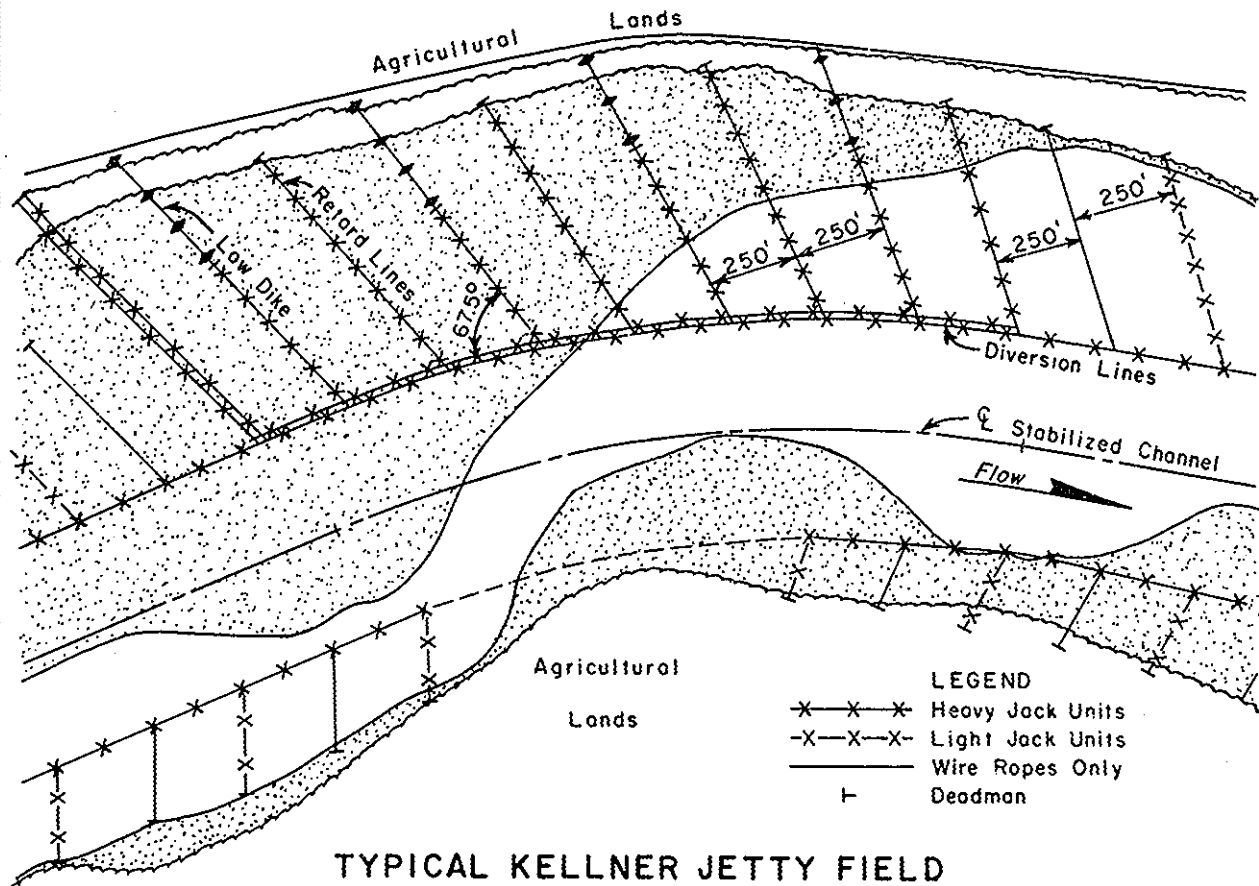


**CACHE CREEK BASIN
CALIFORNIA**

**POSSIBLE
SEDIMENT CONTROL AND
BANK PROTECTION IMPROVEMENTS**

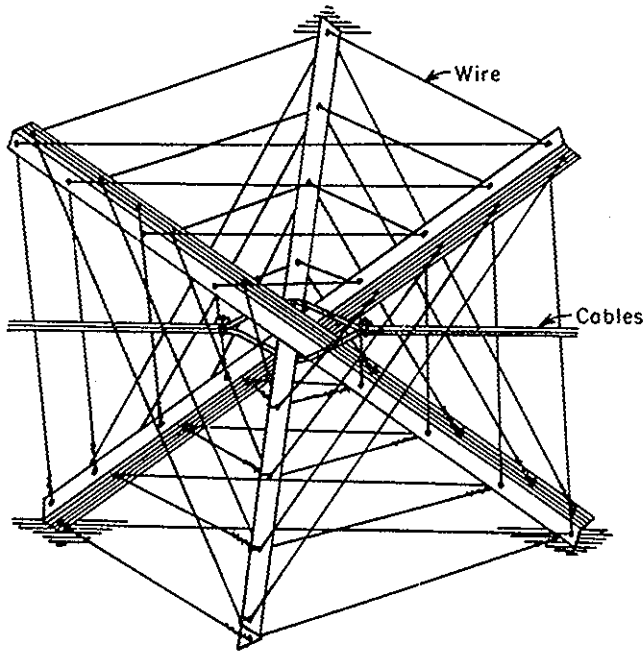
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J.P.S. Date: March 1974
 Drawn: D.J.E.



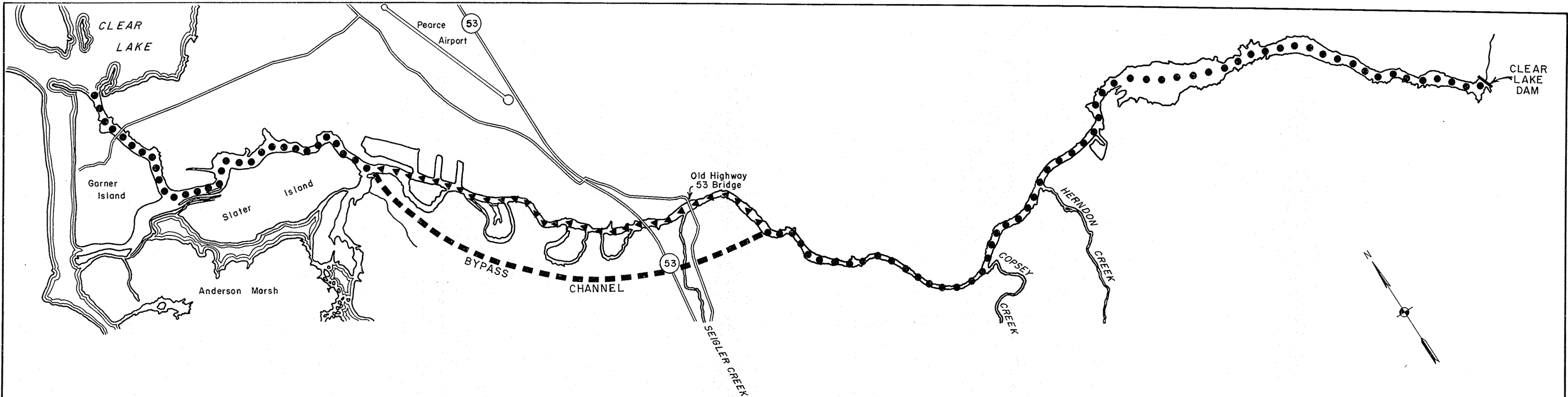
TYPICAL KELLNER JETTY FIELD

STANDARD UNIT KELLNER JACK



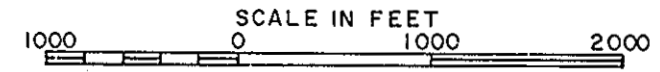
NOTES:

- (1) Unit is usually 16'x4"x4"x1/4" angle iron laced with No. 6 wire.
- (2) Cables are usually 3/4" ϕ .
- (3) Above unit is placed 12 1/2' on center.



- LEGEND**
- State highway
 - Local highway
 - Alternative 1
 - Alternative 2

- ALTERNATIVES**
1. Enlarge Clear Lake Outlet Channel
 2. Enlarge Clear Lake Outlet Channel and Bypass

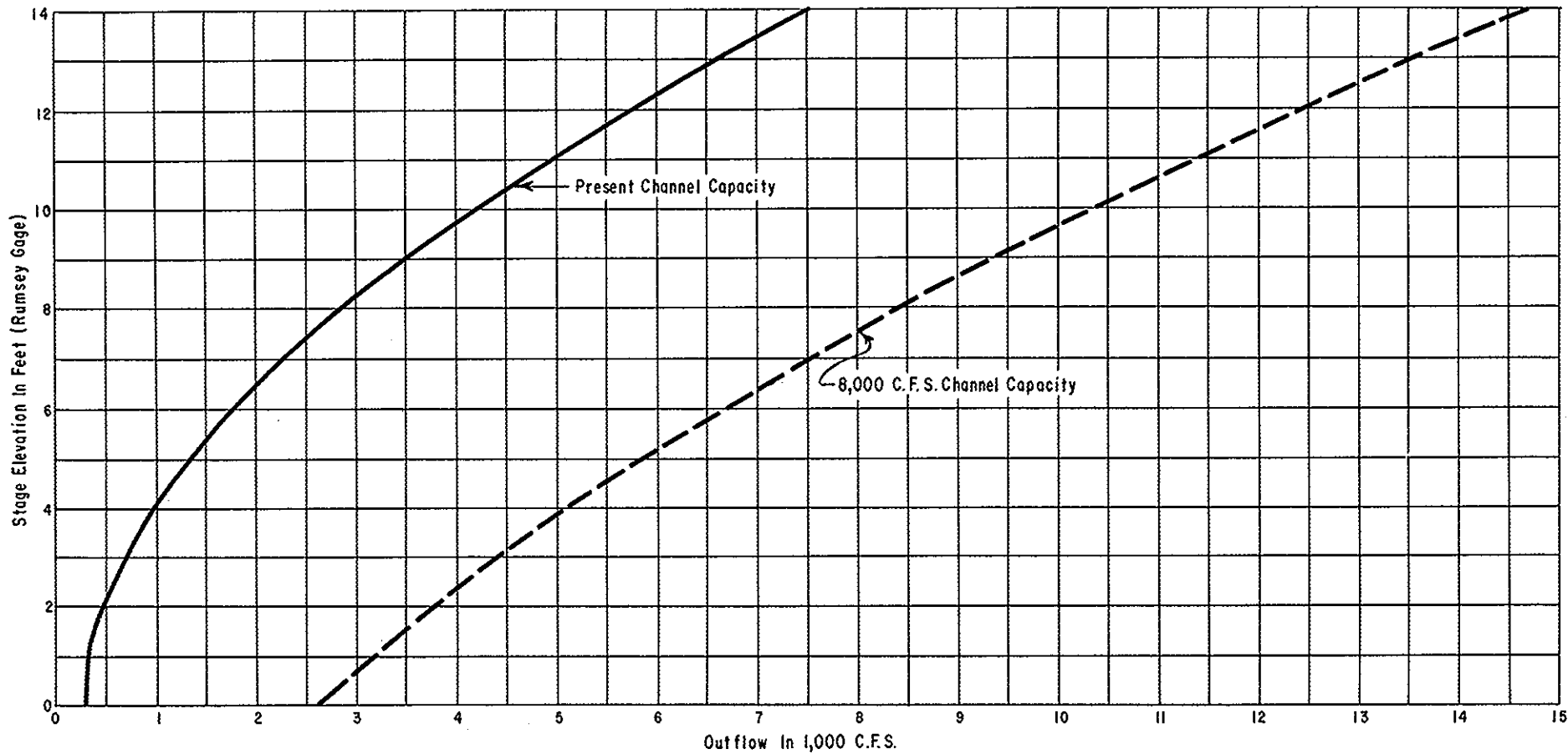


CACHE CREEK BASIN
CALIFORNIA

**CLEAR LAKE
OUTLET CHANNEL
ALTERNATIVES**

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J.P.S. Date: May 1975
Drawn:

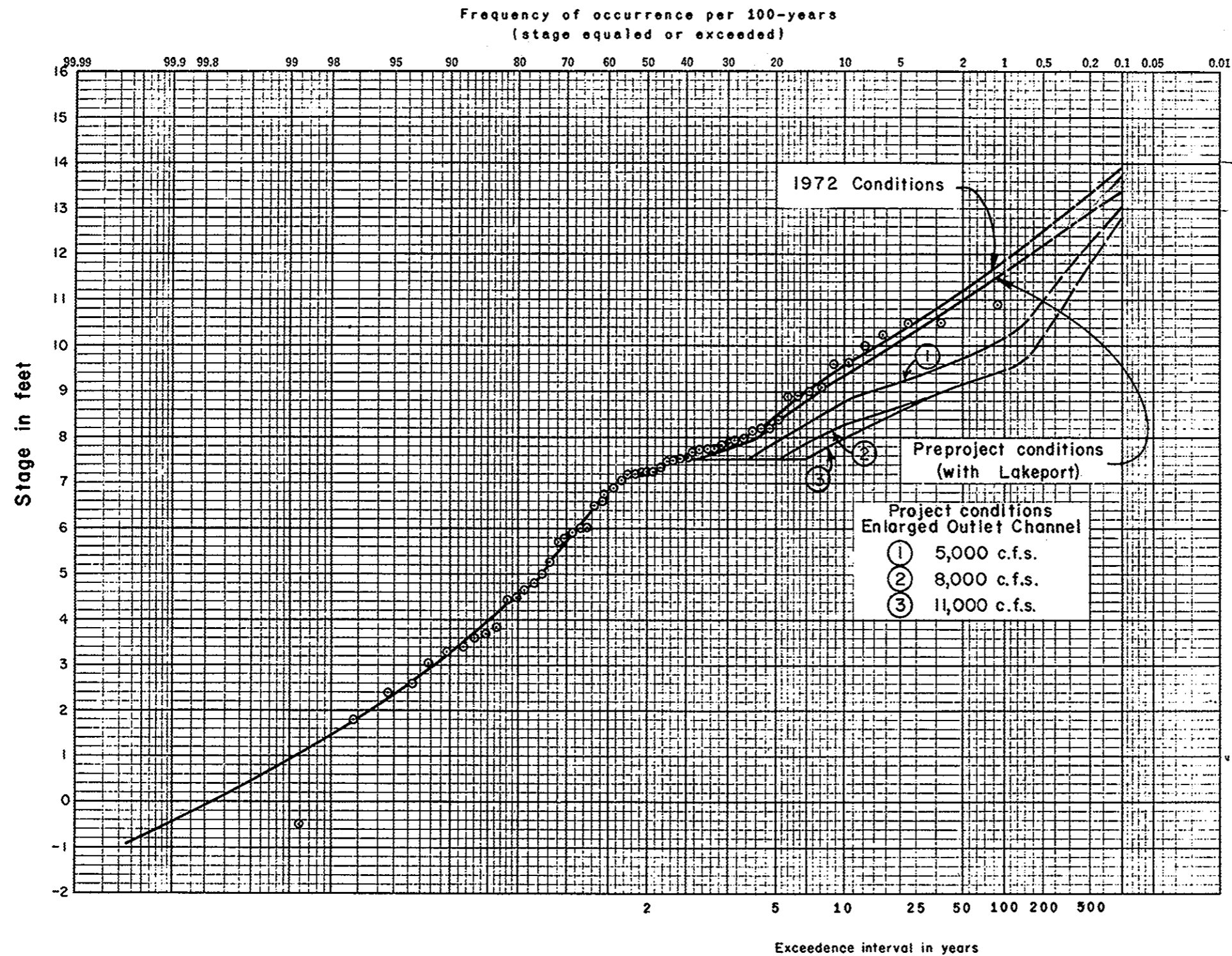


CACHE CREEK BASIN
CALIFORNIA

CLEAR LAKE OUTLET CHANNEL
RATING CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J. P. S. Date: May 1975
Drawn: D. J. E.



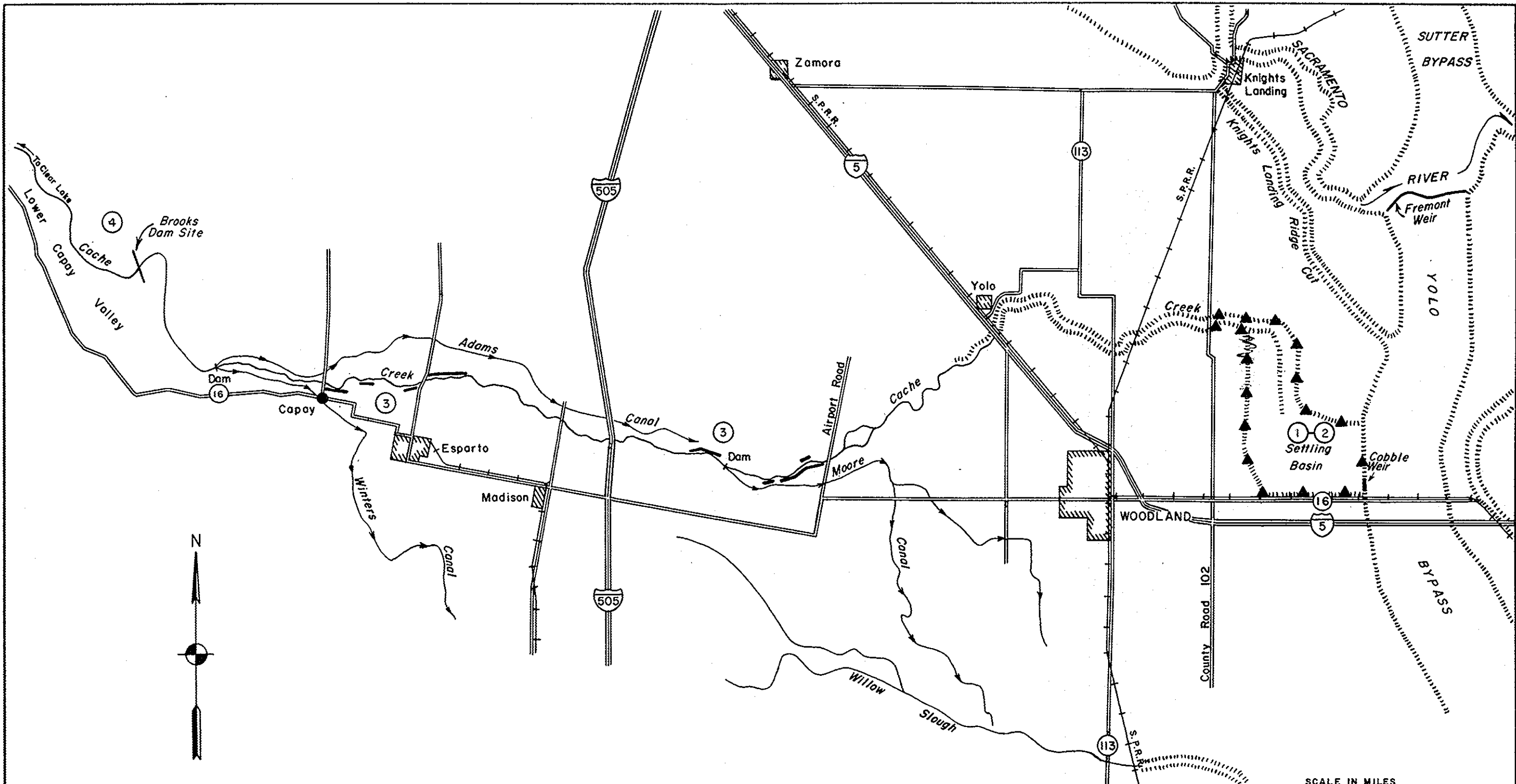
- Clear Lake was operated as follows:
- a. Control Capay to 21,000 c.f.s.
 - b. Release channel capacity when Capay is forecasted to be less than 21,000 c.f.s.
 - c. Release present channel capacity when Capay is forecast to be greater than 21,000 c.f.s.
 - d. Project conditions frequency curve at Capay will be the same as preproject curve.

CACHE CREEK BASIN
CALIFORNIA



CLEAR LAKE
STAGE FREQUENCY

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: M.E.V. Date: FEBRUARY 1974
Drawn: L.H.C.



ALTERNATIVE PLANS

- LEGEND**
-  Sediment Control and Bank Protection
 -  Raise Settling Basin Levees

- ① Raise Settling Basin Levees
- ② Excavate Settling Basin
- ③ Kellner Jetty System
- ④ Brooks Sediment Reservoir

CACHE CREEK BASIN
CALIFORNIA

**SEDIMENT CONTROL AND
BANK PROTECTION ALTERNATIVES**

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J.P.S. Date: March 1974
 Drawn: D.J.E.

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA,
IN AND FOR THE COUNTY OF MENDOCINO

M. M. GOPCEVIC, and THE HOTALING
ESTATE CO., a corporation, and
GEORGE T. RUDDICK,

Plaintiffs,

vs.

YOLO WATER AND POWER COMPANY,
a corporation, and YOLO WATER AND
POWER CORPORATION, a corporation,

Defendants,

COUNTY OF LAKE

and LISLE STUBBS et al,

Intervenor

DECREE

Pursuant to the stipulation of all parties herein reduced to writing and filed in open court on the 7th day of October, 1920, agreeing and consenting that the following judgment and decree be entered in the above entitled action, and upon evidence taken; and finding being waived in open court by all parties;

IT IS HEREBY ORDERED ADJUDGED AND DECREED AS FOLLOWS:

That the defendant herein be perpetually enjoined and restrained from excavating or deepening the outlet of Clear Lake, being the Clear Lake mentioned in the pleadings herein, to any depth greater than four feet below the zero mark on the Rumsey gauge at Lakeport, County of Lake, State of California, which said gage is hereinafter more particularly referred to; and from widening straightening or otherwise interfering with said outlet, except

as may be necessary to carry out the provisions of this decree, all of such work to be with the approval first obtained and under the supervision of the State Railroad Commission of California, or the members thereof; and this injunction shall include the said defendants, their and either of their, officers, agents, servants, employees successors and assigns, and each and all officers and agents of either of them, and all persons acting under or in aid of them or either of them.

That the agents, servants, employees, successors and assigns of the said defendants and the said defendants and each of them, and all persons acting under or in aid of them or either of them be perpetually enjoined and restrained from at any time, or in any way raising the level of said lake in excess of 7.56 feet above zero on said Rumsey Gauge, and from at any time or at any way lowering the level of said lake below zero on said Rumsey Gauge; provided, however, that the rise of said Clear Lake, by reason of storm or flood conditions beyond the control of said defendants, or either of them, to a level in excess of 7.56 feet above zero on said Rumsey Gauge, but in no event to a level in excess of 9.00 feet above zero on said Rumsey Gauge, for any period not exceeding ten successive days, shall not be deemed a violation hereof;

The zero mark on said Rumsey Gauge is 20.1 feet below center of large concrete star in northeast corner of court house yard at said Lakeport, and 21.56 feet below iron step at front entrance to Bank of Lake Building at southeast corner of Main Street and Second Street, in said Lakeport;

That said defendants, and each of them, their officers, agents, employees, successors and assigns and all persons acting

under or in aid of them or either of them, be perpetually enjoined and restrained from drawing off from said Clear Lake an amount of water which, inclusive of evaporation and other losses, will at any time reduce the level of said lake below zero on said Rumsey Gauge; and the said defendants, and each of them, their officers, agents, employees, successors and assigns, be perpetually enjoined and commanded to draw off from said lake an amount of water which, inclusive of evaporation and other losses will reduce the level of the lake so that the elevation thereof on the following dates shall not exceed the following percentages of the actual level on April 15th of each year;

May 1, 97%, June 1 89%, July 1, 79%, August 1, 69% and September 1, 58%.

That said defendants and each of them, their officers, agents, employees successors and assigns, be perpetually enjoined and restrained from drawing off from said lake, during the irrigation season an amount of water which, inclusive of evaporation and other losses shall lower the level of said lake more than two feet in any one month;

It is hereby specially adjudged and decreed that notwithstanding the limits of depression of said lake waters hereinabove described the said defendants, and each of them, their agents, employees, successors and assigns, shall not draw off or allow, and they and each of them are enjoined and restrained from drawing off or allowing the waters of said lake to flow out of said lake at any time at such a rate as that, taking into account evaporation and other losses, the water of said lake shall at the lowest level of any year be below zero on said Rumsey Gauge;

It is further adjudged and decreed that the said defendants, or either of them, shall at or about the specific dates last hereinabove mentioned, notify in writing, through the mails or otherwise, the parties hereto and as well such owners or occupants of land on the rim of said lake as shall register their names and addresses with the defendant, Yolo Water and Power Company, at its office in Woodland, Yolo County, California, of the then existing and respective levels of the said lake.

The drawing off of the water of said lake under the conditions aforesaid, shall be by and through the dam and gates mentioned in the pleadings herein, and the administration conduct and operation of said dam and gates shall be responsive to and in full and fair execution of such conditions, and shall at all times be by and under the State Railroad Commission of California, or the members thereof;

If at any time the injunctive provisions of this decree shall be violated, or departed from in matter of substance and all the provisions of this decree are for this purpose taken to be injunctive then and in such events the said defendants and each of them are hereby enjoined and commanded forthwith thereupon, in the manner and to the extent hereinafter provided, or in default thereof it shall be competent to the plaintiffs or any or either of them, or in default of action in the promises by the plaintiffs or any or either of them, it shall be competent to the interveners, or any or either of them, and said parties are accordingly hereby authorized, at the expense of defendants, their successors and assigns to restore and maintain at the "Grigsby Riffle" mentioned in the complaint herein, but above the present mouth of "Seigler Creek" a suitable and substantial structure or barrier, the crest of which shall not exceed one foot above zero₄ on said Rumsey Gauge except as hereinafter provided;

But it is further and specifically decreed that if at any time, for any physical reason, or otherwise, said dam should cease in any substantial sense, to function in respect to the operation of the same as hereinabove referred to, then and in that event the crest of the aforesaid structure or barrier may be increased and maintained to an elevation of two feet above zero on said Rumsey Gauge, said structure and barrier shall exist and be maintained at all times when a dam shall cease to function as provided in this decree for the operation of the same; provided however that the failure of the defendants or either of them to comply substantially with the terms of this decree, due to temporary, unavoidable causes shall not be deemed a violation of this decree;

It is further adjudged that this decree does not adjudicate upon the extent of the several riparian or littoral rights of any of the parties hereto in the said Clear Lake or the land adjacent thereto nor upon any rights or claims of any of said parties to water rights therein, nor in or over such adjacent lands, and that the injunctive relief hereby granted and provided for is not based upon a waiver by any of said parties of any such substantive rights or claims aforementioned but is subject to full reservations on the part of all and each of said parties of all said substantive rights or claims aforesaid

It is further ordered adjudged and decreed that the said dam and the operation thereof shall at all times be subject to reasonable access and inspection by the parties hereto as well as any person owning land riparian or littoral to said Clear Lake and their duly authorized agents or attorneys; but if any question should arise in respect to the right of any such person or persons to such access and inspection, the same shall be remitted to the state railroad commission of California, or the members thereof for final determination;

That all claims for damages involved in this action or on account of the issuance of the temporary restraining order or preliminary injunction herein are waived and adjudged to be fully settled;

That each party to this action shall pay his own costs.

The signing and filing of this decree shall be deemed to be noticed of the terms thereof and effective as service of any injunctive process consequent thereon.

Done in open Court the 7th day of October, 1920.

A. B. McKenzie

Judge.

CERTIFIED: October 7th, 1920, by the Clerk of said Court to be a full, true and correct copy of the original on file and of record in his office.

ENDORSED: Filed Oct. 7, 1920, HALE PRATHER, Clerk

By W. H. PRATHER, Deputy

RECORDED: October 8th, 1920, in Vol. 60 of Deeds, at page 49.
Records of Lake County, California

C. C. McDonald,
Attorney for Plaintiffs,
Woodland, California

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA,
IN AND FOR THE COUNTY OF YOLO.

MARY E. BEMMERLY AND AGNES H. BEMMERLY,
Plaintiffs,

vs.

THE COUNTY OF LAKE, a Political Subdivision of the State of California, E. L. HERRICK, W. E. REICHERT, L. D. KIRKPATRICK, L. L. BURGER AND J. S. KELSAY, as and comprising the Board of Supervisors of the County of Lake, State of California, THE BOARD OF SUPERVISORS OF THE COUNTY OF LAKE, STATE OF CALIFORNIA, E. L. HERRICK, individually and as a member of the Board of Supervisors of the County of Lake, State of California, FRANK W. NOEL, individually, W. E. REICHERT, as a member of the Board of Supervisors of the County of Lake, State of California, W. T. SMITH, individually, L. D. KIRKPATRICK, as a member of the Board of Supervisors of the County of Lake, State of California, L. L. BURGER, individually and as a member of the Board of Supervisors of the County of Lake, State of California, J. S. KELSAY, individually and as a member of the Board of Supervisors of the County of Lake, State of California, FRANK B. JOHNSON, individually and as a County Surveyor of the County of Lake, State of California, FRANK W. CLARK as Director of the Department of Public Works of the State of California, CLEAR LAKE WATER COMPANY, A CORPORATION, J. R. REEVES, JOHN DOE DREDGING COMPANY, RICHARD ROE DREDGING CO., FIRST DOE, SECOND ROE AND THIRD ROE,

No. 8812

Defendants.

J U D G M E N T

This cause having been regularly called and tried by the Court, and the findings of fact and conclusions of law, and the decision thereon in writing, having been rendered, wherein judgment was ordered in favor of the plaintiffs and against the defendants hereinafter named as prayed for in the complaint and for costs,

IT IS, BY THE COURT, ORDERED, ADJUDGED AND DECREED that the defendants, The County of Lake, a Political Subdivision of the State of California, E. L. Herrick, W. E. Reichert, L. D. Kirkpatrick, L. L. Burger and J. S. Kelsay, as and comprising the Board of Supervisors of the County of Lake, State of California, the Board of Supervisors of the County of Lake, State of California, E. L. Herrick, individually and as a member of the Board of Supervisors of the County of Lake, State of California, Frank W. Noel, individually, W. E. Reichert as a member of the Board of Supervisors of the County of Lake, State of California, W. T. Smith, individually, L. D. Kirkpatrick as a member of the Board of Supervisors of the County of Lake, State of California, L. L. Burger, individually and as a member of the Board of Supervisors of the County of Lake, State of California, J. S. Kelsay, Individually and as a member of the Board of Supervisors of the County of Lake, State of California, Frank B. Johnson, individually and as County Surveyor of the County of Lake, State of California, Frank W. Clark, as Director of the Department of Public Works of the State of California, and Clear Lake Water Company, a corporation, and each and all of them, and their, and each of their attorneys, agents, servants and employees and any and all persons acting under said defendants, or any of them, be, and they and each and all of them are hereby forever enjoined and restrained from in any manner widening, deepening or enlarging the arm or slough which constitutes the outlet of the waters of and from Clear Lake into Cache Creek and from in any manner changing the said outlet so as to increase the flow of waters of and from Clear Lake into Cache Creek. The Clear Lake herein referred to is the Clear Lake described in the plaintiffs' complaint and which is located in the County of Lake, State of California.

IT IS FURTHER ORDERED, ADJUDGED AND DECREED that plaintiffs
have judgment for their costs taxed at Dollars (\$).

Judgment rendered December 18th, 1940.

 /s/ Dal M. Lemmon
Judge of the Superior Court