State of California
The Resources Agency

Department of
Water Resources

California High Water 1982-83

Bulletin 69-83
July 1984

ON THE COVER: Levee break near Ve
on the San Joaquin River, downstrean
its confluence with the Stanislaus Ri
Southern San Joaquin County.

ERRATA

Two errors were discovered after printing Bulletin 69-83.
They are:

1. On page 37, the datum for the Sacramento River at Tehama Bridge should read 0 = -5.7 U.S.C. & G.S. Datum.

2. On page 57 the center right photo is of a levee break at Mildred Island, not Myrtle Island.

Department of
Water Resources

Bulletin 69-83

California High Water 1982-83

July 1984

Gordon K. Van Vleck
Secretary for Resources

The Resources Agency

George Deukmejian
Governor

State of California

David N. Kennedy
Director

Department of Water Resources

FOREWORD

Water year 1982-83 was indeed noteworthy, setting new records for precipitation and runoff in many California river basins. Bulletin 69-83, the sixteenth in a series of reports on high water in the State, presents information on storms, flooded areas, and flood damage during that banner year--October 1, 1982 through September 30, 1983. Much of the information for the bulletin was provided by the Department of Water Resources, the National Weather Service, the U. S. Bureau of Reclamation, and other public and private sources whose assistance we acknowledge gratefully.

In addition, the flood events of 1982-83 affected so many areas of California that a considerable amount of information had to be gleaned from news clippings from a wide variety of news services. Thus the text of Bulletin 69-83 is a digest that may overlook certain noteworthy events and perhaps may not give other events deserved coverage.

The tables and graphs in Bulletin 69-83 are from official sources and are considered reliable and accurate. Included are graphs showing weir overflow days and hydrographs of a number of streams and reservoirs. Of course, hydrologic data may be revised (usually the changes are minor) at a later date on the basis of subsequent studies and information. Therefore, all data should be considered as preliminary and subject to revision.

Additional information concerning specific events can be obtained from your local Office of Emergency Services and from city and county police departments.

David N. Kennedy, Director
Department of Water Resources
The Resources Agency
State of California

CONTENTS

CONTENTS (cont.)

FIGURES

CONTENTS (cont.)

TABLES

APPENDIX A

SACRAMENTO RIVER CREST AND WEIR OVERFLOW RECORDS (figures)

Copies of this bulletin at $5.00 each may be ordered from:
State of California
DEPARTMENT OF WATER RESOURCES
P.O. Box 388
Sacramento, California 95802
Make checks payable to STATE OF CALIFORNIA
California residents add sales tax.

STATE OF CALIFORNIA
George Deukmejian, Governor

THE RESOURCES AGENCY
Gordon K. Van Vleck, Secretary for Resources

DEPARTMENT OF WATER RESOURCES
David N. Kennedy, Director

Alex R. Cunningham Deputy Director	Howard H. Eastin Deputy Director	Robert E. Whiting Deputy Director

Salle S. Jantz
Assistant Director

Division of Flood Management

G. Donald Meixner . . . . Chief

This bulletin was prepared under the direction of

Donald H. Neudeck .Chief, Flood Operations Branch

by

Bill E. Clark* . . . . Retired
William J. Helms . . . . Water Resources Engineering Associate
William A. Mork . . . . Associate Meterologist, Water Resources

Assisted by

William B. Hansell . . . . Water Resources Technician II
Irene O'Hare. . . . . Secretary I
Millie Marion . . . . Senior Stenographer

Drafting under the direction of

Gayle Dowd. . . . . Water Resources Technician II

Editorial and production service by

Earl G. Bingham . . . . Research Writer

Word Processing by

Fran Letcher. Senior Word Processing Technician

*Returned after retirement in 1981 to produce the major portion of the text for this bulletin.

State of California
The Resources Agency
Department of Water Resources

CALIFORNIA WATER COMMISSION

ROY E. DODSON, Chairperson, San Diego
DANIEL M. DOOLEY, Vice Chairperson, Visalia

Stanley M. Barnes . . . . Visalia

Merrill R. Goodall . . . . Claremont

Martin A. Matich. . . . . .San Bernardino

Alexandra C. Stillman . . . . .Arcata

Jack Thomson. . . . . Bakersfield

Orville L. Abbott
Executive Officer and Chief Engineer

Tom Y. Fujimoto
Assistant Executive Officer

The California Water Commission serves as a policy advisory body to the Director of Water Resources on all California water resources matters. The nine-member citizen commission provides a water resources forum for the people of the State, acts as liaison between the legislative and executive branches of State Government, and coordinates Federal, State, and local water resources efforts.

FLOOD EVENTS OF WATER YEAR 1982-83

IT WAS A VERY WET YEAR! In terms of precipitation amounts, runoff volumes, and the geographical extent of flood damage, water year 1982-83 was unparalleled in California's recorded history. Many paragraphs have been written about California's wettest winter in more than a century. Old superlatives have been dusted off and new ones coined to better describe the tragedy, damage, and trauma associated with the State's latest "unusual" weather experience.

California's climate has often been described as variable, inconsistent, and unpredictable. The meteorological events of the last few years give additional credence to those observations. The two extremes of weather patterns -- the record back-to-back dry years of 1976-77 and the all-time record of consecutive wet water years, 1981-82 and 1982-83 -- have now been recorded in less than a single decade!

Normally, California can expect from four to five major storms to track across the State during the five-month period, November through March. The north and central portions usually receive the lion's share of this bounty, which is captured in storage reservoirs and ground water aquifers to be drawn on where and when needed. The economy of the State depends primarily on the winter rains and an ample snowpack to replenish surface and ground water supplies, which are heavily taxed during the characteristically hot summer months.

Some flooding can be expected as a result of the winter storms and ensuing runoff, but it is generally limited to low-lying or flood-prone areas. The extent of flood damage generally relates to the intensity and, in particular, the timing of the storms. The weather systems of 1982-83, however, did not follow the usual script. The storms came early, originated in various quarters of the Pacific, and persisted until early May with only short reprieves.

The stage for a disastrous year of flooding was set even before the 1982-83 water year began. In some parts of California, September 1982 (the close of the 1981-82 water year) was one of the wettest Septembers of record. Subtropical moisture from Hurricane Olivia--which produced unusually heavy rains in the central and southern Sierra--combined with the well-above-average carryover from the very wet 1981-82 water year to infringe on the flood-reservation space in many flood-control reservoirs, and soils became so saturated that the heavy runoff from ensuing storms posed an immediate flood threat. The combination of heavy runoff and wet soils contributed heavily to the unusual events that were to follow.

Few areas of the State escaped the wrath of the 1982-83 storms. Forty-five of California's 58 counties were declared national disaster areas (see Figure 1). Record rainfall was documented at numerous stations throughout the breadth and span of the State. On May 3, 1983, snow water content in the Sierra exceeded 230 percent of normal, and the ensuing runoff resulted in approximately four times the average volume for central valley streams. The persistent and often torrential rains were at times associated with gale-force winds (50-84 mph), which created 20-25 foot waves in the tempestuous Pacific and battered the California coast from Fort Bragg to San Diego.

Landslides of monumental proportions were widespread and long-term road closures due to slides, washouts, and avalanche threat brought financial hardship to local businesses and inconvenience to

Figure 1. COUNTIES PROCLAIMED EMERGENCY AREAS

PUBLIC LAW 93-288

Figure 1. (Continued)

COUNTY	STATE	FEDERAL		
	GOVERNOR'S PROCLAMATION	PL 93-288 PRIVATE ASSISTANCE	U.S.D.A. AGRICULTURAL ASSISTANCE	PL 93-288 PUBLIC ASSISTANCE
NORTH COAST				
DEL NORTE	X	APR. 1, 1983	MAR 23, 1983	MAR. 23, 1983
HUMBOLDT	X	APR 1, 1983	APR 1, 1983	APR 11, 1983
MENDOCINO	X	* FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
NO SAN FRANCISCO BAY				
SONOMA	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
NAPA	X	MAR 21, 1983	MAR 21, 1983	MAR 23, 1983
SOLANO	X	* MAR. 16, 1983	FEB 11, 1983	FEB 11, 1983
MARIN	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
SO SAN FRANCISCO BAY				
CONTRA COSTA	X	* FEB 9, 1983	FEB 9, 1983	FEB 11, MAR 23, 1983
ALAMEDA	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
SAN MATEO	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
SANTA CLARA	X	FEB 9, 1983	FEB 9, 1983	FEB 25, 1983
SANTA CRUZ	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
MONTEREY	X	FEB 14, 1983	FEB 11, 1983	FEB 11, 1983
SAN BENITO	X	* FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
SACRAMENTO VALLEY				
TRINITY	X	* MAR 16, 1983	FEB 11, 1983	FEB 11, 1983
SHASTA	X	MAR 11, 1983	MAR 11, 1983	MAR 23, 1983
TEHAMA	X	MAR 4, 1983	MAR 4, 1983	MAR 23, 1983
COLUSA	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
GLENN	X	MAR 4, 1983	MAR 4, 1983	MAR 23, 1983
BUTTE	X	MAR 4, 1983	MAR 4, 1983	
SUTTER	X	MAR 4, 1983	MAR 4, 1983	MAR 23, 1983
YUBA	X	* MAR 28, 1983	MAR 28, 1983	
YOLO	X	* MAR 11, 1983	FEB 25, 1983	FEB 25, 1983
LAKE	X	* FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
NEVADA	X			
PLACER	X	MAR 21, 1983	MAR 21, 1983	
SACRAMENTO	X	MAR 29, 1983	FEB 22, 1983	** FEB 22, 1983
SAN JOAQUIN VALLEY				
SAN JOAQUIN	X	MAR 28, 1983	FEB 22, 1983	FEB 11, MAR 23, 1983
STANISLAUS	X	MAR 21, 1983	MAR 21, 1983	JUN 3, 1983
MERCED	X	* MAR 21, 1983	MAR 21, 1983	MAR 23, 1983
MARIPOSA	X		JUN 3, 1983	JUN 3, 1983
MADERA	X	MAR 21, 1983	MAR 21, 1983	
FRESNO	X	* MAR 30, 1983	MAR 30, 1983	JUN 3, 1983
KINGS	X	MAR 4, 1983	MAR 4, 1983	MAR 23, 1983
TULARE	X	MAR 21, 1983	MAR 21, 1983	JUN 3, 1983
KERN	X	MAR 4, 1983	MAR 4, 1983	MAR 23, 1983
SOUTHERN CALIFORNIA				
SAN LUIS OBISPO	X	* FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
SANTA BARBARA	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
VENTURA	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
LOS ANGELES	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
ORANGE	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
SAN DIEGO	X	FEB 9, 1983	FEB 9, 1983	FEB 11, 1983
RIVERSIDE	X	* MAR 16, 1983	MAR 16, 1983	JUN 3, 1983
SAN BERNARDINO	X	* MAR 4, 1983	MAR 4, 1983	JUN 3, 1983
IMPERIAL	X			
TOTALS	**45**	**42**	**43**	**39**

* Declared as an adjacent county

** Declared only for those portions of the county located within the Sacramento–San Joaquin Delta thousands of citizens. Agricultural losses due to the flooding, seepage, saturated soils, and delayed planting reached nearly 1/4-billion dollars (approximately one half of all of the flood damage reported). Nature's awesome display of force was capped by at least two tornadoes (a rarity in California) in the Los Angeles area that left a path of destruction and death. In addition, there was a notable increase in wind velocity, intensity, and range of California's typical thunderstorms. Some of the 1982-83 variety of "gully washers" contributed significantly to the State's high death, injury, and property damage totals.

It could have been much worse!

Considering the meteorological events of the past winter, including all of the broken and near-broken precipitation and runoff records, the obvious question becomes: "How was the total damage held to a proportionately low figure (below $600 million)?" Probably the most significant factor contributing to this seeming triumph over the elements was that the storms were spread over a 9-month period (there were 8 consecutive months of above-normal precipitation). Had these unusually strong storm systems been confined to the normal four- or five-month rainy season, the consequences obviously would have been much more serious.

There was, of course, a little bit of luck: Recall the termination of the rainfall and the unseasonably cool temperatures during the peak of the snowmelt period in the southern Sierra Nevada, which moderated the melt and possibly averted disastrous flooding in the San Joaquin Valley.

There is no question that the various entities involved achieved some degree of success in managing the 1982-83 flood fight, but before resting on our laurels, we must realize that, although man's ability to manage the extremes of the elements is sometimes successful, Nature bats last!

Preliminary estimates of storm damage for the 1982-83 water year provided by the Office of Emergency Services (OES) indicate that 8,382 homes were damaged and destroyed ($106,300,000), 793 businesses were damaged and destroyed ($52,350,000) and agricultural losses totaled $213,800,000. Damage to public roads and facilities plus the cost of emergency measures totaled approximately $152 million. Total public and private damage may exceed the $524 million reported to date.

WEATHER PATTERNS OF 1982-83

In California, we ordinarily look toward the Aleutian Islands or the Bering Strait for clues to our winter weather. Every few years, however, our weather is influenced significantly by unusual rises in the ocean temperatures and reversals in the wind patterns along the equator in the South Pacific. These events are now called "El Nino / Southern Oscillation" (ENSO) episodes and are spaced two to ten years apart.

The ENSO episode of 1982-83 was probably the most severe of this century with direct effects, including the devastating hurricanes in French Polynesia, record rainfall in Ecuador and northern Peru, and disruption of marine life and the fishing industry. Figure 2 shows the extreme sea surface temperature anomolies in January 1983; in April 1983, sea surface temperatures reached 86° off the coast of Peru.

The ENSO impact on California weather was complex and indirect. Heat from the warm ocean water intensified the Pacific high pressure ridge between 10° and 20° north latitude. At the same time, air pressure over the Gulf of Alaska reached levels so very low they are unlikely to reoccur for another century. A massive

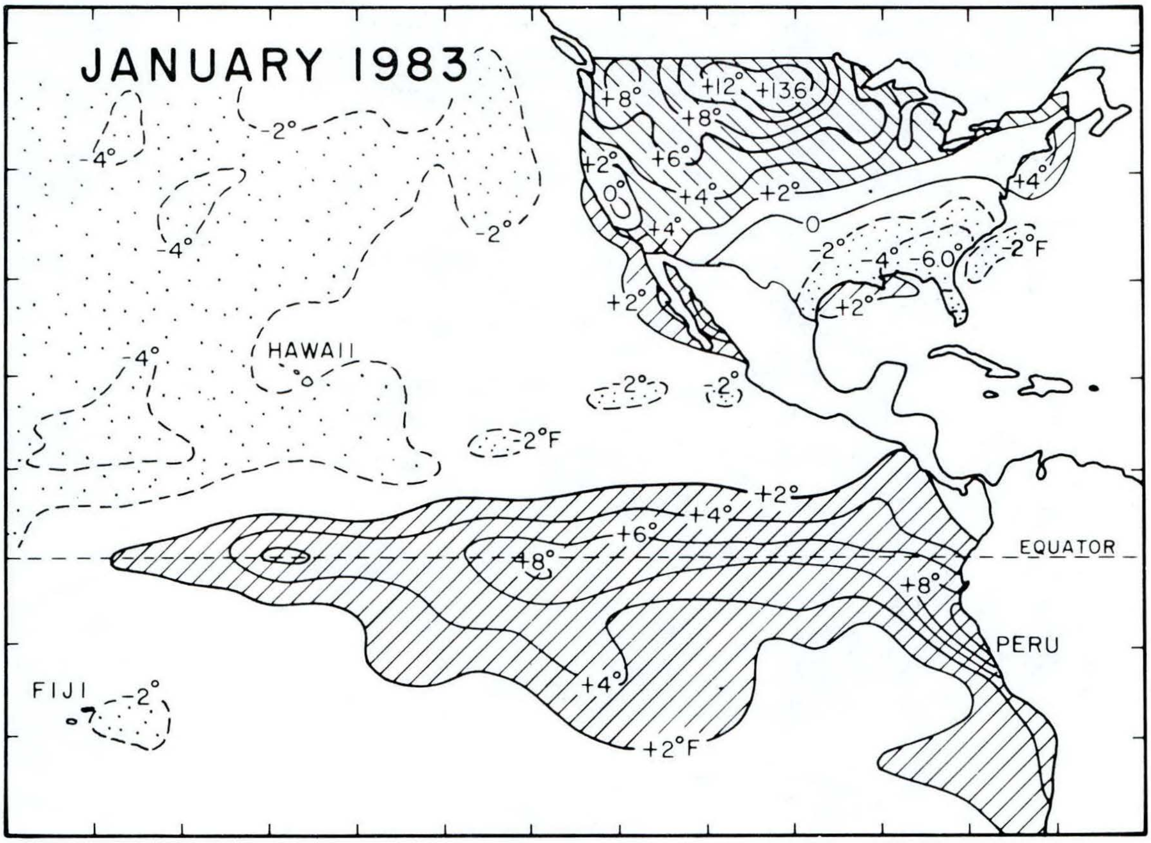


Figure 2. Anomaly of sea-surface and air temperature contoured at intervals of 2°F. Areas of +2°F or greater are hatched, while those of -2°F or less are stippled. (From NOAA publication Storm Data, January 1983.)

squeeze play developed between the areas of contrasting pressure extremes, and the speed of the westerly flow of air across the Pacific was doubled. The familiar jet stream that guides storms into California was intensified and displaced to the south so that storms were hitting the Central California coast more viciously and more often. Storms were also made more violent by release of energy from abnormally warm coastal waters.

Water year 1983 will go down as one of the wettest this century in California, with statewide precipitation averaging 190 percent of normal and in many areas well over 220 percent. In fact, the last two water years are the wettest pair of years on record. Seasonal precipitation for the water year is depicted in Figure 3. New records for water year 1982-83 were set at 49 locations and are listed in Figure 4; 12 of these superseded records just set in water year 1982. The snowpack in water year 1983 was one of the largest on record for the Sierra Nevada; new seasonal accumulation records were set at three-fourths of the snow courses measured. The seasonal total of 796 inches of snow at Norden, near Donner Pass, was exceeded only by the 819 inches in water year 1938; the Southern Pacific Railroad began keeping records more than 100 years ago at Norden.

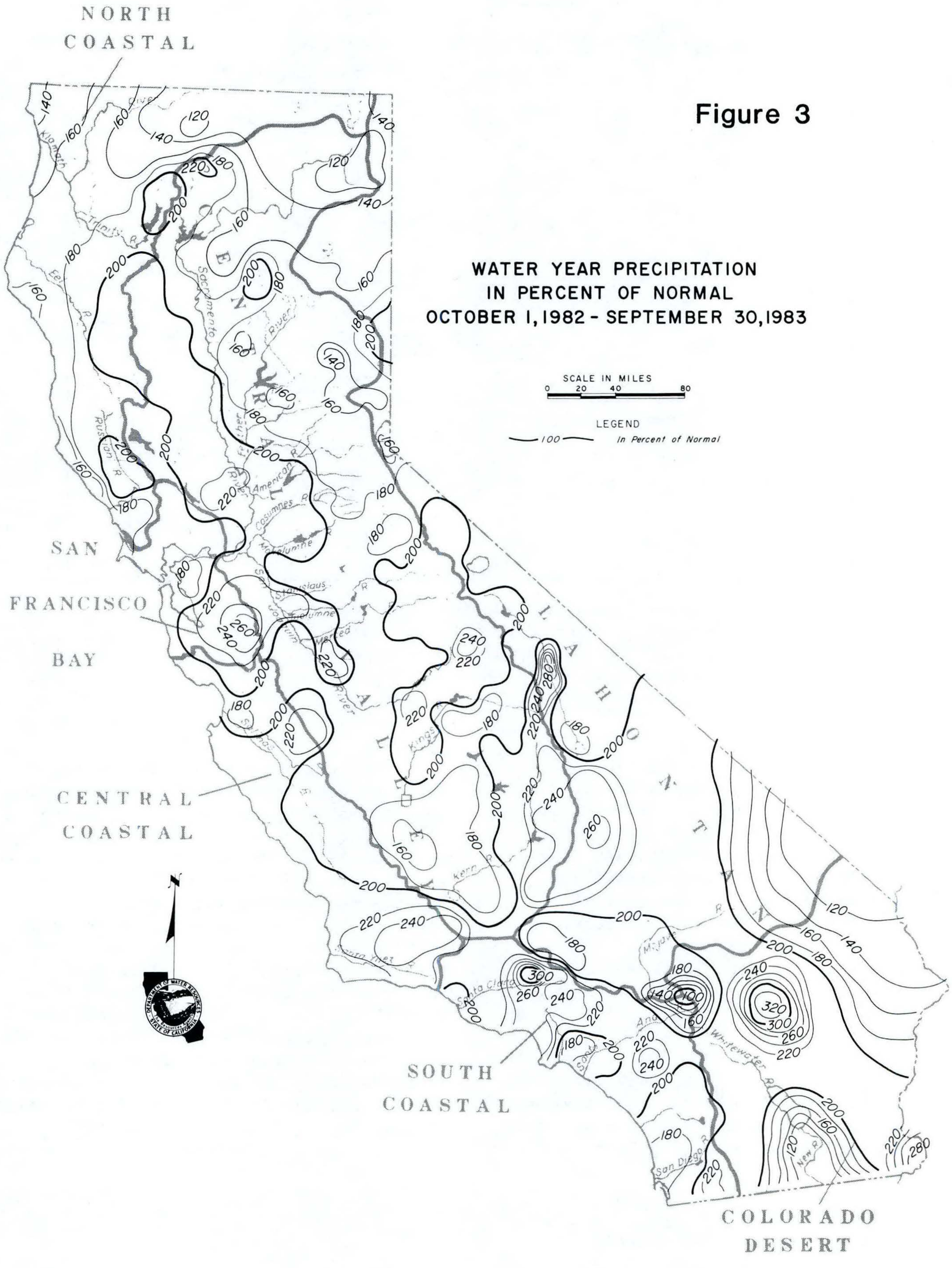


Figure 3

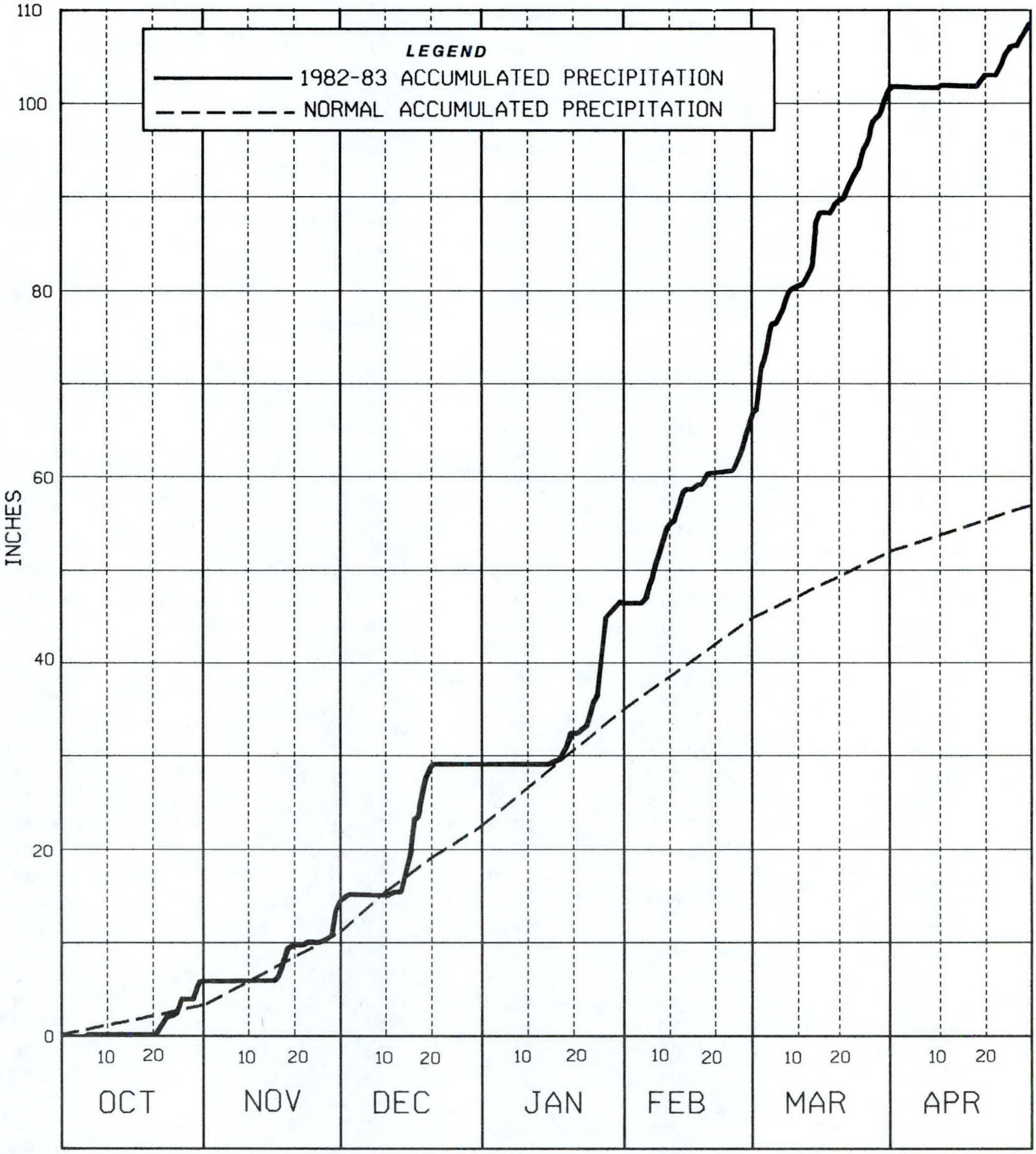
WATER YEAR PRECIPITATION IN PERCENT OF NORMAL OCTOBER 1, 1982 - SEPTEMBER 30, 1983

Figure 4.
RECORD HIGH PRECIPITATION FOR WATER YEAR 1982-83

STATION	RECORD BEGAN	MEAN	PREVIOUS MAXIMUM	YEAR	1983
Antioch	1879	12.85	25.75	1958	27.09
Auburn	1871	33.72	61.50	1982	63.79
Calaveras BT	1930	52.76	97.67	1982	100.25
Canyon Dam	1908	37.00	64.78	1938	66.81
Caribou PH	1921	39.95	66.83	1938	66.83
Chester	1911	30.92	51.66	1956	56.61
Claremont PC	1891	17.90	39.62	1978	41.22
Cobb	1924	63.52	112.54	1938	126.92
Crain Valley PH	1904	39.85	73.91	1978	81.64
Electra PH	1904	29.99	53.84	1982	56.39
Ellery Lake	1925	25.12	41.68	1982	48.94
Florence Lake	1927	21.62	41.70	1982	49.20
Folsom	1872	23.31	44.44	1890	47.64
Fort Bragg	1895	38.00	60.32	1942	62.11
Fresno	1878	9.71	23.06	1969	23.59
Gerber Ranch	1913	18.13	32.15	1982	42.58
Gilroy	1875	20.23	38.44	1890	38.76
Glennville	1910	18.11	32.82	1969	38.45
Graton	1896	41.67	67.41	1941	75.22
Healdsburg	1877	40.54	72.65	1890	83.26
Hetch Hetchy	1911	34.25	60.32	1982	72.40
Hollister 2	1895	13.02	23.66	1907	27.22
Huntington Lake	1913	34.43	72.10	1982	83.30
Knights Ferry	1906	17.68	29.52	1969	33.69
Lakeport	1901	28.82	48.12	1958	54.12
Livermore	1872	14.47	29.86	1890	33.98
Lodi	1889	16.91	34.44	1890	35.08
Los Banos	1874	8.50	16.66	1978	18.73
Mariposa	1893	29.67	56.61	1901	58.05
McCloud	1911	48.11	86.10	1941	90.68
Mount Wilson	1941	34.71	79.67	1978	95.32
Napa	1893	23.82	48.29	1890	50.24
Orleans	1904	50.12	83.49	1904	85.31
Pasadena	1882	20.24	46.41	1941	48.73
Rio Vista	1894	16.43	28.41	1958	31.49
Sacramento	1850	18.03	36.35	1853	36.57
Salt Springs PH	1929	44.40	76.18	1982	82.91
Shasta Dam	1944	61.92	98.07	1958	115.62
Stockton	1868	14.35	28.81	1982	30.31
Tehachapi	1877	10.86	20.63	1886	28.48
Tiger Creek PH	1907	44.70	77.05	1982	78.89
Tracy Carbona	1935	11.39	17.86	1967	21.29
Turlock	1893	11.75	20.74	1969	24.50
Ukiah	1877	36.27	60.97	1890	68.06
Weaverville	1870	38.38	67.40	1904	68.29
Whiskeytown	1960	61.51	99.52	1974	122.41
Wofford Heights	1895	10.40	24.36	1978	28.83
Woodland	1872	17.89	35.68	1982	38.39
Yosemite	1904	35.26	61.09	1938	66.39

Figure 5. ACCUMULATED PRECIPITATION AT SHASTA DAM UPPER SACRAMENTO RIVER BASIN

OCTOBER 1, 1982 TO APRIL 30, 1983



NOTE:
ELEVATION OF STATION 1076 FEET

Table 1 summarizes the precipitation in percent of normal for three important runoff regions of the State. The north includes the drainage basins of the Upper Sacramento and Feather Rivers; the central covers the area from the Yuba to the Merced River; and the south includes the area from the Upper San Joaquin to the Kern River.

Table 1. Percent of Normal Precipiation

Season	North	Central	South
Fall 1982 (Sept, Oct, Nov)	162	236	318
Winter 1983 (Dec, Jan, Feb)	150	144	183
Spring 1983 (Mar, Apr, May)	221	199	199

The wetness of the water year is illustrated by a plot in Figure 5 of the accumulated precipitation at Shasta Dam in the Upper Sacramento River basin. The steep portions of the curve are during storm periods when the accumulations rose rapidly. The October through April accumulation was 108.64 inches (192 percent of normal). The water year total was a record 115.62 inches.

September—December 1982

September 1982 was the first of eight consecutive months of above-normal precipitation in California. It was a record or near record wet September in much of Central and Northern California. But the most unusual weather of the month occurred in the southern Sierra Nevada, when heavy rains were triggered by subtropical moisture from the remnants of Hurricane Olivia. In the upper Kings and San Joaquin basins, storm totals for September 24-26 reached 8.09 inches at Wishon Reservoir, 7.08 inches at Kaiser Point, 5.50 inches at Huntington Lake (September normal of 0.86 inches), and 4.94 inches at Balch (September normal of 0.40 inches). This heavy rain pattern spilled over to the east side of the Sierra Nevada and caused flash flooding on Bishop Creek and its tributaries; Bishop Creek flows exceeded the 100-year expectations.

California enjoyed fair skies and above normal temperatures from October 5 through 15. By October 20, the dominant ridge of high pressure had broken down and was replaced by a large trough of low pressure near 140°W. As this trough moved slowly east, it induced a strong flow of moist, subtropical air from near Hawaii and produced heavy rainfall in Northern and Central California on October 21-26. On the North Coast, storm totals exceeded 8 inches at Honeydew (Mattole River basin) and 7 inches at Gasquet (Smith River basin). In the Sierra Nevada, 8 inches fell at Bucks Lake (Feather River basin), Blue Canyon (American River basin), and Calaveras Big Trees (Stanislaus River basin).

Additional copious rains occurred on October 29-30 with local totals of 4 inches on the North Coast and 2 inches in the Sierra Nevada. Most locations in Central and Northern California far exceeded their October normals; Blue Canyon doubled its normal with 10.05 inches and Huntington Lake quadrupled its normal with 7.20 inches.

A storm from the Gulf of Alaska moved into California on November 8-9, producing the season's first significant Sierra Nevada snowfall and the first good rains for Southern California. About a foot of snow fell at 7,000 feet from Donner Summit to Grant Grove. Rainfall totals in the southland ranged from an inch at San Diego to 3 inches at Santa Barbara. Following a period of record cool, foggy days in the Central Valley November 10-16, several windy and wet Pacific storms moved through California between November 17 and the 30th. The first of these storms (November 17-19) brought 5 inches of rain to many North Coast and Sierra Nevada locations, with 9.3 inches at Honeydew the greatest; that storm also brought 2-5 feet of snow above 7,000 feet. By the end of November, 73 inches of snow covered the ground at Norden.

The most intense and damaging storm of November was born in the Gulf of Alaska and produced wind gusts of 60-80 mph in many exposed locations from San Francisco southward to Los Angeles on November 30. A record low barometric pressure for November of 29.22 inches was recorded at Sacramento on the morning of November 30. That low pressure, the strong west winds, heavy Delta inflows and peak seasonal tides all combined to produce a record-tying high tide at Rio Vista of 9.8 feet at 2:30 p.m. At 5 p.m., a major levee break occurred at Venice Island, and inundation of the island was complete by the next day.

In the Los Angeles area, some 900 trees were downed by the wind, causing widespread power outages. Beach erosion was extensive along the central and south coasts. In the Sierra Nevada, a wild storm on November 29-30 dumped 2-6 feet of snow in less than 30 hours with 50-70 mph wind gusts. Precipitation totals exceeded 5 inches in the storm at many mountain locations in the Sierra Nevada, Southern California, and on the North Coast during the last three days of November. The heaviest totals were 10.32 inches at Willits (Russian River basin) and 8.70 inches at Georgetown (American River basin).

A wet November helped make it the wettest fall season (September, October, November) on record at Calaveras Big Trees, Huntington Lake, and Grant Grove; previous records were set in 1950. When long-term records are examined, fall 1982 will stand as the wettest since 1885 in all of the Sierra basins south of the Merced River.

On December 8-9, moderate to heavy rains fell in eastern San Diego and western Imperial Counties, causing general flooding in the area. The heaviest rains were at Ocotillo with 5.79 inches. Elsewhere in California, December was relatively quiet until a series of Pacific storms on December 13-17 brought very heavy rains to the North Coast and Upper Sacramento River basin. Notable storm totals were 22.1 inches at Honeydew, 11.0 inches at Gasquet, and 7.3 inches at Shasta Dam.

A new series of storms began on the North Coast on December 19 and reached the Sacramento area on December 20. By December 22, the third and final storm of this latest series was battering Central and Northern California with heavy rains and high winds. A record low December barometric pressure was set at Sacramento on December 22 with 29.24 inches at 3:45 p.m. Following passage of this deep low-pressure center, westerly winds gusted to 92 mph at Mt. Tamalpais in Marin County and 70 mph at the Golden Gate Bridge; the bridge was closed for about two hours for only the third time ever. Wind gusts of 90 mph knocked over six electric towers near Tracy, cutting off power to 1.2 million customers in California.

Storm totals for December 19-22 included 11 inches at Honeydew, 15 inches at Mining Ridge (near Big Sur at 4,760 feet elevation), 13 inches at Strawberry (Feather River basin), and 10 inches at Peckinpah Point (San Joaquin River basin). Norden received 7 feet of new snow and the snow depth reached 130 inches on December 23. With only a 1-inch storm total at Los Angeles and nothing during the rest of December, it was a relatively dry month for Southern California.

January 1983

A strong ridge of high pressure dominated the weather scene the first half of January and had many meterologists wondering if the wet winter had run its course. Clear skies on the coast and fog in the Central Valley were daily occurrences. This pattern peaked on January 10 with a record 71° at Eureka, a national high of 87° at Long Beach, and highs only in the low 40s in the San Joaquin Valley. By January 15, however, the ridge had broken down and Pacific storms began to move into Northern California, with the storm track expanding to include Southern California by January 19.

From January 22-29, a relentless series of storms deepened in the eastern Pacific and roared through California with heavy rain and snow, high winds, and massive waves and surf along the coast. January 22-23 and January 26-27 marked passage of the most damaging storms. Figure 6 illustrates three of these major storms via satellite imagery. On January 26-27, wind gusts to 69 mph hit Point Arena while 30-foot waves pounded the Central and North Coasts. Storm totals of 6 inches were common along the North Coast and in the Upper Sacramento River basin. However, the greatest storm totals for January 26-27 included 11 inches at Honeydew, 9.46 inches at Brandy Creek (Sacramento River basin), and 10 inches at Mining Ridge. Del Norte County suffered its worst coastal flooding since a Tsunami struck Crescent City in 1964.

Damage from high tides and 16-foot waves was heavy in Southern California. Rain in the southland during January 22-29 exceeded 8 inches at Santa Barbara and 12 inches at Mount Wilson, with 4.03 inches falling on January 27. In the Sierra Nevada on January 26-27, Lake Tahoe was nearly immobilized with 4 feet of new snow. Snow depths at Norden ranged from 72 inches on the 18th to 152 inches at the end of January.

As in the last half of January, an unusually large number of cyclones formed in the North Pacific and lashed California with frequent high winds and heavy precipitation during February and March. In most areas, February was wetter than January; the statewide average was 190 percent of normal, with some locations over 300 percent.

March was the wettest month of the water year, with statewide precipitation almost three times normal and in some locations more than 700 percent of normal. As an example of storm persistency, Pit River Powerhouse No. 5 had only two days without precipitation in March. Precipitation records for March were set at Whiskeytown Lake (39.62 in.), Shasta Dam (34.55 in.), Trinity Dam (15.01 in.), Folsom Dam (11.34 in.), Huntington Lake (15.90 in.), San Francisco (9.04 in.), Woodland (8.92 in.), Tehachapi (11.63 in. - 705 percent of normal), and Mt. Wilson (25.15 in.).

February—March 1983

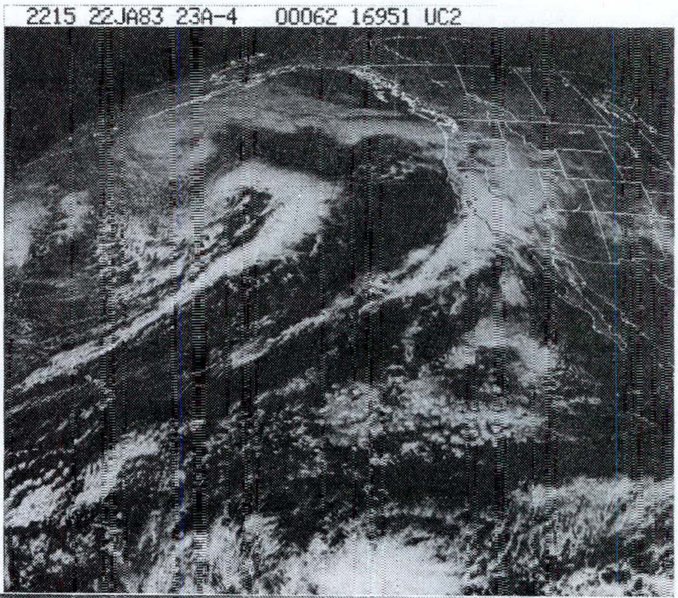
There were several periods of storminess in February, but none compare to the scope and duration of the storm that began on February 25, producing heavy precipitation through March 3 across most of California. A strong flow of moist air from the southwest began producing heavy precipitation on February 25 as the first in a series of frontal systems moved through California.

By February 28, a 972 millibar (28.70 inches) low-pressure center had developed at 38°N, 139°W, or about 800 miles west of San Francisco. The storm center drifted slowly east to a point 300 miles west of San Francisco by the morning of March 3 with the central pressure at 987 mb (29.15 in.). This huge vertically stacked cyclone directed a deep flow of moist, unstable air across California through March 3, with the system filling rapidly and moving inland on March 4. Figure 7 shows a three-day series of satellite pictures of the storm.

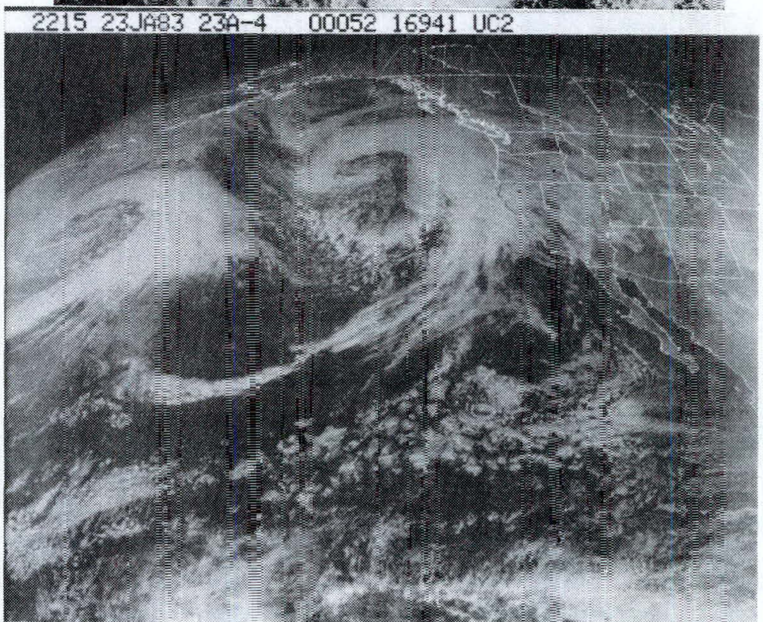
With the snow line between 4,000 and 5,000 feet, the Sierra Nevada was buried with snow; Norden received 80 inches during the storm. In Southern California, Los Angeles County storm totals included Mt. Wilson (5,709-foot elevation), with 25.61 in., and Buckhorn Flats (6,658-foot elevation) more than 30 inches, with 21.07 in. on March 1-2.

Storm totals elsewhere included 28 in.

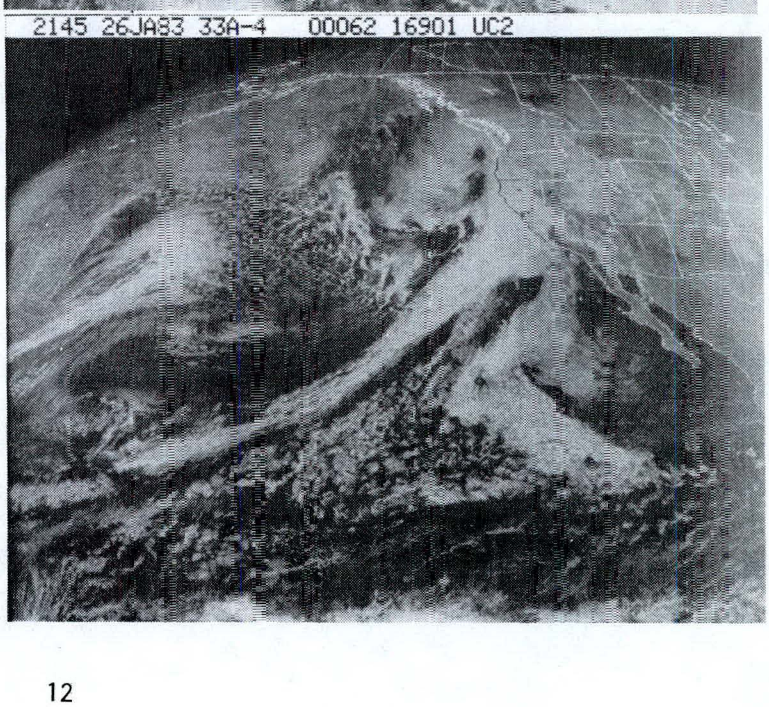
Figure 6



January 22, 1983, 2215 GMT (1415 PST) from GOES WEST. This visual depiction shows a strong cold front with heavy rain moving through Central California and into Southern California, where Santa Barbara received 3 inches of rain. Meanwhile, a new storm was developing near 140°W.



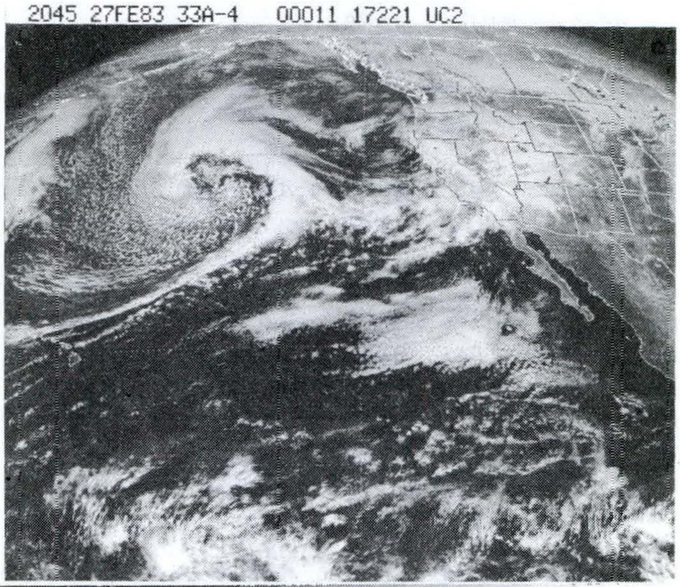
January 23, 1983, 2215 GMT (1415 PST) from GOES WEST. The new storm has intensified and moved rapidly into Northern California, producing rains of 2 to 4 inches at lower elevations and snows of 2 feet in the Sierra Nevada. The next storm in the series is very large and deep, and can be seen along 40°N, between 150° and 170°W.



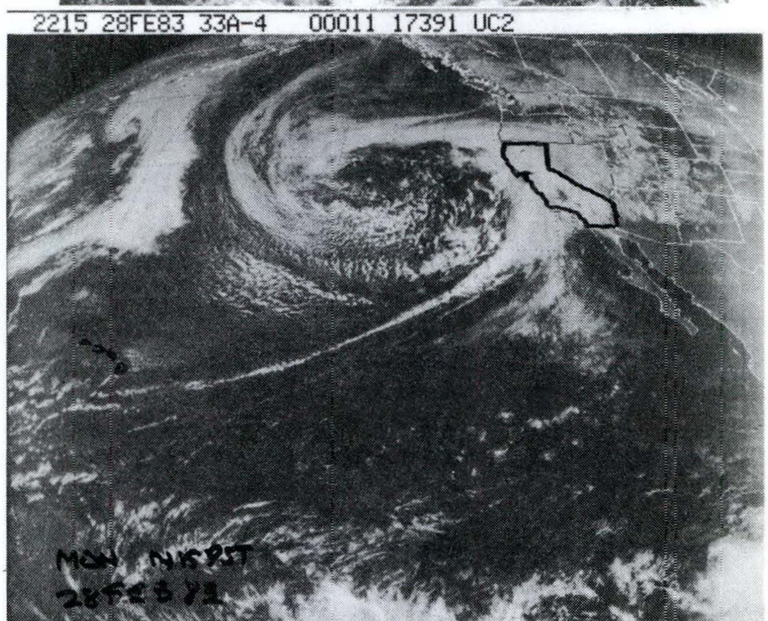
January 26, 1983, 2145 GMT (1345 PST) from GOES WEST. The storm previously seen over the Pacific is shown pounding Central and Northern California with heavy rains and strong winds. The storm produced more than 8 inches of rain at Shasta Dam and more than 10 inches at some locations in the central coastal mountains.

Figure 7

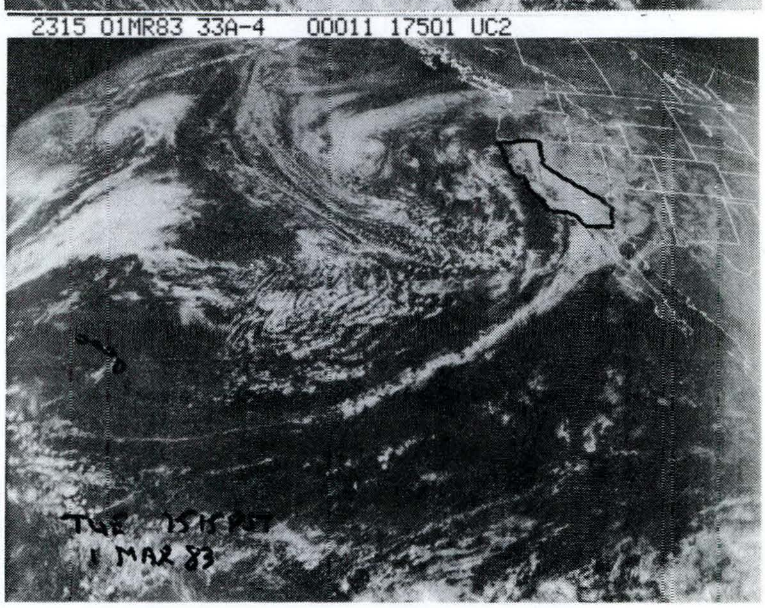
February 27, 1983, 2045 GMT (1245 PST) from GOES WEST. This picture shows a frontal system producing heavy snow in the Sierra Nevada and heavy rains in Southern California. Meanwhile, in the Pacific a low-pressure center is deepening at 38°N, 144°W, and a strong cold front is pushing rapidly east, having just passed 139°W along the 35th parallel.



February 28, 1983, 2215 GMT (1415 PST) from GOES WEST. The low-pressure center had deepened to 972 millibars (28.70 inches), and a strong cold front is battering Northern and Central California with high winds and heavy precipitation. The front in this picture appears very intense and has moved eastward much faster than its parent low-pressure center (38°N, 138°W).



March 1, 1983, 2315 GMT (1515 PST) from GOES WEST. The cold front is bringing heavy rain and severe weather to Southern California, while heavy snow continues in the Sierra Nevada. The low-pressure center is near 38°N, 138°W and is drifting eastward and filling.



at Mining Ridge, 15.90 in. at Shasta Dam, 14.71 in. at De Sabla (Feather River Basin), 7.20 in. at Los Angeles, and 4.64 in. at San Diego. Rainfall in the Mojave Desert was exceptional during the storm with 5.02 in. at Palmdale and 6.05 in. at Lancaster (annual average is 6.65 in.). At least two tornadoes were triggered in Los Angeles County on the morning of March 1, when a strong cold front moved into Southern California; another tornado was reported near Roseville in Placer County on March 3. High winds produced 15-20 foot waves, causing considerable property damage along the central coast March 1-3.

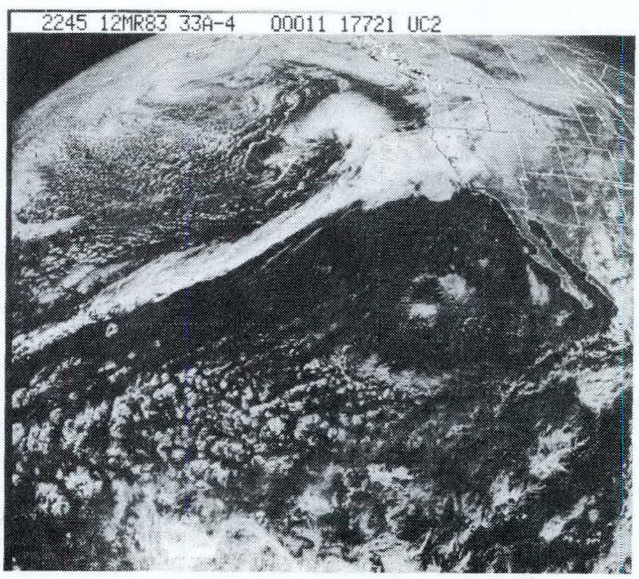
In Northern California, locally heavy thunderstorms developed in the cool, unstable air mass following a cold front on March 10. At 4:30 p.m. in El Dorado Hills (30 miles east of downtown Sacramento), 1/2 inch of rain fell in 6 minutes. At about 9 p.m., the Redding area was pelted with heavy hail, which totalled 6 inches in some places. On March 12-13, a warm Pacific storm gave Northern California one of its heaviest short period rains of the water year. Figure 8 is a visual satellite picture showing the subtropical fetch of moisture from Hawaii into California. At most locations, the precipitation fell in a 24-30 hour period, with the snow level at 7,000 feet.

Storm totals included 9.68 in. at Bucks Lake (Feather River basin), 6.68 in. at Shasta Dam, 5.20 in. at Calaveras Big Trees (Stanislaus River basin), and 6.55 in. at Kentfield in Marin County. Local flash flooding and mudslides were problems in hilly areas. On March 22, a tornado touched down briefly at Citrus Heights in Sacramento County and at Roseville in Placer County. During March, Norden received about 13 feet of new snow; the greatest snow depth was 216 inches on March 28.

April 1983

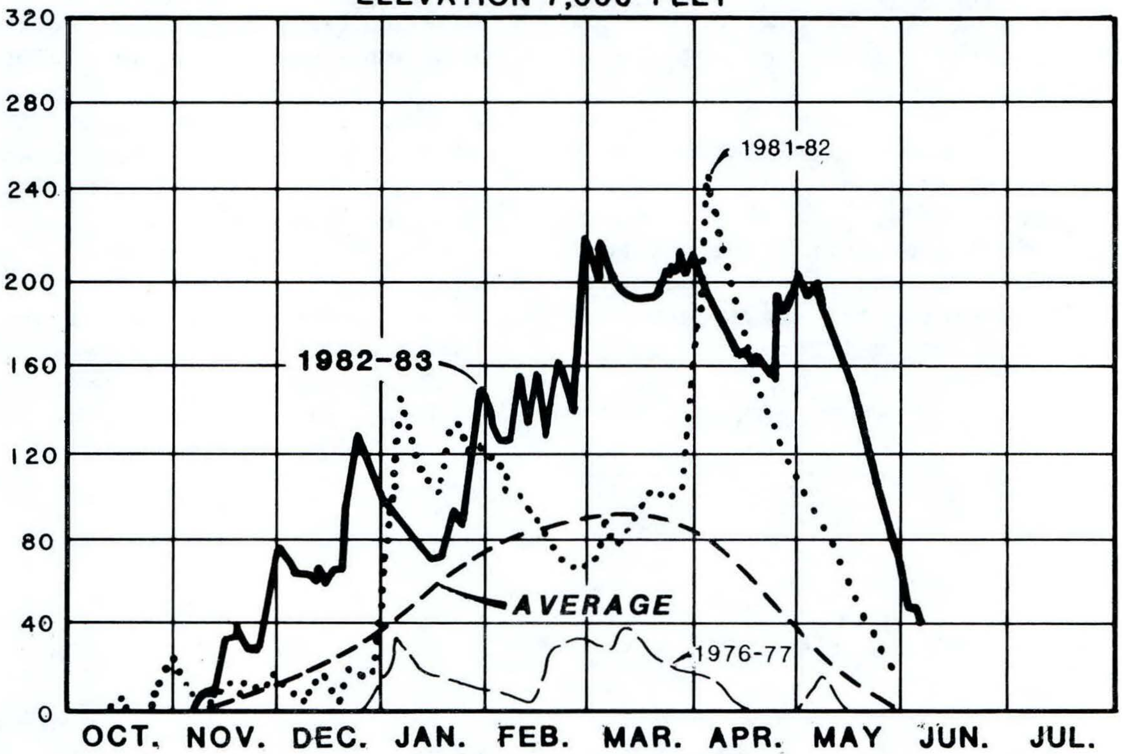
Early April dryness in most areas turned to wetness by April 17 as an active storm track returned in California; many North Coast and Sierra Nevada stations had daily precipitation April 18-30. An upper-level closed low produced heavy rain in Southern California April 17-21. Storm totals were near 3 in. at Santa Barbara and Los Angeles, while 5.21 in. fell at Pasadena. Saturated ground led to more mudslides and street flooding. A cold storm from the Gulf of Alaska produced heavy precipitation in Northern California April 22-25. Some North

Figure 8



March 12, 1983, 2245 GMT (1445 PST) from GOES WEST. A wave is developing on a cold front near 40°N, 130°W, while subtropical moisture is being drawn into the system. Heavy rain is falling in much of Northern California at the time of this picture.

Figure 9. SNOW DEPTH AT DONNER SUMMIT
ELEVATION 7,000 FEET



Coast and Feather River basin storm totals exceeded 4 inches, with 6.4 inches at Honeydew the heaviest. New snow in the Sierra Nevada ranged from 2 feet at 5,000 feet, to 4 feet above 7,000 feet.

An upper level trough deepened west of San Francisco on April 27 and moved inland on April 30; everyone got wet, but the central coastal mountains were drowned, with Mining Ridge measuring 11.5 in. during the storm. Other totals included 2.8 in. at Sacramento, 2.4 in. at Pasadena, and 4.5 in. at Mt. Wilson.

April was another wet California month; most Southern California locations exceeded twice the normal amount, while Sacramento received almost three times the normal rainfall. Snow depths at Norden ranged from 155 inches on April 23 to 204 inches on April 30.

May—September 1983

The skies finally dried out in May, with no big storms during the month and below-normal precipitation in most areas. Temperatures remained cool until May 19, when a hot spell began and lasted through May 30. Peak temperatures were reached on May 27-28 with 98° at Sacramento, 86° at Blue Canyon, and 74° at Lodgepole. Most snowmelt streams reached maximum runoff within two days of these peak temperatures.

Temperatures cooled sharply in early June, with no prolonged heat during the month. Reservoir storage had been efficiently manipulated during May, so that uncontrolled releases and damaging downstream flooding were avoided during the snowmelt. Snow at Blue Canyon was gone by May 24 and at Norden by June 22. Figure 9 presents a profile of the season's snowfall at Norden (Donner Summit).

June and July offered little storminess in California. A strong surge of tropical moisture into Southern California led to heavy thunderstorms and flash flooding in San Bernardino and Kern Counties on August 16-17. At the Lytle

Creek Detention Basin just southwest of San Bernardino, 5.73 in. fell in 3 hours, ending at 6:00 p.m. on August 17, with 7.42 in. falling in 27 hours.

An upper-level closed low-pressure center and unusually warm ocean temperatures combined to produce record-setting heavy rainfall from Fort Bragg northward on August 29-31. New 24-hour and monthly rainfall records for August were established in several locations as follows:

Location	August Rainfall totals, in. 24 hr.	month
Shelter Cove	5.95	8.95
Bridgeville	5.00	7.00
Orleans	3.15	5.24
Gasquet	4.10	4.62
Eureka	1.57	3.20

San Francisco and Eureka recorded their warmest July on record, while August in Los Angeles was the hottest ever seen, with an average temperature of 80.8°.

September saw above normal temperatures in most areas, with showers across northern California during September 22-24. More general rains fell statewide during the final two days of the month, with more than 1 inch in the Sierra Nevada and from Monterey south to Los Angeles; Santa Barbara received 3.20 inches. Two tornadoes touched down in Los Angeles County on September 30.

SUMMARY OF FLOOD EVENTS

This section summarizes the significant flood events of water year 1982-83. A reference map to the hydrographs shown is provided in Figure 10.

NORTH COAST HYDROLOGIC BASIN

For the second consecutive year, the impact of winter storms that normally make the North Coast the wettest section of the State shifted to a more southerly path. Precipitation amounts were nearly 150 percent of normal, but unlike in other hydrological areas, precipitation in the North Coast Hydrologic Basin came far short of record proportions.

The greatest impact of the storms, particularly those associated with strong winds, was felt from Fort Bragg in Mendocino County southward. Heavy seas were responsible for some damage in the Crescent City and Eureka areas, but not to the extent of that suffered southward.

Flows in rivers and streams of the north coast were consistently above normal thoughout the season but maintained surprisingly low levels, considering the amount of precipitation received. Warning stages were infrequently reached, and only on two occasions were flood stages recorded. The rains were torrential at times, but the many respites between weather fronts permitted the flows to recede sufficiently to accommodate the ensuing onslaughts without creating any particular problems. Hydrographs of the Eel, Klamath, Van Duzen, and Smith Rivers are shown in Figures 11-13.

Storm-related damage in the interior of the region was generally limited to mud and rock slides, washouts, and road closures. The latter condition is not unique in this wooded and precipitous terrain, but in 1982-83 such conditions became particularly troublesome.

Figure 10. LOCATIONS OF HYDROGRAPHS

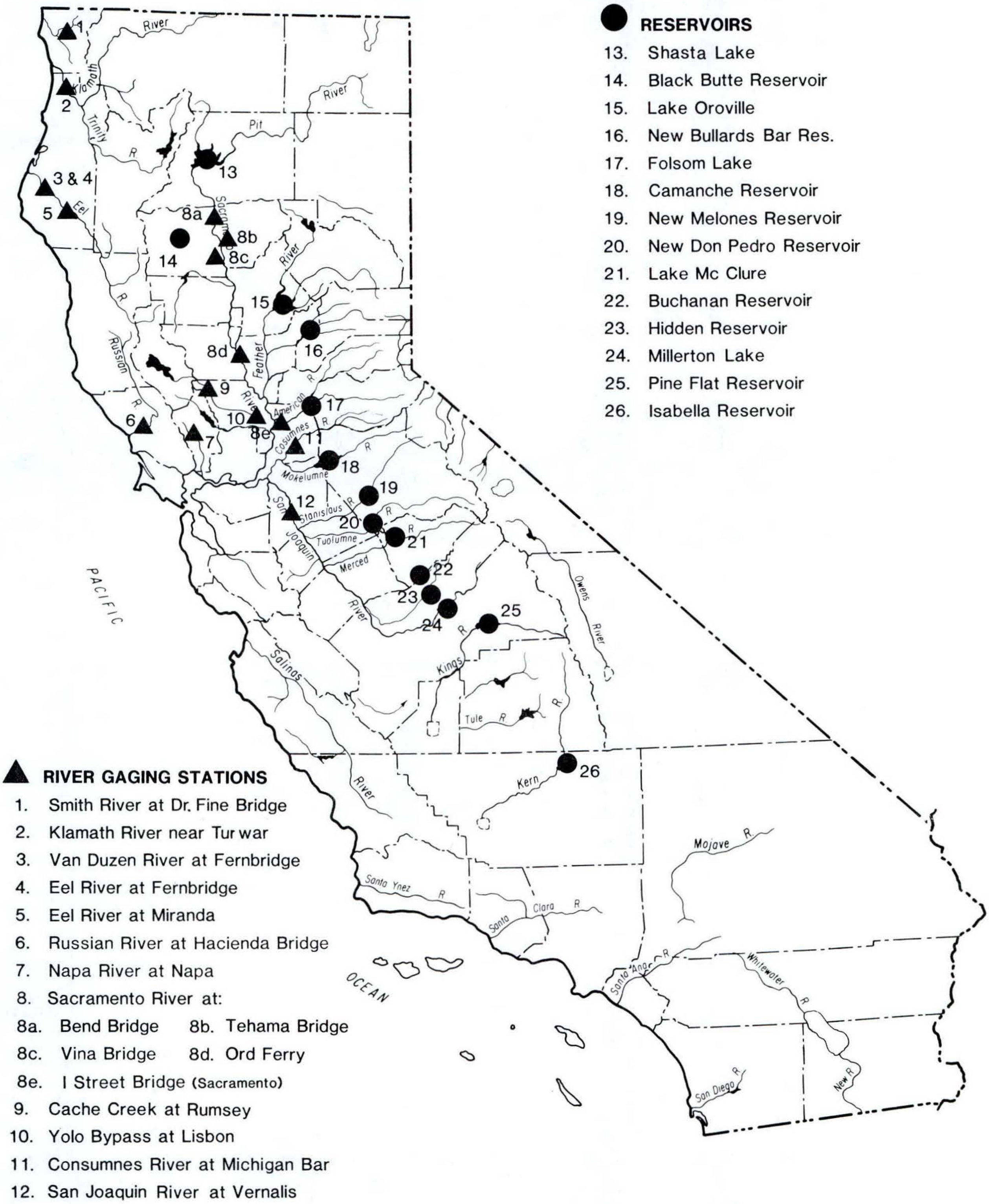
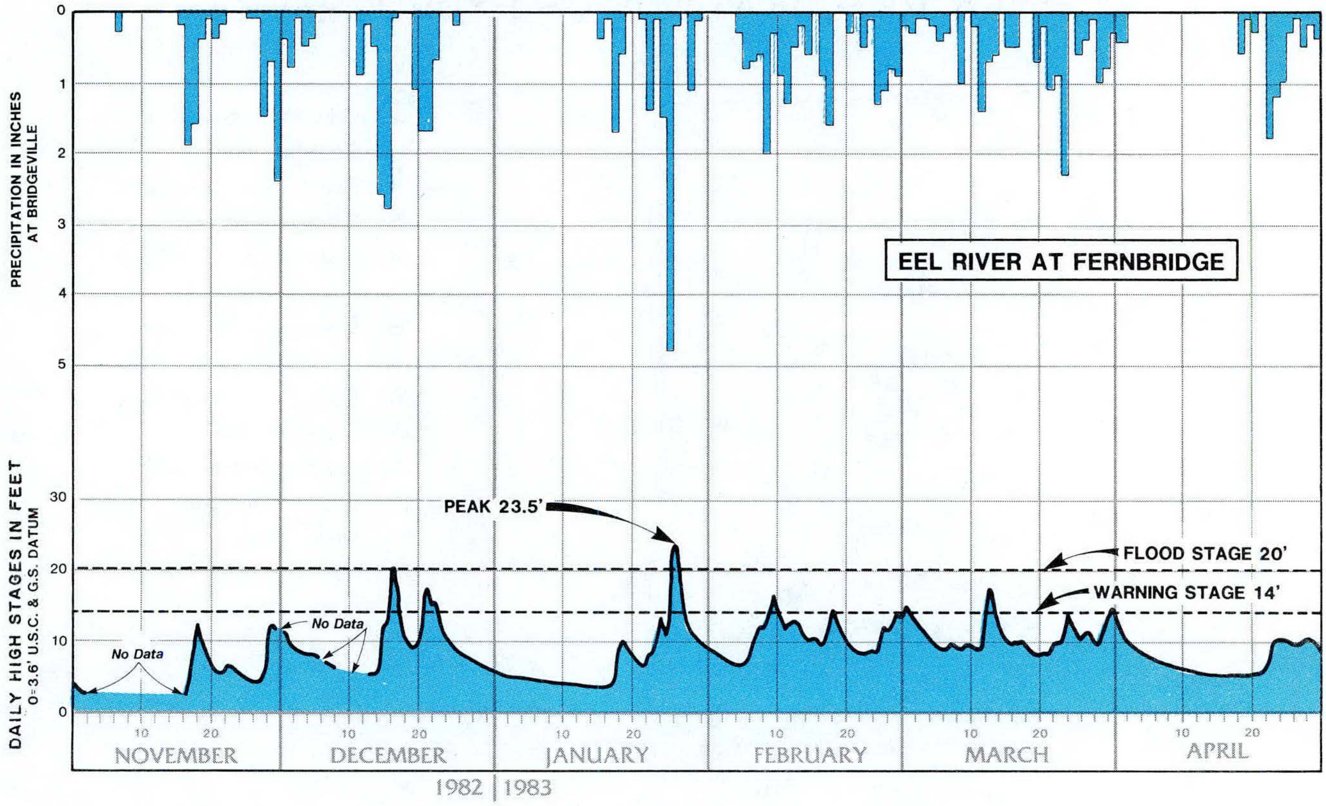


Figure 11. HYDROGRAPHS OF THE EEL RIVER



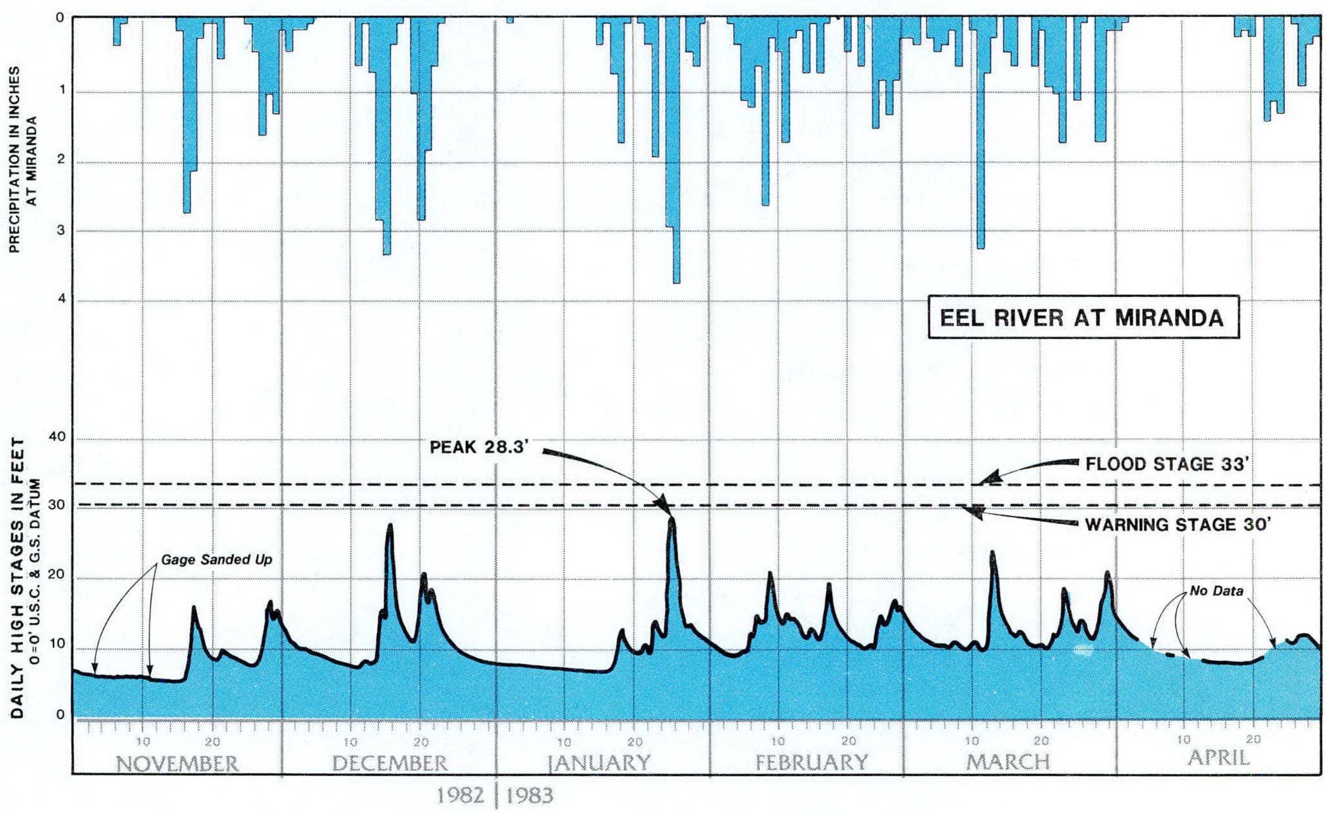


Figure 12. HYDROGRAPHS OF THE KLAMATH AND VAN DUZEN RIVERS

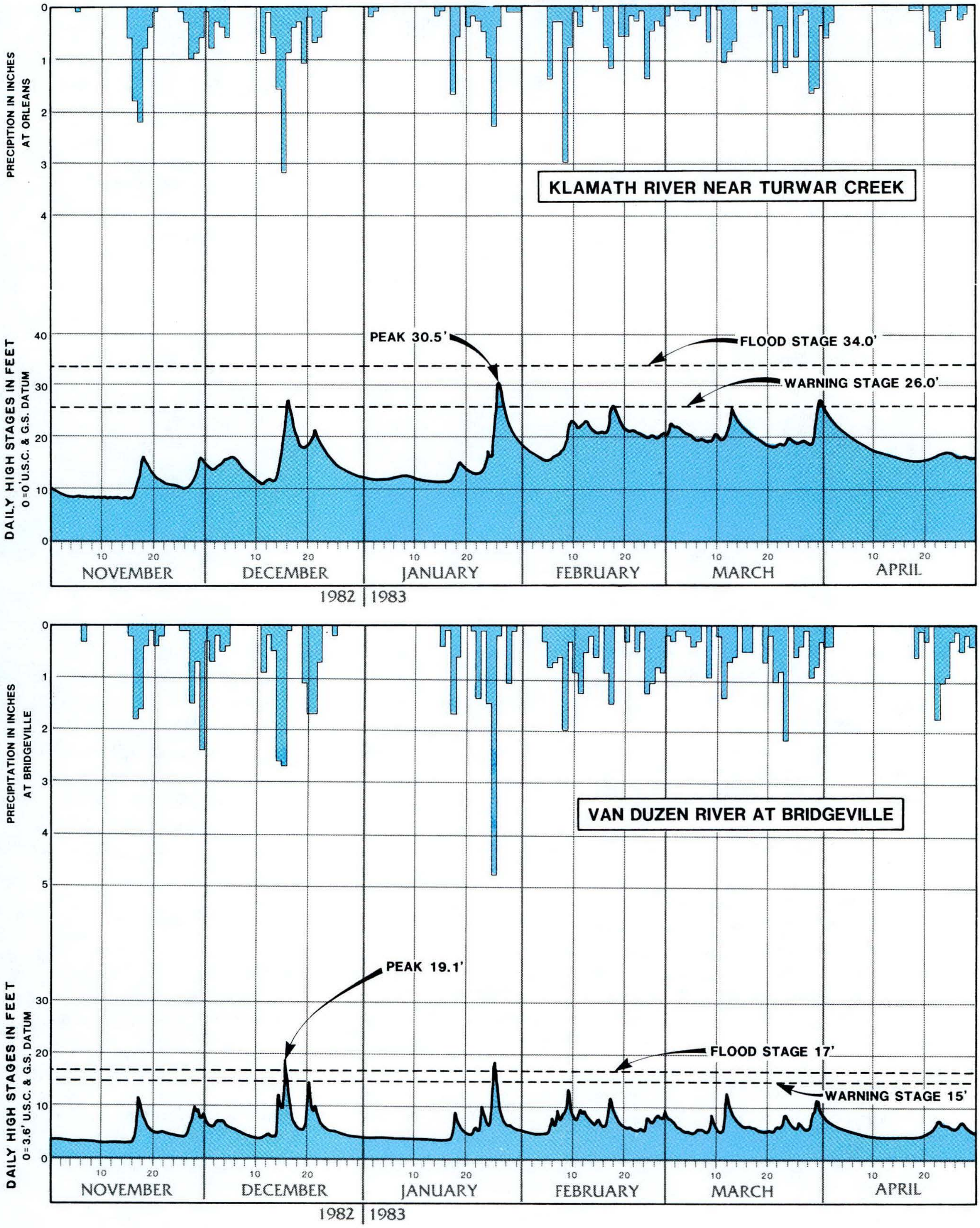
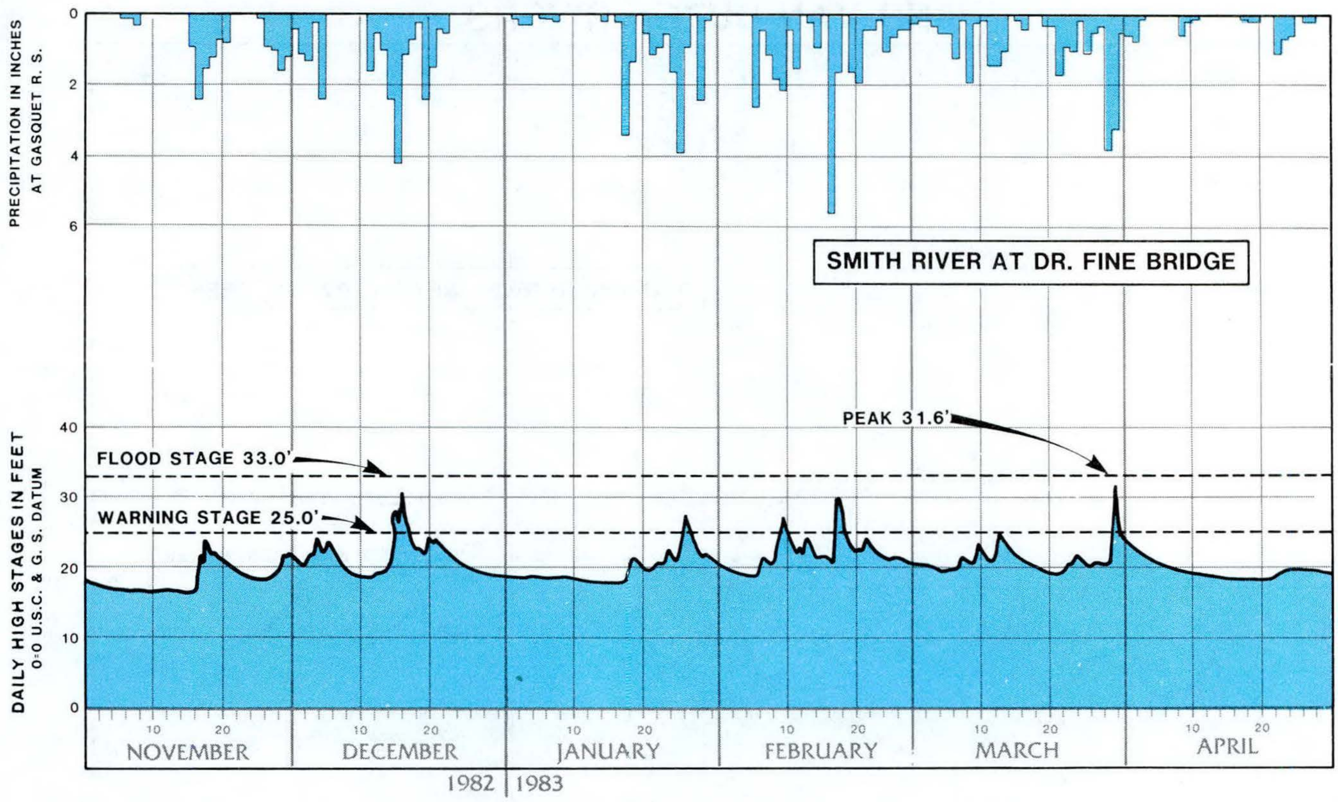


Figure 13. HYDROGRAPH OF THE SMITH RIVER



Along the coast, on-shore winds in the 40-50 mph range with gusts to 70 mph generated 20-25 foot waves, resulting in structural and ecological damage to the coastline. The turbulent seas and debris-laden inlets also dampened the enthusiasm of commercial as well as sports fishermen and further depressed the beleagered tourist and fishery industries.

Del Norte County

The mid-December storms, despite high winds to 85 mph and more than 3 inches of rain in a 24-hour period, left more in the way of inconvenience than storm damage. Power outages and local street flooding, particularly in the Crescent City area, accounted for most of the reported incidents.

Again in late January the raging Pacific storm that spanned the entire State included Del Norte County as one of its victims. Damage in the county, however, was surprisingly light despite the worst coastal flooding since a tsunami struck Crescent City in 1964.

Waterfront facilities, including harbors, were hardest hit. The winds, which were clocked at 60 - 70 mph, toppled trees and caused numerous power outages. The winds also contributed to 10-foot tides and 25-foot breakers, which damaged marinas, scattered logs and debris along main thoroughfares, and breached a section of the inner jetty of the harbor at Crescent City.

For the remainder of the season the main impact of the continuing series of storm was felt further southward. The flooding potential, nevertheless, remained high as rain coupled with strong winds persisted. Flood and emergency officials had little opportunity to relax during the long winter, as river stages remained high and the saturated soil condition posed a serious flood threat should a major storm have struck the area.

City frontloader works at clearing Front Street minutes after a surge of floodwaters carried debris across the roadway

(Triplicate photo by Jeff DeLong)

Traffic was delayed on U.S. 101 south of Crescent City when a car struck a tree

(Triplicate photo by Sherry Heiser)

CRESCENT CITY

DEL NORTE COUNTY

Siskiyou County

A midwinter tropical storm brought as much as 5 inches of rain in a 24-hour period in the southern part of the county. The February 1 storm capped a 15-day series of storms with only short reprieves. The downpour eroded roads, caused mudslides, and clogged drainage systems.

The hills around Dunsmuir became very unstable after 16 inches of rain during a 16-day period completely saturated the slopes. The city's water supply was lost when 80 feet of water main was washed away. Several homes were threatened by the shifting soil, and streets became clogged with mud and debris. The slippage of a portion of Highway 5 also forced the use of a lengthy detour.

During the last week of March, a new storm partially stranded residents of Truck Village, when North Old Stage Road was closed. The fluctuating flood waters were reported to be deeper than anything experienced in the last 25 years.

Humboldt County

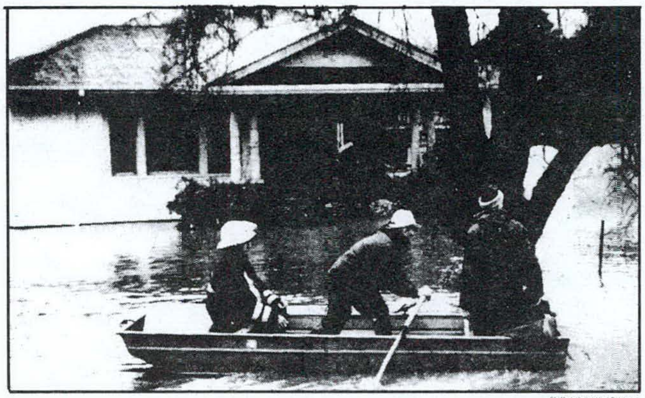
The first significant storm of the season swept through Humboldt County during mid-December. Thousands of homes were without electrical power for as long as 24 hours, when 50-mph winds toppled rain-soaked trees across power lines. Main highways were temporarily closed or limited to one-way traffic due to recurring landslides. The prodigious rains raised river levels to flood stage on the Van Dusen and Eel Rivers and to warning stages on other major streams.

A whopping 10.2 inches of rain in a 24-hour period was reported at the Honeydew gaging station in the Mattole River drainage basin. The town of Petrolia suffered from this deluge and was isolated for a short time due to road closures. Some structural damage was also reported.

An ancient landslide on the Mattole river upstream from Honeydew began to show signs of movement during the late January rains. On April 3, a major movement of the slide formed a dam on the Mattole. Several homes were destroyed by mud and rock slides. A dam 1,300 feet long, 300 feet wide, and 40 feet deep backed up the river and created a body of water locally referred to as "Marijuana Lake." The effect of the dam on future anadromous fish runs has not been determined.

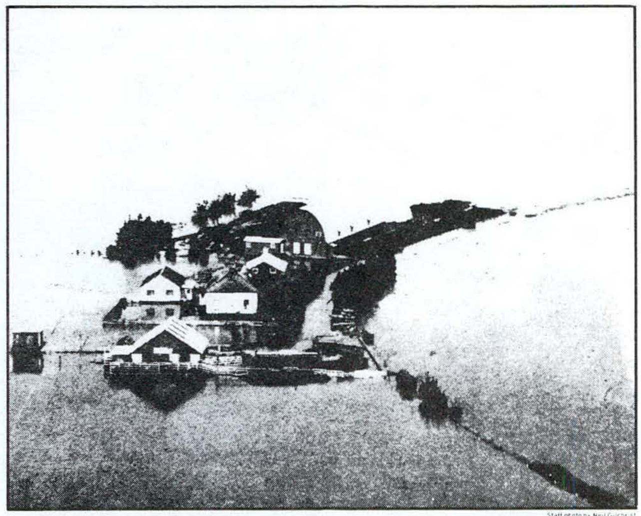
The onslaught in late January and early

HUMBOLDT COUNTY



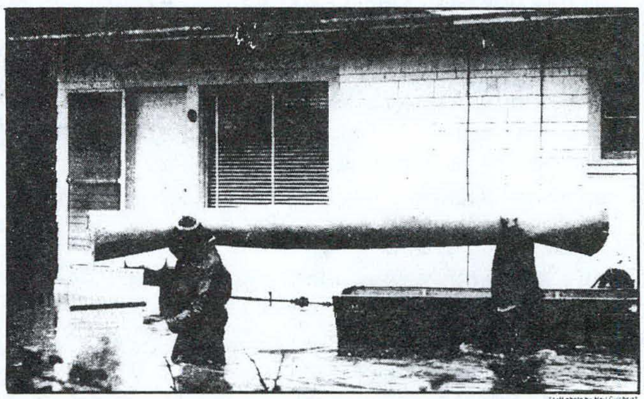
—Staff photo by Neil Gilchrist

Fortunans in the Kenmar Road area (left) use a boat to leave their flooded home.



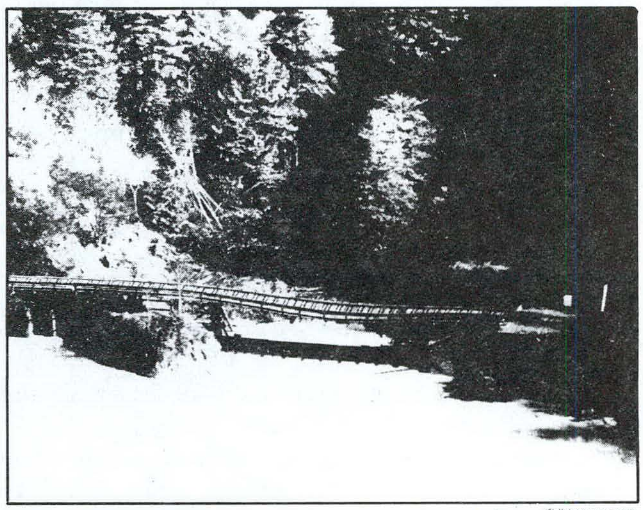
—Staff photo by Neil Gilchrist

Dozens of farms like this in the Eel River delta area are isolated by high water.



—Staff photo by Neil Gilchrist

Some Fortuna flood victims carried household goods to higher ground. Others called on moving vans to remove their possessions. Volunteer firefighters helped.



—Staff photo by Neil Gilchrist

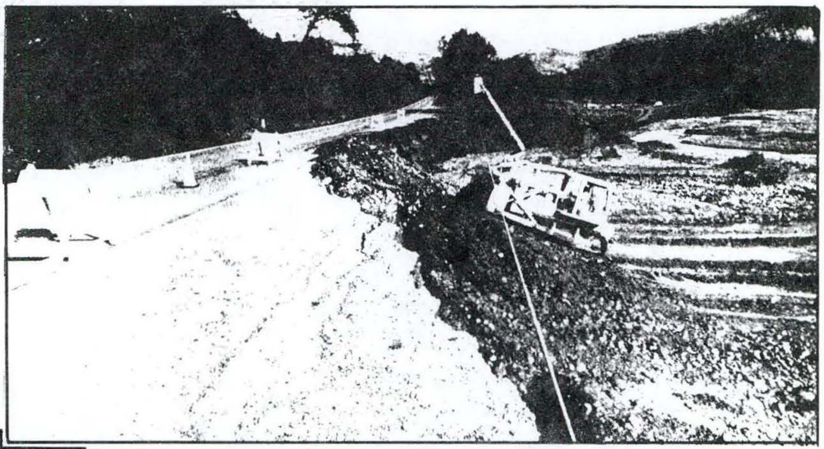
Nanning Creek railroad trestle at Scotia Bluffs sags precariously after flooding knocked out four of its supports. Rail traffic through the county has been halted.

February generated flood stages on the lower reaches of the Eel and warning levels on other streams of the county.

The residents of Starvation Flats, a small community near Alton, were evacuated, and further downstream about 500 cattle and dairy stock in the Eel River delta near Ferndale were moved to higher ground. Numerous schools adjacent to low-lying areas along the Eel were closed as bridges and access roads became inundated. A railroad trestle near Rio Dell was also added to the list of flood damage reports.

Damage from the fourth in a series of Pacific frontal systems to strike within the week was mostly due to the 56-mph winds. Rains were ample to renew high streamflows, but flood damage was minimal. The brief but furiously noisy front, associated with thunder, hail and lightning, left over 13,000 customers without power for several hours.

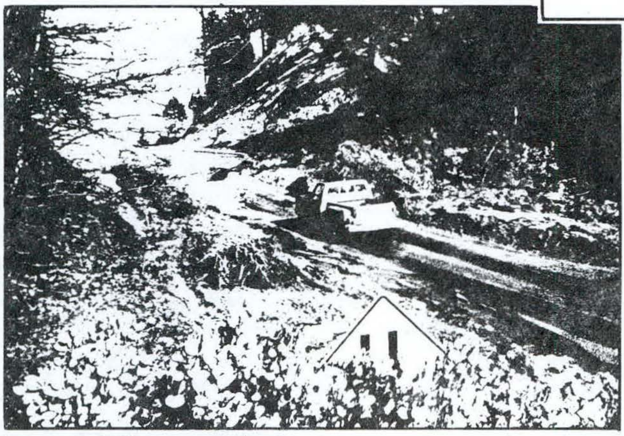
Humboldt County was spared additional harassment from the prolific storms for



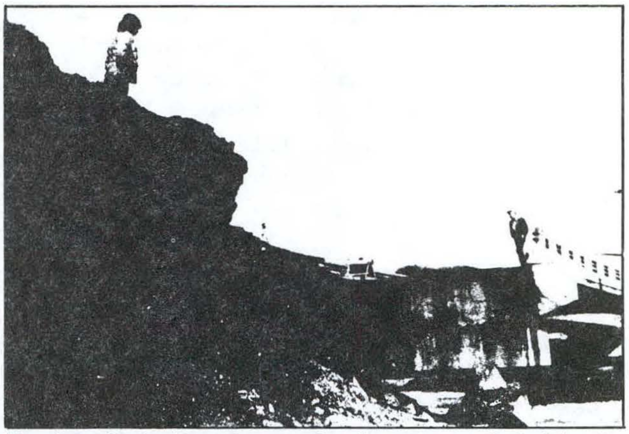
Hwy 299 wash-out east of Junction City
Photo by Phil Nelson

TRINITY COUNTY

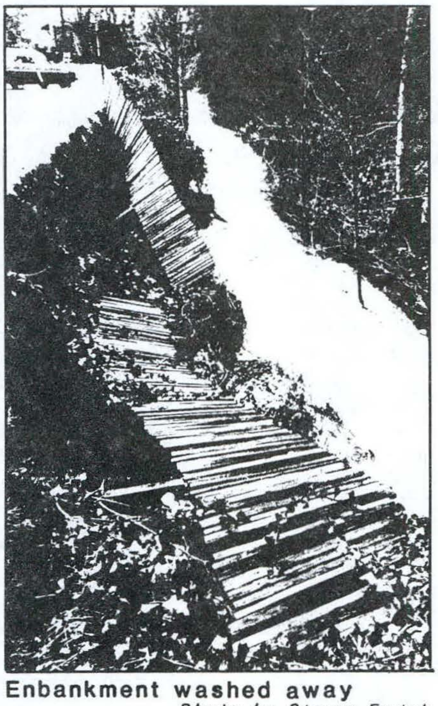
SAVAGE STORMS AFTERMATH



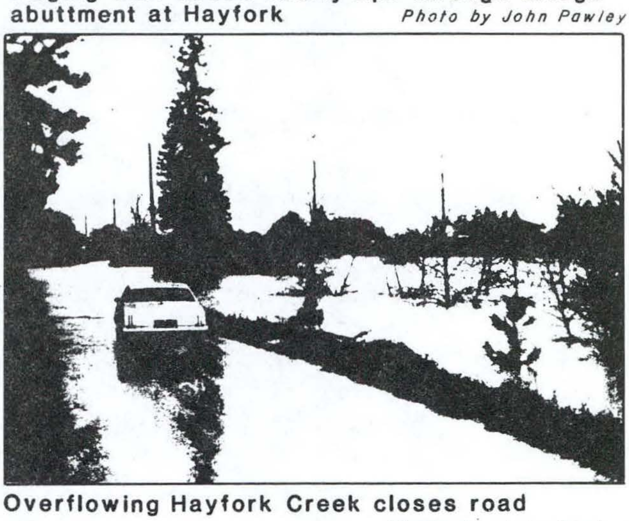
Large slide closed two lanes of Hwy 299 near Buckhorn *Photo by Steven Fritch*



Raging Salt Creek nearly rips through bridge abuttment at Hayfork *Photo by John Pawley*



Enbankment washed away
Photo by Steven Fritch



Overflowing Hayfork Creek closes road
Photo by John Pawley

the remainder of the season when the storm track shifted dramatically southward. Rain and high water, however, persisted.

Trinity County

Storm damage in this sparsely populated county, located in the interior North Coast hydrological region, is generally limited to road damage from landslides, fallen trees, and washouts. Highways 299 and 36 are the primary and secondary thoroughfares that link the upper Sacramento Valley and the northwest coast. Both meander through some of the steepest and most rugged topography in the State and are highly susceptible to damage from violent storms.

Numerous violent storms tracked through the area in Water Year 1982-83. The first significant damage to Highways 299 and 36 occurred in mid-December following a fierce 2-day storm accompanied by strong winds. Mudslides occurred at several sites, making travel hazardous and subject to long delays. Highway 299, near Salyer, was open only to one-way traffic for several days.

Heavy storms invaded the county in late January and lasted spasmodically for nearly two weeks. An incident of note occurred east of Willow Creek, when the massive slide of rock and mud that closed Highway 299 swept a Caltrans heavy equipment operator to his death. At least two other residents lost their lives in accidents related to the hazardous road conditions. Further delay in opening the road occurred, as some slide areas that were cleared and seemingly stabilized were reactivated by the continuing rains.

Mendocino County

Much of the impact of Nature's affront on California's coastline during 1982-83 was felt along Mendocino County's rugged shores. Point Arena, at the county's southern tip, was the hardest hit. Waves, wind, and localized flooding caused the collapse of numerous public and private structures within the reach of the surging ocean. Sadly, some buildings of significant historical value were not spared.

Power failures and washed out roads disrupted communication and isolated many small interior and coastal communities for short periods. Portions of the numerous public parks located on the Mendocino County coast were put out of service due to inundation, damaged facilities, or eroded roads. Many parks in this popular recreation area were unable to accept campsite reservations for several weeks.

SAN FRANCISCO BAY AREA

San Francisco County

A deadly Pacific storm struck the city and county of San Francisco the third week of December. At least two storm-related deaths were reported in the vicinity of the city. Winds as fierce as 70 mph battered the Golden Gate Bridge, causing traffic accidents and closure of the main link between San Francisco and Marin County. The bridge was swaying as much as 5 feet during the storm's peak and prompted the first wind-caused closure of the famous bridge since 1951. Traffic jams were monumental. Officials were also considering closing the Bay Bridge when it was feared the "galloping" traffic lanes of the bridge would trigger additional auto accidents.

The city managed to weather subsequent winter storms with relatively minor damage, however.

East Bay Counties

In general, the East Bay counties of Alameda and Contra Costa, excluding the Delta areas, were spared the devastation suffered in neighboring counties. Street flooding, scattered power outages, and downed trees were reported on several occasions during the long winter, but the damage total fell short of the 1981-82 flooding.

Alameda County

Southern Alameda County was drenched with more than 2 inches of rain on January 26, causing about 95 square miles of the city of Fremont to be flooded to depths ranging from 2 inches to 2 feet. No evacuation or serious injuries were reported. In addition, the rain instigated mudslides that closed Mill Creek and Morrison Canyon Roads. Several streets in the foothill area were filled with as much as 6 inches of mud, and numerous homes were invaded by the mud flows. Preceding this event, a January 22-23 storm knocked out power to nearly 30,000 homes in the East Bay area. The 40-50 mph winds associated with the storm toppled trees and damaged structures. Some highway underpasses flooded, stranding some vehicles. Firemen assisted drivers and occupants in climbing to safety.

Contra Costa County

More than 4 inches of rain fell in portions of Contra Costa County during the weekend of January 22-23, resulting in scattered power outages and some reports of minor flooding. Although much of the county was thoroughly soaked, it generally fared the weekend onslaught better than its neighbors did. A high-tide regime following the deluge, however, closed the Pittsburg-Antioch Highway and flooded waterfront businesses in the Pittsburg area. Moreover, several structures in Martinez were partially flooded, and clogged storm drains in the San Ramon Valley caused flooded roads.

Most Contra Costa County damage was in the Sacramento-San Joaquin River Delta and is reported in that section of this publication (see "SACRAMENTO-SAN JOAQUIN DELTA").

North Bay Counties

The coastal and riverine counties north and adjacent to San Francisco Bay are particularly prone to flooding when high tides and gale force winds comingle with high-intensity runoff. The storms that battered the more than 1,000 miles of Pacific coast on several occasions during the 1982-83 water year left scars along the North Bay coastline that will be visible for a long time. Property damage was not as extensive as that suffered southward, but only because this area is less developed. The interior portion, particularly along the Russian River, is more developed and a popular summer and winter resort area because it is close to the metropolitan areas of the Bay. This area witnessed heavy rains and high river stages, and, although flooding along the Russian River is fairly commonplace, the impact was significantly less than in water year 1981-82.

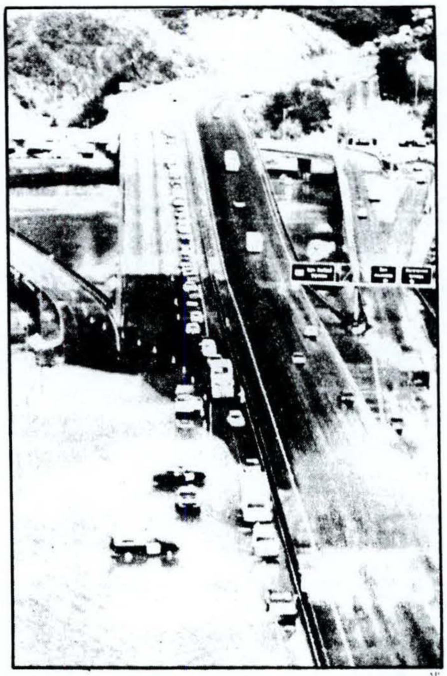
Marin County

The Stinson Beach area of Marin County was particularly vulnerable to the relentless pounding of the 12- to 16-foot waves that persisted throughout the winter. Nearly a score of homes that dot the shore and slopes of the rugged coast finally yielded to the prolonged siege. Others were damaged or threatened by eroding cliffs. The series of storms that hit in late January were the principal offenders. The weather fronts of this series were associated with gale force winds and near record tides.

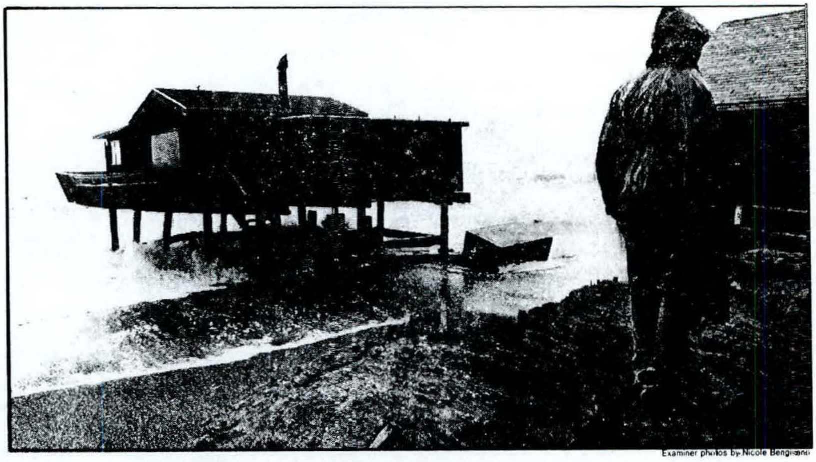
The high tides (7.1 feet at the Golden Gate) caused extensive flooding in the low-lying urbanized tidal plains of the County. Approximately 200 homes and businesses were damaged in unincorpor-

MARIN COUNTY

EXCESSIVE RAIN - TURBULENT OCEAN TAKES A TOLL



Highway 101 at Corte Madera



Examiner photos by Nicole Bengiveno

Invading waves at Stinson Beach

AP Photo

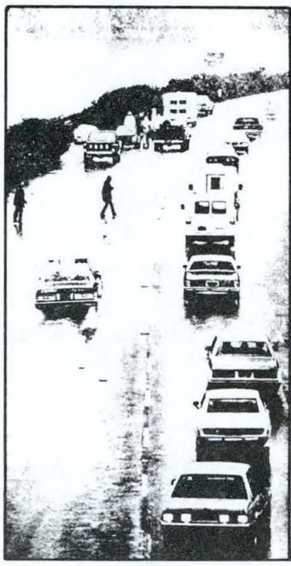
ated Marin County and the cities of San Rafael, Larkspur, and Corte Madera. Inland runoff also had its effect, but the impact was not as great as the infamous storms of early January in the winter of 1982.

Oceanfront resorts and recreation facilities, including marinas, were also damaged by the high surf.

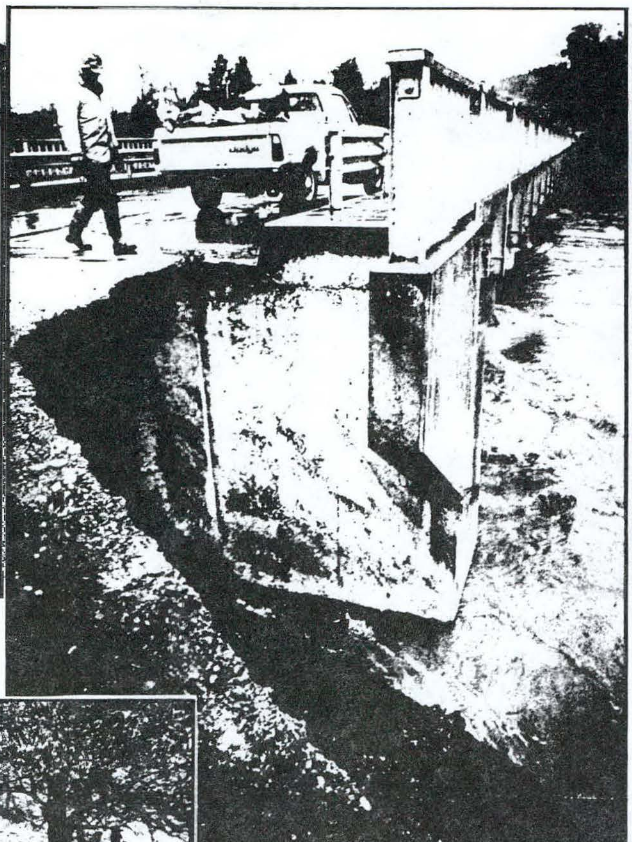
Solano County

Residents of Solano County, particularly those in the Vallejo area, received a preview of storm events to come when a blustery storm in late November caused minor flooding along the waterfront. The heavy runoff from the Napa River and local drain systems could not escape to the Bay because of the high tides and strong onshore winds.

The next major series of storms that struck January 21 and lasted for more than a week raised enough havoc to merit adding Solano County to the growing list of disaster area counties. The failure of a Grizzly Island levee on January 27, which inundated 8,000 acres, and the flooding of Van Sickel Island the same day, were sufficient cause to justify a Presidential Proclamation. The Grizzly Island levees were breached in six places. Fortunately, there was some high ground to accommodate at least 50 head of livestock. Feed for the animals was transported by rowboat. A few duck club caretakers were evacuated by helicopter, but most of the estimated 50 people who live on the Island escaped without notable incident. The herd of 58 Tule Elk, managed by the Department of Fish and Game, were moved to a safe area.



A chain reaction fender-bender blocked traffic on Interstate 80 at Pena Adobe



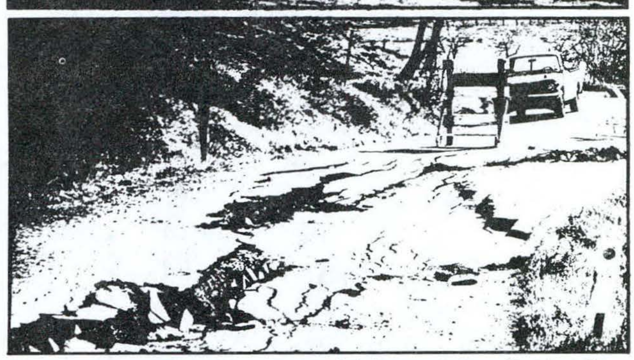
Winds, rain and floods ravaged parts of Solano County as the worst barrage of storms in several years dumped 6 inches of rain in five days on the area and washed away roads, hillsides and threatened Low Water Bridge (left). Vacaville Rural Fire District firefighters waded into the water to sandbag concessions stands (above) and remove canoes from Lake Solano Park downstream from the bridge (below).

Reporter Photos by Dan Trevan and Cliff Polland

An earthen dam barely held back water on California Drive giving residents some nervous moments.

SOLANO COUNTY

Grizzly Island horses share cramped quarters



Parts of Cantelow Road in upper Solano County began sinking during the storms as rain soaked the ground. Roads throughout the county suffered.

Many of the roads of the Suisun Marsh were unserviceable. Flooding in Vallejo was caused by breaches in White Slough and was generally confined to the vicinity of State Highway 37 and Sonoma Boulevard.

The series of weather fronts that struck California in late February caused significant street flooding, particularly in the Fairfield area. Fairfield firemen assisted in evacuating nearly a score of people in low-lying areas, and Public Works employees sandbagged many areas, keeping flooding to a minimum.

More than 6 inches of rain in five days near the end of the storm series triggered landslides, washed out roads, and ruptured water supply lines. The Serenity Hills development was particularly hard hit. Numerous homes in the $200,000 range, characteristic of the development, were damaged or threatened by the shifting and eroding hillsides.

Napa County

The Napa River in Napa County maintained high flows throughout the season, beginning as early as December (Figure 14). Flood stage was reached near Napa in late December, repeated in late January and February, and again in mid-March. In the intervals between, warning and near-warning river levels contributed to the extended flooding of roads and lowlands. On January 26, Edgerly Island on the Napa River flooded.

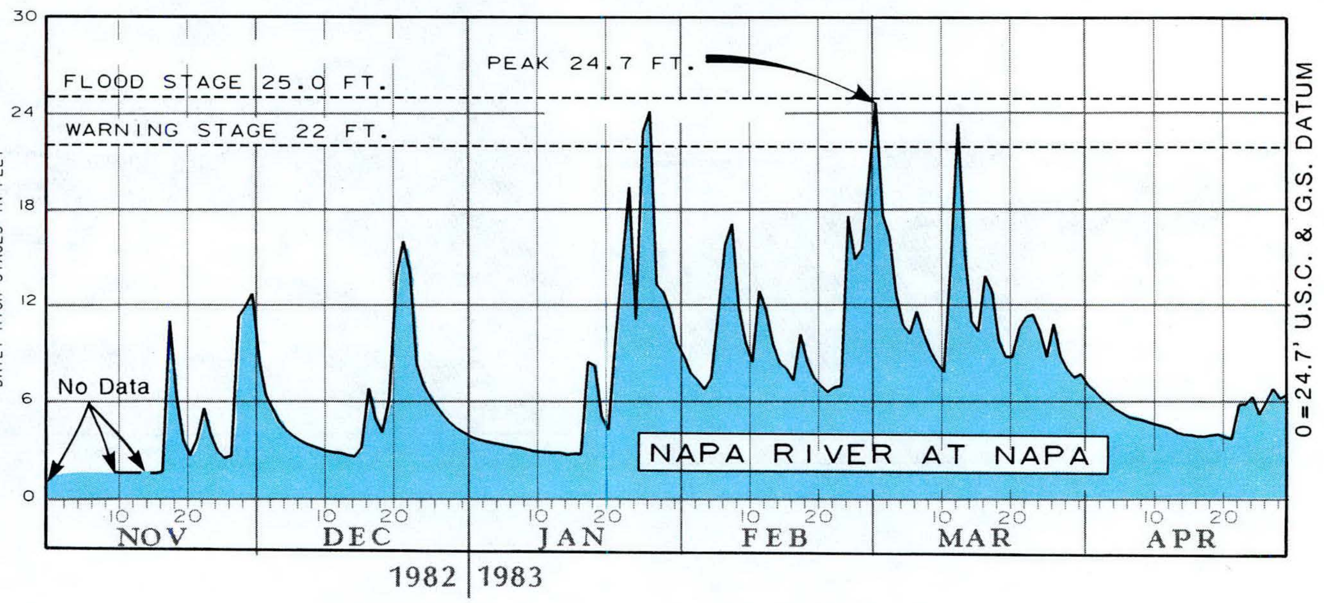
As a result of the storms, Highway 128, in the vicinity of Monticello Dam was closed due to landslides and erosion. Lake Berryessa reached a level of 7 feet above the discharge "Glory Hole," and the water from the spillway tubes severely damaged the road at the base of the dam. The waters continued down Putah Creek, damaging Pleasant Valley Road and the low-water bridge at Lake Solano Park.

Sonoma County

The initial series of destructive storms that struck the Redwood Empire in late Janaury was a preview of the events to follow. Mudslides, washouts, road closures, flooding, and evacuations were commonplace during the remainder of the winter and early spring in this prime agricultural and vacation land.

The heavy runoff generated by record precipitation in the Russian River drainage basin created new peak river stages and inundated the drainage facilities of numerous roads and streets. A

Figure 14. HYDROGRAPH OF THE NAPA RIVER



Highway 1 near Jenner dead-ends

UPI PHOTO

Four-acre sink hole developed on hillside

Associated Press

RECONSTRUCTION WORK ON TAP IN WAKE OF SAVAGE STORMS

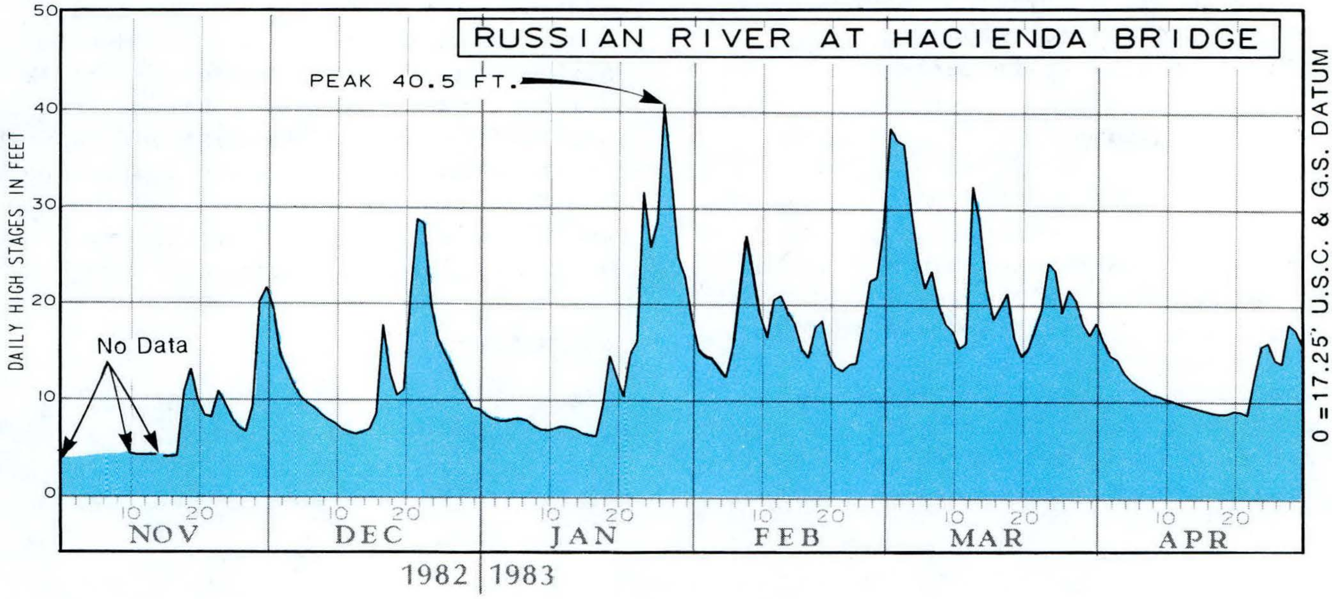
SONOMA COUNTY

hydrograph of the Russian River is shown in Figure 15. Highway 1 experienced mudslides and washouts, some more than 100 feet long, in the Bodega Bay and Jenner areas.

Highway 101, a busy artery betweeen the Bay Area and the North Coast, was the victim of tidal flooding abetted by heavy runoff from San Antonio Creek near the Sonoma-Marin County line. In addition, the residents along several minor streams were forced to evacuate to higher ground as the swollen streams undermined building foundations and swallowed vehicles. Numerous mobile home parks were kept on long-term alert as the rains persisted and the flood water rose to dangerous levels. Fortunately, there were only a few incidents of evacuation and rescue efforts in the established mobile home park areas.

The cumulative effect of the relentless rains during the past two years resulted in some of the highest stages and most

Figure 15. HYDROGRAPH OF THE RUSSIAN RIVER



profound destruction in the history of the Russian and Napa Rivers. The Red Cross, Salvation Army, and other emergency entities, aided by volunteers, provided lodging and comfort to the hundreds of flood victims in the Russian River flood plain.

The huge landslide that changed the course of Sonoma Creek in Black Valley and Glen Ellen and eroded large chunks of property during earlier storms continued to be a threat to local residents. It was feared that the persistent rain would instigate additional slides and dam the already debris-laden streams, destorying numerous homes. Residents of the area worked feverishly to remove debris by hand to ward off the threatened catastrophe.

During a late February storm session, the high tides in the Bay retarded the discharge of the Petaluma River, which flooded numerous homes and structures. At least 300 residents in sections of Petaluma were evacuated during the high-tide period.

South Bay Counties

The unrelenting storms of 1982-83 began their attack on South Bay counties as early as November 19. It was the assault during the last week of January, however, that qualified counties of this area for disaster relief. The late February-early March storms also added significantly to the damage toll, uprooting nearly 5,000 people from their homes in Santa Clara County.

The overflowing creeks in the peninsula were a constant menace throughout the winter, causing landslides and flooding streets and businesses along the bay shore.

The total dollar damage to the coastal and mountain areas may fall short of the January 1982 catastrophe, but the reality and constant threat of a reoccurrence of that historical event did little to soothe anxieties.

San Mateo County

Persistent rains abetted by a series of high tides caused widespread flooding of low-lying areas between San Mateo and Sunnyvale during late January. The many creeks of the area that drain into the Bay are a continuous flood threat during major storm periods. The twisting streams overflowed their banks, causing local flooding. Many of the streams meander through highly developed properties, increasing the chances of heavy flood damage.

Of the many streams that overflowed during the winter of 1982-83, probably the most serious problem occurred along the banks of San Mateo Creek. The three creeks in Palo Alto -- San Francisquito, Matadero, and Barion -- were also problem areas.

The marsh and saltpond areas near Redwood City, called South Shores, were inundated by high tides. Many industrial sites, located on reclaimed areas of the bay, were under water or isolated when high streamflows combined with high tides during January, causing the protective dikes to fail.

Traffic jams along bay shore highways were common due to street flooding by high tides and stream runoff. The temporary closure of the Dumbarton Bridge, due to flooding of the western on-ramp, contributed heavily to the congestion. The Dumbarton Bridge links the Peninsula and the East Bay. Its closure stranded many travelers and commuters.

Santa Clara County

The major storm-related event during water year 1982-83 in Santa Clara County was the flooding of the Alviso district of San Jose. The worst flood ever in

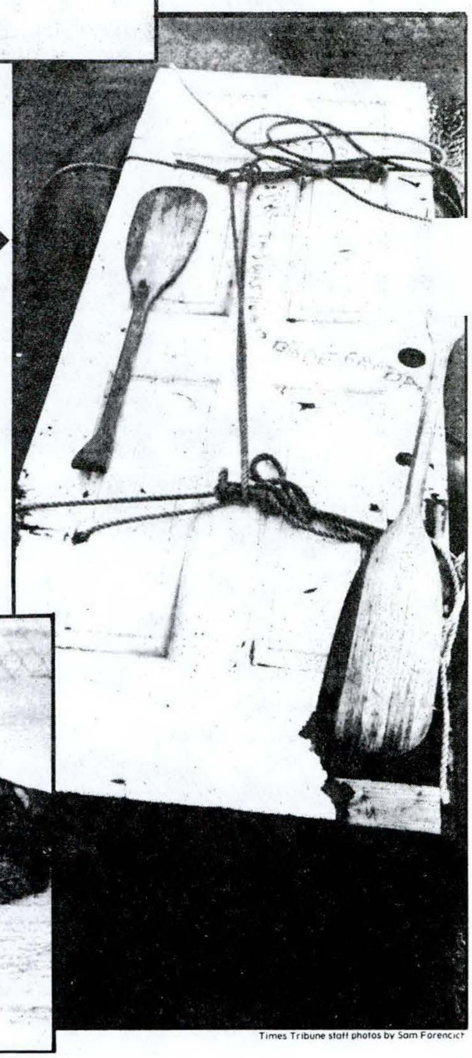
Desperate attempt to contain raising waters with sandbags was lost and Alviso was covered with 6 feet of water

San Jose Mercury News via Associated Press

SANTA CLARA COUNTY

SAN FRANCISCO BAY TOWN VICTIM OF HIGH TIDES AND HEAVY RUNOFF

door

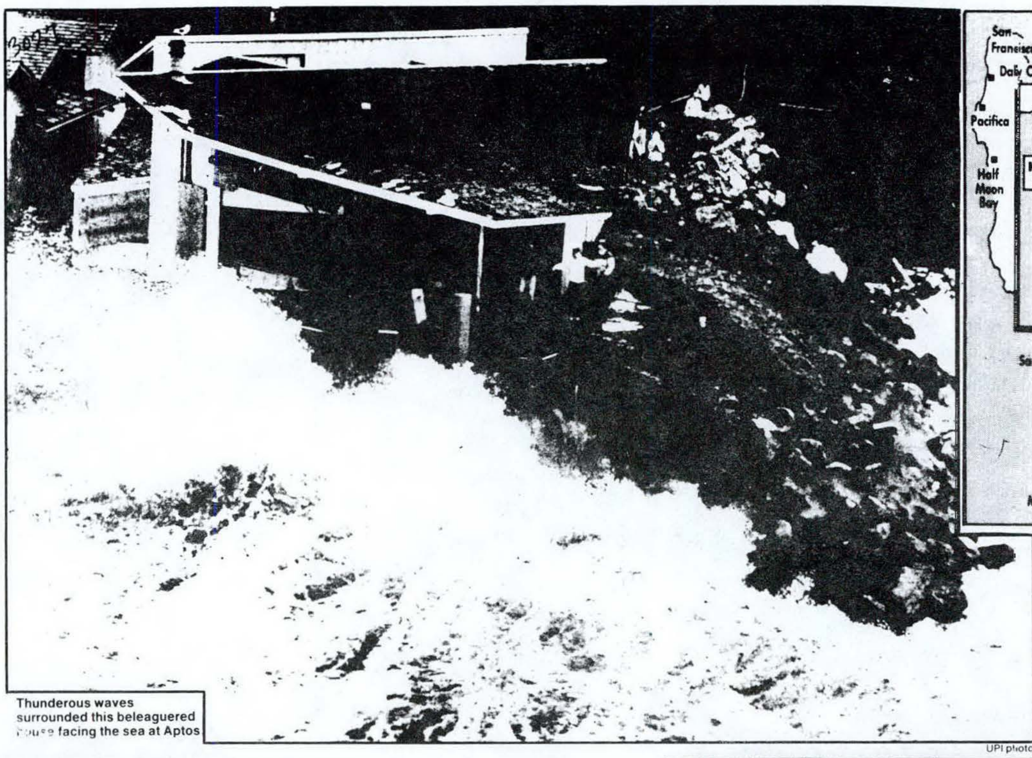


traditional row boat

downed telephone pole

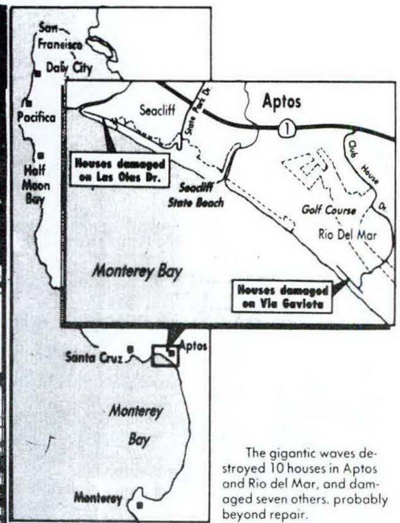
Alviso residents opt for various modes of transportation

Times Tribune staff photos by Sam Forencich



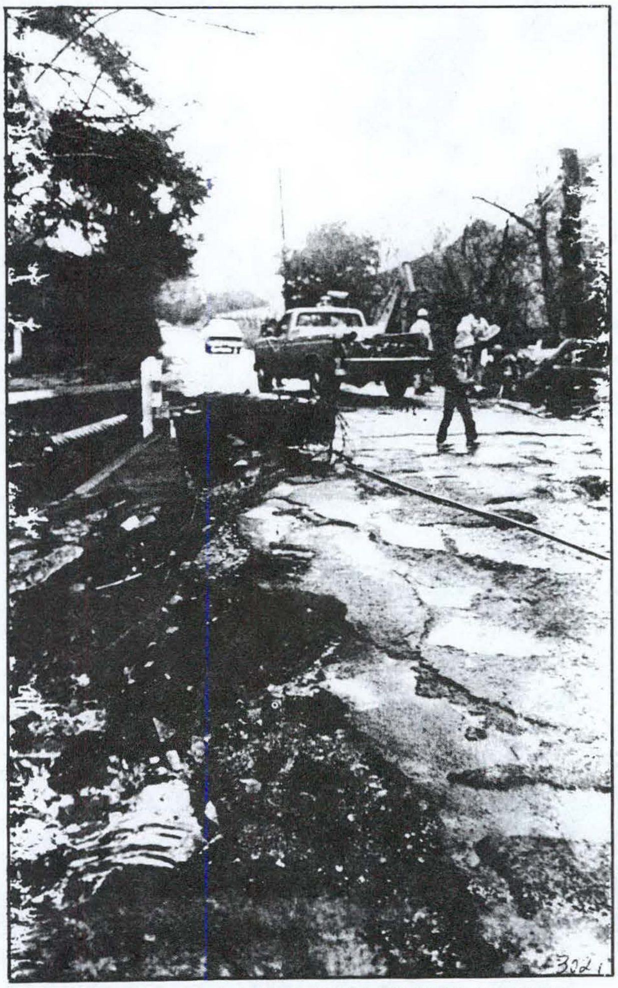
Thunderous waves surrounded this beleaguered house facing the sea at Aptos

UPI photo



The gigantic waves destroyed 10 houses in Aptos and Rio del Mar, and damaged seven others, probably beyond repair.

SANTA CRUZ COUNTY



Surface damage to the Glen Canyon Road bridge occurred after a logjam pushed water over the top

Pete Amos/Sentinel

The San Lorenzo River spilled over its banks at Ben Lomond park

Police blocked off the bridge into Pajaro as the river overflowed the Santa Clara Valley forced 5,000 people to leave their residences in and near Alviso on March 2, when up to 10 feet of flood water inundated 1,000 acres of the bayside community.

Runoff into the County's largest reservoir behind Anderson Dam, located in the foothills south of San Jose, flowed over the spillway into Coyote Creek and inundated the downstream lowlands. Alviso lies 7 feet below sea level and was protected by dikes where Coyote Creek empties into the Bay. Despite the massive flooding, many of the citizens who make their homes in the area were reluctant to leave. Miraculously, evacuations were accomplished without injuries.

After more than a week, many of the flood victims demanded that they be allowed to return, but were restrained by officials enforcing a city edict. The official proclamation preventing habitation in the flooded area was necessary because of the failure of the sewage system. On March 9, however, about 100 residents pushed past police barricades and entered the restricted zone.

It was several days before the water subsided, the sewer was repaired, and the barricades were removed. Many who were anxious to return, after a brief inspection of their devastated dwellings, decided to make their homes elsewhere. Other storm events include significant damage to a bridge upstream on Coyote Creek and the evacuation of residents in the east foothills of San Jose, due to the threat of landslides.

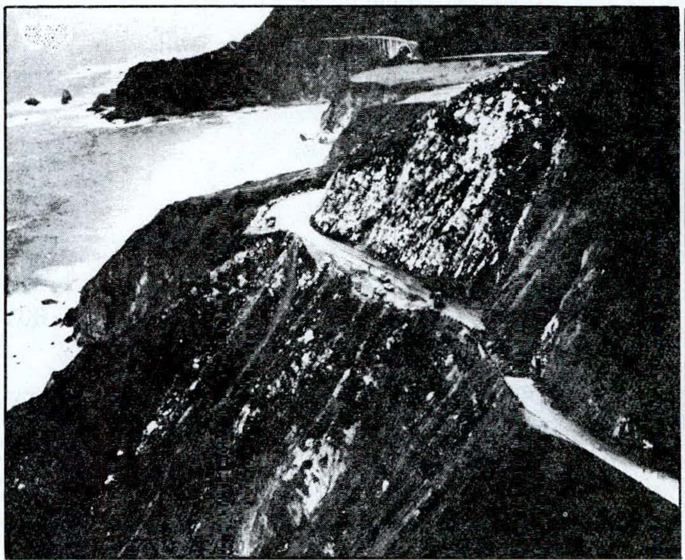
Santa Cruz County

Santa Cruz County coastal communities were seemingly continuously bombarded by high seas during the winter of 1982-83.

A series of four storms in late January, coupled with a seven-foot tide, tore away sections of several homes in Aptos and damaged beaches and facilities. A single wave reportedly smashed ten houses and severely damaged seven others.

A follow-up storm before mid-February unleashed its fury on the tourist town of Capitola and damaged beach front houses and businesses. Many of the homes were no match for the incessant pounding of 12- to 20-foot waves. Part of the city's wharf fell into the ocean, and many of the beach-front businesses dependent upon tourist trade for their survival were closed due to the storm damage.

The early March storm dropped as much as 5 inches of rain in the Santa Cruz mountains. For a while it was feared that there would be a repeat of the January 1982 calamity. Damage reports, however, fell far short of the January 1982 event, but there were some anxious moments. The community of Scotts Valley and those along the San Lorenzo River experienced some flooding. Numerous roads were closed, and the low-lying areas of the city of Watsonville suffered minor damage from backed-up water as the Pajaro River reached flood stages and blocked storm drains.

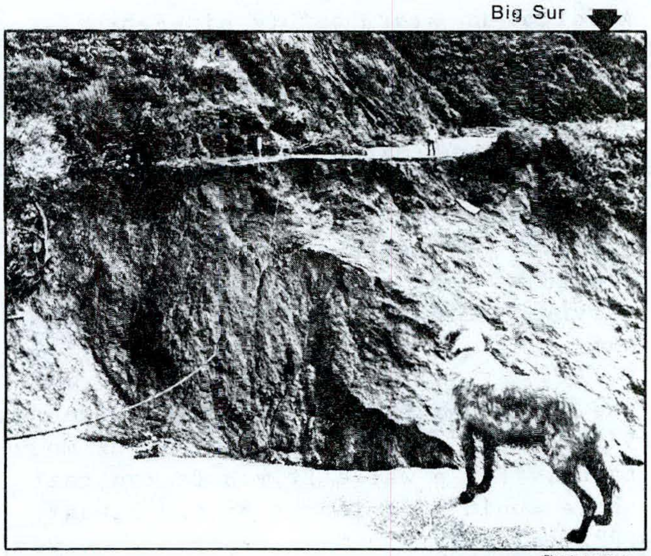


(Herald Photos by Robert Fish)

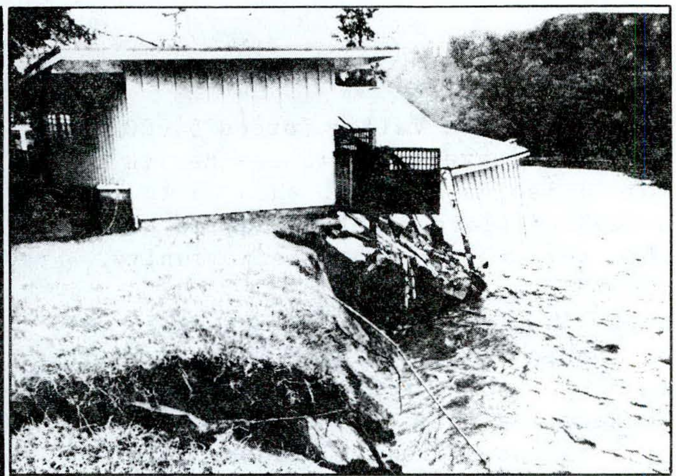
Hurricane Point

Highway 1 blocked by slides

Big Sur

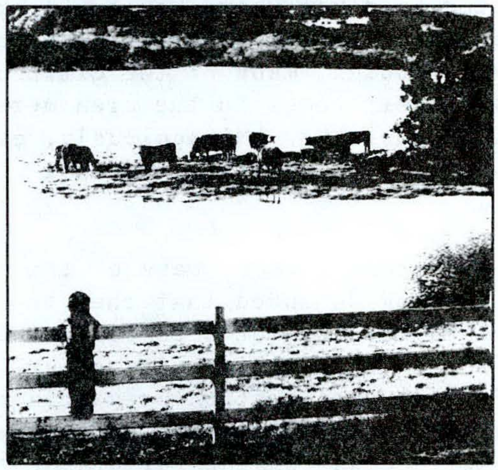


(Photo by Eric Pinchin)



RISING CARMEL RIVER CLAIMS ANOTHER HOME AS A VICTIM

(Herald Photos)



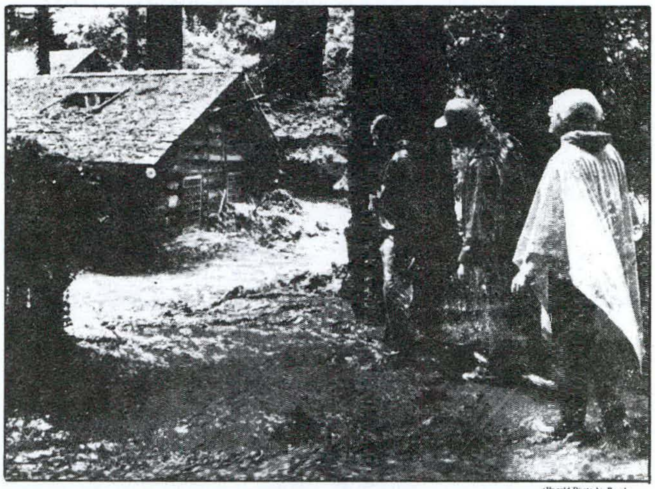
Carmel River Lagoon over-flow strands cattle

MONTEREY

Golf greens flooded (pin in dotted circle)

(Herald Photos)

Canyon road washed away



(Herald Photo by Ben L.)

One of scores of canyon homes destroyed

FLOOD, MUD HIT PLACID PALO COLORADO CANYON

COUNTY

Monterey County

A major storm in mid-November filled the Carmel River and flooded homes around the Carmel River lagoon. A high tide that coincided with the rapid runoff prevented the river from cutting a drainage swath through the lagoon. The river rose so rapidly following the November 18-19 deluge that officials had no time to take preventive measures against the flooding.

The Salinas River reached flood stage at Bradley in late January and again in early March. Late February rains brought flooding to Moss Landing and immediately prompted officials to meet and discuss ways to correct the recurring drainage problems common to the area.

During the early March storms the golf course and recreation areas of the Monterey Peninsula suffered extensive damage when high winds toppled trees and the heavy rains flooded freeways and parking areas. The raging Carmel River also badly eroded some popular public golf courses and private country clubs. Homes of Carmel Valley were frequently isolated by road closures and some flooding reoccurred.

The Palo Colorado Canyon on the Big Sur coast was particularly hard hit by the early month deluge; more than 12 inches of rain fell on the ridge above the canyon and turned Palo Colorado Canyon Road into a river. The root systems of a number of redwood trees more than a century old could not maintain their grip on the saturated soil, and some of them were toppled by high winds. Numerous cabins and homes that line the hillside were swept away or damaged by mudslides, fallen trees, and flood waters.

Many residents of Big Sur were also cut off from the outside world when several sections of Highway 1 were covered by mudslides or slipped into the ocean. The worst damage to the highway between Carmel and Big Sur occurred near Hurricane Point.

SACRAMENTO RIVER BASIN

The Sacramento River Flood Control Project was tested many times during water year 1982-83. Wave after wave of weather fronts brought torrential rains, coupled with strong winds, to the valley floor and record snow to the high Sierra. Early weather fronts were of the warm variety and brought rain to elevations as high as 9,000 feet. Snow from early fall storms was washed away, and the flood reservation space of major reservoirs was quickly encroached.

Water officials and the Flood Operations Center carefully monitored the unfolding of meteorological events that eventually resulted in California's wettest year in recorded history. By midwinter, after evaluating the hydrological conditions, flood personnel realized that the Sacramento Valley and other areas of the State could expect unusual flooding, and steps were taken to mitigate the effect.

On January 26, in the midst of the late January onslaught, under authority of a "Flood Alert" status, the Flood Operation Center expanded its operating hours and staff to coordinate a full-scale flood fight. The Flood Center became a beehive of activity and remained in such a state for the next two months.

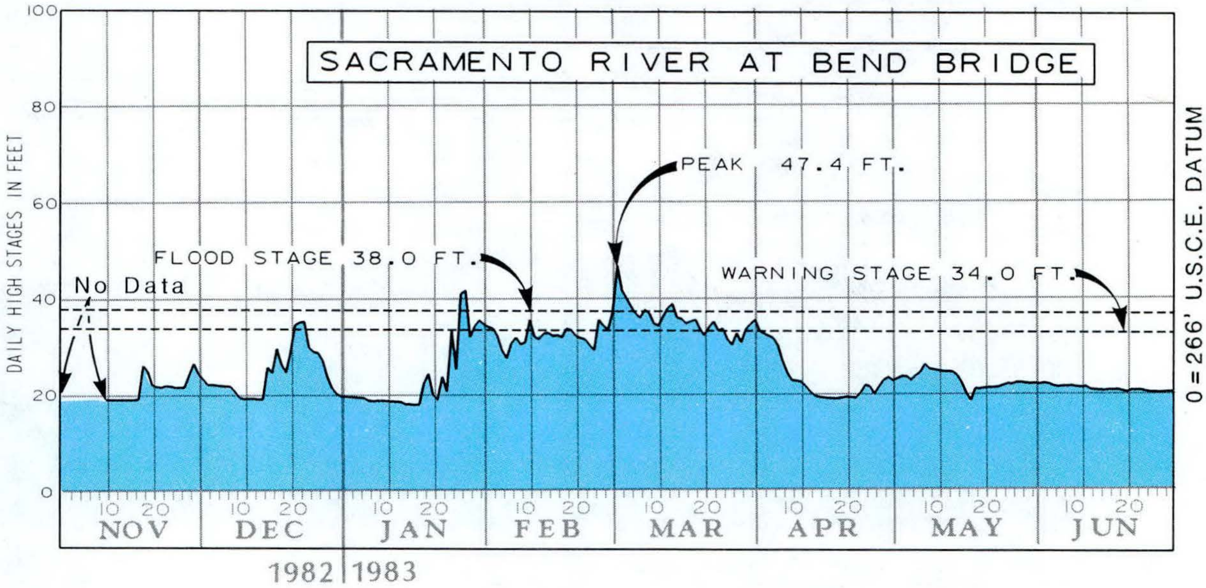
In the upper Sacramento Valley, the rains were continuous and heavy. Tributaries of the Sacramento overflowed their banks and contributed significantly to near record runoff in the Sacramento River System. Coming on the heels of the wet 1981-82 water year, the runoff made this two-year period the wettest since record keeping began in 1849.

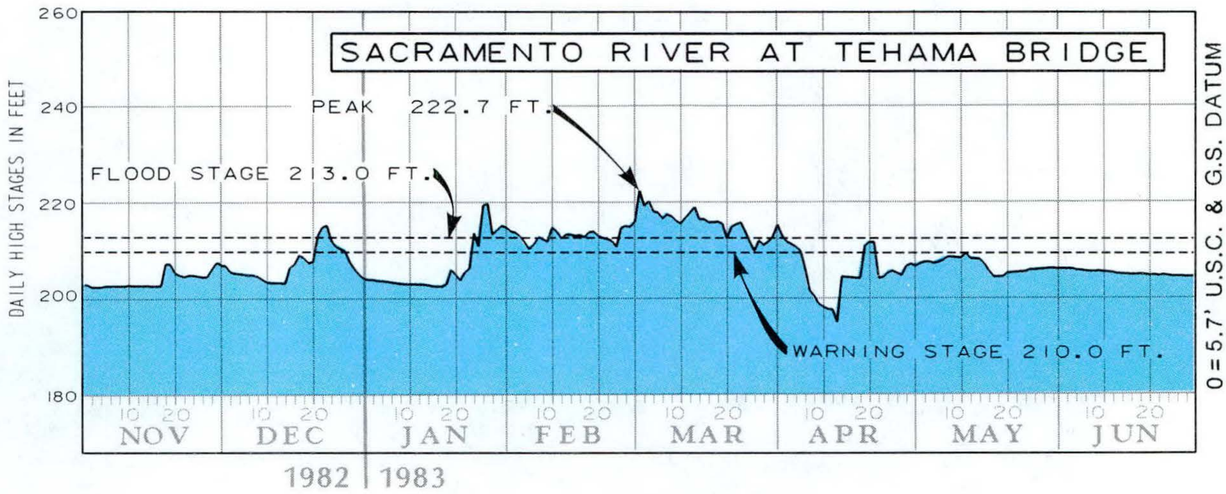
Among the several new river-stage records established this winter was a peak stage of 222.71 feet at Tehama Bridge on March 1. Some "old timers" claim flooding along the Upper Sacramento River and tributaries was the worst ever. Hydrographs of the Sacramento River are presented in Figures 16 and 17.

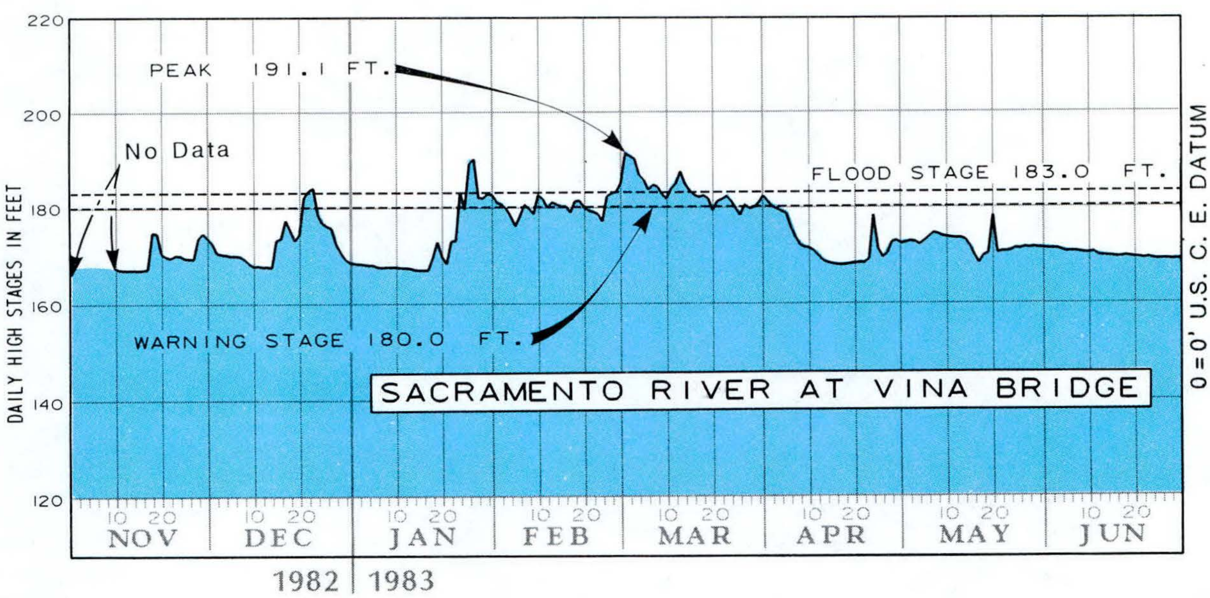
The weirs along the Sacramento, which act as safety valves relieving pressure on river levees by diverting excess water to large bypasses, were pressed into service early in the water year. Floodwater escaped into Butte Basin and into the Sutter and Yolo Bypasses for short periods during November and December. Beginning on January 25, all fixed weirs in the system overflowed without interruption until early April; the sole exception was the Moulton Weir, which ceased flowing briefly on two occasions. The long inundation of the heavily farmed bypasses inundated some unharvested crops and prevented the planting of seasonal crops. A hydrograph showing the depth of flooding in the Yolo Bypass is presented in Figure 18.

The Sacramento River Flood Control Project functioned as designed. Approximately four times the average annual flow passed through the Project during the water year of 1982-83, but damage to the system was amazingly low.

Figure 16. HYDROGRAPHS OF THE SACRAMENTO RIVER

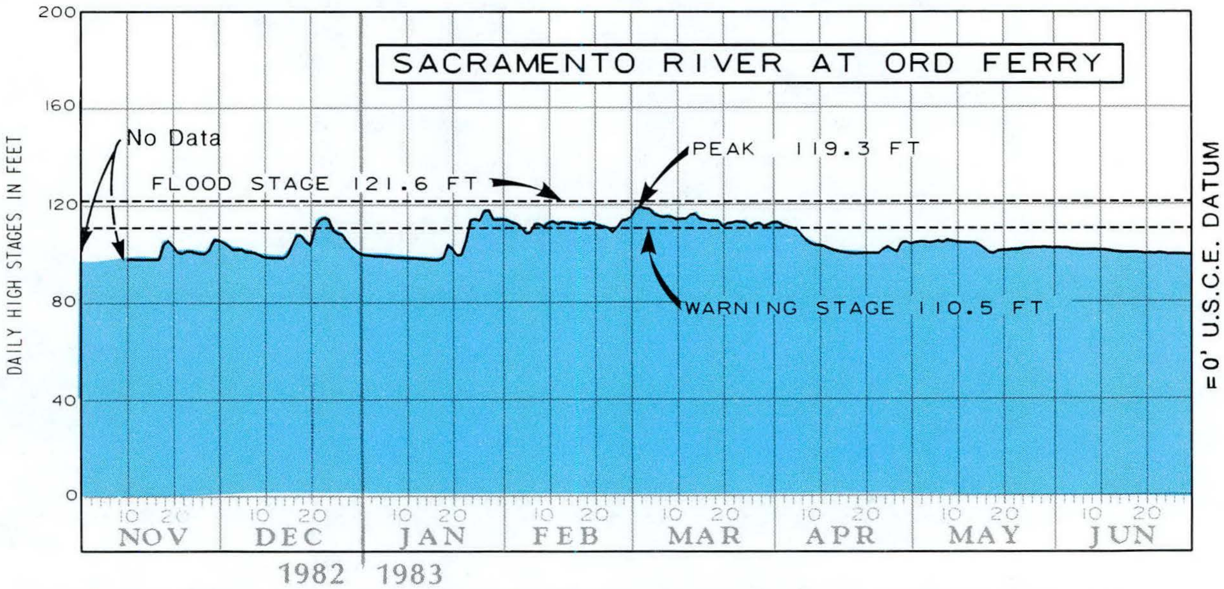






7—78544

Figure 17. HYDROGRAPHS OF THE SACRAMENTO RIVER



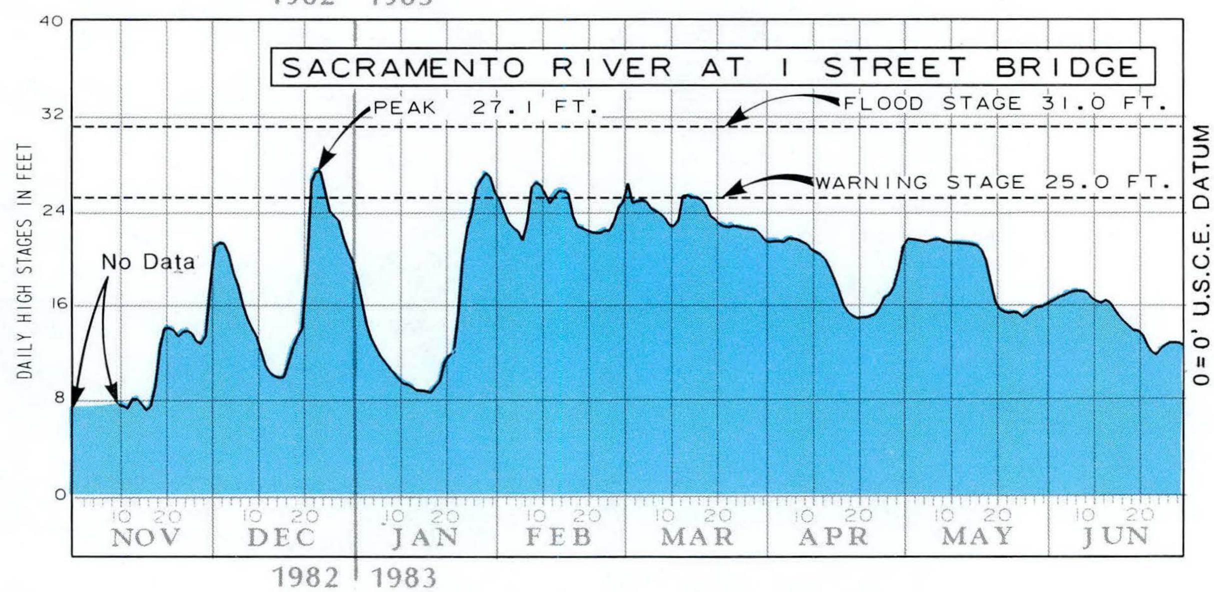
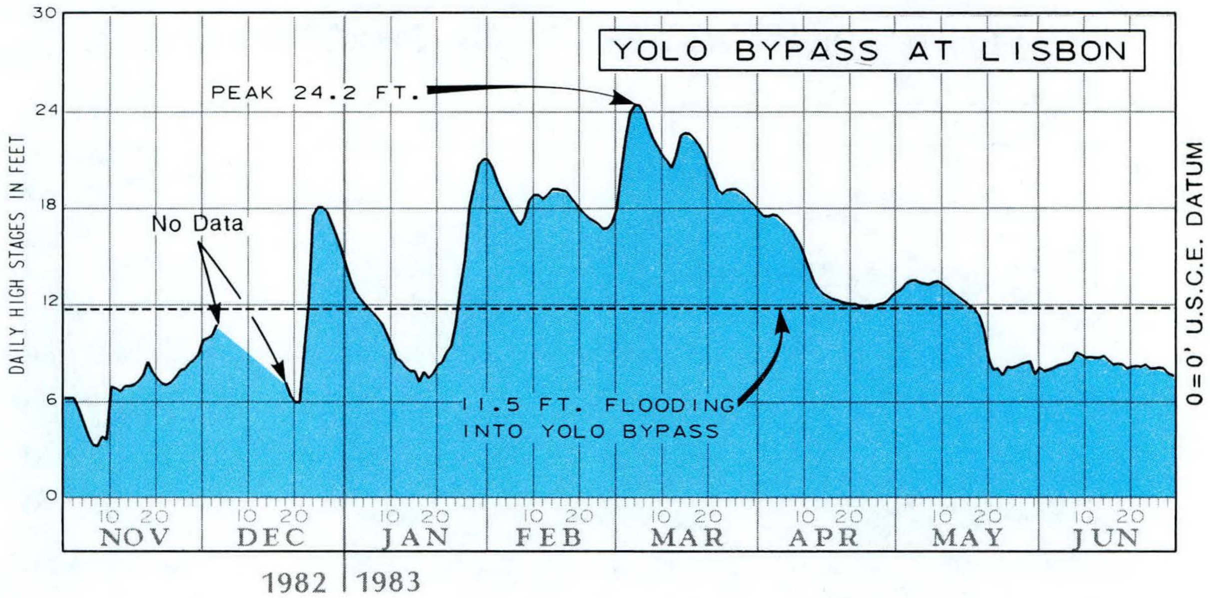


Figure 18. HYDROGRAPH OF THE YOLO BYPASS



Flood events of note as they occurred in counties adjacent to the Sacramento River are reported in the following paragraphs.

Shasta County

A series of storms during the last week of January left a path of destruction in its wake, causing at least one death and one critical injury. While repairing the badly eroded Crystal Creek Road, unsuspecting workmen were engulfed in a wall of mud. The mudslide killed one equipment operator, critically injured his companion, destroyed two pickup trucks and a skip loader, and crushed a 10-passenger bus used to transport inmate workers. Miraculously, none of the inmate workers or other crew workers were seriously injured. In the Whiskeytown area, Clear Creek swept uncontrolled through the community of French Gulch and left the community park in a shambles.

The combination of local runoff and major flood-control releases from Shasta Dam (60,000 cfs) kept local, State, and federal officials busy protecting endangered riverside homes and property between Redding and Red Bluff. For a brief period, the releases from Shasta Lake were reduced substantially to permit bank-protection crews to repair the badly eroded banks. A hydrograph of Shasta Lake is shown in Figure 19.

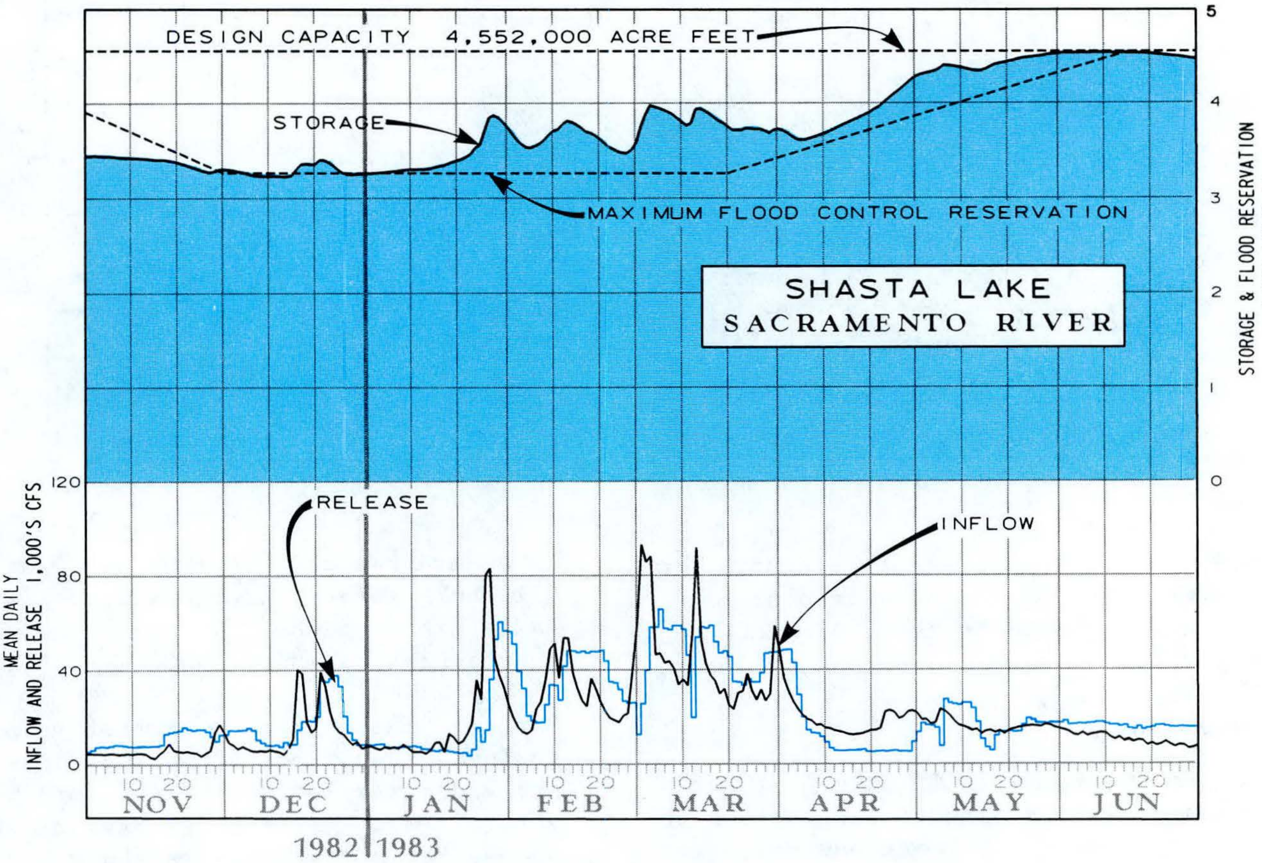
However, there were 20 days of rain during a 25-day period during late January and early February. And more was yet to come. After a few days of sunshine, March came in like the proverbial lion and streamflows rose to extremely high levels. In addition, water-weary residents watched a carbon copy of the earlier storms. As if to underscore the point, the storm series ended with a violent and lengthy thundershower, which concentrated its fury on Redding, knocking out power and flooding streets.

Glenn County

The monstrous storm that hit the North State in late January resulted in major flooding and road closures throughout Glenn County. Travel between Orland and Willows was suspended because of flooding, and numerous secondary roads also became impassable. Northeast Willows was hit hard, and some residents were hemmed in by the surrounding high water.

The early-March storm left its mark on the entire county. Landowners and resi-

Figure 19. HYDROGRAPH OF SHASTA LAKE



dents of Hamilton City battled the raging Sacramento River, which threatened their protective dikes. The flood fighters were not entirely successful, as several private levees overtopped and valuable farmland in the flood plain became inundated. During this period, Black Butte Reservoir was almost full, and flood-control releases of 15,000 cubic feet per second were discharged into Stony Creek during the final week of March (see Figure 20).

Much of the flood water remained ponded well after the river had receded. The incessant rains had raised the groundwater tables in some areas to the extent that the flood water was unable to percolate into the gravelly soil. In many areas, water percolating up from the ground left standing water and flooded basements.

One large loss resulting from flooding in Glenn and the other north state counties was the loss of beehives. Hundreds of hives, valued at several million dollars, were washed away or contaminated by flood waters. Beekeepers frequently store bee colonies in riparian areas, and many were caught off guard by the fast-rising river system. The beekeepers have since developed a telephone warning system and call the State Flood Center frequently to check river-stage forecasts during rainy weather.

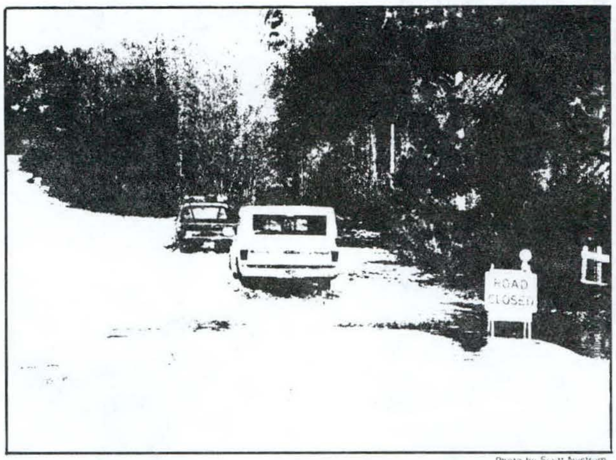
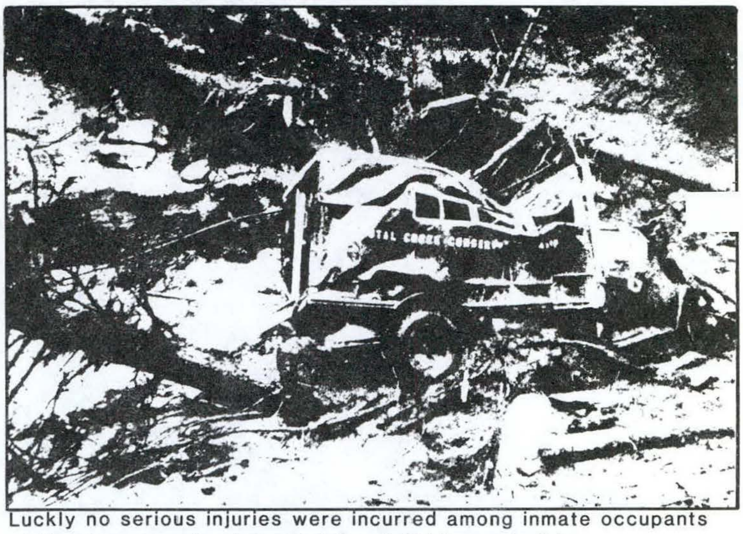
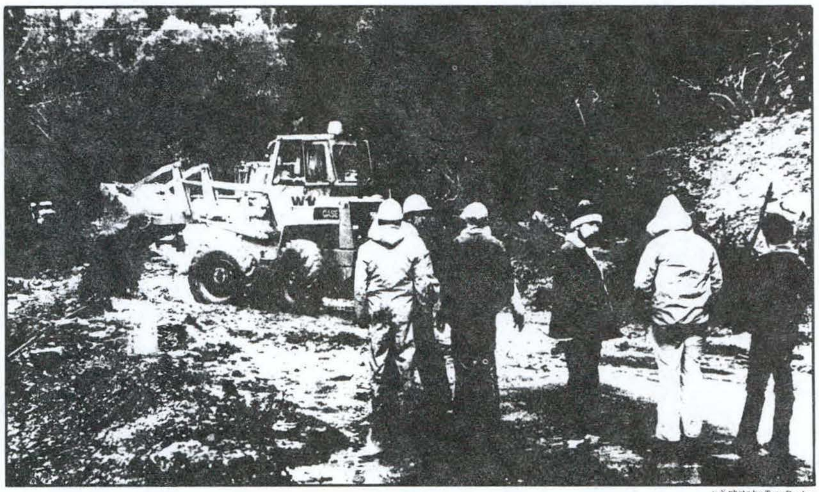


Photo by Scott Nystrom


Luckly no serious injuries were incurred among inmate occupants of this bus, swept off Crystal Creek Rd by mud slide

SLIDES AND HIGH WATER HAMPERED TRAVEL ON MANY COUNTY ROADS


R-S photo by Tom Dunlap

SHASTA COUNTY

Flooded "Balls Ferry Resort"

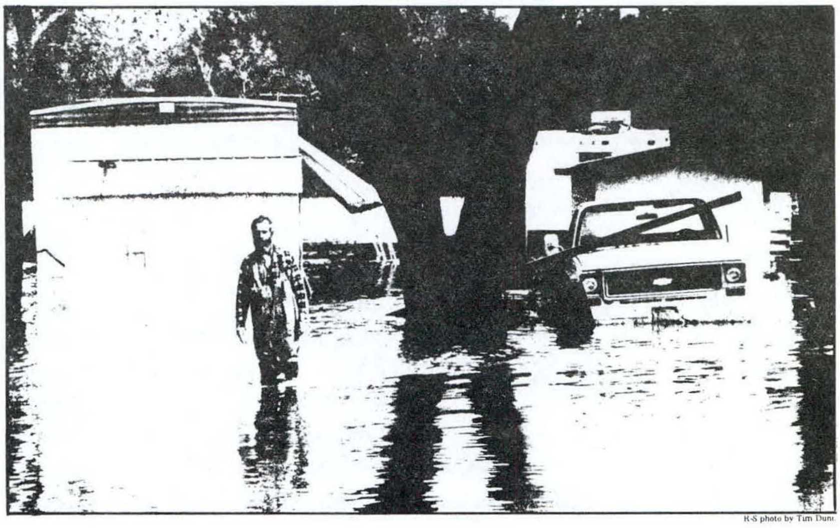
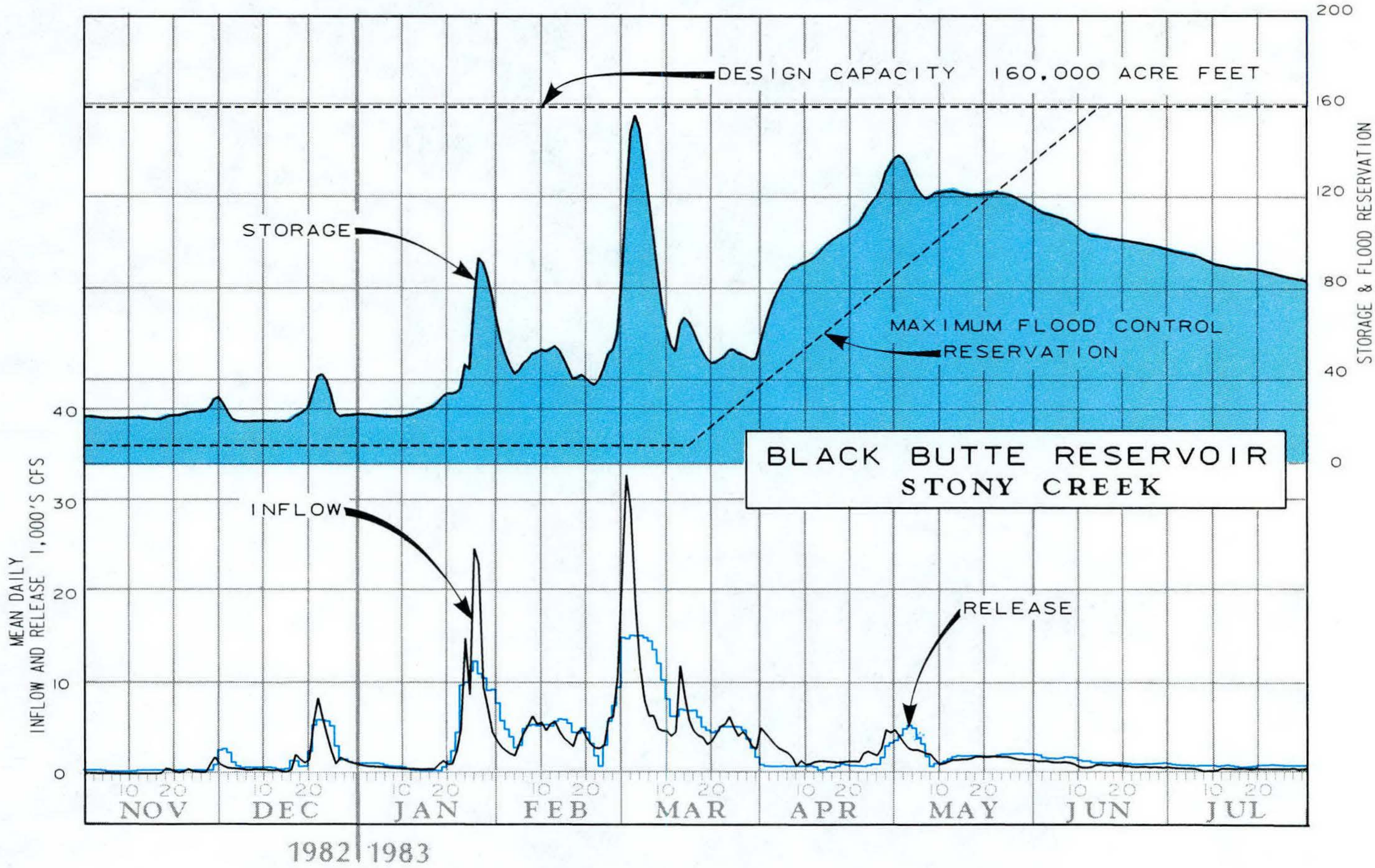

R-S photo by Tom Dunlap

Figure 20. HYDROGRAPH OF BLACK BUTTE RESERVOIR



Butte County

The wind-driven storm of late January kept Oroville police, firemen, and public work crews busy much of the night of January 23-24, repairing and preventing flood damage. More than 1.6 inches of rain during a short period capped a steady downpour and generated creek overflows, flooded stores and apartments, and knocked out power. The strong winds associated with the storm also downed trees and damaged structures.

Nearly 6 inches of rain in less than a week beginning in late February left nearly 80,000 acres of agricultural land under water. An estimated 250 families near Chico were forced to leave their homes. The majority of homes flooded were in Nord. An undetermined number of livestock were also stranded on high ground and had to be fed by boat. Bees and beehive losses were heavy and may prove to be a major agricultural loss.

Yuba-Sutter Counties

Sixteen days of rain during a 22-day period in early March placed many roads in an extremely perilous condition and inundated thousands of acres of fruit trees. Slippage in a Sutter Bypass levee near Robbins, in Reclamation District 1500, remained a major concern for several weeks, and persistent high runoff and strong winds gradually eroded the saturated levees. Prompt action by Reclamation District officials and State flood fighters prevented the loss of a landside section of levee that had slipped vertically at least 2 feet. A 24-hour vigil was kept on the slippage site and other vulnerable areas for an extended period.

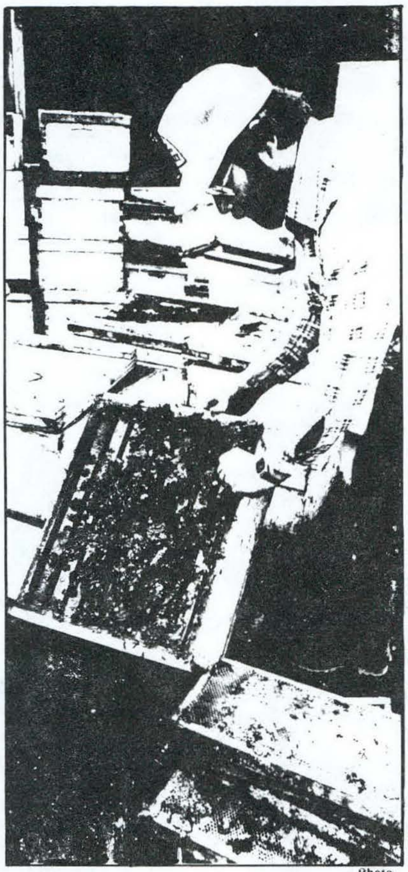


Photo
By T.J. Burnham

Bee keepers hives ruined by flood

GLENN COUNTY

Sandbagging north of Hamilton City

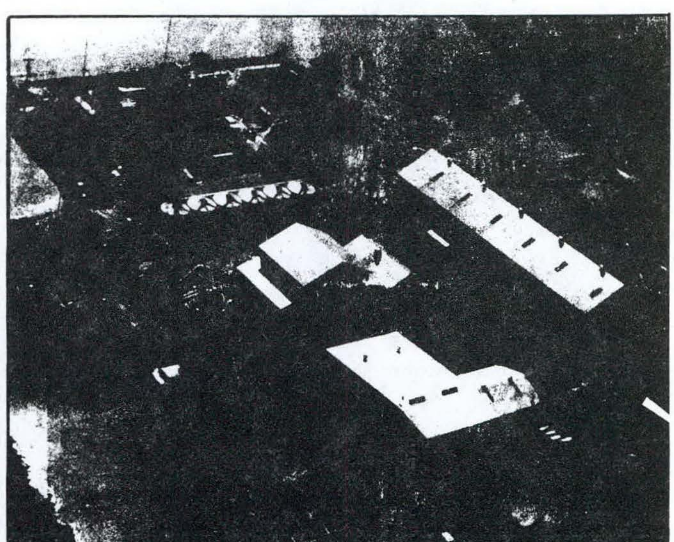
Sandbagging south of Hamilton City

Photos by Rick Sandoval, Monte Weathers and Greg McCombs

BUTTE COUNTY

Car damaged by falling tree in Chico

Mercury Photo by Al Liddle



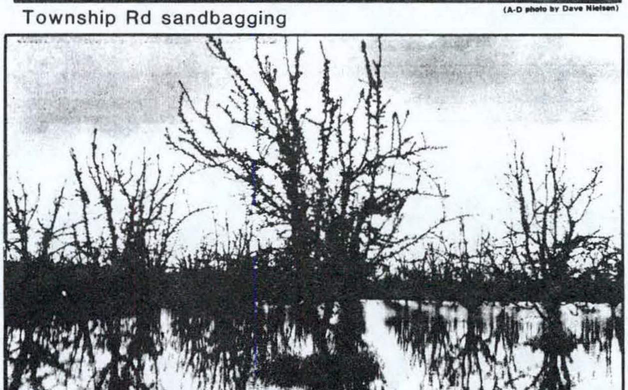
Mercury Photo by Al Liddle

Grain silos and agricultural complex near Sacramento River flooded

Residences and public facilities of Live Oak and parts of Yuba City were hard hit by the downpour of early March. Inadequate drain systems reportedly backed up and were blamed for much of the damage.

Sewage system failures contaminated water wells and added to the problems of the residents. Fortunately, Bullards Bar on the Yuba River, and Lake Oroville on the Feather River prevented flooding along those rivers (Figure 21).

Township Rd sandbagging (A-D photo by Dave Nielsen)

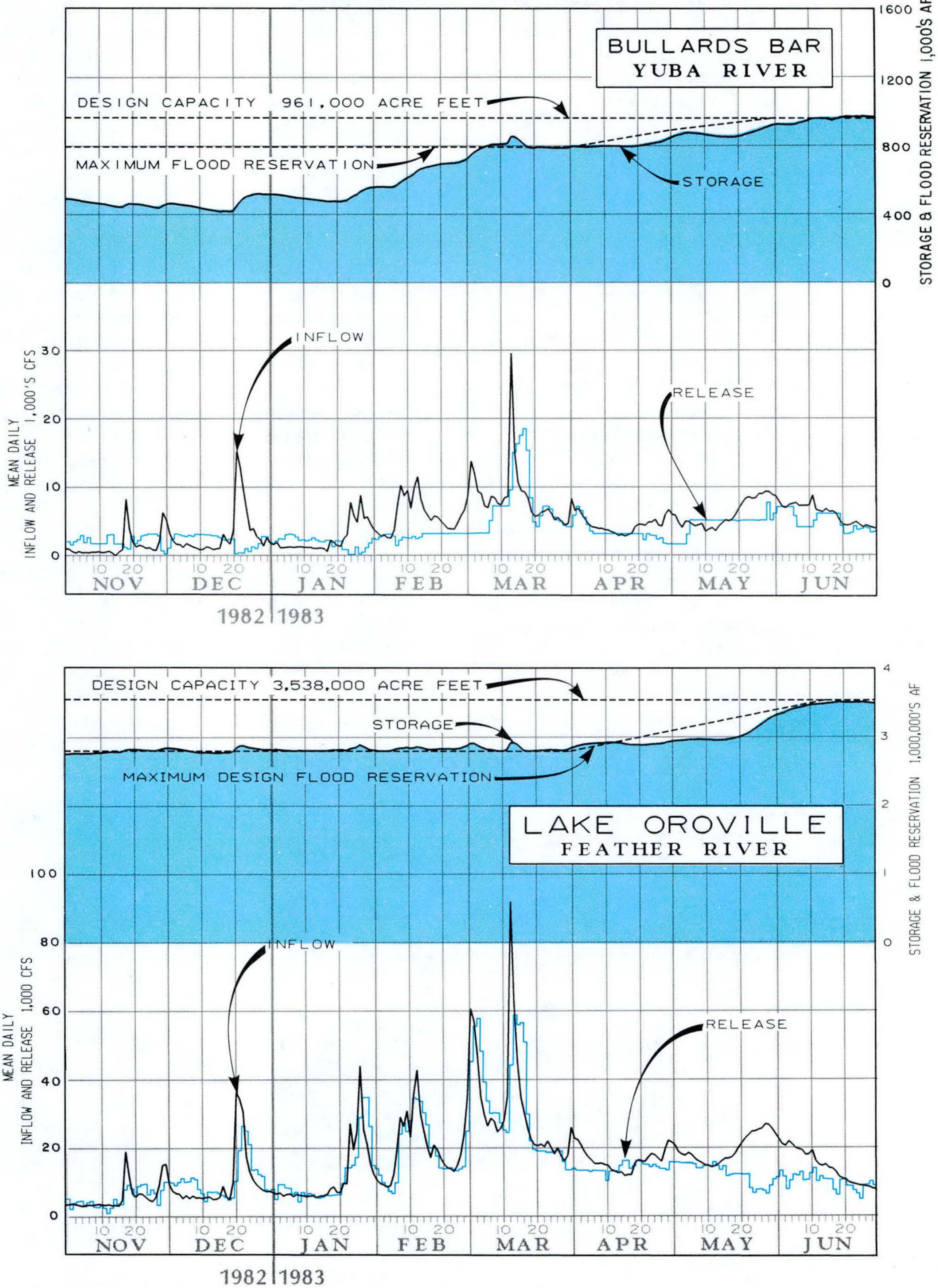


Long standing flood waters threaten prune trees lives

Swollen Feather River gleams in the sunlight (Photo by Jane Ellis)

SUTTER COUNTY

Figure 21. HYDROGRAPH OF BULLARDS BAR AND LAKE OROVILLE



Colusa County

Colusa County was one of the earlier counties to receive disaster designation when the late January onslaught, preceded by wave after wave of weather fronts, resulted in millions of dollars in damage to roads and private property. Several homes and businesses along Highway 20 west of the city of Colusa were flooded during the deluge.

Nor did damage in Colusa County end with the January event. In March, another attack by the elements closed nearly every road in the county, including Highway 20, for a short time. "You can't get there from here," became more of a reality than a joke. Blustery March also turned farms into sponges, preventing farmers from preparing their land for seed and bringing disease to orchards and other wooded crops.

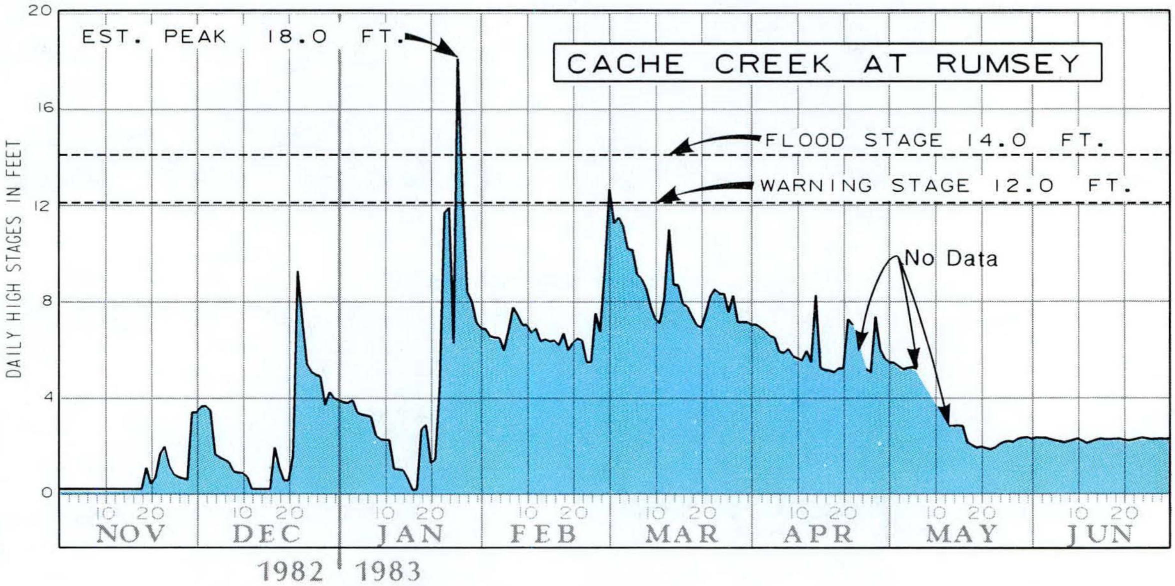
Yolo County

The major storm that struck California during the latter part of January also brought flood stages to Cache Creek (Figure 22). Early on the morning of January 24, the south levee of Cache Creek failed about 2 miles east of Woodland, north of Highway 5. The levee is a part of the Sacramento Flood Control Project, which drains the area south and east of Clear Lake. For a few hours following the break, twelve flood fighters, including DWR personnel and local firemen, were stranded between the site of the break and the stub end of the levee system. A California Highway Patrol helicopter, however, was promptly dispatched to the scene and rescued the flood fighters. Several vehicles were left at the scene but were later ferried to safety.

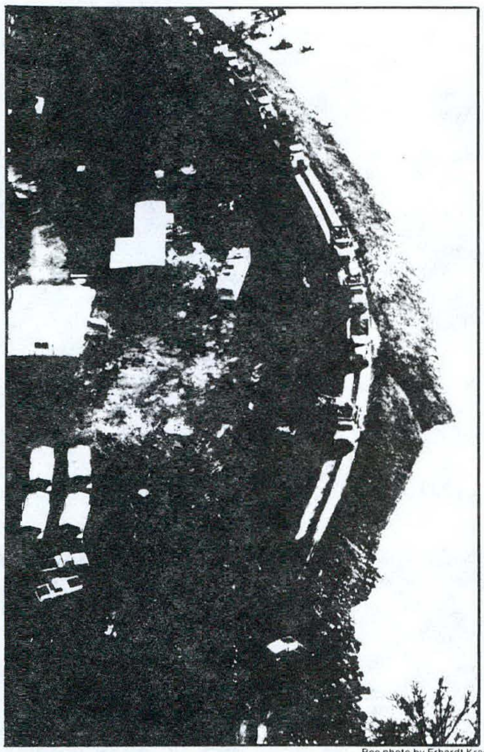
Approximately 600 acres of farmland were flooded as a result of the incident, and another 30 acres were inundated when a hole was punched into the north levee to relieve pressure on gradually deteriorating levees. Upstream from the break, local emergency officials, volunteers, and DWR crews battled successfully to form a protective sandbag barrier around portions of the town of Yolo.

Considerable damage, however, was reported in the Capay Valley north of Woodland along Highway 16. Buildings, equipment, and crops were damaged by overflowing Cache Creek. Emergency crews assisted in evacuating residents of the town of Rumsey.

Figure 22. HYDROGRAPH OF CACHE CREEK

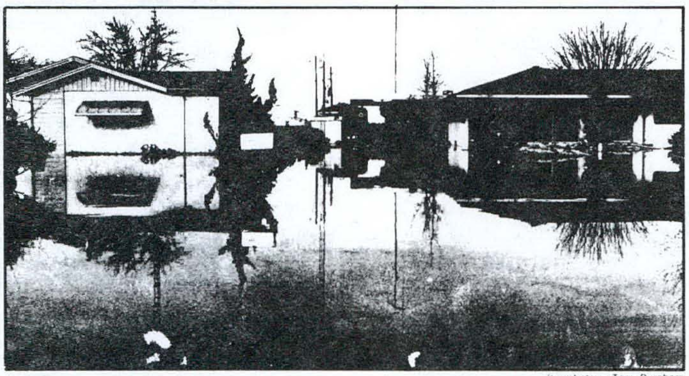


COLUSA COUNTY



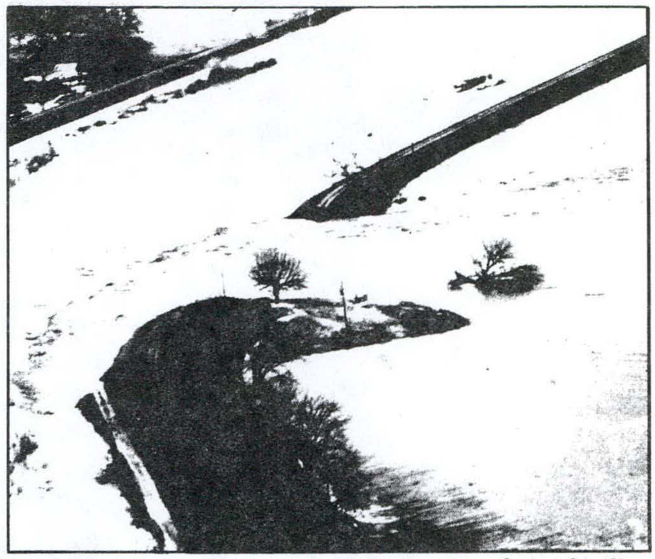
Bee photo by Erhardt Krause

Gravel dumped onto weakened Sacramento River levee north of Colusa



Bee photo by Terry Burnham

Flooded street in City of Colusa



Bee photo by Richard Gilmore

CACHE CREEK LEVEE BREAK

YOLO COUNTY

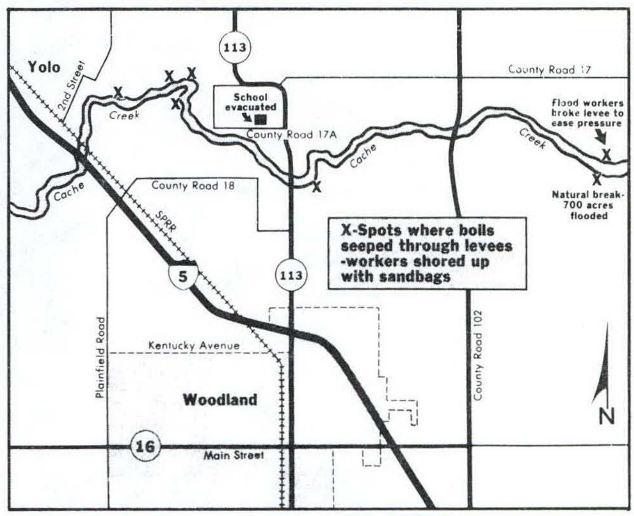
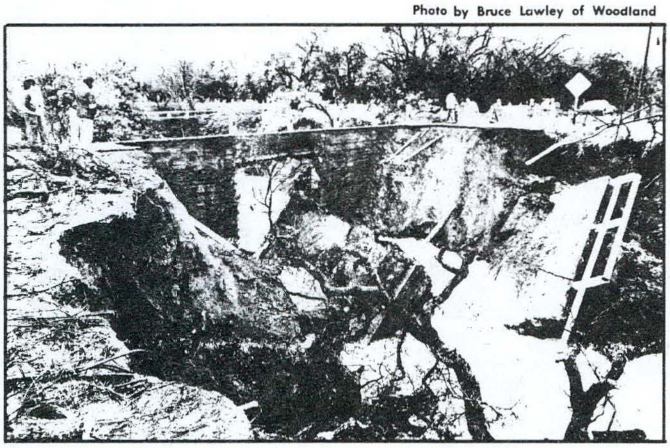


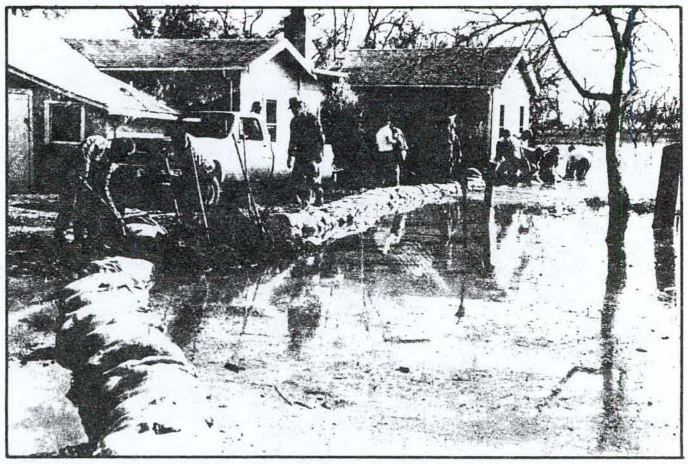
Photo by Bruce Lawley of Woodland



Co. Rd. 79 bridge crumbled into tributary of Cache Creek

Helicopter lands on Co. Rd. 102 bridge over Cache Creek

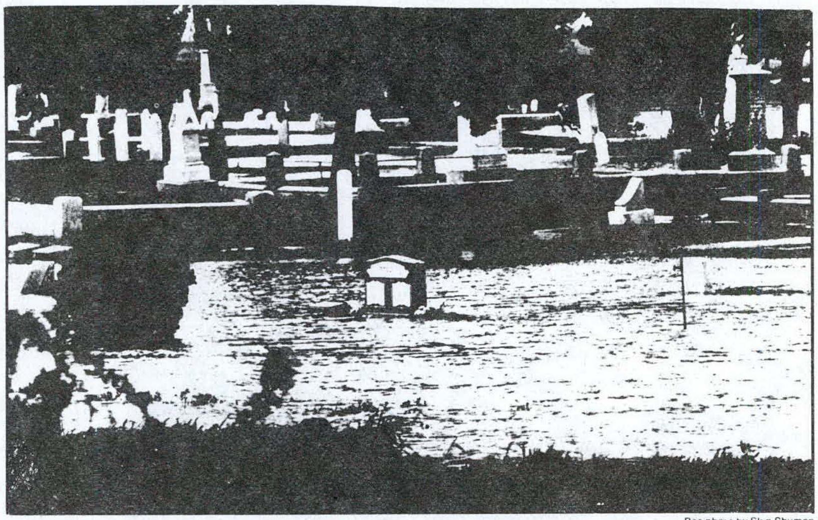
Sandbagging in an effort to prevent more flooding of Knights Landing business



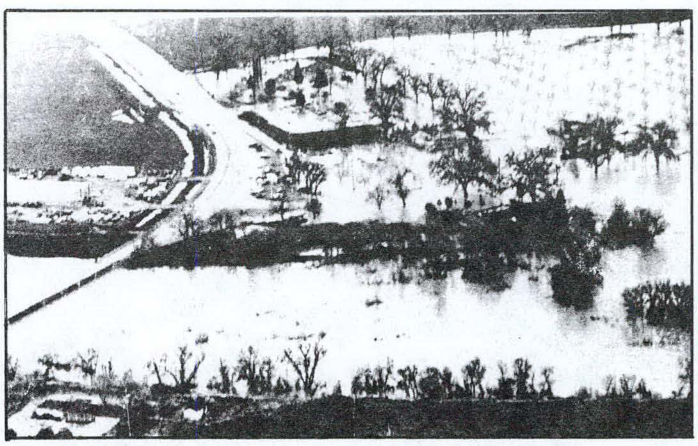
RIDGE CUT CANAL FLOODING

YOLO COUNTY (Cont.)

Flooded Knights Landing cemetery



Bee photo by Skip Shuman



Flood waters cover roads and farms near Zamora and Yolo

The month of March proved to be another flood disaster period for Yoloans. The nearly constant rain not only renewed the problems that had plagued the county during earlier storms but also touched other areas that had previously escaped unscathed.

In the Capay Valley, the March deluge repeated the attack on stream banks, and many landowners and ranchers lost additional land. A concrete bridge over Cache Creek at County Road 79--a bridge that had withstood high water for more than 50 years--failed, leaving seven families stranded on the far side.

In Davis, streets and facilities were flooded by local runoff and overflowing drain ditches. Numerous roads were closed, including County Roads 89 and 90, the main accesses to the County Hospital. A boat was seen paddling down the 17th fairway of the Davis Municipal Golf Course.

As the early March rains continued, additional problems began to emerge. Several houses in the Knights Landing-Zamora area were under water from overflowing local sloughs. Boats were called in to help residents remove their belongings. Volunteers from the Knights Landing, Yolo, and Zamora Fire Departments worked long hours to stave off the steadily rising water.

Meanwhile, the Ridge Cut, a canal running parallel to the Sacramento River from Knights Landing to the Yolo Bypass, backed up water, threatening Knights Landing. A surprising number of volunteers, some from distant areas, constructed sandbag barriers and, except for a cemetary, managed to keep the water out of Knights Landing. Flood-fight efforts in areas south and west of Knights Landing, however, were not as successful.

As the high runoff continued, several portions of the Yolo Bypass levees began to slip. The most noteworthy was a 500-foot section on the east levee upstream from Highway I80. When the slip reoccurred on the landside of the barrier, the Corps of Engineers promptly constructed a landside berm along the damaged section to prevent further slippage. California Conservation Corps crews directed by DWR personnel placed plastic sheets over the levee crown and landside slope to prevent further saturation of the levee by rainfall. This prompt and effective action and 24-hour patrolling by Reclamation District personnel helped alleviate the fears of many residents protected by the levee.

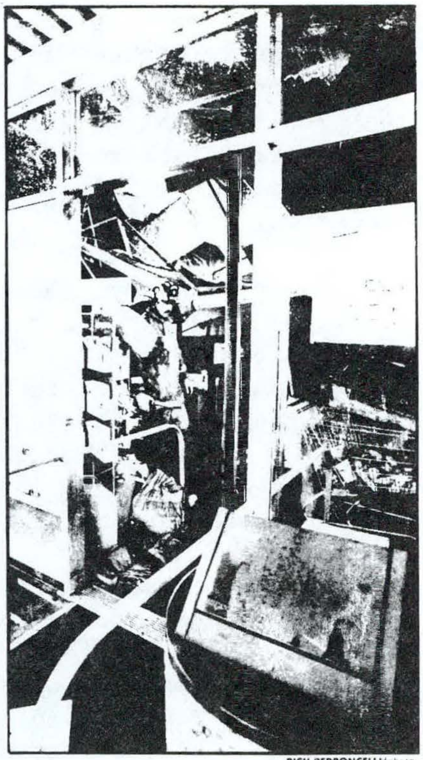
Sacramento County

Sacramento County was designated a disaster area eligible for public assistance on February 22, 1983, but only for those portions of the county located within the Sacramento-San Joaquin River Delta. Although the remainder of the county did not qualify for federal disaster assistance, it did not entirely escape the wrath of the storms. Frequent and widespread street flooding was prevalent and created major traffic jams, leaving motorists stranded for hours at a time. The storm in early February repeatedly flooded homes and businesses in the north area of the city of Sacramento and collapsed the roof of a supermarket. The roof, heavy with water, "creaked" before it fell and gave shoppers enough warning time to escape. In many instances, the flooding and resulting street closures were due to inadequate drainage systems, which were overloaded by the heavy and persistent downpours.

The high stage of the Sacramento River, in the area that skirts the capital city, raised ground water to levels that threatened to damage a main throughfare vital to national defense and interstate commerce. The saturated soil and pressure from high river flows adjacent to the freeway create strong uplifting forces on the depressed section of Interstate Highway 5 that parallels the

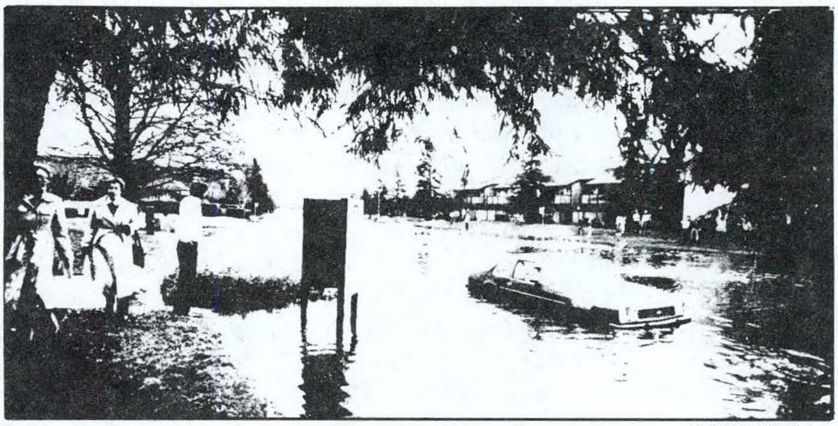
HENRY AU/staff photo

Numerous streets flooded



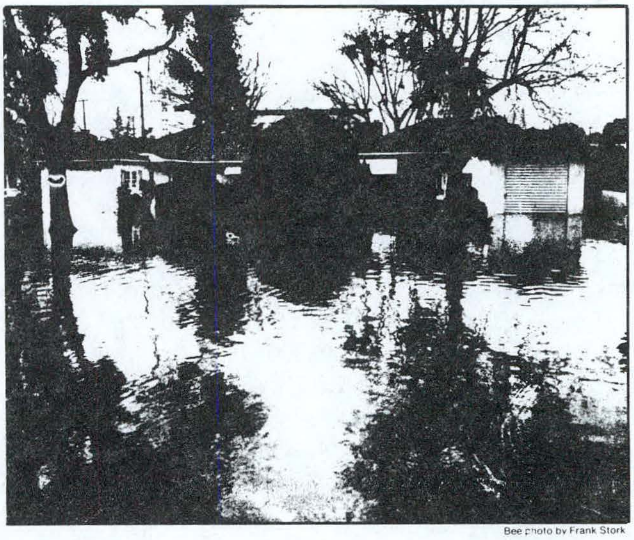
RICH PEDRONCELLI/photo

Store roof collapsed from weight of water



JERRY RAINBOLT/staff photo

SACRAMENTO COUNTY



Bee photo by Frank Stork

Sink hole opened on busy Rosemont St.

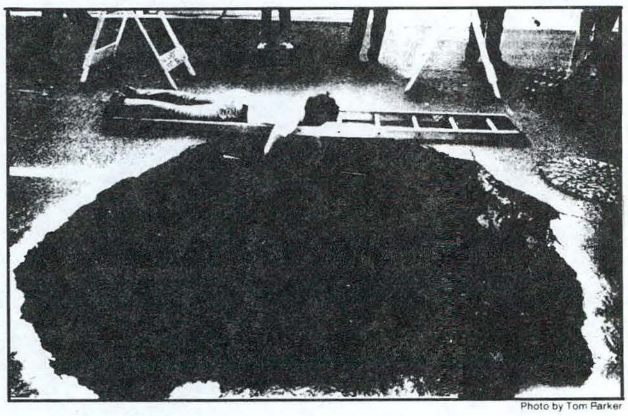


Photo by Tom Parker

city of Sacramento. State engineers determined that well points normally used to remove excessive water from the low section of the freeway had caved in, making it impossible to operate drainage pumps.

To prevent possible damage to the freeway, Caltrans engineers requested that the Division of Flood Management relieve river pressure by opening gates of the Sacramento Weir. Opening the Sacramento Weir gates, two miles upstream from the low section of the freeway, releases excess river water into the Sacramento Bypass; thus, the river level was lowered as it passed Sacramento and the troubled site on the freeway. Beginning on February 16, ten gates were opened for nine days to alleviate the freeway problem. Early in the following month, 36 gates were opened and remained so for more than a month. Even without the freeway problem, the gates would have had to be opened, at least for a period in mid-March, when releases from Folsom Lake into the American River reached 35,000 cubic feet per second (see Figure 23).

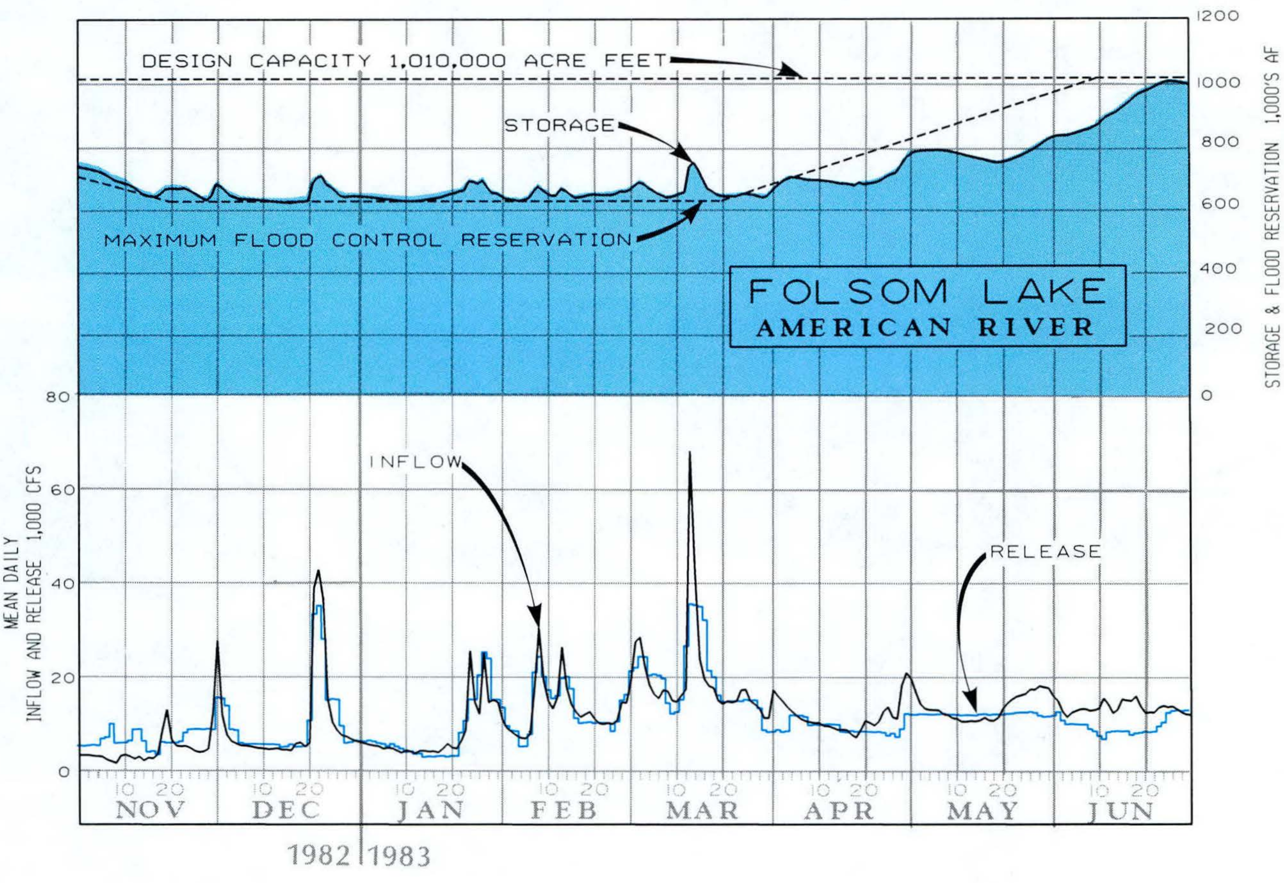
More than two inches of rain doused the central county during a 36-hour period between 4:00 a.m. on March 12 and 4:00 p.m. on March 13. This brought traffic to a virtual standstill in some downtown and suburban Sacramento areas. No major damage, however, resulted from the early March deluge.

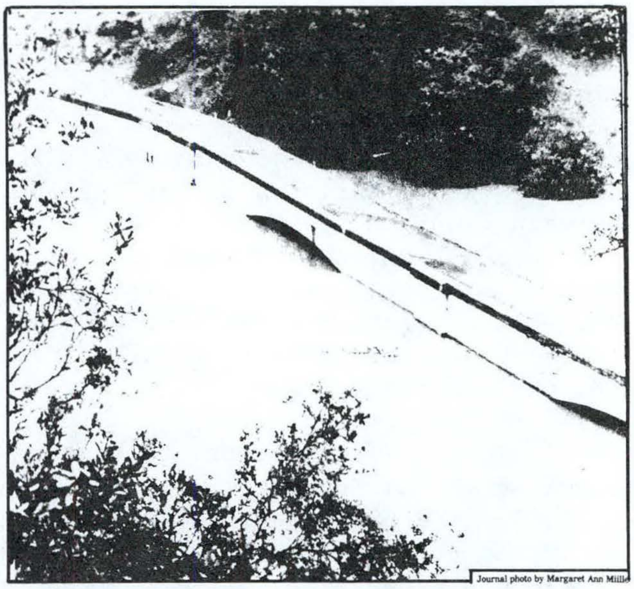
Very few of the weather fronts that stuck California during the winter of 1982-83 missed Sacramento County, but, excluding problems in the Delta portion, damage was generally limited to flooding resulting from overflowing of local creeks and overburdened drainage systems.

Placer County

The third major storm of the 1982-83 water year dumped more than 2 inches of

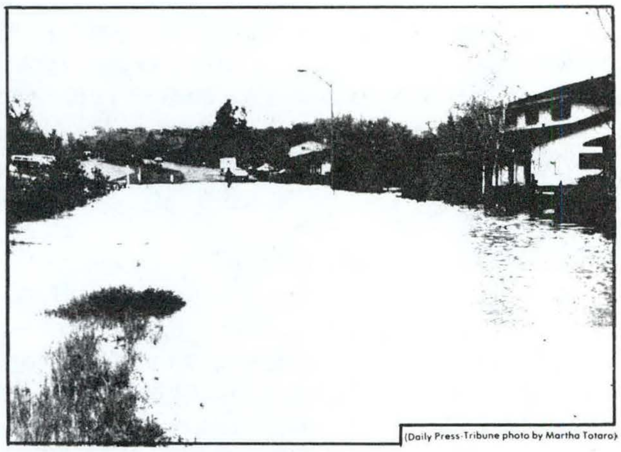
Figure 23. HYDROGRAPH OF FOLSOM LAKE





Journal photo by Margaret Ann Mill

American River and Highway 49 at Cool



(Daily Press-Tribune photo by Martha Totaro)

Whitney Blvd in Rocklin ▲

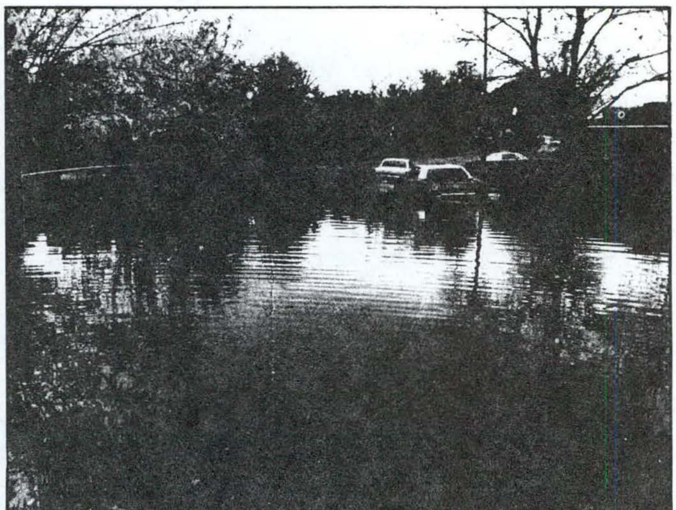
PLACER COUNTY

WIDESPREAD FLOODING

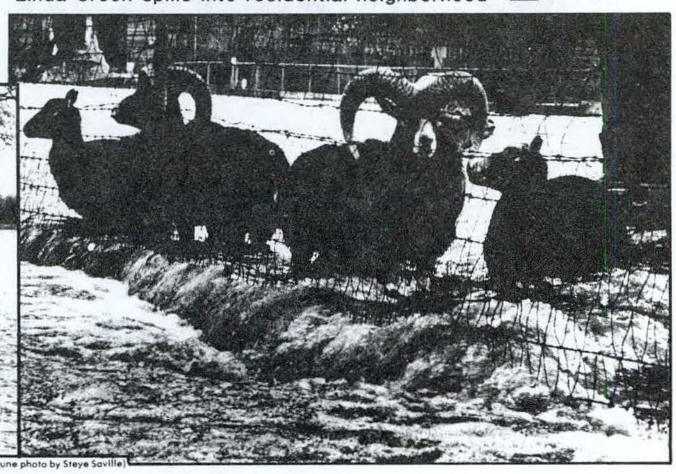
City of Roseville

Car lot falls victim to Dry Creek flood waters

(Daily Press-Tribune photo by Dennis Wyatt)



Linda Creek spills into residential neighborhood ▲



(Daily Press-Tribune photo by Steve Saville)

Flooding "Dry Creek" inundates Royer Park and Zoo rain in a 24-hour period near Roseville. Runoff from the downpour was more than drainage systems could handle, and streets and fields were flooded and homes threatened. Clogged storm drains along Linda and Dry creeks reportedly backed up water to depths of 2 feet.

Another series of weather fronts in mid-February resulted in flooding similar to the November event, but on this occasion the impact was centered chiefly in the Loomis-Rocklin areas. Damage to homes and businesses was slight, but the temporary closing of four major roads made commuting difficult.

Placer County was included in the latest group of disaster areas as a result of the mid-March onslaught. Flooding during the period was labeled the "worst ever." As much as 3 inches of rain in a 6-hour period on March 13 in South Placer County forced many local residents to evacuate homes and businesses.

Flood damage was widespread and into the millions of dollars in Placer County. It is ironic that the last time the county was declared a disaster area was six years earlier, when lack of water was the problem.

Lake County

The prime target of the 1982-83 onslaught in Lake County was the Clear Lake Basin. However, this was not the only area that felt the brunt of the incessant and torrential rains.

Heavy mudslides on State Highways 175, 29, 53, and 20 resulted in partial isolation of the county from the outside world for weeks at a time. Highway 20, a key link to the Sacramento Valley, was particularly hard hit and closed for several weeks. On one occasion, a moving mass of material pushed under a section of the road bed near Grizzly Creek and forced the pavement upward. The upheaval was as high as 15 feet in some places. In addition, 24 county roads were impassable at times, and more than 200 miles of roads not maintained by the county were unserviceable due to slides and washouts. Structural damage, however, was minimal outside of the lake basin due to the scattered habitation.

The major populated and urbanized portions of Lake County are located around the rim of Clear Lake, a natural lake with a normal water surface area of 63 square miles. The channel of Cache Creek is the outlet from the southeast rim of the lake. This 5-mile-long channel between the lake and Clear Lake Dam has a restricted capacity of about 5,000 cfs at a lake elevation of 11 feet Rumsey gage datum. Clear Lake Dam, owned and operated by the Yolo County Flood Control and Water Conservation District, has the capacity to discharge more than 21,000 cfs at lake elevation 11 feet Rumsey gage datum; however, this discharge is not attainable because of the restricted channel capacity of Cache Creek upstream of the dam.

Runoff into the lake is often five or more times the channel outlet capacity, and the lake level can rise rapidly. A portion of the outlet channel was enlarged in 1919 by the Yolo Water and Power Company, and in 1938 by the State of California, the County of Lake, and the Clear Lake Water Company; however, both projects were limited in scope because work was stopped by a court injunction. Two legal decrees have been in effect since 1920 and 1940, the latter of which is the Bemmerly Decree; the Bemmerly Decree prohibits enlarging the outlet channel to increase the flow of water from Clear Lake into Cache Creek.

On March 4, 1983, the lake water surface elevation crested at 10.91 feet Rumsey gage datum (1329.56 NGVD). This was the record high since 1914. The 1958 crest, the previous record, was 10.88 feet.

The expanded lake surface extended for some distance into housing areas adjacent to the lake, flooding many homes. The duration of the flooding caused by

LAKE COUNTY

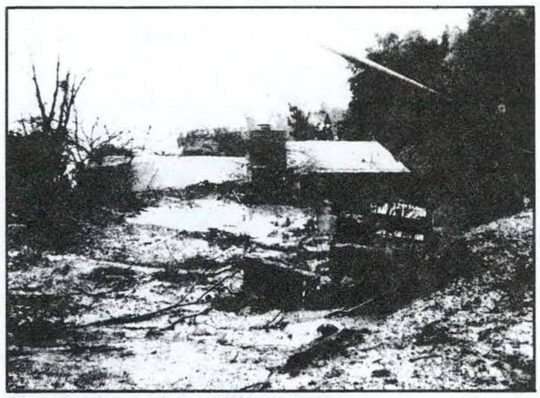
Clearlake Oaks, one of the hardest hit communites

FLOODING AROUND CLEAR LAKE

Kono Tayo subdivision on Highway 20 surrounded by lake waters

Record high lake levels inundated north shore businesses

MUD SLIDE DEVASTATION



Home wiped-out by slide

Portions of Hwy 20 shoved nearly 20 ft into air by mile-long mud slide the high lake level was prolonged by the limited outlet channel capacity. Because of this limited capacity, the lake surface elevation, even under the best of conditions (no additional rainfall), drops only about 1.25 inches per day. The legal maximum lake elevation set forth in the Gopcevic Decree of 1920 is 7.56 feet, and the lake remained above that level for 100 days during spring 1983.

Adding to the woes of flood victims--more than 1,800 were evacuated-- were the failure of sewage systems and the contamination of fresh water supplies. Those residents who chose to remain in flood-stricken areas, particularly in Clear Lake Oaks, were warned to boil all drinking water and to use only the portable sanitary facilities that were provided as an emergency measure to halt the flow of raw sewage.

Along with the flooding of structures on the lake front, hundreds of summer homes and permanent residences located on the lake's perimeter slope were smashed or pushed off their foundations by mudslides. Property damage was exceedingly high, but miraculously only one life was lost. A 3-year old child was killed when a wall of mud slammed into his home.

Storm-related damage totals were estimated at $5 million, but may have been even higher. At least 300 homes and 60 business establishments reported total or partial structural damage.

SACRAMENTO-SAN JOAQUIN DELTA

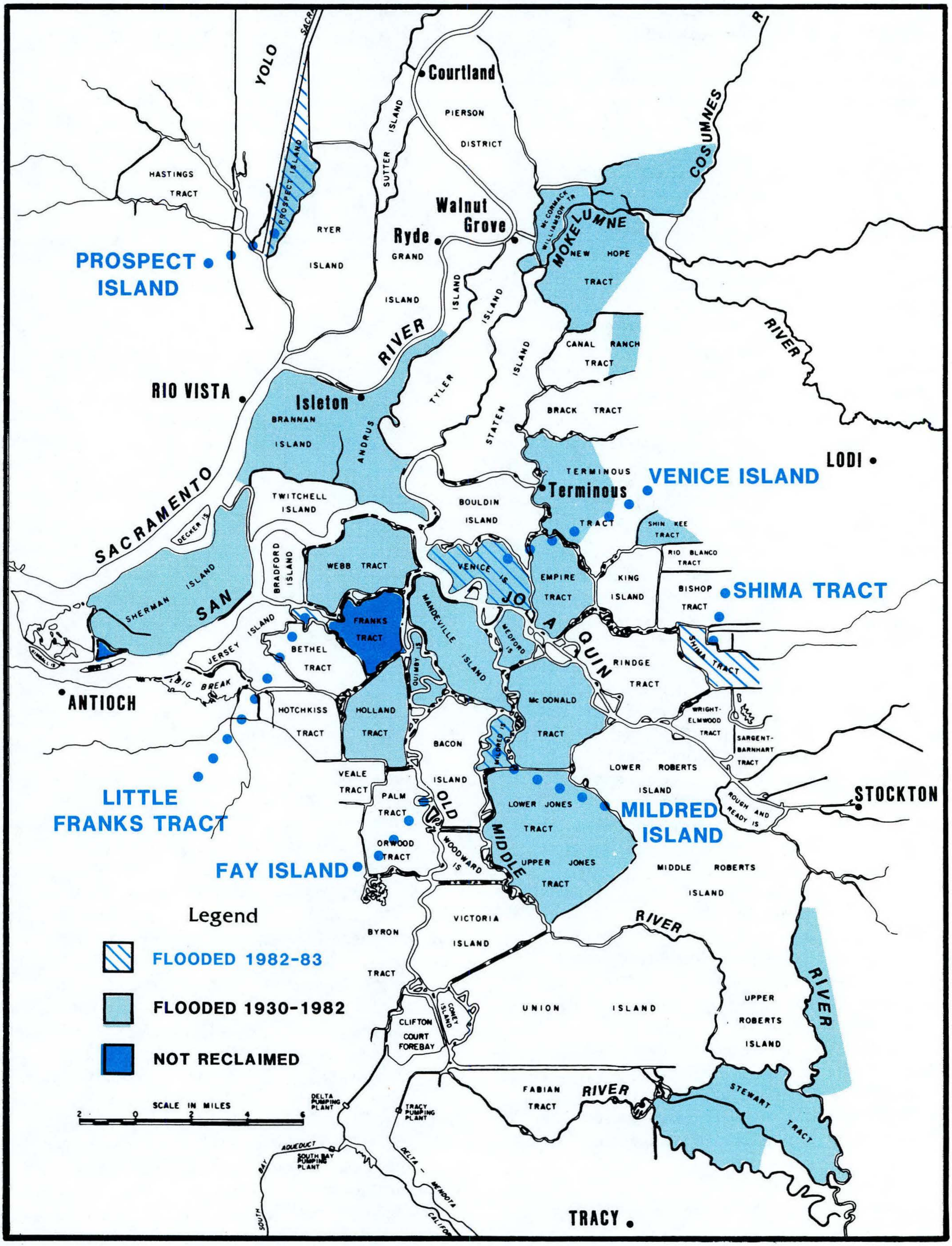
On November 29, 1982 Delta tides became abnormally high. Then on Tuesday afternoon, November 30, the State-Federal Flood Operations Center became deluged with distress calls from Reclamation District officials in the Sacramento-San Joaquin Delta, reporting levee overtopping, heavy seepage, boils, and other problems. By 2:30 p.m. the tide peak had reached Rio Vista, equaling the record tide stage of 9.8 feet recorded in December 1955. As the tide crest moved deeper into the central Delta, the opportunities for a major levee failure increased.

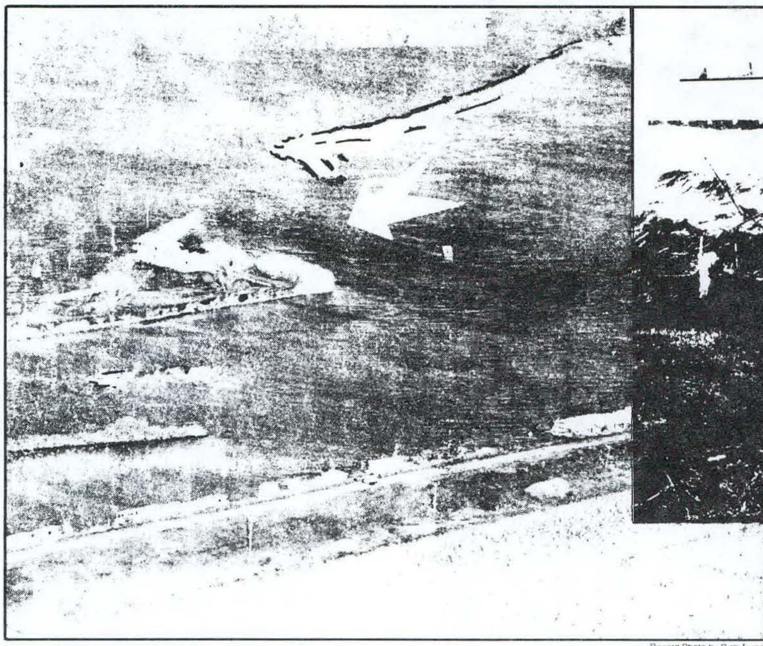
At 5 p.m. a caller reported that Venice Island was flooding because the northeastern levee had breached during the high tide. By mid-morning the next day the breach had widened to over 300 feet, and the entire 3,000-acre agricultural island had flooded to a depth of about 15 feet. Fortunately, most crops had been harvested before the flooding, limiting crop losses to some unharvested corn and recently planted wheat and barley.

An inspection team sent out by the Flood Center on the morning of December 1 reported considerable erosion damage, overtopped levees, and boils, but the flooding was limited to Venice Island. California Conservation Crews were dispatched by the Flood Center and set to work repairing the worst damage before the next high tide cycle, which was due to peak at the end of December.

Nature chose not to wait on the moon for high tides. Consequently, on December 22, 1982, when the tide cycle was at the low point and the daily high tide would have normally reached about 6.5 feet, several events raised the tide levels about 3 additional feet. At 3:45 p.m. the barometric pressure at Sacramento sank to 29.24 inches of mercury. This was a new December record, besting the previous record low of 29.26 inches established on December 3, 1974. At the same time, strong westerly winds were sweeping across the Pacific pushing bay waters back into the Delta. Meanwhile, Delta inflows from the Sacramento and San Joaquin River systems were near 120,000 cubic feet per second. The combined effect of these three separate phenomena was to raise the tide at Rio

Figure 24. DELTA FLOODING 1930-1983





BRYAN PATRICK/staff photo

Venice Island break destroys corn crop

Record Photo by Rich Turner

Myrtle Island victim of broken levee

Associated Press

Webb Tract

AP photo

State Conservation Crews waged exhausting battle with sandbags and plastic on delta levees

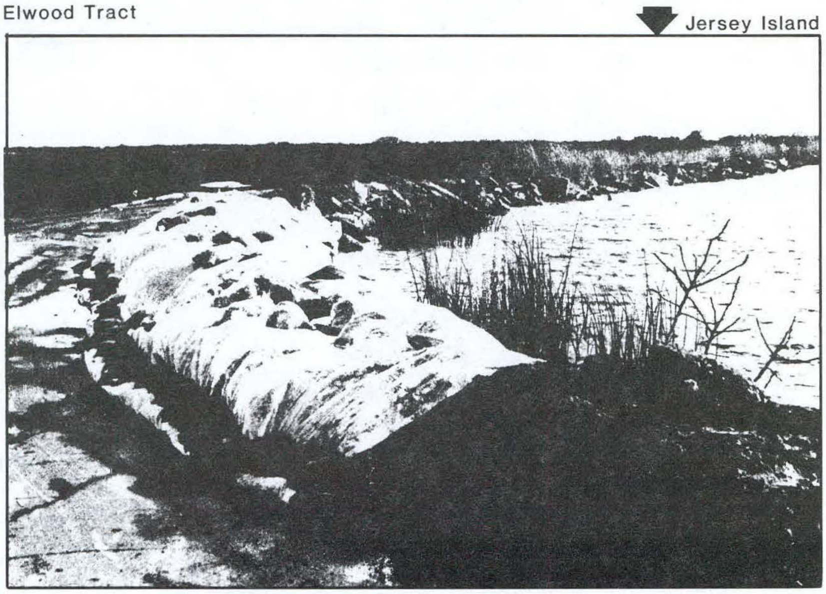
SACRAMENTO - SAN JOAQUIN DELTA

DELTA UNDER SIEGE WIND–RAIN–HIGH TIDES

Elwood Tract

Record Photo by CALIXTHO ROMIAS

Jersey Island



Vista to 9.5 feet, the third highest since January 17, 1980. Serious flooding problems would soon develop in the Delta due to the high spring tides, coupled with heavy river inflows and strong winds. Figure 24 shows a record of Delta flooding since 1930.

On January 27, California turned to the Army Corps of Engineers (COE) for help in the fight to minimize the impact of the record-breaking Delta tides. With State and local flood control funds exhausted, the COE responded immediately with an emergency infusion of $1 million (Public Law 99 funds) to help in the flood fight effort. Local contractors were enlisted to place rock at strategic sites, particularly at the Webb and Empire Tracts, and at Bouldin, Bradford, Jersey, and Brannan-Andrus Islands.

The Department of Water Resources coordinates flood-fighting activities and information and, in cooperation with the California-Nevada River Forecast Center, provides river stage bulletins for major Northern California rivers through its State-Federal Flood Operations Center. The COE keeps one or more representatives at the Center during large-scale flood mobilizations.

The National Weather Service California-Nevada River Forecast Center is adjacent to the Flood Operations Center in the Resources Building in Sacramento. It alerted DWR early of the potential for a series of storms, and forecast the recordbreaking tides that compounded flood-flow problems.

Thanks to the advance warning, California Conservation Corps crews were already mobilized when the storm hit, and up to 15 CCC crews were on Delta levees throughout the week, spreading plastic sheets and laying protective sandbags on Webb, Venice, Tyler, Twitchell, Jersey, Mildred, Kings, and Wright islands and tracts. Delta islands that flooded on January 27 include Mildred Island (1,000 acres) on Middle River; Shima Tract, northwest of Stockton, which was plugged soon after the levee break; the small Fay Island on Old River; and "Little Frank's Tract" on False River. Prospect Island on Miner Slough flooded on January 30. The Mildred, Shima, and Prospect Island breaks flooded a total of 4,600 acres of agricultural land.

This combination of a very high tide cycle (perigean spring tide), combined with strong coastal winds and nearly 300,000 cubic-feet-per-second Delta inflow, raised tides to an all time high. The previous record of 9.8 feet recorded December 26, 1955 was exceeded by more than 0.10 feet on January 26 at 1:15 p.m. The following day (January 27) at the same hour, another record of 10.34 feet was established. This was followed by a 10.17 at 2:15 p.m. on January 28, and a new record of 10.46 feet at 3:00 p.m. on January 29. A preliminary investigation indicates that subsidence of 0.5 to 0.7 feet may have occurred since 1967 in the Rio Vista area, including the site of the Rio Vista gauging station. Therefore, the record of 10.46 feet is an unofficial record and subject to further study.

February 24 began a new series of high tides that exceeded 9 feet at Rio Vista for more than a week (warning stage is 8 feet). On March 3, the morning high tide reached 10.34 feet, which equaled the second highest Rio Vista stage of record.

Pressure on the levees was tremendous because in addition to the persistent and record-challenging tides, even the low tides did not drop below the warning level for several days. Many experts marveled that the Delta levees could withstand this prolonged siege with only minor flooding. Only one island was lost (Prospect Island) during that high-tide period. The survival of several Delta islands can be attributed primarily to the millions of dollars spent in recent years by the Corps of Engineers and the Reclamation Districts to fortify Delta levees, and in no small way to the efforts of California Conservation Corps crews who protected and patched up the badly deteriorated levees with rolls of plastic and sandbags.

On July 30, the loss of another Delta Island was prevented by prompt action and flood-fighting expertise. Flood watchers spotted a boil on Twitchell Island pumping an estimated 200 gallons of material-laden water per minute. Normally, boils that reach this proportion are uncontrollable, and levee failure quickly follows. The Sheriff's Department immediately evacuated people from the area, and boats moored at nearby Owl Resort were moved to a safe place.

Meanwhile, despite the odds against saving the island, the Reclamation District called the Flood Operations Center for advice. The Center at once sent an experienced flood fighter to the site. With the help of local district people, the California Conservation Corps encircled the boil with a horseshoe sack ring to slow the flow. Also, brush-clearing crews and equipment on the waterside of the levee located the source of the water flowing through the levee and, using a back hoe, temporarily plugged the hole. This prompt action ended the crisis, but extensive repair work was required to restore the levee to a safe condition.

SAN JOAQUIN RIVER BASIN

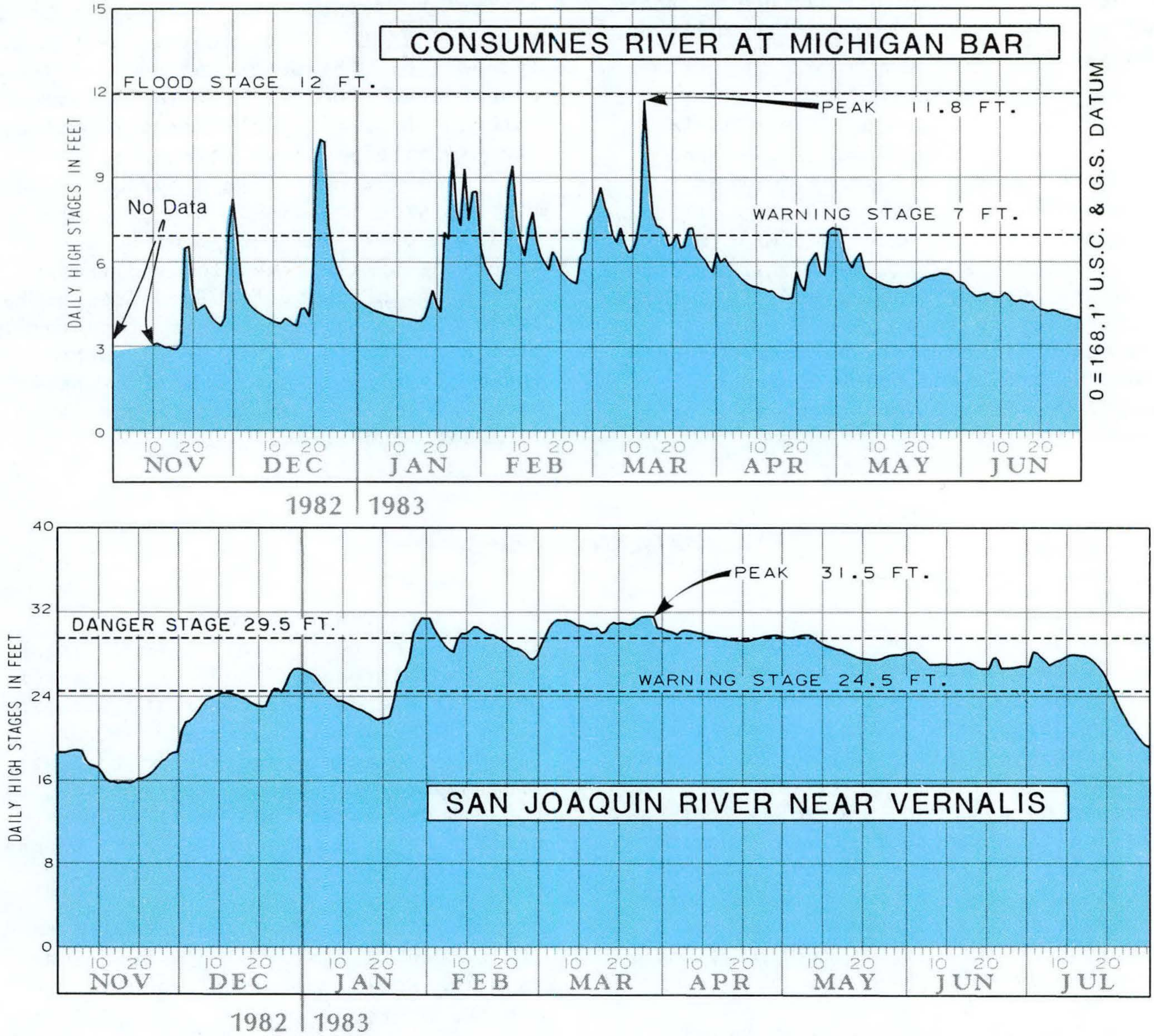
It is not uncommon for rivers of the San Joaquin system to reach or exceed warning levels due to runoff from a major storm, but such high-water periods are usually quite brief. Also, a particularly intense storm or series of storms, may cause infringement on flood-reservation space in reservoirs, but this too is often short-lived. During the winter of 1982-83, however, there were no long-term breaks between storms to permit rivers to recede or allow flood-control reservoirs to fall below flood-reservation criteria.

The San Joaquin River first reached warning stage (24.5 feet) at Vernalis in mid-December. Then, on December 24, a warm intense storm raised the river level to above warning stage, forcing residents of numerous trailer courts and resorts within the river flood plain to leave. Finally, on January 28, the river rose above danger stage (29.5 feet) at Vernalis and remained near or above that level through April. Hydrographs of the San Joaquin River at Vernalis and the Cosumnes River at Michigan Bar are presented in Figure 25.

During this period, four San Joaquin River Flood Control Project levees failed. One near Vernalis in Reclamation District 2064 flooded 6,000 acres; one near the confluence of the Tuolumne River in Reclamation District 2100 flooded 500 acres; another in the Eastside Bypass near Owens Creek flooded about 3,000 acres; and still another upstream of the Chowchilla Canal Bypass flooded an additional 3,000 acres.

Flooding in the San Joaquin Valley sometimes results from snowmelt runoff during late spring and early summer. During the winter, the high slopes of the central and southern Sierra accumulate heavy masses of snow, which melts rapidly during spring and early summer. In 1983, as the water content of the snowpack steadily increased, even after April 1, when it is normally the highest, flood-control officials realized that the threat of flooding along the San Joaquin River system would last into July. Also, there was a possibility that the winter flooding, which had already occurred, would be nothing compared to what lay ahead. There appeared to be little room for the expected snowmelt runoff in the already brimful reservoirs, and flows in the major

Figure 25. HYDROGRAPHS OF THE CONSUMNES AND SAN JOAQUIN RIVERS



rivers were near capacity. Only a marked change in the weather could prevent widespread snowmelt flooding.

Fortunately, an abrupt change in the weather did occur during the peak runoff period, probably averting a serious flood in the valley. Below-normal temperatures during the crisis period, coupled with a relatively dry spring, significantly reduced reservoir inflows. This enabled reservoir operators to reduce storage to levels that could contain the spring runoff. The peak snowmelt runoff occurred about May 31, and in some cases was about three times greater than the maximum discharge design of the flood-control reservoirs along the western slopes of the central and southern Sierra Nevada. Hydrographs of seven of those reservoirs--Camanche, New Melones, New Don Pedro, Lake McClure, Eastman Lake, Hensley Lake, Millerton Lake, and Pine Flat--are shown in Figures 26-30.

Figure 26. HYDROGRAPH OF CAMANCHE RESERVOIR

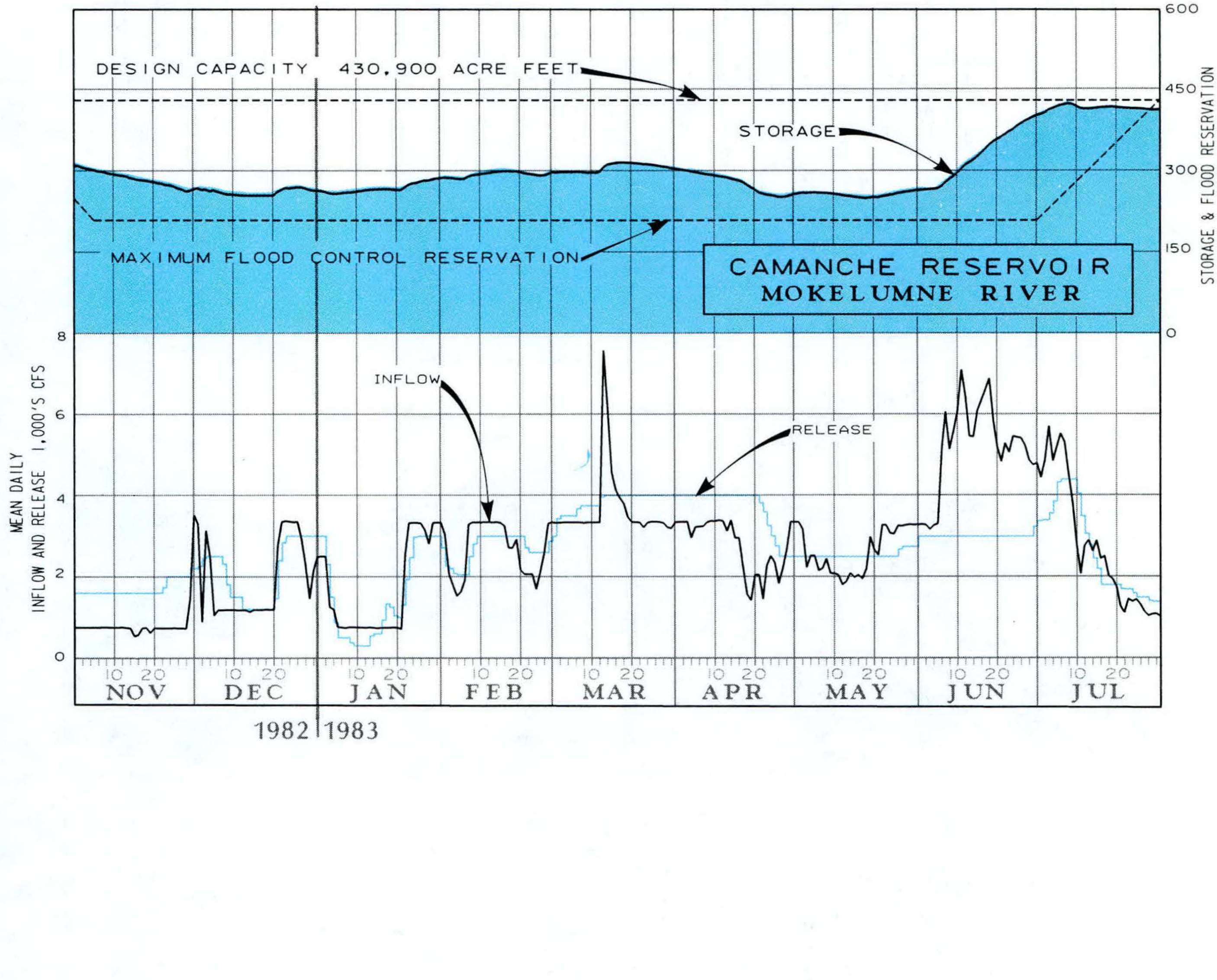
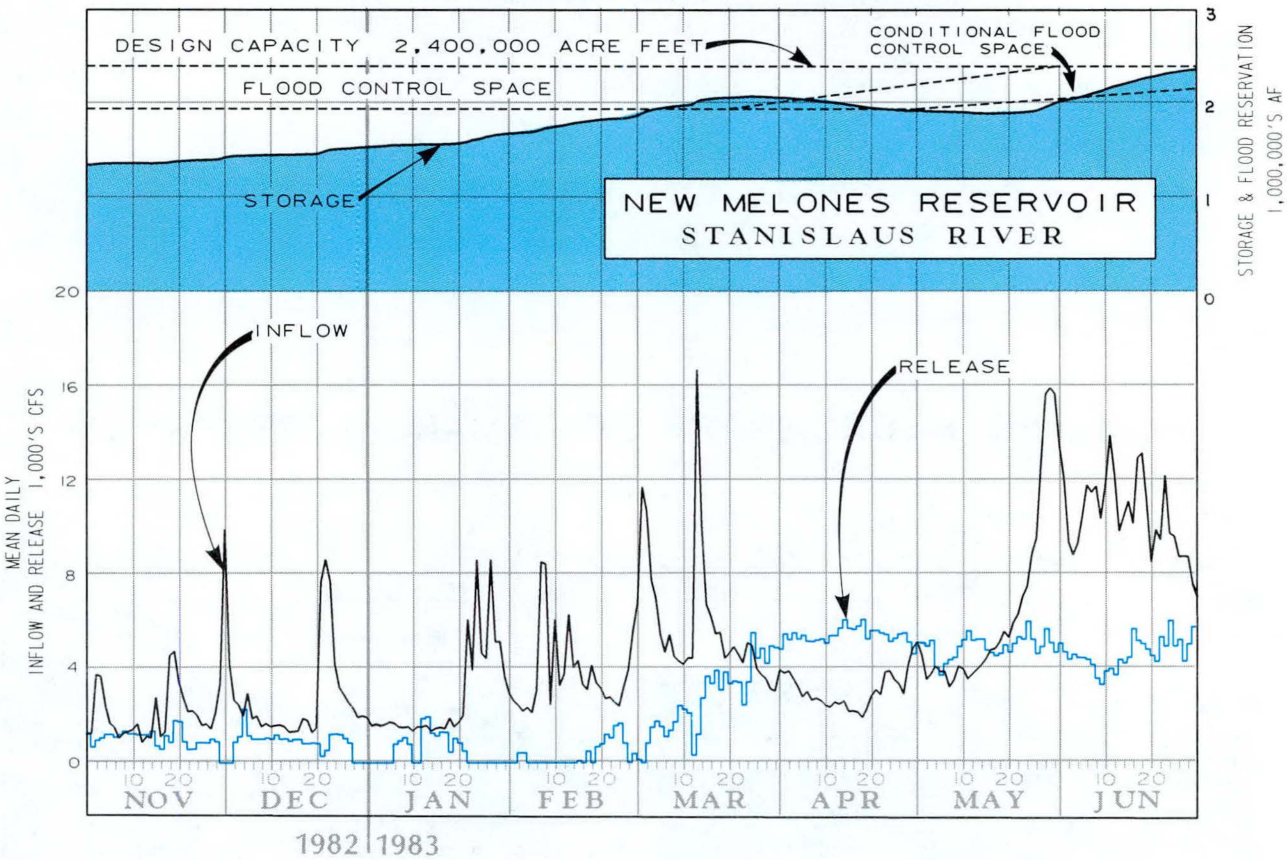


Figure 27. HYDROGRAPHS OF NEW MELONES AND NEW DON PEDRO RESERVOIRS



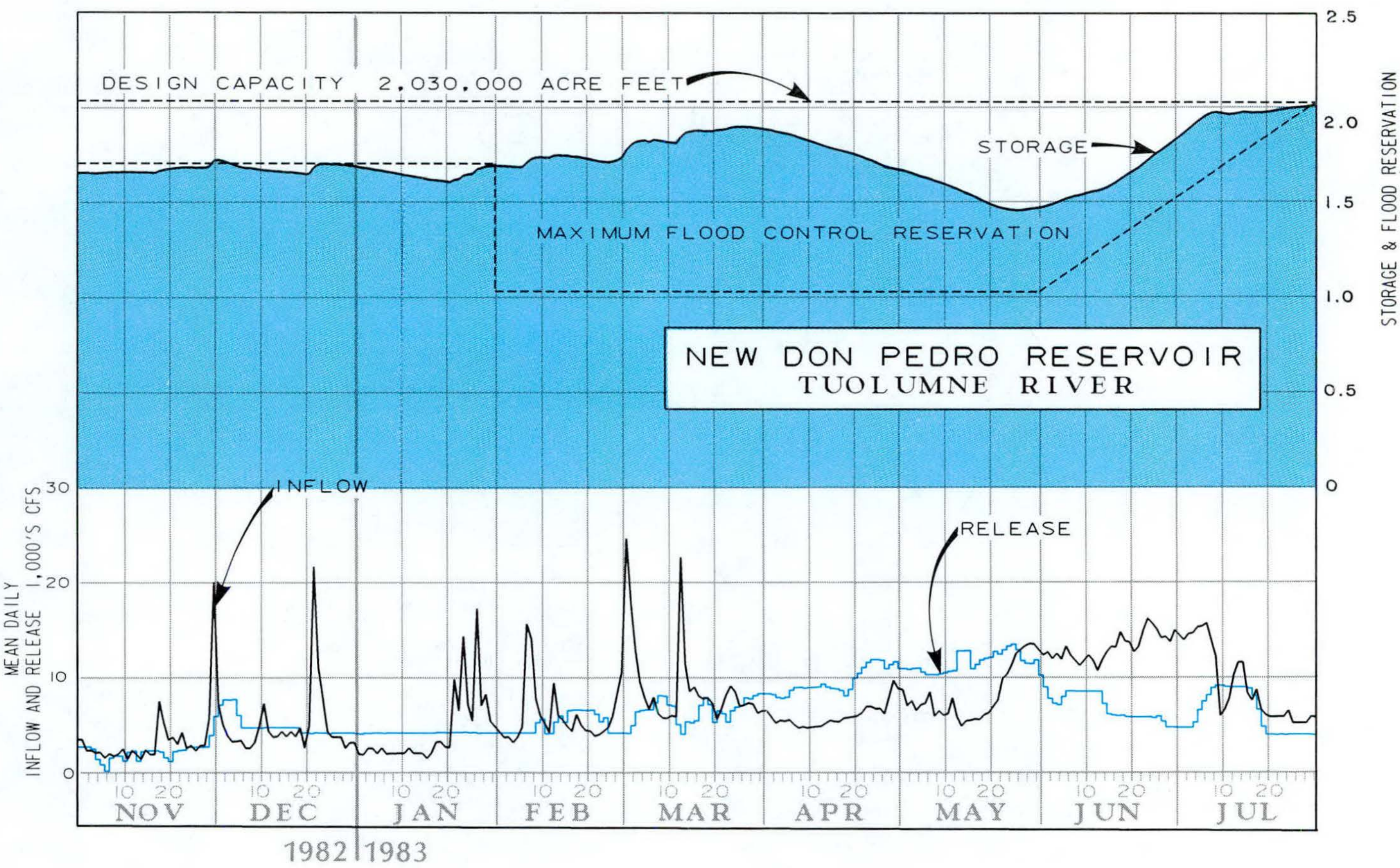


Figure 28. HYDROGRAPHS OF LAKE MC CLURE AND EASTMAN LAKE

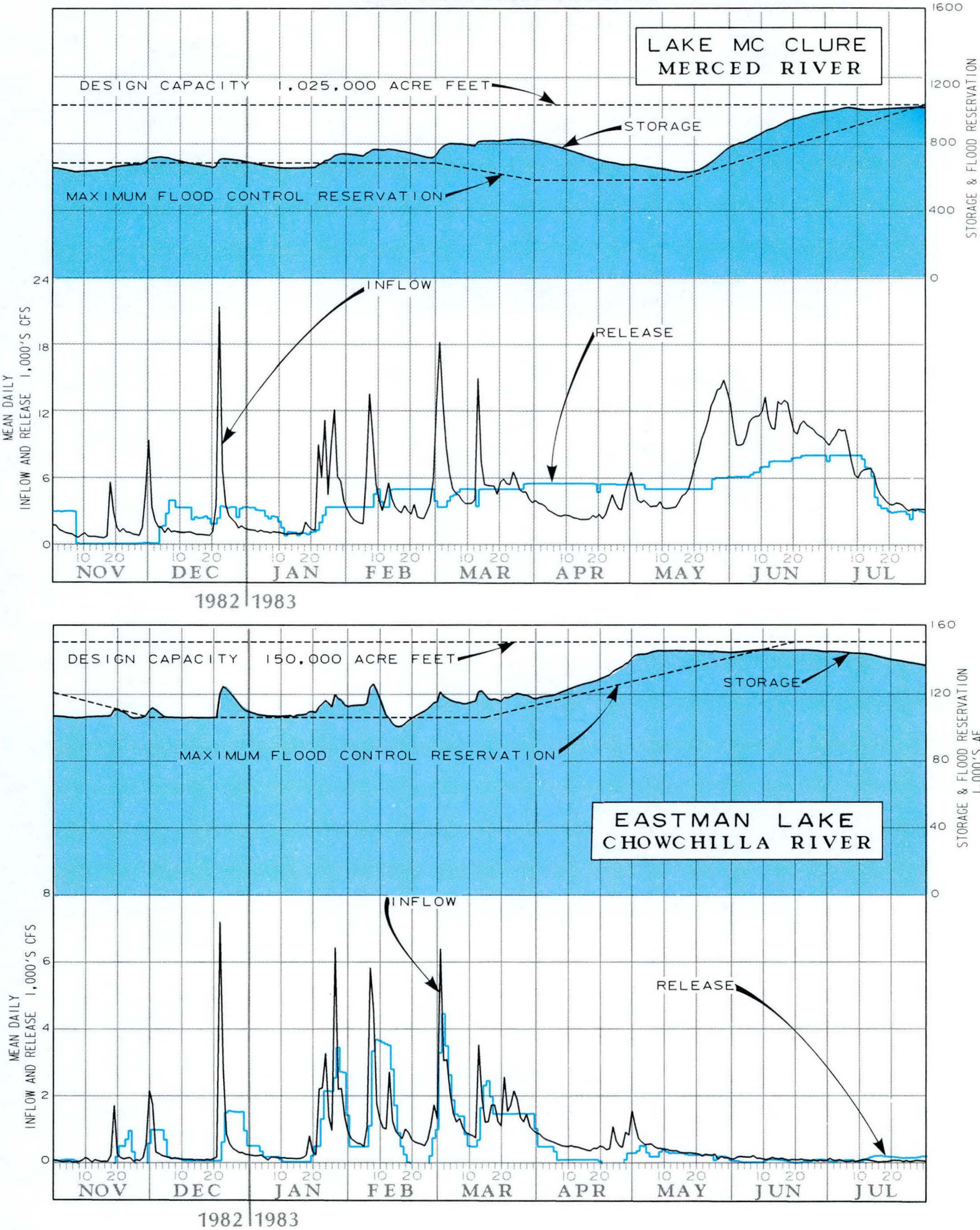
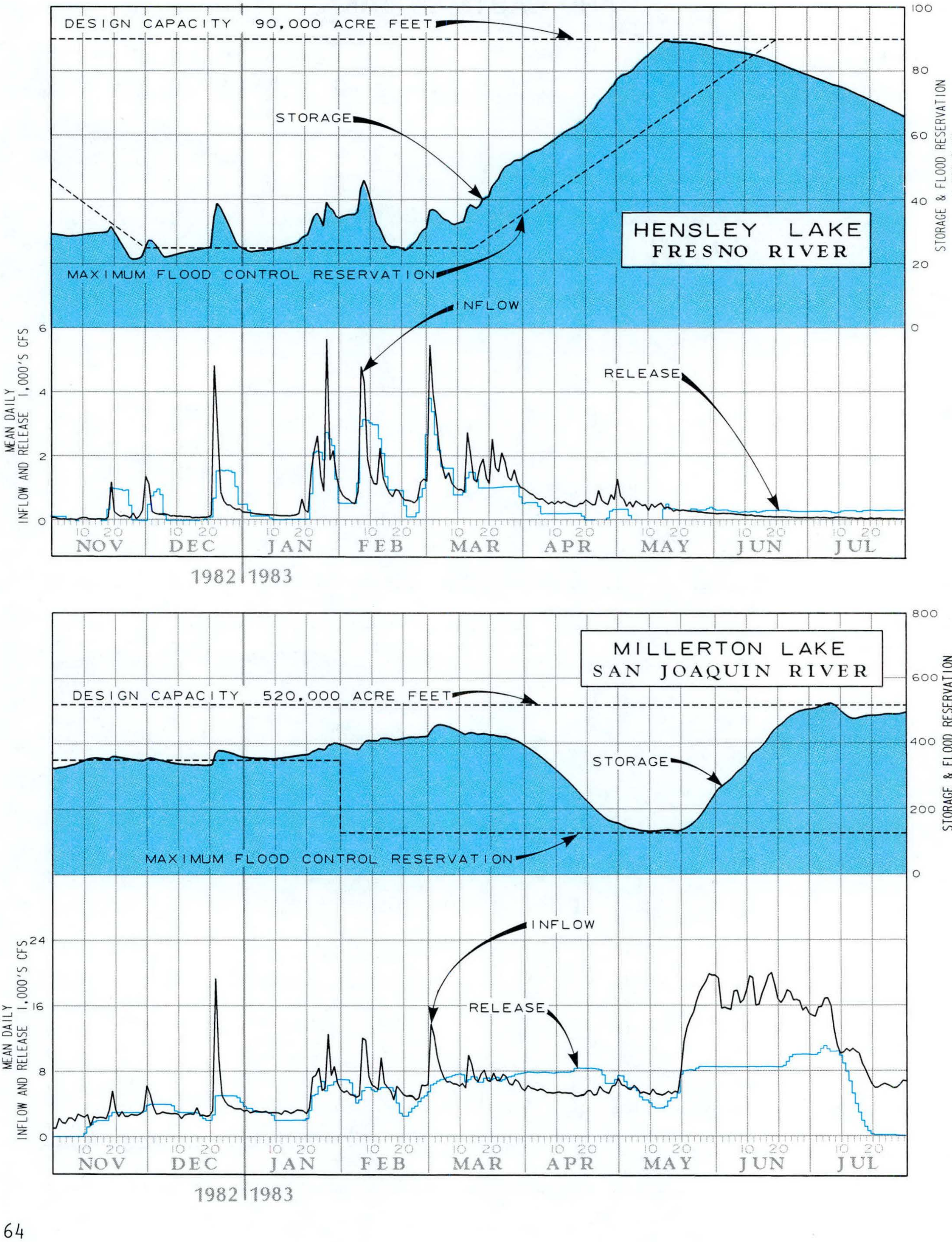
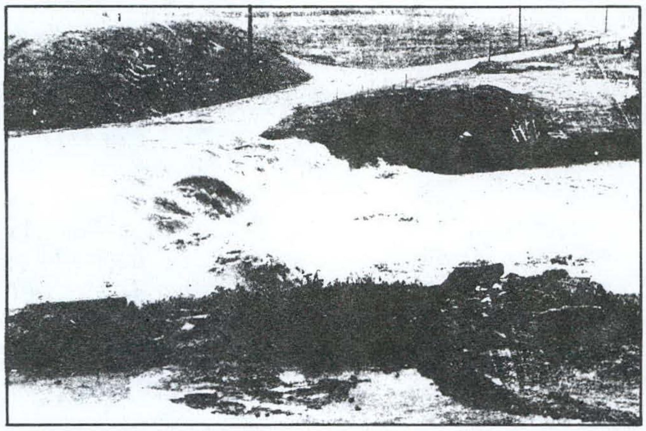
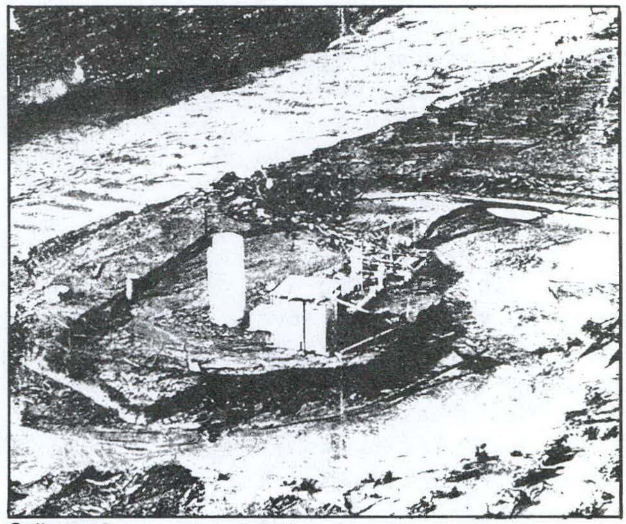


Figure 29. HYDROGRAPHS OF HENSLEY LAKE AND MILLERTON LAKE

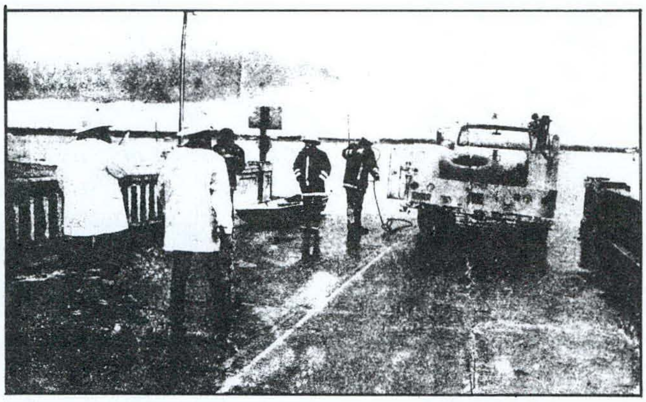


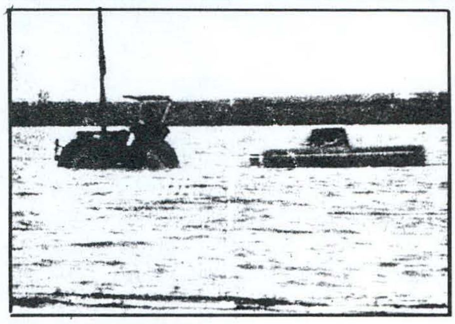




Caliente Creek and Arvin Edison Canal waters churn around farm buildings

KERN COUNTY



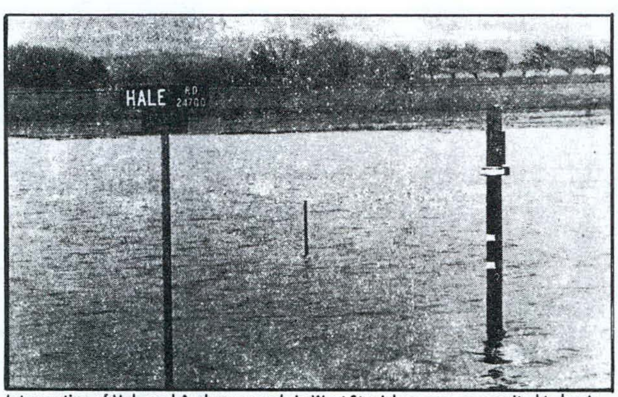


Orestimba Creek overflow

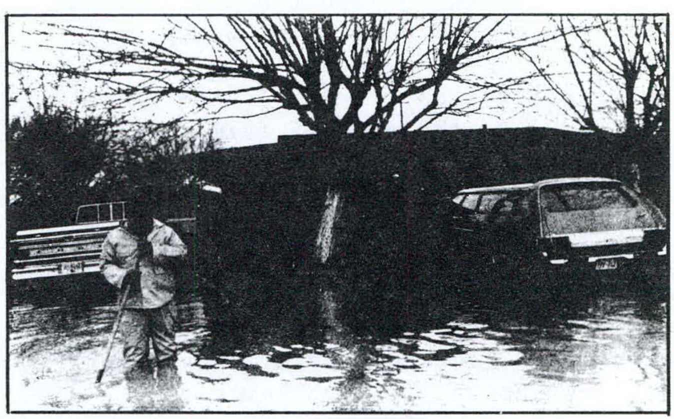
SAN JOAQUIN VALLEY

FEW CALIFORNIA COUNTIES ESCAPED THE WINTER STORMS OF

STANISLAUS COUNTY



Intersection of Hale and Anderson roads in West Stanislaus was more suited to boats.



Flood waters crept to within 1 inch of entering home on Walnut Ave in homes in and near Lathrop. Tens of thousands of sandbags were placed by volunteers, local officials, and State agencies; nevertheless, the flooding damaged the carpets, floors, and foundations of numerous houses.

Even more serious than the structural damage was the failure of septic tanks and the overflow of sewage ponds. Raw sewage, combined with the rain and seepage water, posed a serious health problem. The areas surrounding the city of Tracy and outlying communities such as Banta suffered similar fates. It appears that nonexistent or inadequate drainage systems were the chief contributors to the problems that prevailed for many weeks.

Resorts, marinas, and recreation areas within the flood plains of the San Joaquin River have long accepted some annual flooding as a way of life. High streamflow frequently occurs as a result of snowmelt runoff during late spring and drives occupants of trailer parks to higher ground. During the 1982-83 water year, river stages reached the warning level of 24.5 feet at Vernalis in mid-December and near or above danger stage between January 21 and May 8.

In addition to flooding resorts, marinas, and trailer parks, seepage inundated thousands of acres of farmland adjacent to the river. Financial losses due to damage to trees and vines and loss of unharvested and unplanted crops were severe in San Joaquin County.

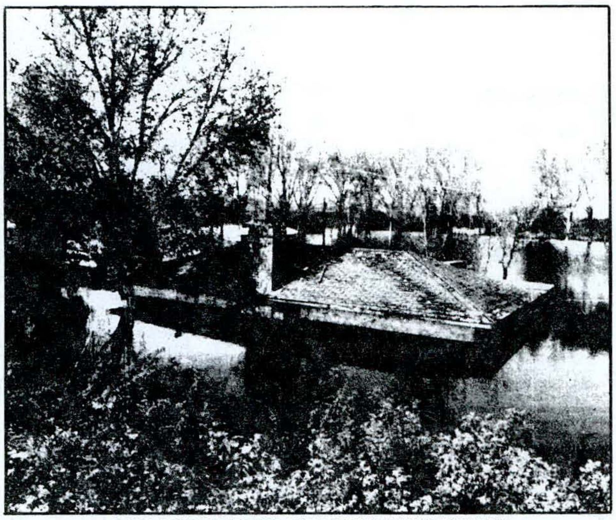
Levee failures on the San Joaquin River also added to the woes of farmers and other inhabitants of the southern part of the county. In addition to the failure of private levees upstream, a project levee break occurred March 29 on the east side about 1/2-mile south of Airport Way near Vernalis. The flood waters were contained by high ground on the east and the Trahern levee on the north, but only after 6,000 acres were flooded. Nearly 200 people were forced to evacuate their homes. Flooded agricultural land included 120 acres of pears and 550 acres of grapes; an undetermined extent of grain and alfalfa acreage was also flooded.

Following the break, the main objective of the flood fighters was to contain the water within the already-flooded 6,000 acres. The ability of the substandard Trahern levee to act as a buffer was a key to the strategy. CCC crews were rushed to the scene and promptly protected the waterside slope with plastic. The levee crown elevation was raised as much as 1 foot in several sites by the U. S. Army Corps of Engineers.

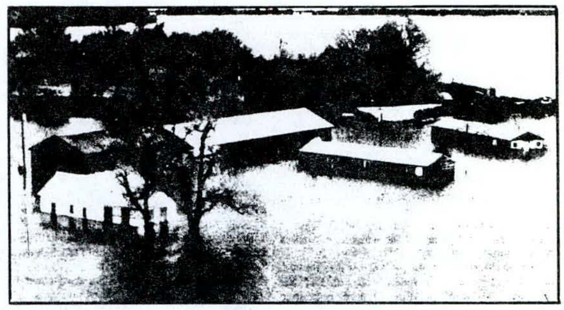
In addition to raising the crown high enough to prevent overtopping, the workers constructed a pad on the landside toe of the levee to decrease seepage and stabilize the levee. Approximately 12,000 tons of aggregate base was trucked from a local quarry to raise the levee, and 1,200 square yards of fabric covered with 12,000 tons of filter rock were required to complete the seepage pad. At the time of the break, the river stage at nearby Vernalis was 31.5 feet (2 feet above the danger level).

As soon as the water level in the flooded area was stabilized and it was determined that the Trahern levee would hold, the local Reclamation District cut a 10-foot-wide slot in the east San Joaquin River levee about 2 miles downstream from the break to allow the major portion of the flood water to flow back into the river. On April 5 the breach was closed. When water ceased flowing back to the river through the downstream cut, it too was closed, and the remaining floodwater was pumped back into the river.

This project, while successful, did not entirely solve the excess water problem for farmers of this and other areas adjacent to the San Joaquin River. When the river reaches a stage of 24.5 feet at Vernalis, seepage of significant

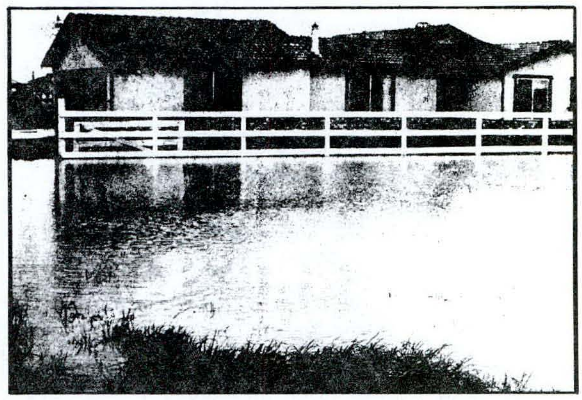


FLOOD WATERS INUNDATED THIS HOME NEAR SAN JOAQUIN CITY

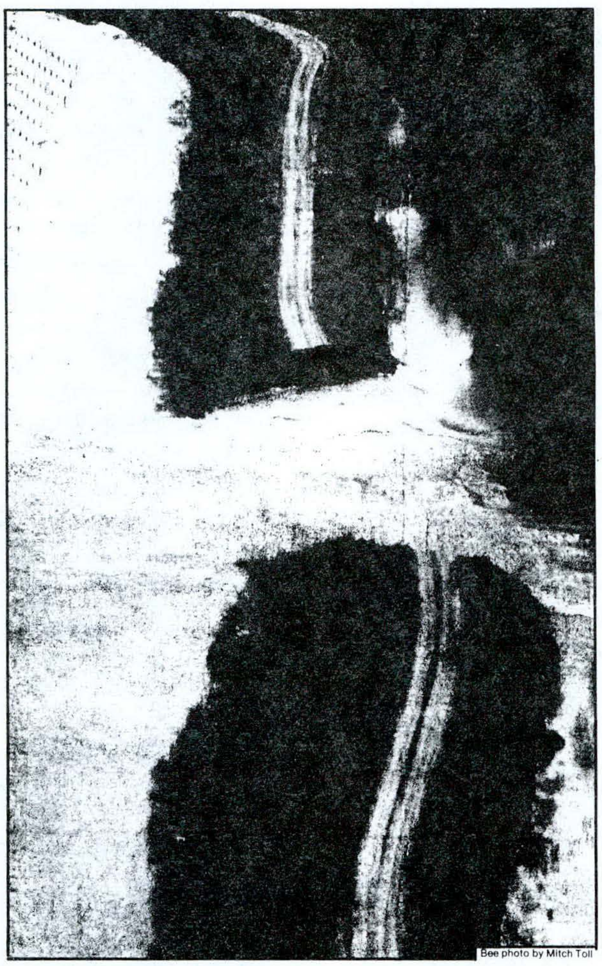


Manteca farm

Many farms and homes flooded after levee break

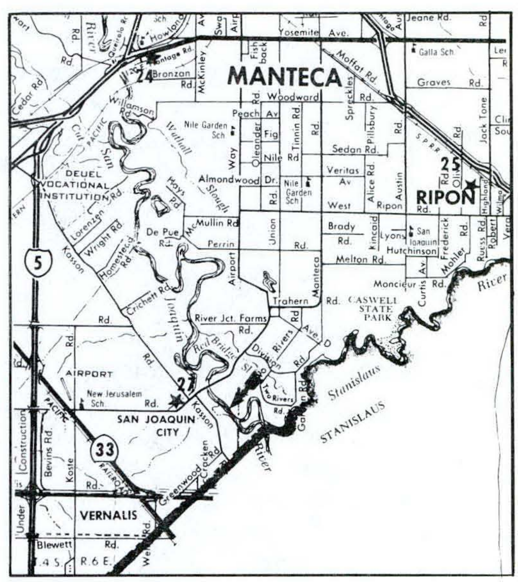


SAN JOAQUIN COUNTY



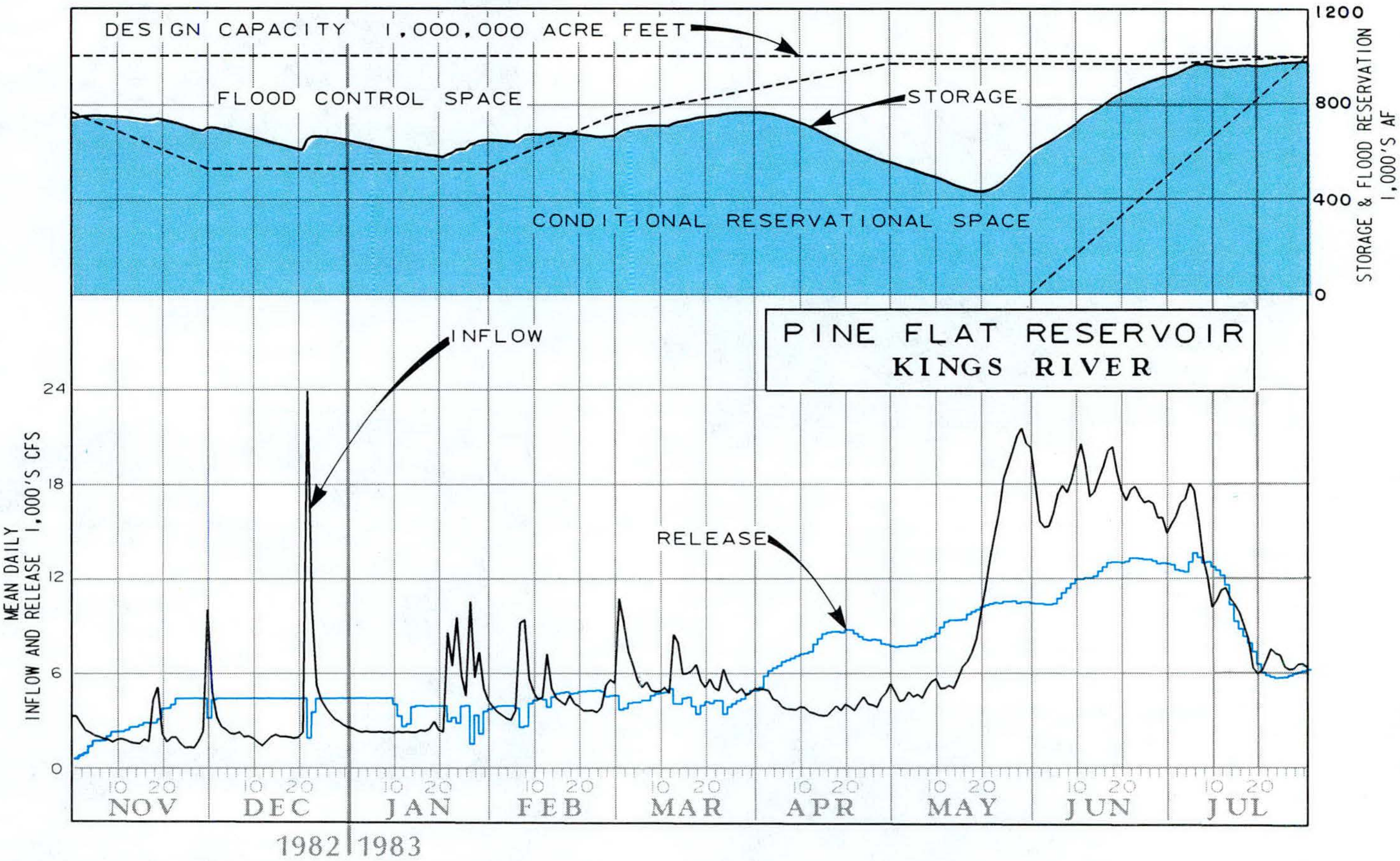
Bee photo by Mitch Toll

SAN JOAQUIN RIVER BURST THROUGH LEVEE



Arrow indicates break

Figure 30. HYDROGRAPH OF PINE FLAT RESERVOIR



San Joaquin County

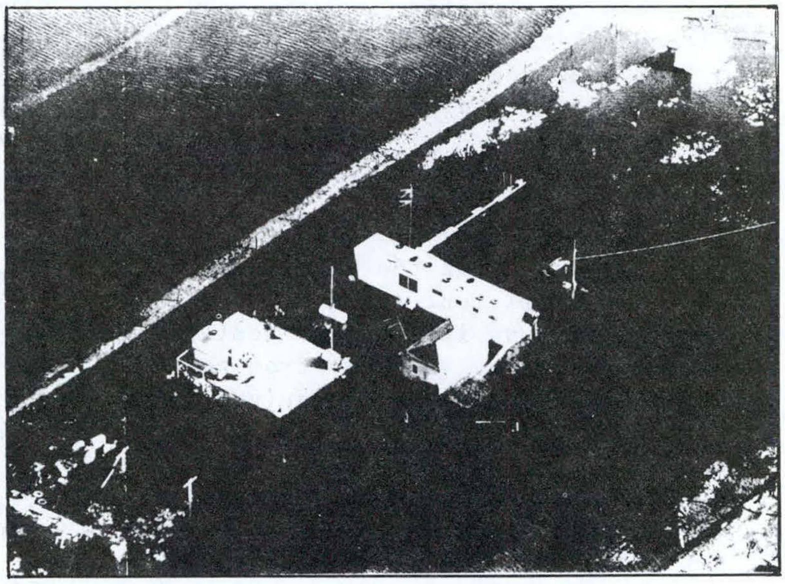
Flooding in San Joaquin County, excluding the Delta Island levee failures that led to the designation of the county as a disaster area, occurred mainly during March. The flooding of Delta Islands in the county is described elsewhere in this report (see "SACRAMENTO-SAN JOAQUIN DELTA").

The first indication of what was in store for San Joaquin County citizens came on November 30, when a super tide of 9.80 (Rio Vista) lapped over the walkway downtown along Stockton Channel. No serious damage occurred at this time, but resorts and restaurants in the vicinity were threatened.

On March 16, residents of New Hope Landing were evacuated when it appeared that a 300-foot section of a levee 6 miles upstream was in jeopardy. Persistent rainfall and heavy runoff weakened the levee near the junction of the Mokelumne and Cosumnes rivers. The area took on the appearance of a vast inland sea as private levees failed, and streams, backed up by high tides, inundated thousands of acres of this sparsely populated area. Orchards and pastureland in the vicinity of Peltier Road in the north county were waterlogged for long periods. It was feared that water-related diseases, such as root rot, might take a heavy toll on perennial crops. South of Stockton, the continuous rain and high stages along the San Joaquin River caused various problems in resorts, trailer parks, and farmlands located in this vast area.

The combination of torrential rains and seepage proved to be too much for the pumping plants and drainage systems of many small communities. Additional pumps were donated and borrowed but made only a small dent in the water volume. Water at least 1 foot deep was reported

Inundated farm near Stevinson



Sun Star - photo by Pat McNally, Westside Bureau

200 ft. portion of San Luis Reservoir Recreation Area Rd slipped away . Estimated bill for repair $150,000

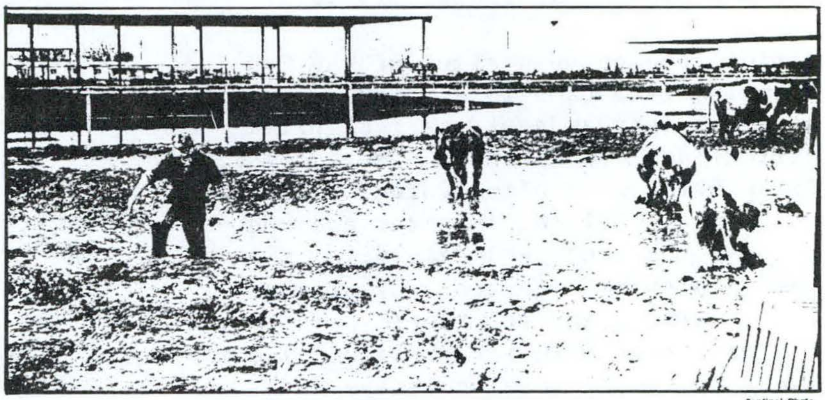
MERCED COUNTY

COUNTIES

MAJOR LOSSES FROM

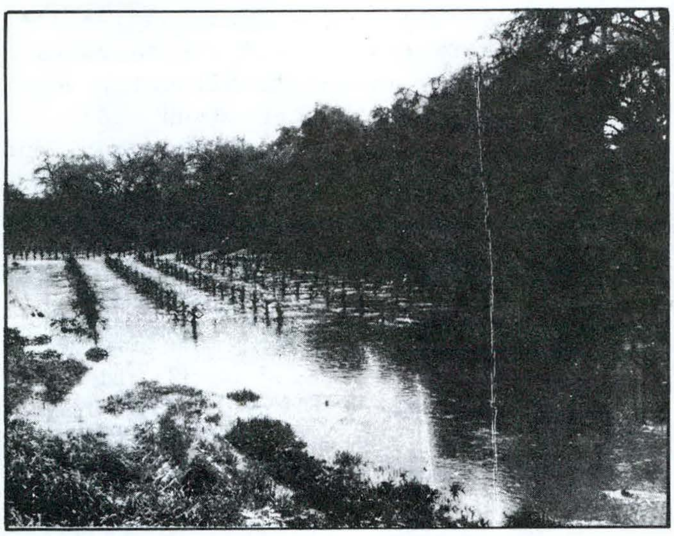
1982 - 83

Kings River flooding results; man and cows slosh through muck



Sentinel Photo

KINGS COUNTY



Flooded vineyard by Reedley

photo by Diane Slocum

Hubcap deep water creates hazard for Sanger motorists

FRESNO COUNTY

amounts can be expected. In the lower San Joaquin River the stage exceeded 24.5 feet (warning stage) until July 21, well after the normal planting season (see Figure 25).

Stanislaus County

Most of the impact of the abnormally intense and persistent storm of the 1982-83 winter was felt in the western part of the county. Seepage from near-capacity flows in the San Joaquin River, and overflow of the usually placid streams that drain the eastern foothills of the Coast Range, kept the communities of Newman, Crows Landing, and Patterson in a flooded or partially flooded stage for several months. Beginning in late January, the impact of the saturated soils and swollen reservoirs due to early storms began taking its toll.

Agriculture on both sides of the San Joaquin River came to a virtual standstill as thousands of acres of prime agricultural land became a soggy mess. Dairy herds were often forced to stand up to their bellies in water and mud. Feeding the stock and delivering milk became difficult chores. Orestimba, Crow, Salado, and Del Puerto were among the many creeks that over-flowed their banks on one or more occasions and flooded portions of small communities. Police, firemen, the Red Cross, and other emergency bodies were frequently called on to rescue, evacuate, and comfort flood-stricken victims. The closure of numerous roads and contamination of water wells also became serious problems.

At about 7:00 a.m. on March 5, a San Joaquin River Flood Control Project levee failed, flooding 500 acres in Reclamation District 2100. The breach occurred opposite the mouth of the Tuolumne River. Two homes and two duplexes were flooded, and some corn and alfalfa were destroyed. Fortunately, residents were able to get themselves and most farm equipment to higher ground.

Stanislaus County became eligible for public and private disaster assistance in late March, when repeated flood losses began to mount. For a time, it also appeared imminent that more flooding would occur during the spring snowmelt period.

Merced County

Rainfall in Merced County reached 250 percent of normal by late March. The wet weather was chaotic to agricultural interests. In Merced County, when the farmers have a bad year, it has a "ripple" effect on much of the county's economy.

One of the hardest hit was the low-lying Stevenson area, which was flooded by Bear Creek and Canal Creek. Other flooded areas include Los Banos, La Grande, and Helmar. Streets in Merced and other urban areas began to deteriorate rapidly, as standing water began seeping beneath the road surfaces.

Some 3,000 acres of Merced County farmland were flooded when the west levee of the East Side Bypass breached opposite to Owens Creek on February 4, 1983. The levee breach was one of four that occurred in the San Joaquin River Flood Control Project during water year 1982-83.

Fresno and Madera Counties

Persistent high winds accompanying the late January storms left thousands of Fresno County residents without power. Trees toppled by 35-mph winds made travel unpredictable and hazardous, and some roads were closed. As the storm extended into February, street flooding added to the problems of commuters and business establishments.

High-water problems along the San Joaquin River continued until mid-July because, as runoff pressure from the storm systems eased, runoff pressure from the record snowpack began. Releases and spills from Millerton Lake into the San Joaquin River reached 11,000 cfs on July 6. Levees came within inches of overtopping in the reach between Gravelly Ford and the Chowchilla Canal Bypass structure. The channel capacity in this reach is rated at 8,000 cfs; seepage from the river caused standing water in many orchards and vineyards for long periods.

About 3,000 acres in Madera County were flooded when the right bank levee of the San Joaquin Flood Control Project breached about 1 mile upstream of the Chowchilla Canal Bypass control structure.

Tulare County

A series of storms struck Tulare County in late 1982 and early 1983. Heavy runoff coupled with releases from Terminous Dam occurred in December 1982 and continued on through January, February, and March 1983, flooding thousands of acres of farmland along Cottonwood Creek in Tulare County and along Cross Creek in Tulare and Kings counties. Much of this flood water eventually found its way into the Tulare Lake bed.

For many years, the flood plain of Cross Creek was several miles wide, extending much of the distance between the St. Johns River and the Tulare Lake bed. Recently, however, increased development has adversely changed the character of the flood plain. In September 1982, the State Reclamation Board adopted Cross Creek as a "designated floodway" in an effort to bring order to the reclamation of lands in the flood plain. The resulting levee construction and channel filling diverted flood waters onto lands not previously inundated by minor flows, causing serious flooding problems along Cross Creek during the winter of 1982-83. During February 1983, the flood waters were heavy enough to close the northbound lanes of State Highway 99 for several days.

Other areas of the county, including the cities of Visalia and Lindsay, had their share of street flooding and interrupted services. In terms of aesthetic value, however, the uprooting of hundreds of stately elms and oaks that had previously enhanced the cities and urban areas was the most grevious loss. Some of the trees lost had been planted during the 1940s and '50s. Another flood-related cost that had a significant impact on the storm-ravaged cities was the overtime paid to public works employees, who worked long hours to protect lives and property during the storms.

Kings County

In terms of agricultural losses caused by flooding, Kings County will rank among the leaders, primarily due to the inundation of the Tulare Lake bed in the southwest part of the county. The flooding of Tulare Lake bed and its impact on adjacent areas is described in another section (see "TULARE LAKE BASIN").

Other areas and businesses were also hard hit. Near Lemoore, the near-capacity flows in the North Fork Kings River raised the water table to the surface of the soil in many places. Standing water and deep mud in the Island District of the northwest part of the county destroyed crops and cut dairy production. Alfalfa was subject to root rot, and the saturated soil could not support fruit trees, which toppled due to the high winds and their own weight.

Newborn calves drowned in mud that was several feet thick in some dairies. Dairy cattle produced less milk, as they had to walk through deep muck to feed troughs and milking barns. Also, many areas of the district were turned into small ponds, which became a haven for gnats and biting insects that further weakened the cattle.

Numerous county roads were closed by the flooding. Many bridges and culverts became clogged with silt, and road surfaces and shoulders were damaged. In addition, many levees and flood works were damaged, and numerous power lines and poles were toppled by the high winds.

Kern County

During a 24-hour period (March 1 and 2) a winter storm dropped an estimated 6 to 8 inches of rain at the confluence of Caliente, Walden Basin, and Tehachapi creeks. The Caliente Creek Stream Group, located wholly within Kern County, drains a portion of the southern ends of the Sierra Nevada and part of the northwesterly slopes of the Tehachapi Mountains.

As a result of this 24-hour deluge, which equalled the annual average rainfall for the area, water 4 to 5 feet deep scoured the creekbed and tore out 12 miles of the Caliente Bodfist road. The flash flood also destroyed at least 15 homes and damaged most of the remaining 50 homes along this reach. In the path of the avalanche of flood water was the town of Lamont, which lies 10 miles southeast of Bakersfield. The flood water deposited 3 to 6 inches of alluvial silt throughout the Lamont area.

San Benito County

The last weekend of February will long be remembered by residents of San Juan Batista. It began Friday afternoon (February 25) when the brimfull creek in the San Juan Canyon could no longer contain the runoff. In a matter of minutes, the escaping water, described by some witnesses as "like a flash flood" or "it looked like a dam had broken," had reached heights of 6 feet as it roared across the highway, flooding the main artery connecting Hollister and San Juan and southbound Highway 101. Fortunately, no one was seriously injured by the flooding but residential yards in the water's path were eroded and littered with storm debris. The damage was held to a minimum by the civic-mindedness of neighboring citizens who helped those in distress and assisted in sandbagging and cleaning debris from choked watercourses.

As the storm continued into March, other areas of the county began to feel the impact of the 80-mph winds and torrential rains. Near Hollister, buildings were blown down and equipment damaged. Runoff into the San Benito River was pushing the water level to record heights. Some residents along Cowden Road were without potable water for the second time during the winter, when about 1,000 feet of pipeline was washed away. Residents of the area were also virtually isolated as many roads became badly eroded.

The raging San Benito River, swollen by more than 6 inches of rain in a 3-day period, cut a destructive path through some of the county's finest farmland. One ranch lost "15 acres of the best farmland in the county."

The southern and middle parts of San Benito County were especially hard hit. Power outages and loss of communications isolated some residents for several days. Downed trees severed telephone and electric lines, while erosion caused by the swift runoff made travel on vital roads impossible or extremely hazardous.

TULARE LAKE BASIN

Tulare Lake Basin lies in the heart of the San Joaquin Valley. This land-locked basin drains the Kings, Kaweah, Tule, and Kern rivers as well as numerous smaller streams of the southern Sierra.

Since the introduction of flood-control dams on the western slopes of the Sierra, which also provide irrigation water, the Tulare Lake bed, under normal conditions, is extensively farmed and has proved to be highly productive. The lake bed, however, is not entirely a grower's paradise; weather conditions markedly influence its character. Ordinarily, runoff into the lake bed can be managed, but above-normal runoff, as during the spring and summer of 1983, causes problems for growers.

Figure 31 illustrates the magnitude of runoff from the Kings River Basin. Most of the flood-control releases from Pine Flat Reservoir (on the Kings River) are routed up the North Fork Kings River into the San Joaquin River. In 1983, however, the releases were greater than the 4,750-cfs capacity of the North Fork channel, and 250,000 acre-feet had to be diverted south into the Tulare Lake bed.

There is much evidence that 100 or more years ago Tulare Lake may have been the largest body of fresh water entirely within the area of the United States. No one knows for sure, but historians have estimated that at one time the lake was as much as 75 miles long and 35 miles wide, with a surface elevation of 225 feet. Water from the lake once flowed freely northward to the Sacramento-San Joaquin Delta.

However, the size of the lake has dwindled considerably since the frontier days. The surface level has not reached 200 feet for the last 100 years, and on several occasions the lake has been virtually dry. A peak stage of 191.44 feet was recorded on July 13, 1983, short of the modern record of 192.5 feet established in 1969.

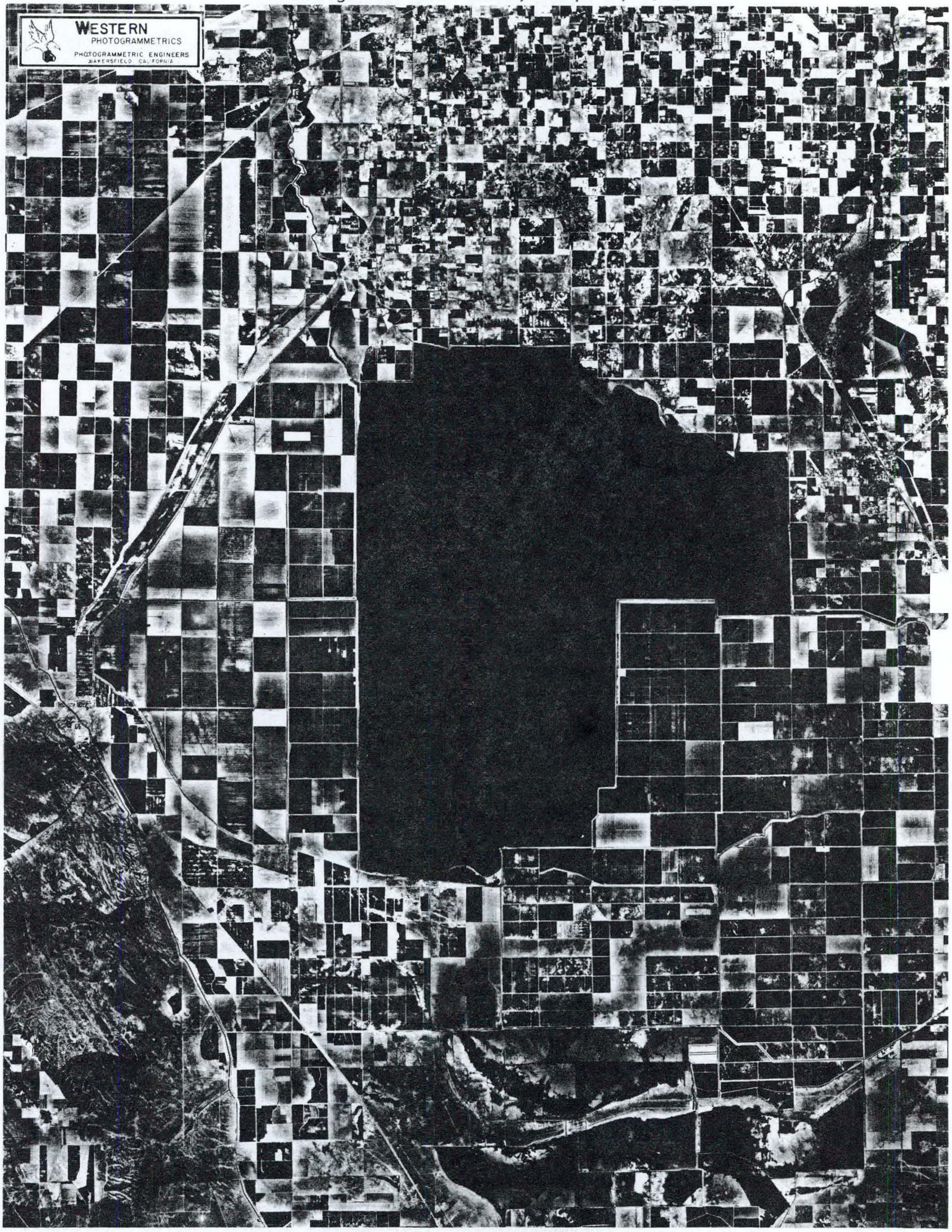
When it appeared that communities bordering Tulare Lake bed were about to be flooded by rising water in the lake bed, the Corps of Engineers constructed 3 miles of new levee and raised 4.5 miles of existing levees at the north end of the lake to protect the town of Stratford. An additional 8 miles of levees on the south and west sides of Corcoran were also raised to prevent flooding in that community. Also, a large, expensive gin in the lake bed was dismantled and relocated to protect it from flood damage.

Officials estimate that 82,000 acres of prime agricultural land was taken out of production in 1983 because of the 880,000 acre-feet of water trapped in the basin. Cotton, wheat, safflower, and seed alfalfa are crops usually planted in the flooded area.

Approximately 795,000 acre-feet of runoff that would have reached the Tulare Basin was diverted into the State Water Project through the Kern River-California Aqueduct Intertie, constructed in 1976. This flood-mitigation facility probably averted flooding of the communities of Corcoran and Stratford. The diversion of excess water, at no expense to the State, began on December 3, 1982 and was terminated on February 10, 1984. As much as 6,337 acre-feet per day free-flowed through the intertie during peak runoff periods in May, June, and July. The hydrograph of Lake Isabella (Figure 32) shows how the snowmelt runoff affected reservoir releases into the lower Kern River.

It soon became apparent that irrigation demands and evaporation would not lower the water sufficiently to enable farmers to reclaim the land. Engineers estimated that at least 400,000 acre-feet of water would have to be pumped northward into the San Joaquin River to bring the land back into productivity by 1985.

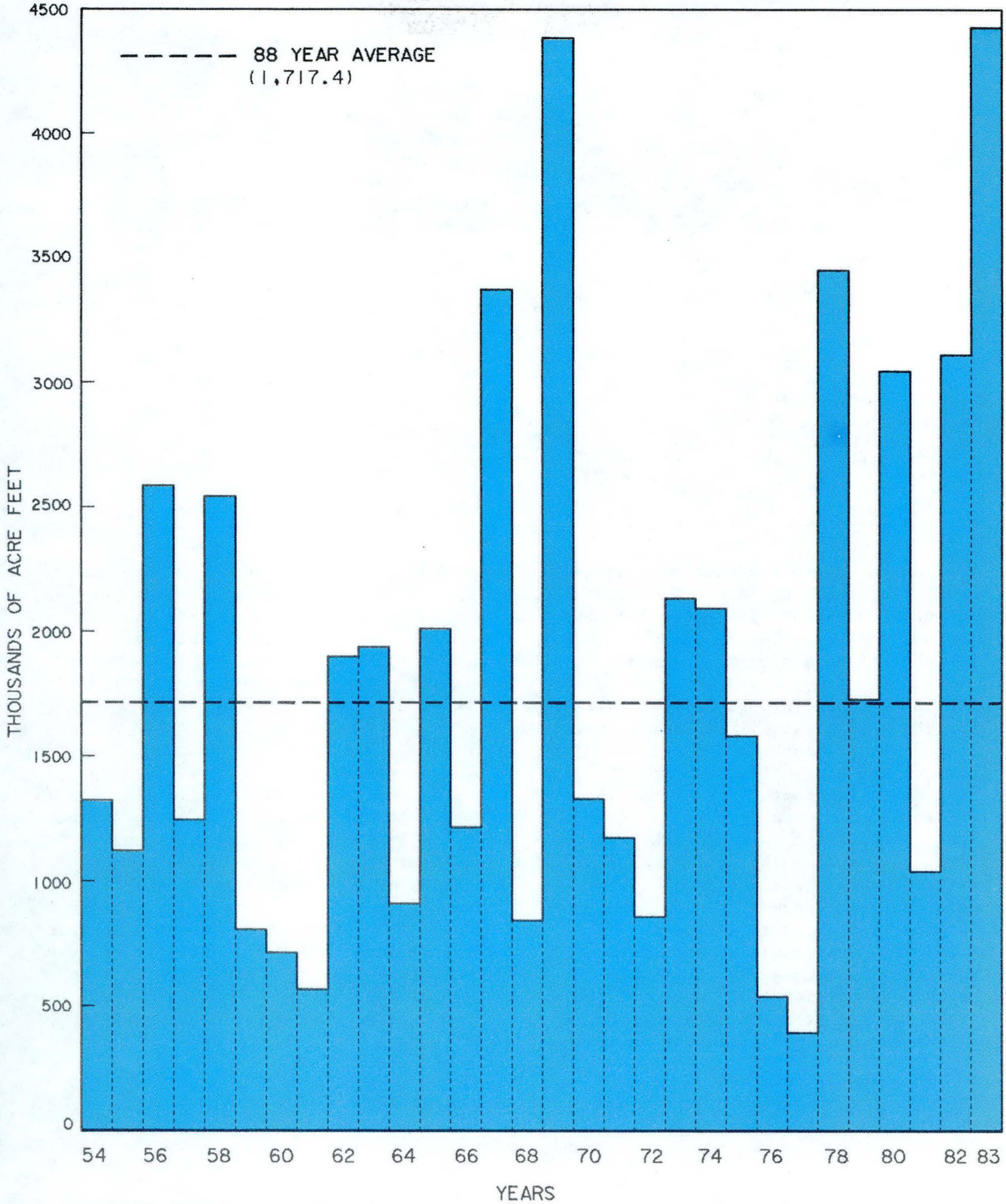
Flooding in Tulare Lake, July 23, 1983



SCALE OF MILES

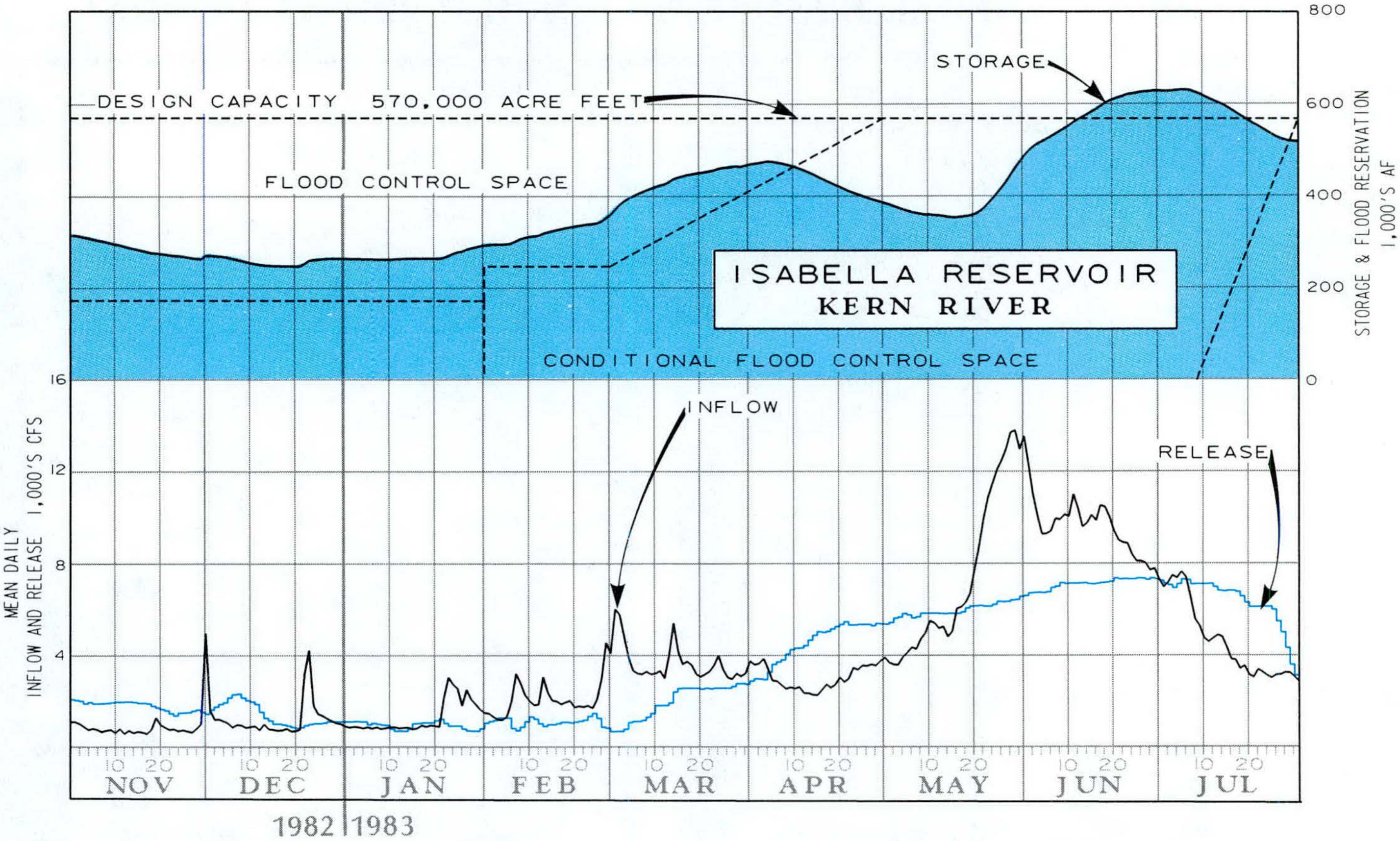
0 1 2 3 4 5 6

Figure 31. ANNUAL RUNOFF OF KINGS RIVER AT PIEDRA



SOURCE: TULARE LAKE AREA ELIGIBILITY DETERMINATION, DWR SEPT. 19, 1983 Pg. 9a

Figure 32. HYDROGRAPH OF ISABELLA RESERVOIR



Landowners determined that pumping and dewatering costs of from $12 million to $20 million would offset gross revenue losses of $25 million that appeared imminent if no action were taken.

A plan was then introduced that called for the water to be lifted a total of 43 feet in four stages, along the South Fork of the Kings River, where it would empty into the North Fork of the Kings River and then flow downstream to the San Joaquin River to the Delta. The first series of pumps, with a capacity of 1,300 cubic feet per second (cfs), was located at Nevada Avenue; number 2 pumping station, with a capacity of 1,150 cfs, was installed at Empire I; the third station at Smith Crescent is capable of pumping 1,000 cfs; and the final lift is at North Crescent, having a capacity of 1,000 cfs. The declining capacity toward the North Fork of the Kings River is designed to allow pumping for local use during the peak irrigation season. The project is designed to remove approximately 2,000 acre-feet of water per day from the flooded Tulare Lake bed.

The only real objection to the pumping project came from conservation groups and State Fish and Game officials, who feared pumping would allow the predatory white bass to invade the Delta and endanger the striped bass and salmon populations. The white bass was introduced into Central California lakes by the State Department of Fish and Game as a sport fish many years ago, but efforts to confine them to a few mountain lakes have proven futile. Thousands moved into Tulare Lake during high snowmelt periods.

SOUTHERN CALIFORNIA

Southern California is generally noted for its sunshine, movie stars, smog, and, in particular, mild winters. Annual rainfall ranges from a high of 17 inches near Santa Barbara to less than 2 inches in portions of the high desert regions. Metropolitan areas along the coast normally can expect about 10 inches of precipitation. This so-called "ideal" climate partially explains why two thirds of California's population resides in the lower third of the State.

During the winter of 1982-83, however, those who chose to escape the characteristically blustering storms of the north state by migrating to warmer and dryer Southern California did little to improve their lot. Much to the chagrin of various chambers of commerce and disappointment of vacationers, the south state was continuously beset by persistent storms throughout the fall, winter, and spring of the 1982-83 season. Most of the flood-related damage occurred along the Pacific Coast shore, but significant damage also occurred inland.

The 200-mile coastline from Santa Barbara to San Diego suffered some of the worst damage in its history from the storm that hit on January 27. At least three municipal piers and cargo wharfs were completely destroyed or extensively damaged. Boats were cast adrift, and nearly 1,000 homes between Santa Barbara and the Mexican Border were lost or damaged by 15- to 20-foot waves. Traffic snarls due to slides and flooded intersections made highway travel risky and subject to long delay.

Some beach front properties were hard hit, and evacuations became necessary. Many locally famous landmarks and expensive homes of celebrities were destroyed. Public facilities were also victims of the storms. In addition to the piers, sea walls, lifeguard towers, parking lots, coastal roads, and highways that eventually yielded to the persistent pounding of high waves, the famous southern California beaches were badly eroded and suffered lasting damage.

Inland flooding was less severe, but flash flooding caused giant land and rock slides. Evacuation became necessary in some communities when the existing flood-control and drainage systems proved to be no match for the tremendous volumes of water generated by local electrical storms.

San Luis Obispo County

The coastline of San Luis Obispo County was the hardest hit by a storm in late January but flood damage was not confined to that area. The entire length and breadth of the county felt the wrath of the storm. The combination of steady rain, strong winds, and high tides created 20-foot waves, which eroded beaches and destroyed or damaged numerous beachfront homes and public facilties. The cliffs that line Pismo Beach were badly eroded, and the foundations of private structures were undermined.

Lopez Dam was filled by the accumulated runoff from early storms and spilled into the swollen Arroyo Grande Creek. Flooding was common along the creek on its path to the ocean. The normally docile San Luis and Carpenter creeks also overflowed their banks and flooded pastures and grazing land north of Avila Road. The North Beach Campground was inundated, and many of the parks facilities were damaged or lost.

San Luis Obispo County was struck again by a series of weather fronts in early March. A windy Pacific storm battered the coast with 25-foot waves, causing significant damage to shoreline property. Portions of the piers at Avila Beach, Pismo Beach, and Cayucos Beach were knocked out by the unrelenting high sea. In Port San Luis, four boats sank in rough waters. The entrance to Morro

Bay also became unpassable because the breakwater was damaged. Portions of Los Osos were inundated with water up to 5 feet deep, and a score of homes were damaged.

In the interior county, Paso Robles suffered extensive road and street damage due to erosion and undermined pavement. Road closures were commonplace. A washout and landslide closed Highway 166. Other main arteries, including Highway 101, were limited to one-way controlled traffic.

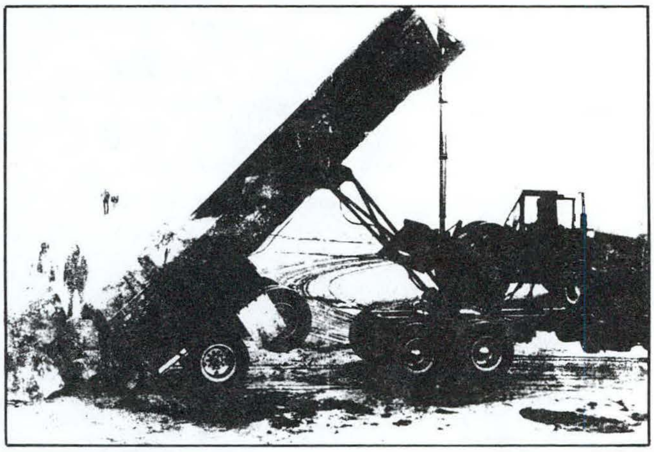
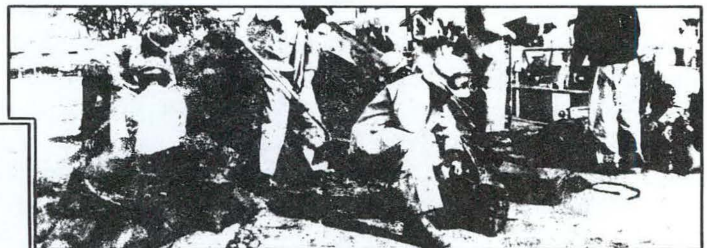


Photo by John Read

Trucks dump rocks and California Conservation Corps members fill sandbags in an effort to avert damage from distructive waves at Pismo Beach

SAN LUIS OBISPO COUNTY



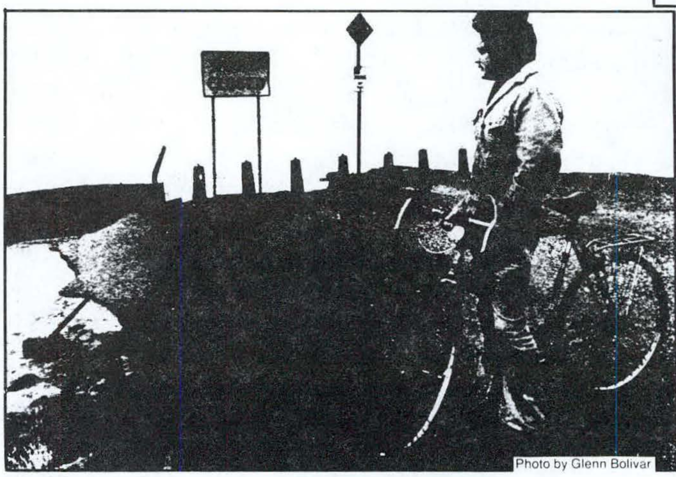


Photo by Glenn Bolivar

Damage never the less did occur, closing Pismo Beach State Park (left) and undermining beach front home, to note a few of the causalities

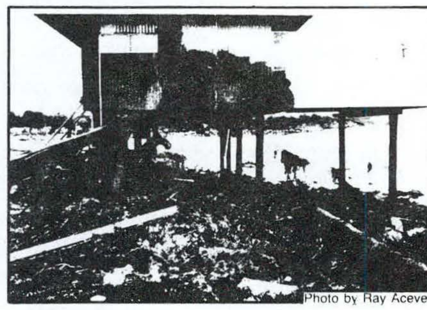


Photo by Ray Acevedo

Santa Barbara County

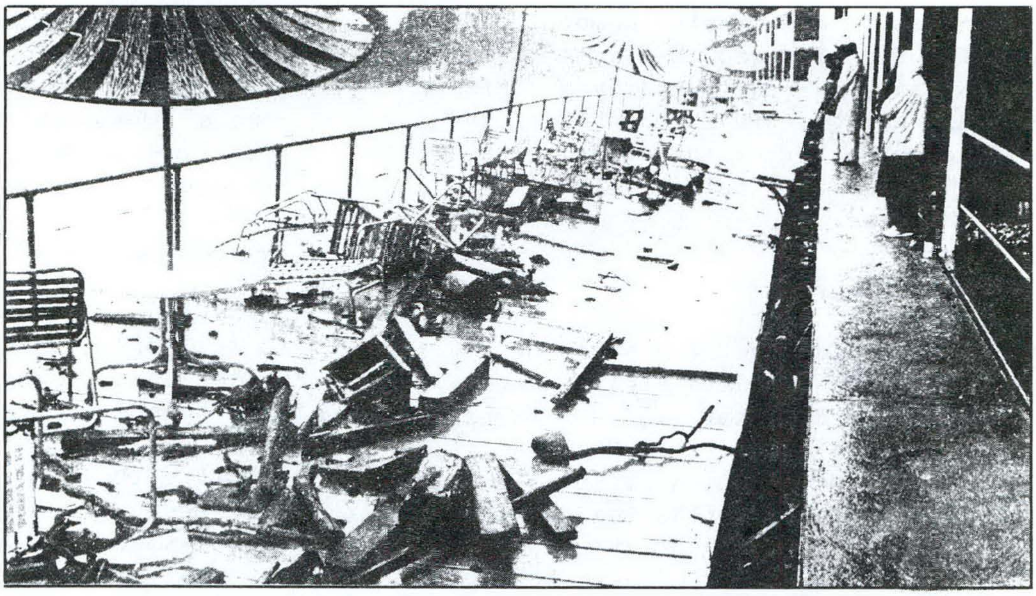
Late in January, 1983, Santa Barbara County was hit by the roughest combination of high tides and heavy rain in decades. The one-two punch forced the evacuation of several county residents, disrupted passenger-train and highway travel, and devastated beach front property.

The Montecito area was hardest hit by the January onslaught. Some 4 inches of rain in a 24-hour period, combined with 7.1 foot tides, caused nearly a million dollars in damage to beach-front structures in one small area. In that area, 36 structures were damaged and 5 more were declared unsafe. Other beaches in the county, including those of Santa Barbara and Carpenteria, also suffered extensive damage.

The massive Janaury storm also blasted the interior county. The rain-swollen Santa Monica River closed Suey and Bonita roads. The downpour also filled reservoirs, causing spilling and the closure of additional roads. More than 50,000 residents were without power for extended periods.

Another series of storms that struck the county in late February and continued during the first week of March was a repeat of the earlier onslaught. Winds

Hotel Deck Wreckage

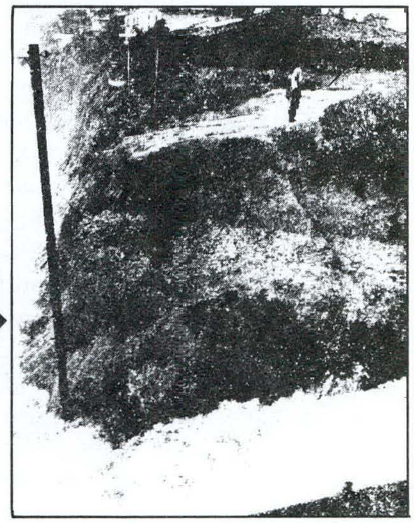


News-Press photo by Bob Ponce

Marooned Restraurant

News-Press photo by Bob Ponce

Ila Vasta



News-Press photo by Rafael Maldonado

Huge wave races towards homes

News-Press photo by Jason Bleibtreu

AWESOME SURF BATTERED COASTAL PROPERTIES

SANTA BARBARA COUNTY

of 50 to 70 mph created a monstrous surf, which ravaged the Santa Barbara coastline, destroyed nearly a score of homes, damaged piers and wharfs, and littered harbors with debris. The brunt of the storm was felt mainly along Padaro Lane.

Ventura County

The first flood-related storm of significance hit the Oxnard area on February 25. Hardest hit was the Silver Strand Beach community. Five families were evacuated, and their homes became uninhabitable when flooding caused a sewage backup. Some of the flooding at Silver Strand Beach and neighboring areas was reportedly due to the failure of pumps at the Naval Construction Battalion Center at Port Hueneme.

As the storms continued into March, rainfall totals in 5-inch amounts resulted in widespread highway flooding. The destructive floodwaters from levee failures and the overflow of Calleguas Creek closed roads, inundated thousands of acres of farmland, and forced residents in low lying areas from their homes. In addition, families of 100 mobile homes at the Camarillo Springs Mobile Home Park were evacuated. Many streams, including Calleguas Creek, reached their highest stage in recorded history.

The six days of relentless rain also raised havoc in the eastern part of the county. Small lakes in and near Simi Valley could not contain the runoff despite extensive pumping. When portions of the earthern dams on these small lakes began to fail, nearly 1,500 residents were evacuated.

Los Angeles County

Uncharacteristic weather began taking its toll of death and destruction in Los Angeles County even before winter officially began. Shortly after the first week of November an arctic storm began battering the county with rain, hail, snow, thunder, lightning, high winds, and chilling temperatures. The Malibu area was, seemingly, the selected target for the November storm.

Late summer wildfires had denuded slopes of the surrounding steep canyons, rendering them vulnerable to erosion by heavy rains. The torrential rains triggered flooding and mudslides, which resulted in traffic snarls, power outages, and damaged homes. The Pacific Coast Highway became a commuter's nightmare as mud, rocks, and debris littered the traffic lanes. One death was attributed to the hazardous driving conditions created by the November storm.

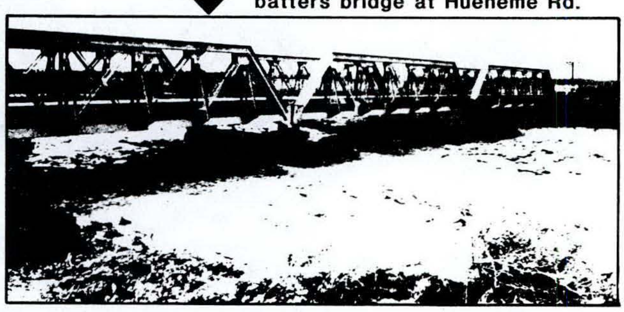
At one period during the onslaught, a brief but intense hailstorm caused flooding that damaged about a dozen homes along Board Beach Road. The 20-minute hailstorm reportedly blocked flood control drains and sent rainwater

Scott Vlha Camarillo Daily News plane courtesy Air Camarillo

Mobile home park threatened by spilling waters of Conejo Creek

VENTURA COUNTY

Raging waters of Calleguas Creek batters bridge at Hueneme Rd.



streaming into living rooms of many beachfront homes, some valued at about $2 million. The hailstones, which reportedly were as large as marbles and golfballs, were piled 2 to 3 feet deep in places.

The last week of January was also a hectic period for residents of beachfront communities of the county. A series of four Pacific storms in less than a week battered the coast, ripped away large portions of piers and oceanfront homes, and flooded widespread residential areas. Three aging piers succumbed to the relentless pounding of 15-foot waves.

The 100-foot tip of Santa Monica's historic municipal pier collapsed, carrying with it a restaurant and the harbormaster's office. Public work crews worked around the clock to remove debris, especially the shattered piling and timbers that were acting as a battering ram and demolishing structures. Several floating docks were torn loose from their moorings and small craft were

LOS ANGELES COUNTY

MIKE MEADOWS / Los Angeles Times

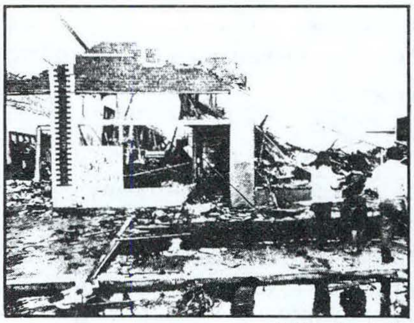
San Fernando Valley waterway Roscoe Blvd

UPI Telephoto

Sand bags fortify Sunset Beach home

Huntington Beach neighborhood

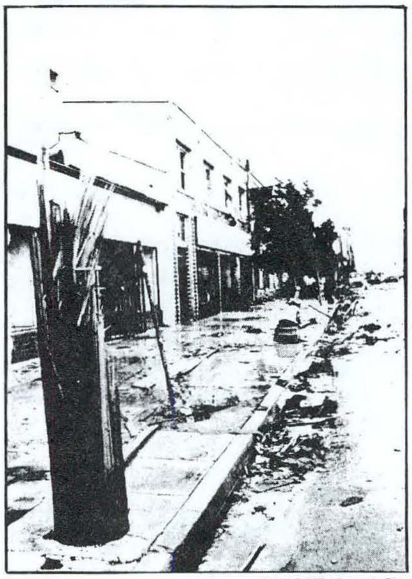
The Register



BEN OLENDER / Los Angeles Times   FITZGERALD WHITNEY / Los Angeles Times   BEN OLENDER / Los Angeles Times

Scenes of destruction along Broadway after the tornado swept through: a gutted store near 41st Street, a damaged church at 43rd Street and a car nearly buried by bricks at the same intersection.

TORNADO RIPS THROUGH LOS ANGELES



BEN OLENDER / Los Angeles Times

splintered power pole on debris-strewn Broadway near Vernon.

DON CLEMENT / Los Angeles Times

Associated Press

Cars in an alley near Central Los Angeles are half-buried by debris after a tornado tore through area.

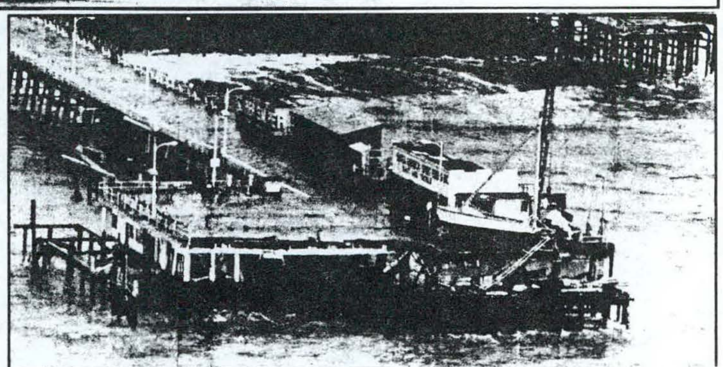
JACK GAUNT / Los Angeles Times

A 100-yard gap punched in the breakwater at San Pedro Harbor by the slashing waves; four fishing boats in the harbor were sunk.

LOS ANGELES COUNTY
(Cont.)

JOE KENNEDY / Los Angeles Times

House at 26652 Latigo Shore Drive in Malibu, battered by week of storms, collapses into the sea. Built in 1929, two-story house was used in 1945 as set for filming of "Mildred Pierce."



Evening Outlook Photo by Bob Smith

Harbormaster's office on northwest corner of Santa Monica Pier missing after waves sent it to sea

WAVES LASH HOMES, PIERS, HARBORS

cast adrift. In the Redondo Beach area, about 40 business establishments were flooded, including five restaurants and a hotel, where 200 guests were evacuated.

Officials estimate that beaches between Pacific Palisade and Torrance were reduced an average width of 150 feet by the storm-generated surf, which took about 1 million cubic yards of sand out to sea. Restoration of the beaches by artificial means will be a costly project.

The south state, including Los Angeles County, received another drenching during the last days of February. A rare tornado spawned by the late February storm touched down in Central Los Angeles, destroying or damaging 100 homes and businesses before jumping a freeway and ripping into the Convention Center, tearing away sections of the huge structure's roof. Although the twister caused millions of dollars in damage and injured 25 persons, miraculously no one was killed. Areas of the county reported as much as 2 inches of rain in a 3-hour period.

Vehicle accidents due to flooded streets and freeways were rampant. Runoff from the storm, and failure of a pumping system that was hit by a lightning bolt, flooded the Long Beach Freeway and left motorists stranded. City emergency crews used inflatable rafts and ropes to rescue passengers from their disabled vehicles. One traffic-related death was attributed to the flooding.

During the summer of 1983, in the midst of an August heat wave, a tropical storm hit the county shortly after mid-month and caused widespread damage. The lightning storms and high winds caused considerable damage in the San Gabriel and San Fernando valleys. Flooded homes, closed roads, and power outages prevailed. Ironically, the storm brought little relief from the heat wave.

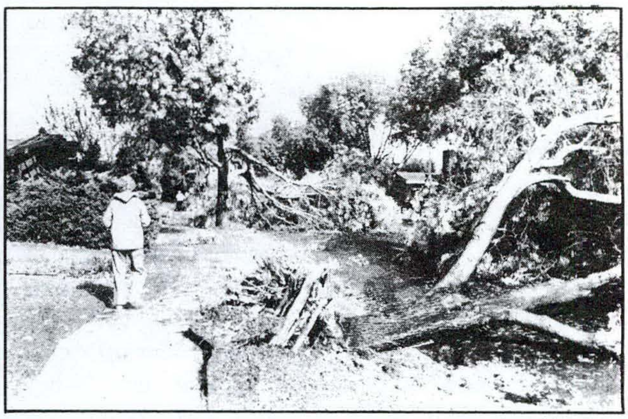
Orange County

Early in the 1982-83 winter, Orange County residents got a sample of what was to come. On November 30, an arctic-spawned storm raked the county with 70-mph winds and heavy rains, which flooded portions of two coastal communities and triggered an industrial accident that forced the evacuation of more than 3,000 persons. A minor explosion and fire occurred at an oil and chemical facility, when a storm-related power outage disabled the cooling system of a 6,000-gallon tank of styrene monomer, causing fumes to be vented over a wide area of businesses and homes. Fortunately, there were no reports of injury or illness.

The stong winds associated with a high-tide period pushed water over the seawalls at Sunset Beach and Anaheim Bay and flooded several homes. In the Newport Beach area the high tide and winds played havoc. In addition to the flooding of homes, numerous boats were torn loose from their moorings and severely battered. Fortunately, workmen were able to rescue all the craft but one -- a fifty-foot sailboat that was beached near the Bay Island Bridge.

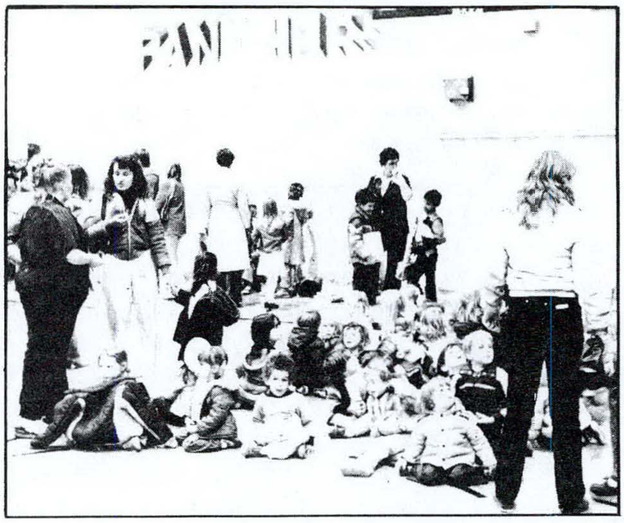
Another attack by a storm from the Gulf of Alaska picked Southern California as its target in late January and left its mark there. More than 650 homes throughout the county were damaged by waves and flooding. A section of the Pacific Coast Highway in the Huntington Beach area was closed by waves breaking across the road. The turbulent seas also severely damaged Seal Beach piers.

Another storm that had been forecast to hit Orange County the first of March and cause widespread flooding arrived as scheduled and lived up to its advance billing. Hundreds of homes were flooded as a result of the deluge, which brought normal activities almost to a standstill.



Photos by DOUG GANSELANES

Residents inspect storm damage in Rossmore area near Los Alamitos, trees, power lines were knocked down through out the area.



CLIFF OTTO / Los Angeles Times

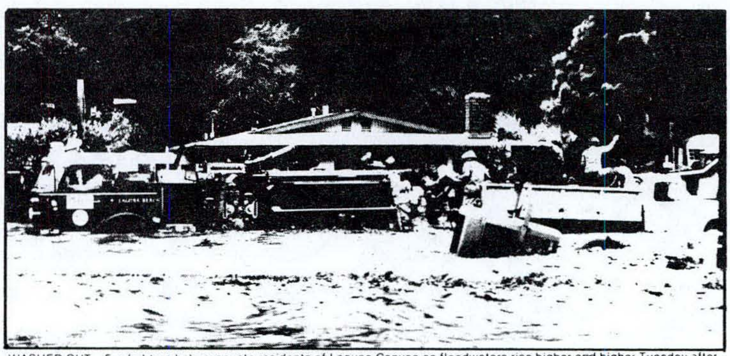
Preschoolers from the Orange Early Achievement Center wait it out at Orange High School after a fire and explosion at a chemical plant forced them and about 3,000 others to flee.

HIGH WINDS, RAIN LASH COUNTY

DON KELSEN Los Angeles Times

Only sign fragment remained after waves destroyed shop on San Clemente pier

ORANGE COUNTY



WASHED OUT—Firefighters help evacuate residents of Laguna Canyon as floodwaters rise higher and higher Tuesday afternoon. (Photo by Randy Riis)

CANYON FLOODED RESIDENTS FLEE

WORST WEATHER IN MEMORY

The torrential downpours -- a half inch of rain in 8 minutes at one point and 4 inches in a 6 hour period -- filled the county's storm-drain system to overflowing and then covered dozens of square miles with instant lakes. In Huntington Beach more than 700 homes were flooded, some with 4 1/2 feet of water, when flood control levees failed.

Elsewhere in the county, a small twister reportedly touched down along Harbor Boulevard. The most serious damage occurred near Santa Ana, where more than 20 mobile homes were damaged. Scattered residential flooding was reported throughout the county. Residents of Laguna Canyon and Laguna Beach suffered home and business losses as 2.85 inches of rain fell in 24 hours. Rescue workers evacuated people and animals. Power outages due to felled trees and traffic snarls caused by the flooded streets and washed-out roads prevailed during the long-to-be-remembered deluge of February 26 through March 2.

San Diego County

San Diego County was hit by a North Pacific storm system in late November. Winds as strong as 57 mph toppled trees, disrupted power service, tore roofs from structures, and damaged vehicles and equipment. Heavy rains also caused streams to overflow. At least one child lost his life when the vehicle in which he was a passenger overturned into the roiling waters of a creek northeast of Carlsbad.

A strong storm system combined with a high-tide cycle during the last week of January hammered the San Diego coastline from Oceanside to Baja California. The 7.6-foot tide and 15-foot waves joined

SAN DIEGO COUNTY

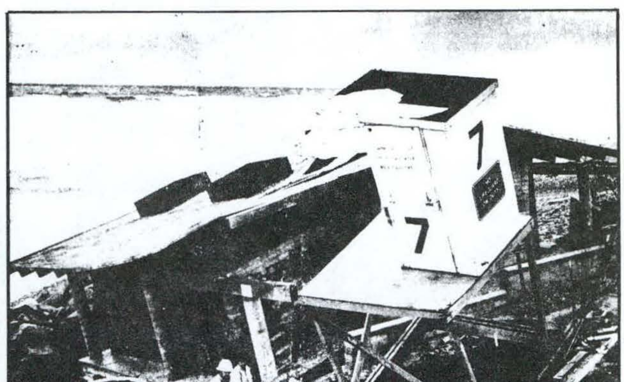
Photo by Bill Maier
Vehicles on Spray Street in Ocean Beach were submerged at high tide today

Tribune photo by Dennis Huls
Torrey Pines Beach —Damage along Old Highway 101.

SURF DAMAGE

Cardiff State Park

Dan Rios/The Times-Advocate



BATH HOUSE at Carlsbad State Beach has been destroyed by 15-foot storm surf.

forces to give beach communities their worst battering in many years. The sea attacked with such fury that 400-pound boulders were tossed about and porches were stripped from beachfront establishments. Pilings that supported piers and wharfs were snapped like matchsticks, and bath houses and lifeguard stations were dislodged and torn apart. Portions of coastal highways and boulevards were closed by wave erosion and storm-tossed debris across the traffic lanes. The coastal communities, and, in particular, the beaches of Carlsbad, Cardiff-by-the-Sea, Del Mar, La Jolla,Mission Beach, Ocean Beach, and Imperial Beach suffered the most damage.

San Diego County residents, still in shock from the late January event, were broadsided by another series of weather fronts in late February and early March. The 7-day period of intense storms brought additional flooding and damage to coastal communities. Damage also occurred in the interior county.

In the San Marcos area at least a dozen roads were closed, causing numerous motorists to be stranded, and many residents of low-lying areas were forced from their homes. Winds exceeded 35 mph at times, but did not contribute significantly to damage totals. In terms of agricultural losses, however, at least one major crop, strawberries, was a casualty of the early March storm.

San Bernardino County

The first significant storm, in terms of flood damage, struck San Bernardino County in late February and continued into March. It began as a steady, gentle ground-soaking drizzle, and ended in a series of heavy rains and cloudbursts. The saturated earth at times became a torrent of mud that rushed down canyons and streets, burying everything in its path.

In the wake of the storm's path, at least one person drowned, more than 20 were injured, 300 homes and businesses were damaged, and 2,000 dairy cattle died. Highways closed by mudslides, standing water, falling rocks or debris included highways 330, 138, 18, and 60.

FLOODED STREETS

Chino

Staff photo by Gail Fisher

Rancho Cucamonga

Staff photo by Hal Stoelzle

SAN BERNARDINO COUNTY

A near tragedy occurred when a school bus carrying 16 students from the Chino Unified School District ran off the road and rolled into the flood-swollen Cucamonga Wash at Chino-Corcoran Road. Fortunately, the youngsters were uninjured and were rescued by a farmer using a skiploader.

Flood damage in Victorville was relatively light, but some street flooding occurred, leaving behind huge piles of mud and debris. The most obvious damage in Victor Valley was to desert roads and highways; the damage was caused by mudslides, which blocked traffic, and by sunken pavement, which collapsed after being undermined by rushing rainwater. Overflowing Lytel Creek stranded many residents and also exacted its toll of damaged roads and flooded homes.

The small, predominately residential community of Upland extends into the foothills of the San Gabriel Mountains. It lies in a historical drainage path with an extremely steep gradient. As a result of sheetflow flooding that reached depths of 3 feet, nearly 100 residences and commercial buildings were affected. At least 10 homes suffered major damage.

During the summer of 1983, San Bernardino County residents finally got some relief from the two-week record-breaking heat wave that began early in August. The relief, however, did not come in the expected manner. A mid-August tropical storm pounded the high desert regions of the state and added to the high flood damage totals. Two days of intense thunderstorms triggered flash floods, closing highways, flooding homes, and stranding residents and motorists. More than 20 vehicles on National Trails Highway at Hodge, just south of Barstow, were swept away by a 4-foot wall of water rushing down from the hills. The trapped motorists and passengers were rescued by Southern California Edison Company employees. County roads closed by the storm were Highways 66, 247, and portions of Ambay Road, a major east-west artery in the south county.

Prior to the mid-August deluge, the Colorado river, which borders the southeastern part of the county, was very high early in July due to Rocky Mountain snowmelt and damaged riverfront property. California Conservation Corps personnel protected many mobile homes and residences with sandbag barriers.

Riverside County

Hardest hit by the stormy weather that plagued Riverside County during water year 1982-83 was Lake Elsinore. The additional runoff generated by unusually heavy rains during the first week of March caused the overflow at Railroad Canyon Dam to reach its highest level in recent memory. At one point, the water was 4.24 feet over the top of the dam (the previous record was 4.10 feet recorded during the historic 1980 storm).

The community of Lake Elsinore, which has been beset with flooding problems in recent years, was once again threatened. It soon became apparent that the high inflow from the San Jacinto River, which feeds Lake Elsinore, would raise the lake level to above the floodplain of 1,255 feet. The seven pumps installed to meet the 1980 crisis were reactivated and began lowering the lake level on June 22. This action limited the peak surface elevation to 1,262.04 feet on May 17, considerably lower than its 1980 peak of 1,265.72 feet. Damage along the lakefront was also proportionately lower. However, at least three businesses and eight houses suffered damage, and the costs of repairing roads and bridges and clearing debris were estimated at $3 million.

The intense thunderstorms during mid-August flooded at least two dozen homes in the city of Riverside and filled underpasses with water. The raging Colorado River (due to snowmelt) began to affect the southeastern county early in July, and property and structures adjacent to the right bank of the river were damaged.

Imperial County

Imperial County did not qualify as a disaster area until July of 1983, but this does not necessarily mean that it was not without significant flooding prior to that time.

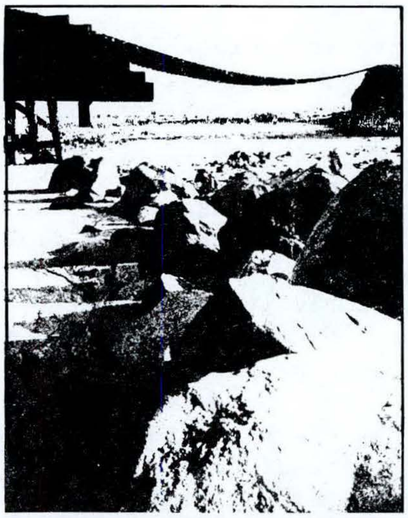
As early as December 8, hundreds of Imperial County residents--particularly these in the vicinity of Ocotillo, whose homes were threatened by raging mountain creeks--were evacuated as a two-day storm system battered the county with heavy rain and strong winds. There was no report of injury or death. Damage from the flooding was generally limited to the destruction of two railroad trestles and the washout of main roads, including Interstate 8, which links San Diego and Phoenix. The Westside Main Canal of the Imperial Irrigation District and the Central Main Drain, designed to carry off agricultural run-off, were extensively damaged and flooded fields and some homes.

The 350 percent-of-normal rainfall in the county also brought the surface elevation of Salton Sea to minus 226.30 feet on March 7, the highest level in more than 50 years. The construction of earthen and sandbag barriers kept flooding to a minimum along the sparsely settled waterfront.

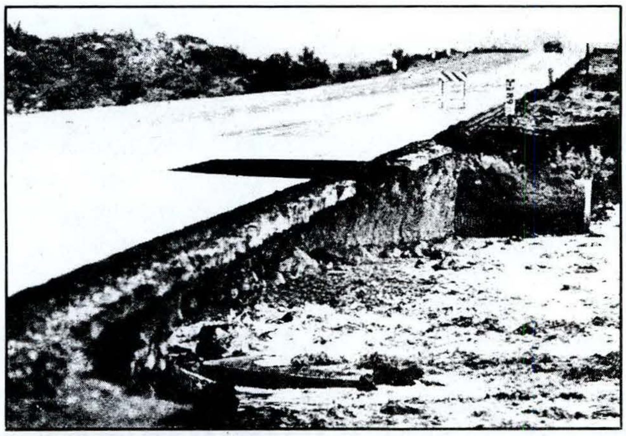
On July 1, Imperial became the forty-fifth county to receive Presidential Disaster Declaration status, when runoff from the massive Rocky Mountain snowmelt surged through the Colorado River system. Damage in the three California counties bordered by the Colorado was estimated in excess of $3 million. Nearly 150 residences (mobile homes and permanent structures) and 15 businesses were damaged or destroyed by the rampaging river. Damage to docks, cabanas, and other structures was also significant.

IMPERIAL COUNTY

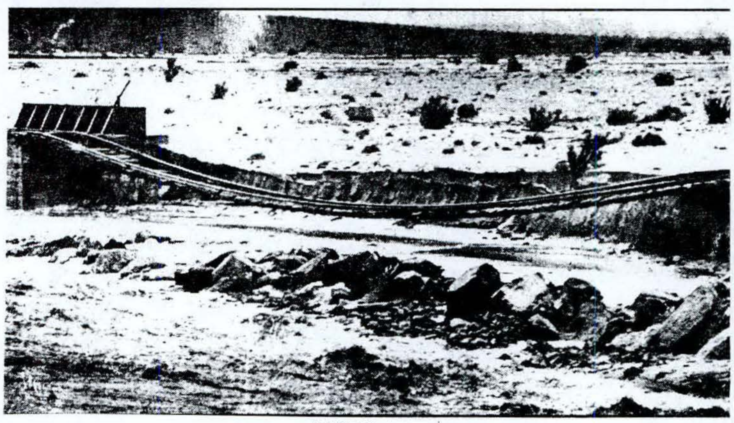
DESERT RAVAGED BY STORMS



December storm aftermath Flood waters undercut Interstate 8 and washed away railroad line outside Ocotillo



Interstate 8, linking San Diego and Phoenix, is undercut by flood waters just outside Ocotillo.

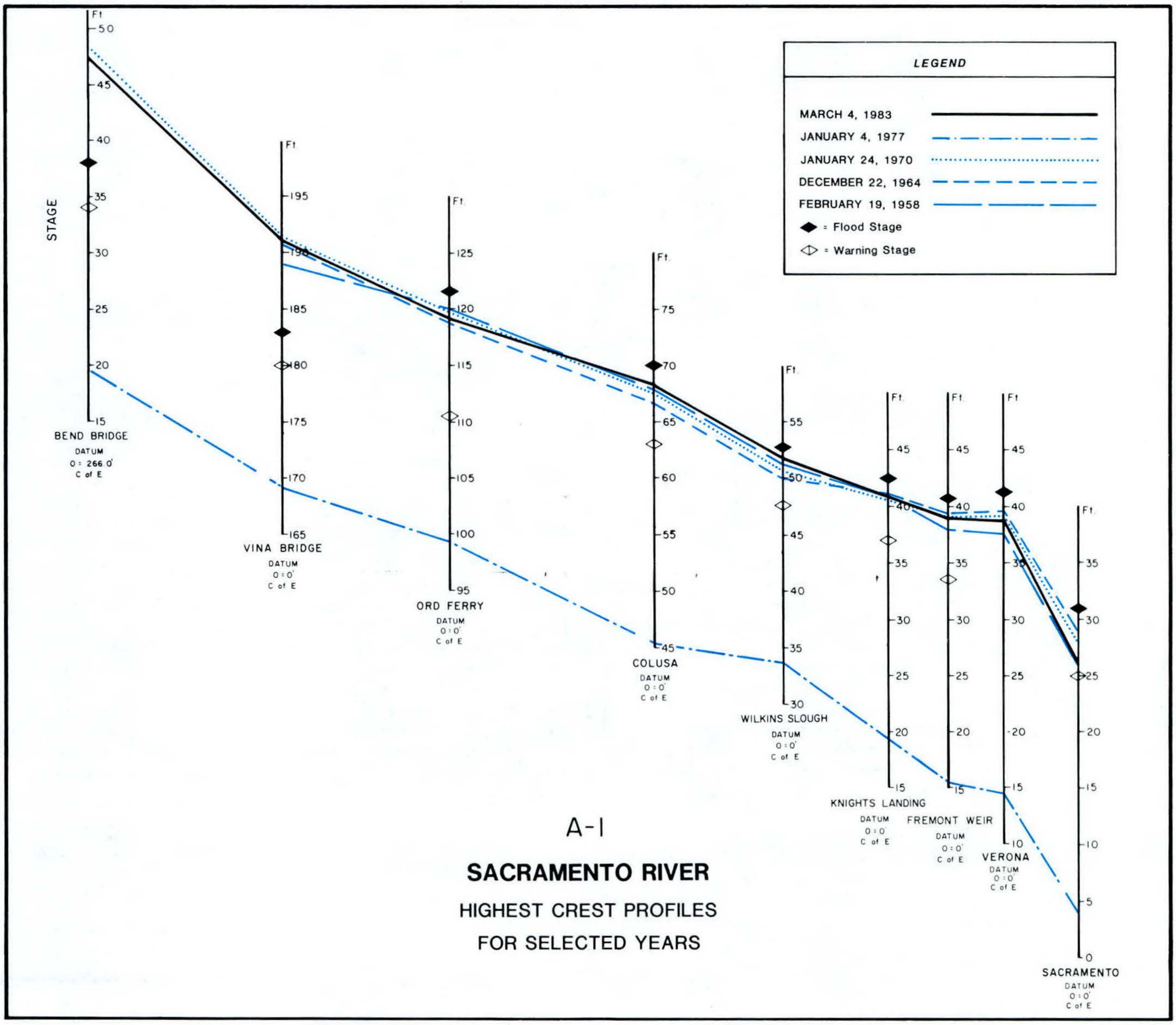


DAVE GATLEY / Los Angeles Times

August storm takes heavy toll from resultant flash flood

APPENDIX A

Sacramento River Crest
and
Weir Overflow Records



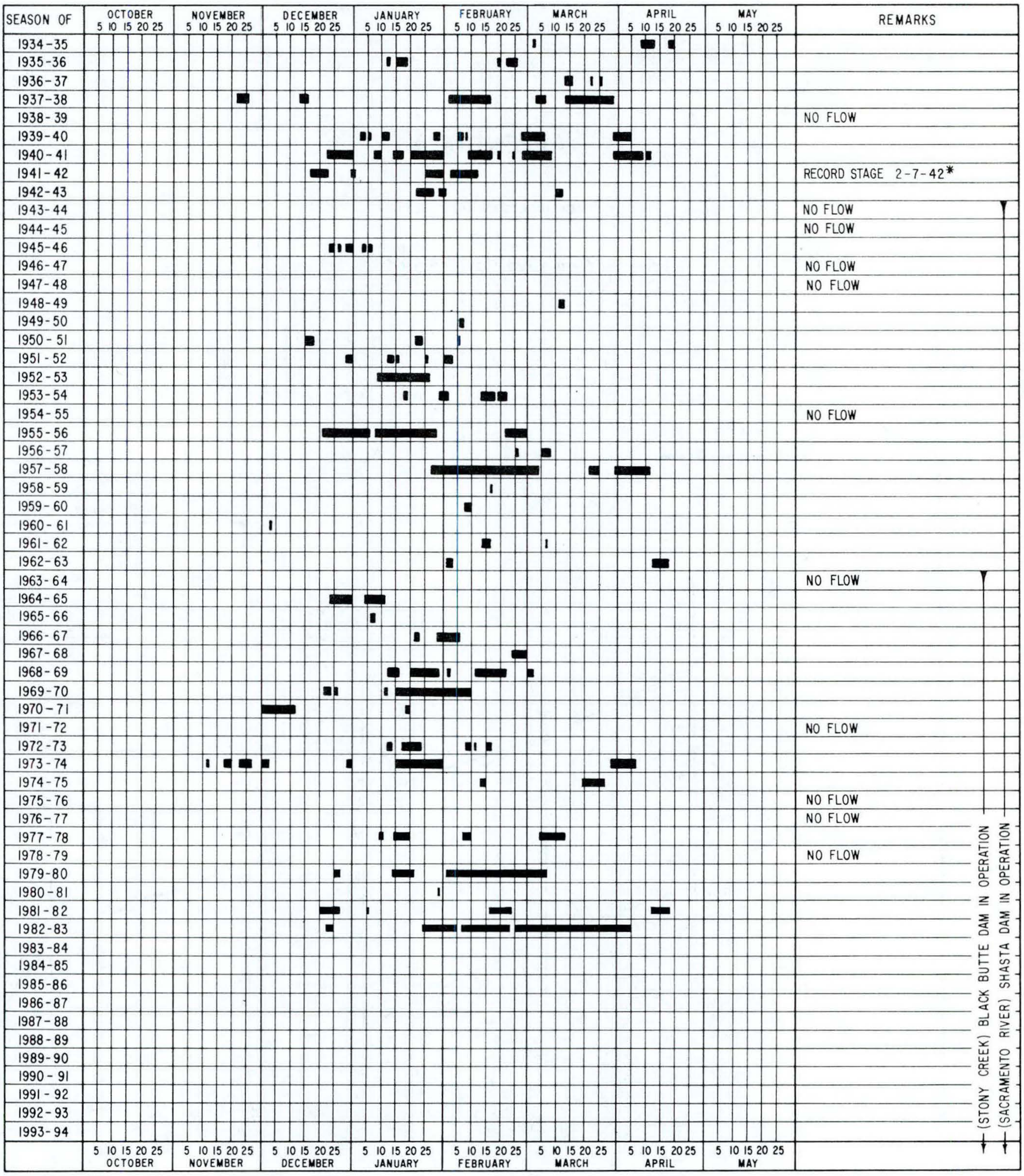
A-1

SACRAMENTO RIVER

HIGHEST CREST PROFILES

FOR SELECTED YEARS

Figure A-2 PERIOD OF RECORD OF OVERFLOW OF THE MOULTON WEIR



NOTE:

Data compiled from records of D.W.R. stream gaging station "Sacramento River at Moulton Weir."

Datum: 0 = 0' U.S.E.D.

Period of record: 1935 to present

Crest elevation = 76.75 feet

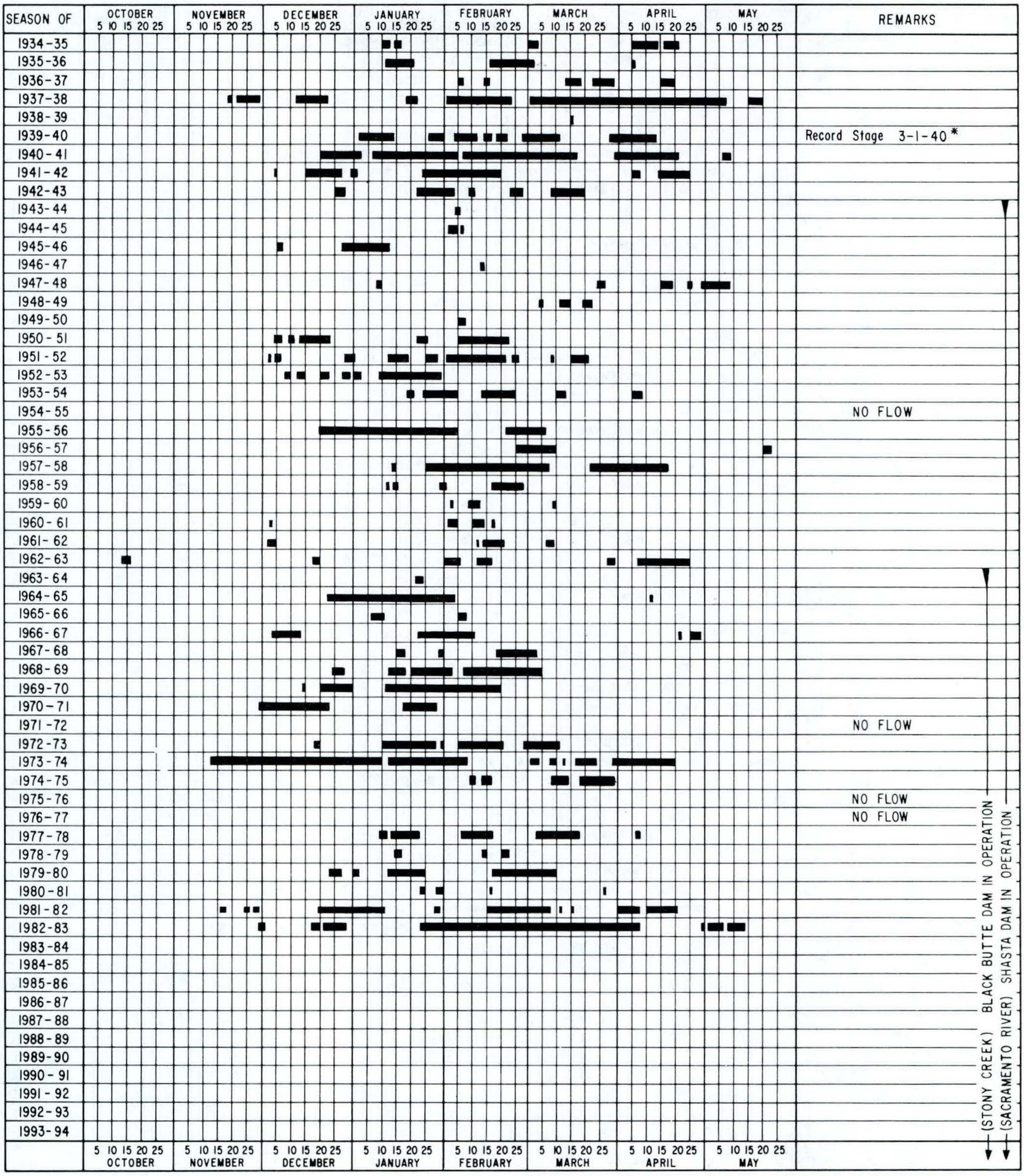
LEGEND

▬ Designates periods of flow over weir

* 83.8 feet

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

Figure A-3 PERIOD OF RECORD OF OVERFLOW OF THE COLUSA WEIR



NOTE:

Data compiled from records of D.W.R. stream gaging station Sacramento River at Colusa Weir

Datum: 0 = 0' U.S.E.D.

Period of record: 1935 to present

Crest elevation: 61.80 feet

LEGEND

▬ Designates periods of flow over weir

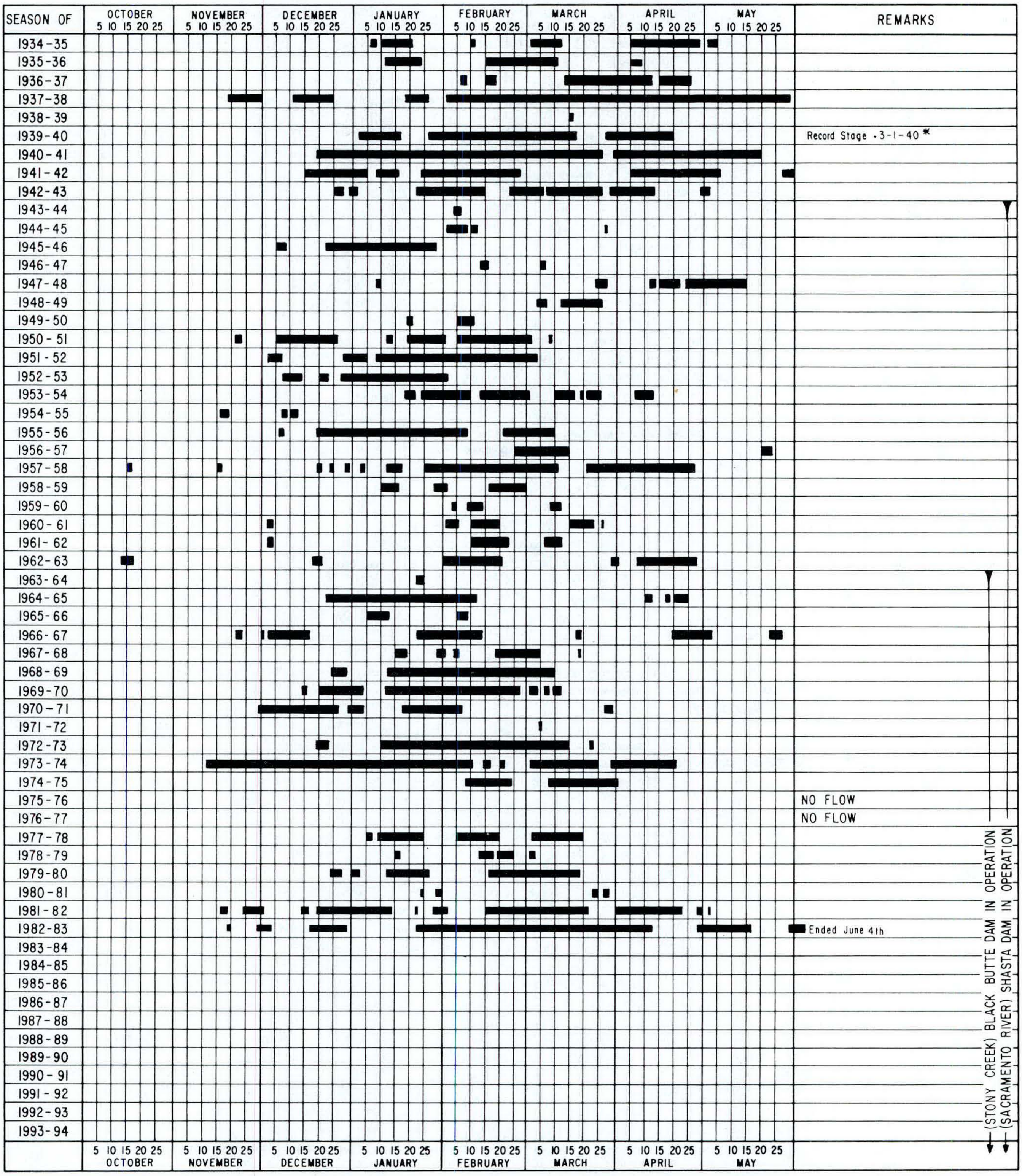
* 70.6 feet

STATE OF CALIFORNIA

THE RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES

Figure A-4 PERIOD OF RECORD OF OVERFLOW OF THE TISDALE WEIR



NOTE:

Data compiled from records of D.W.R. stream gaging station "Sacramento River at Tisdale Weir"

Datum: 0=0' U.S.E.D.

Period of record: 1935 to present

Crest elevation = 45.45 feet

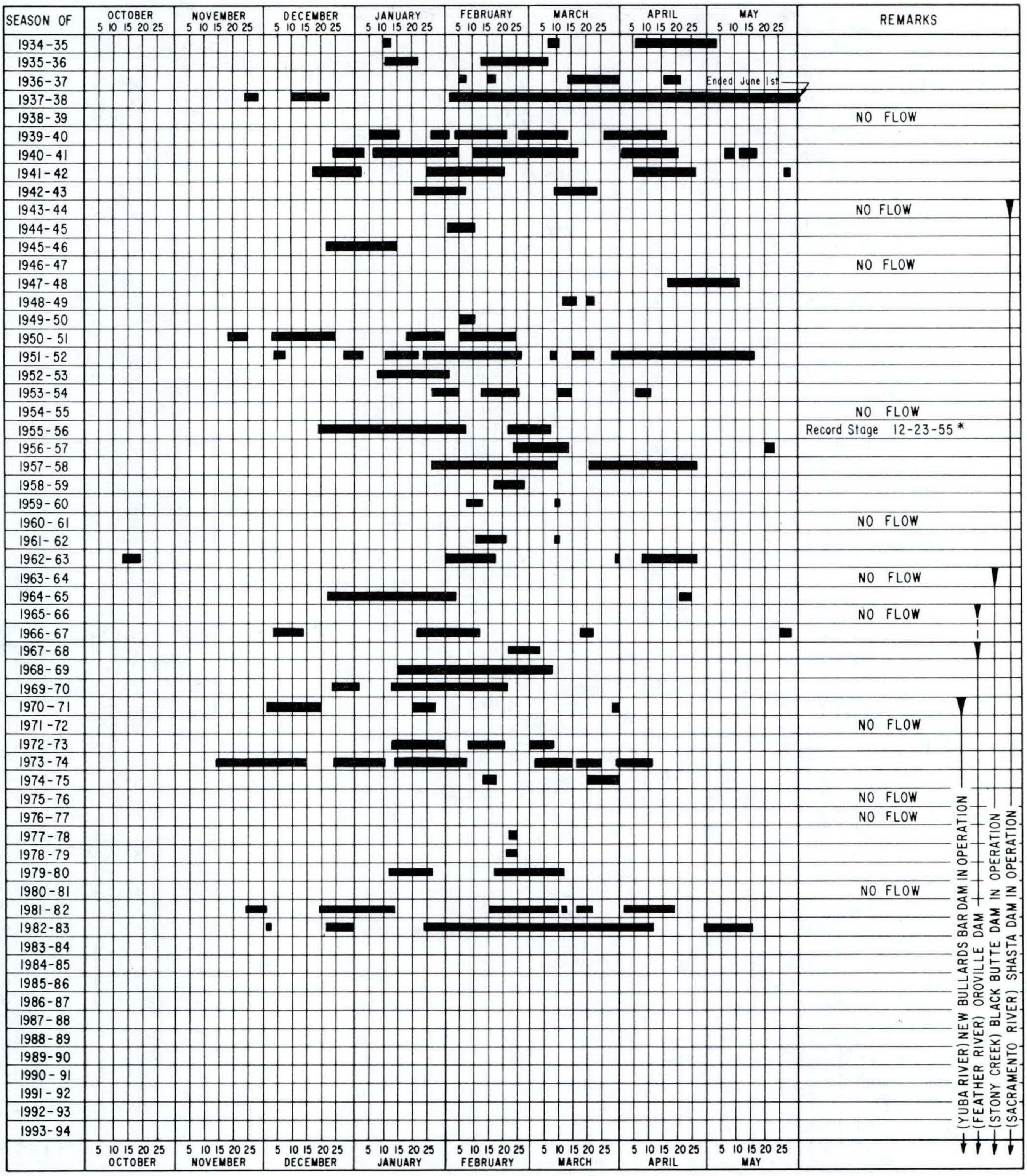
LEGEND

▬ Designates periods of flow over weir

*53.3 feet

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

Figure A-5 PERIOD OF RECORD OF OVERFLOW OF THE FREMONT WEIR



NOTE:

Data compiled from records of D.W.R. stream gaging station "Sacramento River at Freemont Weir, West End"

Datum: 0 = 0' U.S.E.D.

Period of record: 1934 to present

Crest elevation = 33.50 feet

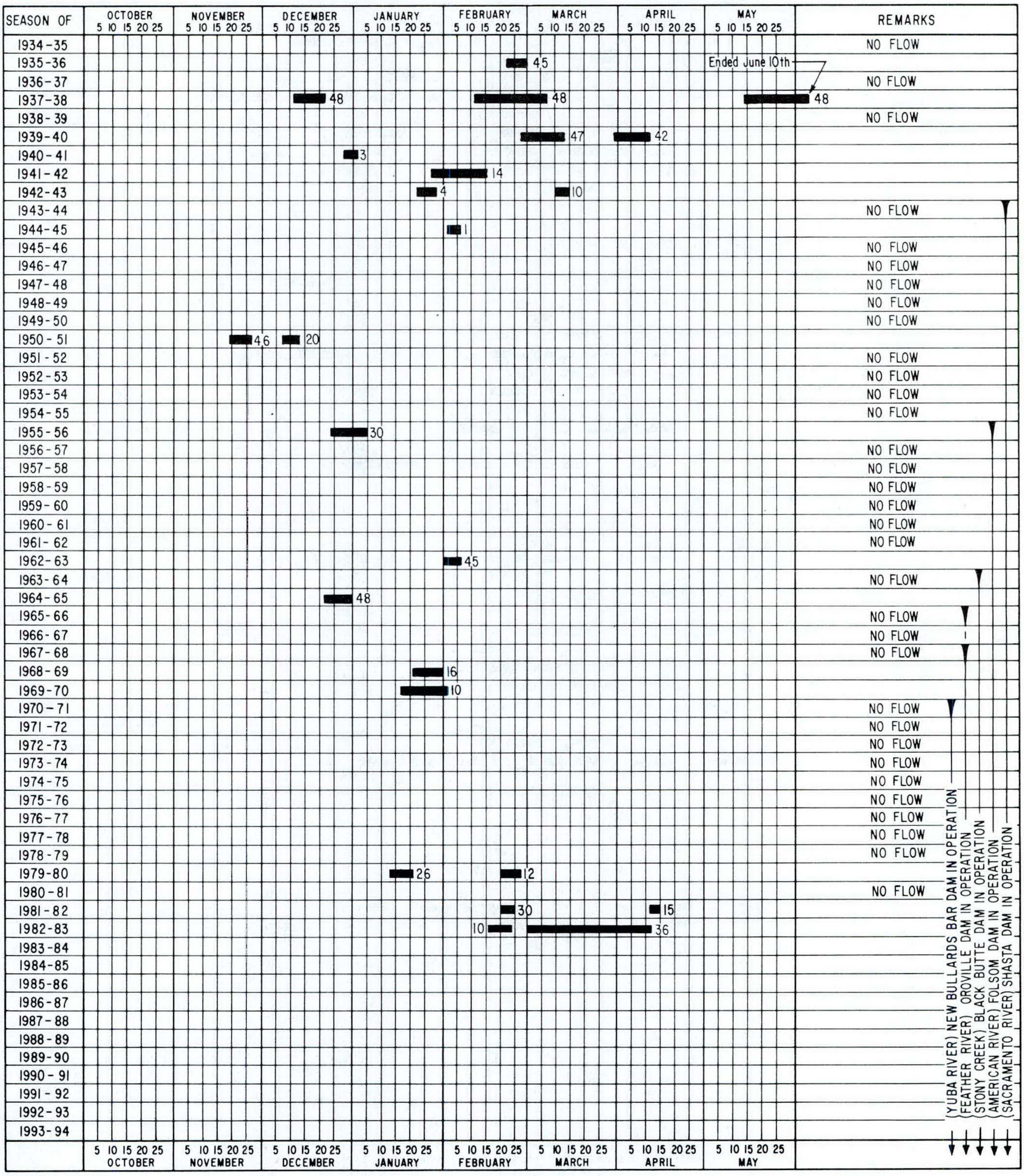
LEGEND

Designates periods of flow over weir

* 39.7 feet

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

Figure A-6 PERIOD OF RECORD OF OVERFLOW OF THE SACRAMENTO WEIR



NOTE:

Data compiled from records of D.W.R. stream gaging station "Sacramento Weir Spill to Yolo Bypass, near Sacramento.

Datum: 0=0' U.S.E.D.

Period of record: 1926 to present

Crest elevation = 24.75 feet

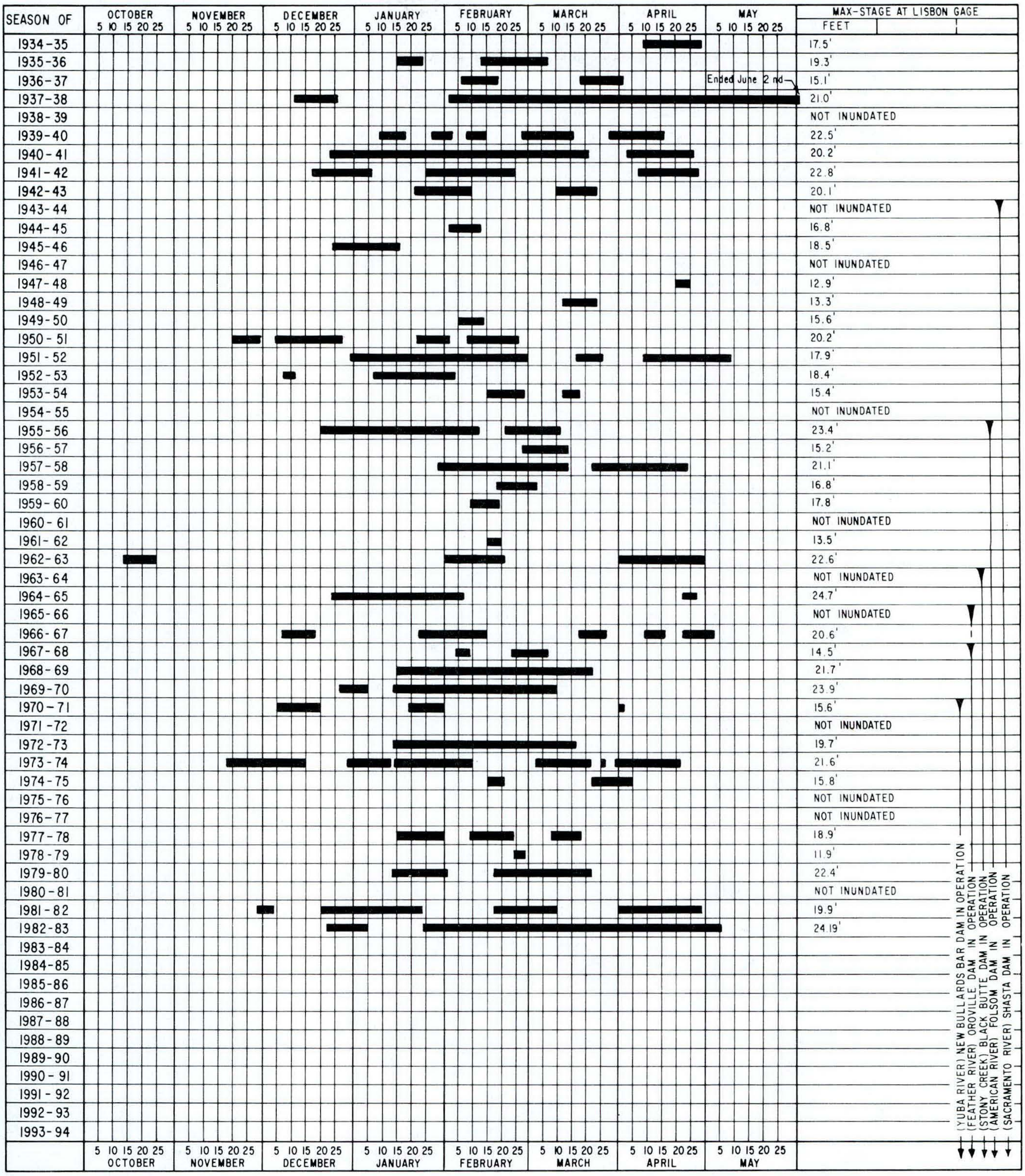
Elevation of top of gates = 31.0 feet

LEGEND

5 Designates periods of flow over weir and total number of gates opened.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

Figure A-7 PERIOD OF RECORD OF INUNDATION OF THE YOLO BYPASS



NOTE:

Data compiled from records of D.W.R. stream gaging station "Yolo Bypass near Lisbon."

Datum: 0=U.S.E.D. Datum

Period of Record: 1914 to Present

Assumed overflow of Bypass at stage above 11.5' on the Lisbon gage.

LEGEND

▬ Designates period of inundation of Bypass.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

CONVERSION FACTORS

Quantity	To Convert from Metric Unit	To Customary Unit	Multiply Metric Unit By	To Convert to Metric Unit Multiply Customary Unit By
Length	millimetres (mm)	inches (in)	0.03937	25.4
	centimetres (cm) for snow depth	inches (in)	0.3937	2.54
	metres (m)	feet (ft)	3.2808	0.3048
	kilometres (km)	miles (mi)	0.62139	1.6093
Area	square millimetres (mm^2)	square inches (in^2)	0.00155	645.16
	square metres (m^2)	square feet (ft^2)	10.764	0.092903
	hectares (ha)	acres (ac)	2.4710	0.40469
	square kilometres (km^2)	square miles (mi^2)	0.3861	2.590
Volume	litres (L)	gallons (gal)	0.26417	3.7854
	megalitres	million gallons (10^6 gal)	0.26417	3.7854
	cubic metres (m^3)	cubic feet (ft^3)	35.315	0.028317
	cubic metres (m^3)	cubic yards (yd^3)	1.308	0.76455
	cubic dekametres (dam^3)	acre-feet (ac-ft)	0.8107	1.2335
Flow	cubic metres per second (m^3/s)	cubic feet per second (ft^3/s)	35.315	0.028317
	litres per minute (L/min)	gallons per minute (gal/min)	0.26417	3.7854
	litres per day (L/day)	gallons per day (gal/day)	0.26417	3.7854
	megalitres per day (ML/day)	million gallons per day (mgd)	0.26417	3.7854
	cubic dekametres per day (dam^3/day)	acre-feet per day (ac-ft/day)	0.8107	1.2335
Mass	kilograms (kg)	pounds (lb)	2.2046	0.45359
	megagrams (Mg)	tons (short, 2,000 lb)	1.1023	0.90718
Velocity	metres per second (m/s)	feet per second (ft/s)	3.2808	0.3048
Power	kilowatts (kW)	horsepower (hp)	1.3405	0.746
Pressure	kilopascals (kPa)	pounds per square inch (psi)	0.14505	6.8948
	kilopascals (kPa)	feet head of water	0.33456	2.989
Specific Capacity	litres per minute per metre drawdown	gallons per minute per foot drawdown	0.08052	12.419
Concentration	milligrams per litre (mg/L)	parts per million (ppm)	1.0	1.0
Electrical Conductivity	microsiemens per centimetre (uS/cm)	micromhos per centimetre	1.0	1.0
Temperature	degrees Celsius (°C)	degrees Fahrenheit (°F)	(1.8 × °C)+32	(°F−32)/1.8

State of California—Resources Agency
Department of Water Resources
P.O. Box 388
Sacramento
95802

CALIFORNIA DEPARTMENT OF WATER RESOURCES
THE RESOURCES AGENCY